

Before the
Federal Communications Commission
Washington, D.C. 20554

In the Matter of )
)
Amendment of Parts 1, 2, 15, 25, 27, 74, 78, 80, )
87, 90, 97, and 101 of the Commission's Rules )
Regarding Implementation of the Final Acts of the ) ET Docket No. 12-338
World Radiocommunication Conference ) (Proceeding Terminated)
(Geneva, 2007) (WRC-07), Other Allocation Issues, )
and Related Rule Updates )
)
Amendment of Parts 2, 15, 80, 90, 97, and 101 of the )
Commission's Rules Regarding Implementation of )
the Final Acts of the World Radiocommunication ) ET Docket No. 15-99
Conference (Geneva, 2012)(WRC-12), Other )
Allocation Issues, and Related Rule Updates )
)
Petition for Rulemaking of Xanadoo Company and )
Spectrum Five LLC to Establish Rules Permitting ) IB Docket 06-123
Blanket Licensing of Two-Way Earth Stations With )
End-User Uplinks in the 24.75-25.05 GHz Band )
)
Petition for Rulemaking of James E. Whedbee to )
Amend Parts 2 and 97 of the Commission's Rules to )
Create a Low Frequency Allocation for the Amateur )
Radio Service )
)
Petition for Rulemaking of ARRL to Amend Parts 2 )
and 97 of the Commission's Rules to Create a New )
Medium-Frequency Allocation for the Amateur )
Radio Service )

REPORT AND ORDER, ORDER, AND
NOTICE OF PROPOSED RULEMAKING

Adopted: April 23, 2015

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By the Commission:

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## I. INTRODUCTION

1. By this action, we take necessary steps to implement the decisions of the World Radiocommunication Conferences held in 2007 and 2012. Our decision consists of three components: 1) a Report and Order that amends the Table of Frequency Allocations (Allocation Table) in Section 2.106 of the rules and a number of related service rules to implement certain radio frequency (RF) allocation decisions from the Final Acts of the World Radiocommunication Conference (Geneva, 2007) (*WRC-07 Final Acts*);<sup>1</sup> 2) an Order that updates the International Table portion of the Commission’s Allocation Table to reflect the allocation decisions from the Final Acts of the World Radiocommunication Conference (Geneva, 2012) (*WRC-12 Final Acts*);<sup>2</sup> and 3) a Notice of Proposed Rulemaking that proposes to amend the Allocation Table and related service rules to implement certain RF allocation decisions from the *WRC-12 Final Acts*.

## II. EXECUTIVE SUMMARY

2. In the Report and Order (WRC-07 R&O), we implement allocation decisions from the *WRC-07 Final Acts* and make certain related updates to our service rules, including those for the Amateur Radio Service, Aviation Services, passive sensors, and maritime Automatic Identification Systems (AIS). Specifically, we:

- Allocate the 135.7-137.8 kHz band (2200 meter band) to the amateur service on a secondary basis.
- Raise the secondary amateur service allocation in the 1900-2000 kHz band to primary status, while providing for continued use by commercial fishing vessels of radio buoys on the “open sea.”<sup>3</sup>
- Allocate the 108-117.975 MHz and 960-1164 MHz bands to the aeronautical mobile (route) service (AM(R)S) on a primary basis for Federal and non-Federal use.
- Allocate the 5091-5150 MHz band to the aeronautical mobile service (AMS) on a primary basis for Federal and non-Federal use, limited to aeronautical mobile telemetry (AMT) for flight testing of aircraft and “Aeronautical Mobile Airport Communications System” (AeroMACS) networks.<sup>4</sup>
- Remove non-Federal AMT allocations from the 2310-2320 MHz and 2345-2360 MHz bands and an unused radionavigation service allocation from the 24.75-25.05 GHz band.
- Revise Part 87 of the Commission’s rules to update and correct the aviation services rules.

<sup>1</sup> The *WRC-07 Final Acts* are available at [http://www.itu.int/dms\\_pub/itu-s/oth/02/01/S020100002C4006PDFE.pdf](http://www.itu.int/dms_pub/itu-s/oth/02/01/S020100002C4006PDFE.pdf). 47 C.F.R. § 2.106.

<sup>2</sup> The *WRC-12 Final Acts* are available for purchase at <http://www.itu.int/pub/R-ACT-WRC.9-2012>.

<sup>3</sup> The open sea is the water area of the open coast seaward of the ordinary low-water mark, or seaward of inland waters. 47 C.F.R. § 80.5.

<sup>4</sup> The term “AeroMACS” refers to the emerging wireless communications network in the 5091-5150 MHz band that operates in the airport surface domain. See paras. 51-61 and 222-232, *infra*, for further discussion of this issue.

- Extend AIS capability by allocating the 161.9625-161.9875 MHz (AIS 1) and 162.0125-162.0375 MHz (AIS 2) bands to the mobile-satellite service (MSS) (Earth-to-space) and the aeronautical mobile (off-route) service (AM(OR)S) on a primary basis for Federal and non-Federal use.
- Protect passive sensors in the 1400-1427 MHz, 10.6-10.68 GHz, 23.6-24 GHz, 31.3-31.8 GHz, 50.2-50.4 GHz, and 52.6-54.25 GHz bands from harmful interference by generally adopting WRC-07's unwanted emissions levels for active services in six adjacent bands (1390-1395 MHz, 1427-1452 MHz, 22.55-23.55 GHz, 49.7-50.2 GHz, 50.4-50.9 GHz, and 51.4-52.6 GHz) and its in-band sharing criteria for the 10.6-10.68 GHz and 36-37 GHz bands.<sup>5</sup>
- Establish Federal coordination areas in California and Guam for non-Federal terrestrial operations in the 17.7-19.7 GHz range.

3. In the Order (WRC-12 Order), we update the International Table portion of the Commission's Allocation Table to reflect the *WRC-12 Final Acts*.<sup>6</sup>

4. In the Notice of Proposed Rulemaking (WRC-12 Notice), we propose to amend Parts 2, 15, 80, 90, 97, and 101 of the Commission's rules to implement allocation decisions from the *WRC-12 Final Acts* and make certain updates to our rules. Specifically, we propose to:

- Allocate the 8.3-11.3 kHz band to the meteorological aids service on a primary basis.
- Allocate the 472-479 kHz band (630 meter band) to the amateur service on a secondary basis.
- Amend the amateur service rules to provide for use of the 135.7-137.8 kHz (2200 meter) and 472-479 kHz (630 meter) bands. Amateur stations would share the band with power line carrier (PLC) systems operated by electric utilities. Amateur stations would be permitted to operate in these bands at fixed locations when separated from electric transmission lines by a specified distance.
- Amend Part 80 of the Commission's rules to authorize radio buoy operations in the 1900-2000 kHz band under a ship station license.
- Limit the use of the 495-505 kHz band to the maritime mobile service.
- Allocate seven frequency bands (4.438-4.488 MHz, 5.25-5.275 MHz, 16.1-16.2 MHz, 24.45-24.65 MHz, 26.2-26.42 MHz, 41.015-41.665 MHz, and 43.35-44 MHz) to the radiolocation service (RLS) on a primary basis for Federal and non-Federal use, allocate the 13.45-13.55 MHz band to the RLS on a secondary basis for Federal and non-Federal use, limit the use of these RLS allocations to oceanographic radars, require that these radars not cause harmful interference to, or claim protection from, existing and future stations in the incumbent fixed and mobile services, and amend Part 90 of the Commission's rules accordingly.
- Reallocate the 156.7625-156.7875 MHz (AIS 3) and 156.8125-156.8375 MHz (AIS 4) bands to the MSS (Earth-to-space) on a primary basis for Federal and non-Federal use to allow for greater probability of vessel tracking, with resulting benefits to maritime safety and security.
- Seek comment on the ability of Federal/non-Federal AMT stations to share spectrum with the incumbent services in the 4400-4940 MHz and 5925-6700 MHz bands.
- Extend the AM(R)S allocation from the 5091-5150 MHz band (adopted in the WRC-07 R&O) by also allocating the 5000-5091 MHz range to the AM(R)S on a primary basis for Federal and non-Federal use. AM(R)S use of the smaller 5000-5030 MHz range would extend the tuning range

<sup>5</sup> A passive sensor is a measuring instrument in the Earth exploration-satellite service (EESS) or in the space research service (SRS) by means of which information is obtained by reception of radio waves of natural origin. 47 C.F.R. § 2.1(c).

<sup>6</sup> The International Table is included in the Commission's Allocation Table for informational purposes only. 47 C.F.R. § 2.104(a).

for AeroMACS, with the use of the 5010-5030 MHz band limited to those requirements that cannot be met in the 5000-5010 MHz and 5091-5150 MHz bands. AM(R)S use of the 5030-5091 MHz band would support line-of-sight control links for unmanned aircraft.

- Allocate the 7850-7900 MHz band to the meteorological-satellite service (space-to-Earth) on a primary basis for Federal use.
- Allocate the 15.4-15.7 GHz band to the RLS on a primary basis for Federal use.
- Allocate the 22.55-23.15 GHz band to the space research service (SRS) (Earth-to-space) on a primary basis for Federal and non-Federal use and allocate the 25.5-27 GHz band to the SRS (space-to-Earth) on a primary basis for non-Federal use.
- Delete the aeronautical mobile service allocation from the 37-38 GHz band.
- Encourage operators of fixed stations operating in the 81-86 GHz and 92-94 GHz bands to take all reasonable steps to ensure that their unwanted emissions power in the 86-92 GHz band does not exceed the levels recommended by WRC-12.

### III. BACKGROUND

#### A. Allocation Table

5. The Commission's Allocation Table, contained in Section 2.106 of the rules, sets forth the allocation of radio frequencies both domestically and internationally.<sup>7</sup> Except as otherwise provided for in Section 2.102 of the rules, the assignment, licensing and use of frequencies between 9 kHz and 275 GHz must be in accordance with the Allocation Table in Section 2.106. The Allocation Table is a formatted graphical table of six columns that are divided into cells, with each cell representing a specific frequency band (band).<sup>8</sup> The Allocation Table consists of three sections: 1) the International Table of Frequency Allocations (International Table),<sup>9</sup> which is subdivided into three Regional tables (columns 1-3);<sup>10</sup> 2) the United States Table (U.S. Table), which is subdivided into the Federal Table of Frequency Allocations (Federal Table) (column 4) and the non-Federal Table of Frequency Allocations (non-Federal Table) (column 5);<sup>11</sup> and 3) a cross-reference to relevant FCC Rule Part(s) (column 6).<sup>12</sup>

<sup>7</sup> An "allocation" is an entry in the Allocation Table of a given frequency band that designates its use by one or more terrestrial or space radiocommunication services or the radio astronomy service (together, "radio services") under specified conditions. A "station" is one or more transmitters and/or receivers at one location for conducting radio communications. When a frequency band is allocated to one or more radio services on a primary basis, the Commission protects the authorized stations from interference based on the order in which the station license was issued unless it specifies a different protection arrangement. Stations of a secondary service may not cause harmful interference to, nor claim protection from, stations of a primary service to which frequencies are already assigned or may be assigned at a later date. 47 C.F.R. §§ 2.1(c), 2.104(d), 2.104(e)(2), 2.105(c).

<sup>8</sup> A "band" is a continuous set of frequencies lying between two specified limiting frequencies. See Recommendation ITU-R V.662-3, "Terms and definitions," at 14. For the purpose of simplifying the discussion in this proceeding, we sometimes refer to multiple contiguous frequency bands as a "range." A "sub-band" (also referred to as a "segment," particularly in amateur radio contexts) is a portion of a frequency band.

<sup>9</sup> The International Table is described in 47 C.F.R. § 2.104. The International Table currently reflects the "Table of Frequency Allocations" shown in Article 5, Section IV of the ITU *Radio Regulations*, Edition of 2008, except for certain corrections and updates. 47 C.F.R. § 2.100. In the WRC-12 Order, *infra*, we update the International Table in Section 2.106 to generally reflect the ITU *Radio Regulations*, Edition of 2012.

<sup>10</sup> For the allocation of radio frequencies, the ITU has divided the world into three Regions and has entered the allocations for these Regions in the International Table. The United States and most of its insular areas are in ITU Region 2, which is generally North America and South America. ITU Region 1 is generally Europe, Africa, the Middle East, the former Soviet Union, and Mongolia. ITU Region 3 is the rest of Asia and Australasia. See 47 C.F.R. § 2.104(b) for the ITU's official definitions and map of the Regions.

<sup>11</sup> The U.S. Table is described in 47 C.F.R. § 2.105.

The frequency band referred to in each allocation is shown in the top left-hand corner of the cell(s) of each of these tables.

6. The International Table displays the allocations and international footnotes that have been adopted by the International Telecommunication Union (ITU). The U.S. Table is the Commission's means of organizing and presenting how the radio spectrum is used in the United States and its Region 2 insular areas. In the United States, radio spectrum may be allocated for either Federal or non-Federal use exclusively, or for Federal/non-Federal shared use.<sup>13</sup> Thus, the Federal Table component of the U.S. Table shows the frequencies used by the Federal government and administered by the National Telecommunications and Information Administration (NTIA), and the non-Federal Table component of the U.S. Table shows the frequencies used by all other entities and administered by the Commission.<sup>14</sup> All relevant footnotes are shown within the U.S. Table, and the text of these footnotes immediately follows the Allocation Table in Section 2.106.<sup>15</sup> The International Table, the Federal Table, and the FCC Rule Part(s) are included in the Allocation Table for informational purposes only.<sup>16</sup>

### B. World Radiocommunication Conferences

7. The ITU<sup>17</sup> allocates frequency bands to various radio services generally on either a worldwide or Regional basis and enters these radio services in its International Table as part of the *Radio Regulations*.<sup>18</sup> The ITU revises its International Table and other provisions in its *Radio Regulations* at periodic World Radiocommunication Conferences (WRCs).

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<sup>12</sup> The FCC Rule Part(s) cross-references are described in 47 C.F.R. § 2.105(e).

<sup>13</sup> 47 C.F.R. § 2.105(b).

<sup>14</sup> NTIA regulates and approves the use of spectrum by Federal departments and agencies and maintains the Federal Table in its *Manual of Regulations and Procedures for Federal Radio Frequency Management (NTIA Manual)*. See Section 305(a) of the Communications Act of 1934, as amended, 47 U.S.C. 305. The Commission regulates and approves the use of spectrum by non-Federal entities and maintains the non-Federal Table in Section 2.106. See Sections 303 and 305(a) of the Communications Act of 1934, as amended, 47 U.S.C. 303, 305(a); and 47 C.F.R. §§ 2.102(a) and (b)(2), 2.105(a), 2.106.

<sup>15</sup> Any footnote consisting of "5." followed by one or more digits, e.g., 5.53, denotes an international footnote. Where an international footnote is applicable, without modification, to both Federal and non-Federal operations, the Commission places the footnote in both the Federal Table and the non-Federal Table and the international footnote is binding on both Federal users and non-Federal licensees. If, however, an international footnote pertains to a service allocated only for Federal or non-Federal use, we place the international footnote only in the affected Table. Any footnote consisting of the letters "US" followed by one or more digits, e.g., US7, denotes a stipulation affecting both Federal and non-Federal operations. U.S. footnotes appear in both the Federal and non-Federal Tables. Any footnote consisting of the letter "G" followed by one or more digits, e.g., G2, denotes a stipulation applicable only to Federal operations. Federal footnotes appear solely in the Federal Table. Any footnote consisting of the letters "NG" followed by one or more digits, e.g., NG2, denotes a stipulation applicable only to non-Federal operations. Non-Federal footnotes appear solely in the non-Federal Table. In some cases, a letter, or letters, may be appended to the digit(s) of a footnote number to preserve the sequential order. 47 C.F.R §§ 2.105(d)(5), 2.106.

<sup>16</sup> 47 C.F.R. §§ 2.104(a), 2.105(d)(3) and (e).

<sup>17</sup> When we refer to the ITU in this document, we are generally referring to ITU Radiocommunication Sector (ITU-R). The work of ITU-R is organized and coordinated by the Director of the Radiocommunication Bureau (referred to as the "Bureau" in the ITU *Radio Regulations*, including the International Table). Under its Constitution, the ITU shall effect allocation of bands of the RF spectrum, the allotment of radio frequencies and the registration of RF assignments...in order to avoid harmful interference between radio stations of different countries. WRCs shall normally be convened every three to four years...to consider specific radiocommunication matters. See COLLECTION OF THE BASIC TEXTS OF THE INTERNATIONAL TELECOMMUNICATION UNION ADOPTED BY THE PLENIPOTENTIARY CONFERENCE (Edition 2011) ([ITU Constitution and Convention](http://www.itu.int/en/ITU-R)), pp. 4, 9, 17, 77, 86. See also <http://www.itu.int/en/ITU-R>.

<sup>18</sup> The ITU may also include conditions for the use of an allocation, which are listed in international footnotes.

8. The ITU convened WRC-07 from October 22 to November 16, 2007, in Geneva, Switzerland, and adopted allocation changes that affect both Federal and non-Federal entities.<sup>19</sup> The Commission initiated a proceeding to complete the domestic implementation of certain WRC-07 allocation changes.<sup>20</sup> The Report and Order below addresses these WRC-07-related rule changes.

9. The Commission conducted its primary preparations for WRC-12 via its 2012 World Radiocommunication Conference Advisory Committee (WAC), which held eight public meetings between January 13, 2009, and April 19, 2011, to evaluate and approve recommendations and preliminary views that were later submitted for Commission consideration.<sup>21</sup> The ITU held a Conference Preparatory Meeting (CPM) from February 14-25, 2011, to prepare and approve a report on the technical, operational, and regulatory/procedural matters relevant to the WRC-12 Agenda.<sup>22</sup> In addition, the United States worked with other administrations to craft common proposals for Region 2 (North and South America).<sup>23</sup> By September 19, 2011, the Commission and NTIA had jointly transmitted their allocation proposals to the U.S. Department of State (*U.S. Proposals for WRC-12*).<sup>24</sup>

10. The ITU convened the World Radiocommunication Conference 2012 (WRC-12) from January 23-February 17, 2012, in Geneva, Switzerland, and adopted allocation changes that affect both Federal and non-Federal entities.<sup>25</sup> Subsequently, the ITU revised its *Radio Regulations*.<sup>26</sup> We are initiating a new rulemaking proceeding to commence the domestic implementation of certain of the WRC-12 allocation changes. Specifically, in the Order, below, we reflect the International Table as it is generally shown in the 2012 Edition of the ITU *Radio Regulations* in the Commission's Allocation Table. In the companion WRC-12 Notice, below, we make proposals that implement the domestic allocation

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<sup>19</sup> Subsequently, the ITU revised its *Radio Regulations* to include the *WRC-07 Final Acts*. See ITU *Radio Regulations*, Edition of 2008 (available at <http://www.itu.int/pub/R-REG-RR/en>). For an overview of U.S. participation in WRC-07, see United States Delegation Report [on] World Radiocommunication Conference 2007, submitted to the Secretary of State by Ambassador Richard M. Russell, United States Head of Delegation ([U.S. Delegation Report](#)). See also ITU [Results of WRC-07 "Bringing all radio services together,"](#) presented at the ITU Regional Radiocommunication Seminar, April 14-18, 2008, Buenos Aires, Argentina.

<sup>20</sup> Amendment of Parts 1, 2, 15, 74, 78, 87, 90, and 97 of the Commission's Rules Regarding Implementation of the Final Acts of the World Radiocommunication Conference (Geneva, 2007) (WRC-07), Other Allocation Issues, and Related Rule Updates, ET Docket No. 12-338, *Notice of Proposed Rulemaking and Order*, 27 FCC Rcd 14598 (2012) (*WRC-07 NPRM and Order*). In this item, we refer to the respective components of the *WRC-07 NPRM and Order* as the *WRC-07 NPRM* or the *WRC-07 Order*.

<sup>21</sup> The WAC was chartered under the Federal Advisory Committee Act (FACA) to provide to the Commission with advice, technical support, and recommended proposals for WRC-12. The Commission published the committee's recommendations for public comment. After consideration by the U.S. Government, many of the recommendations became a part of the U.S. views and draft proposals. See <http://www.fcc.gov/ib/wrc-12/>.

<sup>22</sup> See ITU Radiocommunication Sector "CPM Report on technical, operational and regulatory/procedural matters to be considered by the 2012 World Radiocommunication Conference," March 2011 (*CPM Report to WRC-12*, which is available at <http://www.itu.int/pub/R-ACT-CPM/en>). See also [Resolution ITU-R 2-6](#) (2012).

<sup>23</sup> See "U.S. contributions sent to CITELE PCC.II," available at <http://transition.fcc.gov/ib/wrc-12/citel/>.

<sup>24</sup> The U.S. Proposals for the WRC-12 consisted of three letters from the Commission and NTIA to the U.S. Department of State: First Tranche (February 17, 2011); Second Tranche (RCS-2394/1, June 21, 2011); and Third Tranche (September 19, 2011) (together, *U.S. Proposals for WRC-12*, available at <http://transition.fcc.gov/ib/wrc-12/us/>).

<sup>25</sup> See "2012 World Radiocommunication Conference 2012 (WRC-12) - Agenda and References (Resolutions and Recommendations)" ([WRC-12 References](#)) and ITU Press Release, Feb. 17, 2012 at [http://www.itu.int/net/pressoffice/press\\_releases/2012/10.aspx](http://www.itu.int/net/pressoffice/press_releases/2012/10.aspx).

<sup>26</sup> The ITU *Radio Regulations*, Edition of 2012, include the *WRC-12 Final Acts* (ITU *Radio Regulations*). The ITU *Radio Regulations* are available at <http://www.itu.int/pub/R-REG-RR-2012>.

changes from the *WRC-12 Final Acts*. In this action, we cite to various ITU-R Recommendations and Reports to which the ITU provides free online access.<sup>27</sup> In addition, in Appendix A, we provide a glossary of frequently used radiocommunication service terms and we list the symbols for the ITU-defined frequency ranges that are used throughout this document.

#### IV. REPORT AND ORDER (WRC-07 R&O)

11. In this Report and Order, we amend Parts 1, 2, 25, 27, 74, 78, 80, 87, 90, 97, and 101 of the Commission's rules to complete the implementation of certain allocation decisions from the *WRC-07 Final Acts*.<sup>28</sup> As procedural background, several significant events followed the conclusion of WRC-07 in Geneva and the subsequent publication of its final acts. First, on August 20, 2009, NTIA forwarded to the Commission (and subsequently updated on September 28, 2009; July 26, 2012; February 25, 2013; March 4, 2014; and February 11, 2015) its recommendations for implementation of the *WRC-07 Final Acts* in the U.S. Table.<sup>29</sup> The Commission adopted the *WRC-07 Clean-up Order* to update the International Table to reflect the WRC-07 allocation changes, as well as to make non-substantive editorial revisions to the Allocation Table and other rule sections.<sup>30</sup> Subsequently, on November 15, 2012, the Commission adopted the *WRC-07 NPRM*, which contained a comprehensive set of proposals to update the allocations and certain related service rules for portions of the RF spectrum between 108 MHz and 20.2 GHz.<sup>31</sup> We received 68 comments and 12 reply comments in response to the *WRC-07 NPRM*.<sup>32</sup> In discussing the various proposals, below, we use a different organizational approach from the *WRC-07 NPRM*. First, we evaluate those proposals that commenters discussed in their filings. We then briefly address those proposals that generated no discussion in the record.

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<sup>27</sup> The ITU-R Recommendations are available at <http://www.itu.int/pub/R-REC>, and the ITU-R Reports are available at <http://www.itu.int/pub/R-REP>.

<sup>28</sup> As part of our comprehensive review of the Allocation Table, we also make certain minor allocation changes that are not related to the *WRC-07 Final Acts* and make certain minor conforming changes to the Commission's service rules, as further described below.

<sup>29</sup> See Letter from Karl B. Nebbia, Associate Administrator, Office of Spectrum Management, NTIA, to Julius P. Knapp, Chief, Office of Engineering and Technology, FCC, ET Docket No. 12-338, filed August 20, 2009 ([NTIA WRC-07 Recommendations](#), [pages 27-52 of the NTIA WRC-07 Recommendations](#), and [pages 53-60 of the NTIA WRC-07 Recommendations](#)). Subsequently, NTIA corrected and supplemented its recommendations for WRC-07 domestic implementation. See NTIA Letters, filed September 28, 2009 ([NTIA WRC-07 Supplement](#)); July 26, 2012 ([NTIA Second Supplement](#)); February 25, 2013 ([NTIA Third Supplement](#)); and March 4, 2014 ([NTIA Fourth Supplement](#)). See also Letter from Paige Atkins, Associate Administrator, Office of Spectrum Management, NTIA, to Julius P. Knapp, Chief, Office of Engineering and Technology, FCC, ET Docket No. 12-338, filed February 11, 2015 ([NTIA Final Supplement](#)).

<sup>30</sup> Amendment of Parts 1, 2, 15, 25, 73, and 90 of the Commission's Rules to Make Non-Substantive Editorial Revisions to the Table of Frequency Allocations and to Various Other Rules, *Order*, 25 FCC Rcd 9712 (OET, 2010) (*WRC-07 Table Clean-up Order*). Because the amendments to the Allocation Table in the *WRC-07 Table Clean-up Order* were limited to changes of a non-substantive, editorial nature, it was necessary for the Commission's staff to create four U.S. footnotes (US226, US444, US444A, US519) to replicate the pre-WRC-07 text of four international footnotes (RR 5.226, RR 5.444, RR 5.444A, RR 5.519). *WRC-07 Table Clean-up Order*, 25 FCC Rcd at 9723-24, paras. 21-25.

<sup>31</sup> *WRC-07 NPRM*, 27 FCC Rcd 14598. Because preparation of the *WRC-07 NPRM* necessitated a comprehensive review of the Allocation Table and related rules, the Commission's proposals also included some allocation changes and service rule updates not directly related to the *WRC-07 Final Acts*.

<sup>32</sup> This count includes late-filed submissions. The National Academy of Sciences' Committee on Radio Frequencies (CORF) requests that we accept its late-filed Reply Comments. We note that there were also comments and other reply comments filed late in this proceeding. In the interest of having as complete and accurate a record as possible, we are accepting all late-filed submissions and waive the requirements of 47 C.F.R. § 1.415(d). We provide a list of the parties in Appendix C.

## A. Amateur Service Use of LF and MF Bands

### 1. 2200 Meter Band (135.7-137.8 kHz)

12. In this section, we allocate the 135.7-137.8 kHz (2200 meter)<sup>33</sup> band to the amateur service on a secondary basis. In accordance with an international requirement, we also limit amateur stations transmitting in the 2200 meter band to a maximum equivalent isotropically radiated power (EIRP) of 1 watt (W).<sup>34</sup> However, we defer consideration of operating parameters for the amateur service in this band to the *WRC-12 Notice* below.

13. **Background.** In the U.S. Table, the 130-160 kHz band is allocated to the fixed service (FS) and maritime mobile service (MMS) on a primary basis for Federal and non-Federal use.<sup>35</sup> WRC-07 allocated the 135.7-137.8 kHz band to the amateur service on a secondary basis in all ITU Regions. WRC-07 also adopted RR 5.67A,<sup>36</sup> which restricts the use of this allocation to amateur stations transmitting with a maximum radiated power of 1 W (EIRP).<sup>37</sup> There are no non-Federal stations in the FS and MMS that are licensed to operate in the 135.7-137.8 kHz band, and Federal use of this band is relatively light.<sup>38</sup>

14. Footnote US2 explains that in the 9-490 kHz band, “electric utilities operate Power Line Carrier (PLC) systems<sup>39</sup> on power transmission lines for communications important to the reliability and

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<sup>33</sup> In the Amateur Radio Service, wavelength bands, rather than frequency bands are the usual means of identifying radio spectrum. We note that wavelength ( $\lambda$  in meters, m) is equal to the speed of light (c, which is taken to be  $3 \times 10^8$  m/s) divided by frequency (f in hertz, 1/s), e.g.,  $\lambda = c/f = (3 \times 10^8 \text{ m/s}) / (136 \times 10^3 \text{ 1/s}) \approx 2200 \text{ m}$ . In this proceeding, we often use the term “2200 meter band” when referring to the 135.7-137.8 kHz band.

<sup>34</sup> See n.37, *infra*.

<sup>35</sup> The FS is a radiocommunication service between specified fixed points, and the MMS is a mobile service between coast stations and ship stations, or between ship stations, or between associated on-board communication stations; survival craft stations and emergency position-indicating radiobeacon stations may also participate in this service. 47 C.F.R. § 2.1(c).

<sup>36</sup> In the ITU *Radio Regulations*, a reference to international footnote 5.67A would be shown as “No. 5.67A,” which means provision No. 5.67A of Article 5. Instead of using this abbreviation, to more clearly indicate that we are referring to an international footnote while still using a convenient shorthand, we will use the abbreviation for Radio Regulation (RR), *i.e.*, “RR 5.67A.”

<sup>37</sup> EIRP is the product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna (absolute or isotropic gain). Effective radiated power (ERP) (in a given direction) is the product of the power supplied to the antenna and its gain relative to a half-wave dipole in a given direction. We note that ERP is equal to EIRP divided by 1.64, e.g., 1 W EIRP = 0.61 W ERP. See “Guidelines for Determining the Effective Radiated Power (ERP) and Equivalent Isotropically Radiated Power (EIRP) of a RF Transmitting System,” Office of Engineering and Technology, FCC, Nov. 30, 2010 (available at <https://apps.fcc.gov/oetcf/kdb/forms/FTSSearchResultPage.cfm?switch=P&id=47469>).

<sup>38</sup> *WRC-07 NPRM*, 27 FCC Rcd at 14605, n.35.

<sup>39</sup> A PLC system is an “unintentional radiator” used by an electric power utility entity on transmission lines for protective relaying, telemetry, *etc.*, for general supervision of the power system. An unintentional radiator is a device that intentionally generates RF energy for use within the device, or that sends RF signals by conduction to associated equipment via connecting wiring, but which is not intended to emit RF energy by radiation or induction. 47 C.F.R. §§ 15.3(t), (z). PLC systems operate by the transmission of RF energy by conduction over the electric power transmission lines of the system. PLC systems do not include those electric lines which connect the distribution substation to the customer or house wiring. PLC systems “are subject only” to the requirements specified in Section 15.113. 47 C.F.R. § 15.113. We note in particular that PLC systems operate within the 9-490 kHz band “without a limit on the level of radiated emissions that leak from the power lines.” Revision of Part 15 of the Rules regarding operation of radio frequency devices without an individual license – USCG/FAA petition for reconsideration, GEN Docket No. 87-389, *Memorandum, Opinion and Order*, 5 FCC Rcd 7060, para. 3 (1990).

security of electric service to the public. These PLC systems operate under the provisions of 47 CFR part 15, or Chapter 8 of the *NTIA Manual*, on an unprotected and non-interference basis with respect to authorized radio users.”<sup>40</sup> Under the Commission’s rules, a power utility operating a PLC system was required to submit the details of all existing systems plus any proposed new PLC systems or changes to PLC existing systems to an “industry-operated entity.”<sup>41</sup>

15. Previously, in ET Docket No. 02-98, the Commission declined to allocate the 135.7-137.8 kHz band to the amateur service after finding a potential for interference between the proposed amateur radio and incumbent PLC operations.<sup>42</sup> In 2009, James E. Whedbee (Whedbee) requested that the Commission allocate the 135.7-137.8 kHz band to the amateur service on a secondary basis and that the Commission amend Part 97 of its rules to provide for this use.<sup>43</sup> Prior to the *WRC-07 NPRM*, the Commission had not revisited its decision nor taken action on Whedbee’s petition for rulemaking.

16. Proposal. In the *WRC-07 NPRM*, the Commission sought comment on whether the 135.7-137.8 kHz band should be allocated to the amateur service on a secondary basis, with use limited, as specified in RR 5.67A, to amateur stations transmitting at a maximum EIRP of 1 W.<sup>44</sup> Because PLC systems provide communications important to the reliability and security of electric service to the public, the Commission stated that it would consider adding an amateur service allocation to the 135.7-137.8 kHz band only if it were comfortable that amateur radio and utility PLC systems could successfully coexist in this band.<sup>45</sup> It noted that the *2002 Amateur Radio NPRM* recognized the potential for experimental amateur operations in the band and asked about subsequent developments that would inform a re-evaluation of the decade-old decision.<sup>46</sup> In particular, the Commission sought comment on technical rules or methods that could be implemented to assure such coexistence and, in particular, on the appropriate maximum field strength level and minimum separation distance from PLC systems for secondary amateur service operations in the band.<sup>47</sup> The Commission further sought comment on whether requiring individual amateur stations in the 135.7-137.8 kHz band to be “quasi-coordinated” for fixed use at a

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<sup>40</sup> 47 C.F.R. §§ 2.106 footnote US2. As background, we note that the Commission revised its rules in 1983 “to implement a new U.S. Footnote to provide enhanced recognition of [PLC] systems in the 10-490 kHz frequency band. Rules establishing a notification procedure, an industry-operated entity to oversee the notification process, and a data base [were] also adopted so that band occupants can cooperate to the extent practicable to minimize or eliminate mutual interference.” Amendment of Parts 2, 15, and 90 of the Commission’s Rules to provide recognition for power line carrier operations of electric utilities in the bands 10-490 kHz, Gen. Docket No. 82-9, *Report and Order*, 52 Rad. Reg. 2d (P&F) 1713, para. 1 (1983).

<sup>41</sup> 47 C.F.R. §§ 15.113(a), 90.35(g). Currently, the Utilities Telecom Council (UTC) acts in this capacity.

<sup>42</sup> Amendment of Parts 2 and 97 of the Commission’s Rules to Create a Low Frequency Allocation for the Amateur Radio Service, ET Docket No. 02-98, *Notice of Proposed Rule Making*, 17 FCC Rcd 8954, 8963 at para. 25 (2002) (*2002 Amateur Radio NPRM*); *Report and Order*, 18 FCC Rcd 10258, 10263-64 at paras. 16-20 (2003) (*2003 Amateur Radio R&O*); *Memorandum Opinion and Order*, 19 FCC Rcd 6536 (2004). See also ARRL Petition for Rule Making, RM-9404, received Oct. 22, 1998 (ARRL LF Petition); ARRL Erratum, RM-9404, received Nov. 18, 1998 (ARRL LF Erratum).

<sup>43</sup> See Whedbee Petition for Rule Making, filed Nov. 25, 2009, posted in ET Docket 12-338 on Nov. 23, 2012 (Whedbee LF Petition).

<sup>44</sup> *WRC-07 NPRM*, 27 FCC Rcd at 14606, para. 16.

<sup>45</sup> *WRC-07 NPRM*, 27 FCC Rcd at 14606-07, para. 17.

<sup>46</sup> *WRC-07 NPRM*, 27 FCC Rcd at 14606, paras. 15-16.

<sup>47</sup> *WRC-07 NPRM*, 27 FCC Rcd at 14607, para. 19.

specified location, an option that the Utilities Telecom Council (UTC) suggested in 2002, holds merit.<sup>48</sup>

17. Comments. The American Radio Relay League (ARRL) and 22 individual amateur service licensees submitted comments in support of allocating the 135.7-137.8 kHz band to the amateur service on a secondary basis;<sup>49</sup> and UTC, the Edison Electric Institute (EEI), and nine electric utilities submitted comments opposing this allocation.<sup>50</sup>

18. According to ARRL, the WRC-07 action provides good cause for the Commission to reevaluate its prior decision not to adopt an amateur service allocation.<sup>51</sup> ARRL argues that the 2003 Commission decision was not premised on a technical compatibility analysis but was instead based on an abstract concern by the utility industry for interference-free PLC operations.<sup>52</sup> It states that the Commission “simply balanced the perceived importance of PLC systems against the acknowledged desirability of creating the first LF allocation for the amateur service, assuming that there was some interference potential.”<sup>53</sup>

19. Amateur service commenters contend that interference will not occur to PLC systems from amateur operations. For example, several amateur service commenters state that there have been no reports of interference to PLC systems from amateurs operating under experimental licenses<sup>54</sup> and others report that experimental licensees transmit with an EIRP greater than 1 W at distances much nearer to PLC systems without interference problems arising.<sup>55</sup> One amateur service commenter states that PLC systems operate at noise levels several orders of magnitude greater than the magnitude of amateur

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<sup>48</sup> *Id.* Had the Commission allocated the 135.7-137.8 kHz band to the amateur service on a secondary basis in 2003, UTC offered to conduct a “quasi-coordination” process to reduce the risk of interference to PLC systems. Under the UTC suggestion, the Commission would have required that amateur operators submit data to UTC about their proposed operations. UTC would then notify utilities about those amateur operations that may impact their PLC systems. Utilities and amateur operators would cooperate to avoid causing interference to each other’s operations. See UTC Comments, ET Docket No. 02-98, filed July 29, 2002, at 9.

<sup>49</sup> See ARRL Comments at 17-18. The 22 individual amateur service licensees that submitted comments and/or reply comments are John K. Andrews (Andrews), Perry D. Ballinger (Ballinger), Hugh P. Bunn (Bunn), David L. Compton (Compton), John H. Davis (Davis), Thomas K. Duncan (Duncan), James M. Fitton (Fitton), Laurence J. Howell (Howell), Neil Klagge (Klagge), Nickolaus E. Leggett (Leggett), William F. Osler (Osler), Michael L. Peak (Peak), Dale Putman (Putnam), Frederick H. Raab (Raab), James Rodenkirch (Rodenkirch), Jay Rusgrove (Rusgrove), Anthony Scandurra, Albert Sheppard, David Tessitore (Tessitore), Craig Wasson (Wasson), Whedbee, and Warren H. Ziegler (Ziegler).

<sup>50</sup> The nine electric utilities that commented are American Electric Power Company (AEP), American Transmission Company LLC (American Transmission), CenterPoint Energy Houston Electric, LLC (CenterPoint Energy), Dayton Power and Light Company (DP&L), Entergy Services, Inc. (Entergy), Exelon Corporation (Exelon), Great River Energy (GRE), NextEra Energy, Inc. (NextEra), and PPL Electric Utilities Corporation (PPL Electric).

<sup>51</sup> See ARRL Comments at 8.

<sup>52</sup> *Id.* at 9-10.

<sup>53</sup> *Id.* at 9.

<sup>54</sup> See ARRL Comments at 16, Andrews Comments at 3-4, Howell Comments at 2, Klagge Comments at 1, Rusgrove Comments at 1. Andrews points out that this frequency band has been authorized in Europe for some time with no reports of interference. Andrews Comments at 4.

<sup>55</sup> See Zeigler Comments at 1 (has operated an experimental station with a maximum measured EIRP of 6.5 W; its “transmitting antenna is 900’ from a high tension power line with an active PLC with no interference issues after 12,000 hours of operation”), Whedbee Reply Comments titled “Quick Reply Comment to Last Minute UTC Submission” (March 28, 2013) at 1, and Wasson Reply Comments at 1. Wasson also states that an allocation would consolidate LF experimentation and therefore “the potential for interference is greatly reduced and the task of identifying the source of interference is made easier.” See Wasson Reply Comments at 2.

signals.<sup>56</sup> ARRL contends, in particular, that there is no risk of interference between amateur stations and PLC operations when they are separated by one kilometer (km).<sup>57</sup>

20. By contrast, UTC and EEI assert that nothing has changed since 2003 to cause the Commission to alter its decision not to allocate the band for the amateur service.<sup>58</sup> UTC and EEI state that in 2003 the “Commission provided extensive technical analysis” to support the decision not to make an amateur service allocation in the band and that for the same reasons the Commission should again decline to adopt this allocation.<sup>59</sup> Furthermore, UTC argues that there is no practical coexistence mechanism to enable sharing between amateurs and PLC.<sup>60</sup> It states that amateur radio operations are unpredictable and uncoordinated and power limits by themselves would not protect PLC systems. UTC reiterates its comments from 2003 that antenna height limits and other technical restrictions must also be established to mitigate interference.<sup>61</sup> In addition, Entergy Services, Inc. states that unlike other licensed facilities such as navigation beacons, procedures to prevent interference between PLC systems and amateur stations will not be possible “because amateur radio operators using the reallocated spectrum may not necessarily operate at a permanent, fixed location, making it difficult for utilities with PLC systems to ascertain if an interference condition may exist that it needs to address.”<sup>62</sup>

21. A number of utilities emphasize the high cost of moving or modifying PLC systems to avoid interference from amateur stations.<sup>63</sup> In addition, UTC and several utilities also express concern that amateurs would use their status under the proposed allocation to force utilities (which operate on an unlicensed basis) out of the band.<sup>64</sup> According to the Dayton Power and Light Company, the fact that this secondary allocation has been made in other countries is irrelevant because “[u]tilities in those countries may not be using the same frequencies for their control equipment.”<sup>65</sup>

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<sup>56</sup> See Bunn Reply Comments at 1. One amateur points out that a Wisconsin utility bordering Canada has not experienced “dire” consequences even though Canada has allocated the 135.7-137.8 kHz band to the amateur radio service. See Whedbee Reply Comments to Exelon Corp. *et. al.* filed on Feb. 15, 2013 at 1-2. Considering that Canada is separated from Wisconsin by Lake Superior, we do not find this fact particularly relevant.

<sup>57</sup> ARRL Reply Comments at 4 and Annex A. In support of its assertion that there is no potential for interference from amateur stations transmitting with a maximum EIRP of 1 W to PLC systems at separation distances greater than 1 km from a transmission line carrying the PLC signals, ARRL’s submitted a technical analysis that draws on a 1985 NTIA technical report which considered the potential interference from fixed stations to PLC systems in the 150-190 kHz band. See Andrew Farrar, Herb Dobson, Fred Wentland, *Evaluation Techniques – Fixed Service Systems to Power-Line-Carrier Circuits*, Report TR-85-181, U.S. Department of Commerce, Sept. 1985, at p. 5-77 (available at <http://www.its.bldrdoc.gov/publications/2204.aspx>).

<sup>58</sup> See UTC/EEI Reply Comments at 9.

<sup>59</sup> *Id.*

<sup>60</sup> See UTC Comments at 6.

<sup>61</sup> UTC Comments at 6-7.

<sup>62</sup> See Entergy Comments at 2-3.

<sup>63</sup> Utilities estimate the cost of changing the PLC frequency on one transmission line to be between \$10,000 and \$500,000. Exelon Comments at 3, GRE Comments at 4, and NextEra Comments at 3. CenterPoint Energy Houston Electric, LLC estimates the cost of replacing its 60 existing PLC systems at \$9.6 million while GRE estimates the cost of replacing its 10 PLC systems with fiber-optic systems at \$18-36 million. CenterPoint Energy Comments at 2 and GRE Comments at 4. Several amateur service commenters claim that these cost estimates are highly inflated. See Ballinger Reply Comments at 2 and Raab Reply Comments at 2.

<sup>64</sup> See AEP Comments at 1, PPL Electric Comments at 6, and UTC Comments at 4.

<sup>65</sup> DP&L also states that power lines of 100 kV or more are the major transmission lines that move power across the country (as part of the “Bulk Electric System”), and that these power lines have been identified by Congress, the North American Electric Reliability Corporation (NERC), and the Federal Energy Regulatory Commission (FERC) (continued....)

22. Decision. In the *WRC-07 NPRM* we stated that we would add an amateur radio allocation to the 135.7-137.8 kHz band only if we were comfortable that amateur stations and PLC systems could coexist. We conclude that such sharing of the band is possible. Since the Commission last considered this issue, amateurs have successfully operated in the band under experimental licenses without reported PLC interference. We are also encouraged by the fact that numerous fixed radionavigation beacons, which operate at much higher powers, share spectrum with PLC systems without reported interference.<sup>66</sup> As discussed below, the exact scope of acceptable amateur operations in the band is a matter that warrants further examination.

23. We are unconvinced by the claims of UTC and electric utility commenters that coexistence of amateur stations and PLC systems is not possible. These claims largely rest on the assumption that amateur stations in the band would operate under the rules applicable to other amateur bands which, in general, permit mobile operations and operations at high power and with any type of antenna. It is clear that we will have to establish appropriate requirements for amateur use of the band if we are to ensure compatibility with PLC systems. Such requirements will likely include limiting amateur operation to fixed locations that are suitably distant from the transmission lines upon which PLC systems operate, as well as the imposition of power limits and other technical rules to govern amateur operation. The existing record offers useful comments in this regard. For example, American Electric Power Company (AEP), while opposed to the proposed allocation, also acknowledges that amateur radio operations would likely have to “include an extremely large antenna or [be in] very close proximity to a transmission line” to raise interference concerns.<sup>67</sup> Amateur radio commenter Davis agrees with UTC’s statement that the Commission’s suggestion in the *WRC-07 NPRM* to limit antenna height “would help to provide some basis upon which to further develop a coexistence mechanism for fixed amateur radio operations, but not for mobile.”<sup>68</sup>

24. We reach our decision because there are tangible benefits in providing for licensed amateur use in the 135.7-137.8 kHz band. Besides promoting harmonization with relevant WRC-07 decisions, the addition of a secondary amateur allocation will provide amateur operators with new opportunities for experimentation with equipment, techniques, antennas, and propagation phenomena in a frequency range that is significantly different from all other bands allocated for this service.<sup>69</sup> However, given that the band is of interest to the amateur community for its experimentation potential in contrast to the routine and widespread communication activities among users that are common characteristics of other amateur bands, we can also expect that the amateur interest in the band will continue to be limited and specialized.

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as “critical facilities of national importance.” See DP&L Comments at 2. Cf. UTC Comments at 7 (PLC systems in Europe use the band only for in home applications where the risk of interference is less than in the U.S.).

<sup>66</sup> In the 9-490 kHz range, there are 578 Federal assignments for the radio beacon stations (station class ALB) in the aeronautical radionavigation service (ARNS). We note however that the assigned frequencies for ALB stations actually extend only from 191 to 429 kHz, and that the output power of these stations range from 10 W to 4 kW. This study was conducted using the Government Master File (GMF) for March 7, 2015.

<sup>67</sup> AEP Comments at 1-2. AEP is opposed to the proposed allocation largely on the basis that its PLC signals could become an unlicensed interference source to licensed Amateur Radio users, and AEP would have to disable its systems to comply with FCC regulations regarding harmful interference.

<sup>68</sup> UTC Comments at 6-7. Davis Reply Comments at 4.

<sup>69</sup> See ARRL Comments at 2-3 and 13-14 (discussing how the band offers a unique environment for propagation experimentation that cannot be duplicated in any other current amateur service allocation and describing how amateur experiments in this band can lead to advances in the detection and decoding of weak signals in the presence of ambient noise which, in turn, will contribute to the radio art). See also Andrews Comments at 1-2, Duncan Comments at 1, Leggett Comments at 3-4, and Peak Comments at 1-2.

25. We also recognize the importance of PLC systems operating under Section 15.113 of our rules. UTC and the utilities emphasize the continued importance of PLC systems to the reliability of electric service.<sup>70</sup> AEP states that PLC systems are used extensively because they are a cost-effective component of a power system protection scheme.<sup>71</sup> According to UTC there are now almost 2,100 PLC transmitters operating in this frequency band.<sup>72</sup> Great River Energy (GRE) states that interference from amateur stations could potentially cause protective relaying equipment to fail to operate which could result in damage to transformers and other equipment that cost millions of dollars in addition to causing outages to thousands of people.<sup>73</sup> NextEra Energy, Inc. (NextEra) states that it and other utilities are in fact being required to use more of the band to help ensure the reliability and security of electric service to the public.<sup>74</sup> American Transmission Company LLC claims that reallocation would require it and other electric utilities to abandon a large swath of already-crowded PLC spectrum for which there is no practical, cost- or time-effective substitute.<sup>75</sup>

26. The amateur community has made it clear that it has no intent to diminish or supplant PLC operations.<sup>76</sup> Accordingly, we are taking a measured and deliberate approach to the introduction of licensed amateur operations into the band. The secondary amateur allocation we adopt does not by itself convey authority to amateur licensees to operate in the band. Rather, we defer consideration of the appropriate amateur rules for operation in the band to the accompanying WRC-12 Notice. Amateur use will be governed by any future service rules that specify when, how, and under what conditions we will permit amateur use of the 135.7-137.8 kHz band.<sup>77</sup> We intend to structure these service rules to promote shared use of the band among amateurs and PLC systems.<sup>78</sup> Amateurs will not be able to use their allocation status to force unlicensed PLC operations out of the band, and utilities will have no cause to abandon or incur large costs to modify existing PLC systems.

27. Taking steps to enhance efficient, shared use of our scarce spectrum resource both serves the public interest and promotes fundamental Commission spectrum management goals. We recognize the relative public benefits of PLC and amateur radio, and we explicitly reject the suggestion that we must choose one to the exclusion of the other. Our objective is to allocate spectrum on a secondary basis to amateur stations in a manner that is compatible with existing PLC systems. However, we also expect to permit amateur operators to make use of the allocation in a manner that is less burdensome and more productive than they are currently afforded under the experimental authorization process.<sup>79</sup>

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<sup>70</sup> See UTC/EEI Reply at 2-3.

<sup>71</sup> See AEP Comments at 1.

<sup>72</sup> See UTC Comments at 4, n.12. See also GRE Comments at 4 (stating that it uses PLCs on approximately 72% of its transmission lines and substations greater than 115 kV).

<sup>73</sup> GRE also states that PLC technology is “not going away,” and that PLCs continue to be used for protective relaying in newly built transmission lines. See GRE Comments at 2-3.

<sup>74</sup> See NextEra Comments at 2.

<sup>75</sup> See American Transmission Comments at 3-4.

<sup>76</sup> “Amateur Radio operators have a long history of successful sharing with Part 15 devices in other bands. Never has the Amateur Service attempted to oust an unlicensed user from an Amateur allocation due to interference concerns.” ARRL Reply at 7.

<sup>77</sup> Until service rules are adopted, amateur operators may continue to apply under the Commission’s experimental licensing program to use the 135.7-137.8 kHz band.

<sup>78</sup> See discussion of proposed service rules, paras. 167-180, *supra*.

<sup>79</sup> If, after consideration of the record, we conclude that a method to permit the operation of existing PLC systems is not readily achievable, we will defer the adoption of service rules and amateur users will have to continue to use the experimental licensing process to operate in the band.

28. In making this secondary amateur service allocation, we acknowledge that we are following a different path than the Commission did in its *2003 Amateur Radio R&O*. However, our decision today both recognizes and builds on the foundation the Commission laid in its *2003 Amateur Radio R&O*. The *2003 Amateur Radio R&O* implicitly assumed that amateur stations would not operate at fixed locations. The service rules we propose today include appropriate limitations, such as restricting amateur stations to fixed locations suitably distant from PLC operations, that we believe will permit shared use of the band.<sup>80</sup> Moreover, the spectrum management landscape has changed since 2003. The Commission has adopted spectrum sharing arrangements in a number of other bands, which makes us confident that a coexistence arrangement between amateur stations and PLC systems is possible.<sup>81</sup> Advancements in geographic information system (GIS) technologies and mapping capabilities provide further assurances that mechanisms exist for maintaining sufficient distances between amateur sites and the transmission lines used by PLC systems.

29. For these reasons, we conclude that it is in the public interest to add a secondary amateur service allocation to the non-Federal Table in the 135.7-137.8 kHz band. In accordance with the WRC-07 Final Acts, we also restrict use of this secondary amateur service allocation to amateur stations transmitting a maximum EIRP of 1 W by adding a reference to RR 5.67A to the U.S Table for this band.

## 2. Raising the Amateur Service in the 1900-2000 kHz Band to Primary Status

30. In this section, we adopt the Commission's proposal to raise the secondary amateur service allocation in the 1900-2000 kHz band to primary status.<sup>82</sup> We also delete the primary radiolocation service (RLS) allocation within the United States. However, to support spectrum use by the U.S. commercial fishing fleet that was identified in the record, we maintain a limited RLS allocation to support radio buoy operation on the open sea in the 1900-2000 kHz band.

31. Background. Currently, the amateur "160 meter" band consists of two frequency bands: the 1800-1900 kHz band, which is allocated solely to the amateur service on a primary basis, and the 1900-2000 kHz band, which is allocated to the RLS on a primary basis for Federal and non-Federal use and to the amateur service on a secondary basis under the terms of footnote US290.<sup>83</sup> Historically, the larger 1715-2000 kHz band was allocated exclusively for amateur radio use, but subsequently the size of this allocation was reduced and its use was severely limited.<sup>84</sup> By 1983, the Commission had adopted the current allocations for the 1800-1900 kHz and 1900-2000 kHz bands.<sup>85</sup> The last station license that authorized the use of the non-Federal RLS allocation in the 1900-2000 kHz band expired in 2004.<sup>86</sup> The

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<sup>80</sup> Our proposed technical rules further bolster our decision to change course from the *2003 Amateur Radio R&O*.

<sup>81</sup> See, e.g., *Unlicensed Operation in the TV Broadcast Bands*, ET Docket Nos. 04-186 and 02-380, *Second Report and Order and Memorandum Opinion and Order*, 23 FCC Rcd 16807 (2008) (unlicensed device operation in the television bands); Amendment of Parts 2 and 95 of the Commission's Rules to Provide Additional Spectrum for the Medical Device Radiocommunication Service in the 413-457 MHz band, ET Docket No. 09-36, *Report and Order*, 26 FCC Rcd 16605 (2011) (low-powered implanted medical device operation in several bands used by radars and land mobile systems); Amendment of the Commission's Rules to Provide Spectrum for the Operation of Medical Body Area Networks, ET Docket No. 08-59, *First Report and Order and Further Notice of Proposed Rulemaking*, 27 FCC Rcd 6422 (2012) (medical telemetry devices operating in an aeronautical mobile telemetry band).

<sup>82</sup> *WRC-07 NPRM*, 27 FCC Rcd at 14608, para. 20.

<sup>83</sup> See 47 C.F.R. § 2.106.

<sup>84</sup> *WRC-07 NPRM*, 27 FCC Rcd at 14608-09, para. 22.

<sup>85</sup> Amendment of Part 2 of the Commission's Rules Regarding Implementation of the Final Acts of the World Administrative Radio Conference, Geneva, 1979, General Docket 80-739, *Second Report and Order*, 49 FR 2358, 2360, paras. 21 and 24 (Jan. 19, 1984) (*WARC-79 Second R&O*).

<sup>86</sup> On March 31, 2015, Commission staff conducted a review of the 1900-2000 kHz band using the Commission's Universal Licensing System (ULS) database and found no active call signs.

current Federal use of the 1900-2000 kHz band is relatively light, with only 10 assignments that authorize operations in this band.<sup>87</sup>

32. Proposal. In the *WRC-07 NPRM*, the Commission proposed to amend the U.S. Table to remove the Federal and non-Federal RLS allocations from the 1900-2000 kHz band and to raise the secondary amateur service allocation to primary status because there appear to be few (if any) RLS stations operating in this band.<sup>88</sup> It requested comment on the status of Federal RLS stations that are authorized to operate in the San Diego area, and the extent to which NTIA would need us to recognize these stations as grandfathered Federal users. The Commission also anticipated that the other relatively low-power Federal assignments would continue to operate on an unprotected and non-interference basis. Consequently, the Commission proposed to delete footnote US290 from the list of U.S. footnotes and delete the 1900-2000 kHz band and several limitations that pertain only to that band from the Radiolocation Service Frequency Table in Section 90.103(b) of the Commission's rules. It also proposed to amend Section 97.303 of our rules by revising paragraph (c) to remove the 1900-2000 kHz segment from the list of frequency segments that are allocated to the RLS in the United States and other nations, and by revising paragraph (g) to list, by ITU Region, where amateur stations transmitting in the 160 meter band must not cause harmful interference to, and must accept interference from, stations authorized by other nations. The Commission concluded that these actions would update the Commission's rules to reflect actual use and – after more than half a century – restore this 100 kilohertz of spectrum to nearly exclusive amateur radio use.

33. Comments. We received comments from the ARRL and 43 individual amateur service licensees in support of the Commission's proposal.<sup>89</sup> An additional commenter, ITM Marine (ITM), requests that we “keep this band available for radio location devices,” citing extensive use by radio buoys.<sup>90</sup> ARRL states that it is timely to restore to the amateur service access to the entire 1800-2000 kHz band on a primary basis. It notes that the 1900-2000 kHz band was only available for re-accommodation of displaced licensees from the 1605-1705 kHz band, but that the use of technology with inherently greater reliability and general spectrum efficiency advancements mean that relocations into the band are no longer necessary.<sup>91</sup> ARRL also requests that we simply delete the entire text of the current

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<sup>87</sup> One Federal assignment authorizes land and mobile stations in the RLS to transmit on 1922 kHz using a necessary bandwidth of 600 Hertz within a protected radius of 193 km centered on San Diego, California. All other Federal assignments in the 1900-2000 kHz band are for unallocated uses and thus these assignments operate on an unprotected and non-interference basis. See *WRC-07 NPRM*, 27 FCC Rcd at 14609, para. 23.

<sup>88</sup> *WRC-07 NPRM*, 27 FCC Rcd at 14609, para. 24.

<sup>89</sup> See ARRL Comments at 22-27. The 43 individual amateur service licensees that submitted comments and/or reply comments include 9 parties that commented on 2200 meter band issues (Compton, Fitton, Osler, Peak, Putnam, Rodenkirch, Scandurra, Tessitore, Whedbee) and the following 34 parties: Robert L. Atkinson, Nathan Bargmann (Bargmann), Lloyd Berg, Robert Bethman (Bethman), Todd Carpenter (Carpenter), Donald B. Chester (Chester), Roger Cooper (Cooper), Steve Courts (Courts), Danny Douglas (Douglas), George Dubovsky, Richard Duccini (Duccini), Brad Farrell (Farrell), Benjamin A. Governale (Governale), James T. Hanlon, Michael M. Harang (Harang), Hamilton Hicks, Robert G. Hoffman, Brian Holloway, John R. Holmes, Patrick Jankowiak, Richard W. Jensen, Jerry Klemm (Klemm), Michael R. Kincaid, James Michener, Anthony Muttillio, Robert E. Naumann, David C. Olean (Olean), Richard L. Pettit (Pettit), Glen Reid, Ken Reid, Greg Schultz (Schultz), Peter G. Smith, Owen Wormser (Wormser), and William C. Wright III. We note that Wormser filed on behalf of “The 1865 Morning Group,” which consists of “almost 400 Amateur Radio operators who use 160 [meters] daily for regional, nighttime long-haul, and emergency communications.”

<sup>90</sup> See ITM Comments, which are titled “Letter to the FCC,” at 2. The ITM Comments are listed in the docket under the president of the company, Steve Beaver.

<sup>91</sup> See ARRL Comments at 22-25.

Section 97.303(g) because this rule section would no longer applicable.<sup>92</sup>

34. Amateur radio commenters endorse our observation that there is little or no non-Federal RLS activity in the band. For example, several commenters state that RLS signals in the 1900-2000 kHz band are not receivable at their locations.<sup>93</sup> Others agree that radiolocation beacons in the 1705-2000 kHz range have fallen out of use.<sup>94</sup> A number of commenters state that both the 1705-1800 kHz and 1900-2000 kHz segments “appear devoid of radiolocation beacons, except for a few weak signals reportedly from low-power radio buoys used on the high seas by commercial fishermen.”<sup>95</sup>

35. Amateur radio commenters describe numerous ways in which the allocation would be beneficial to the amateur service. ARRL, in particular, notes that the 1800-2000 kHz band is capable of and is used for worldwide skywave and groundwave communications; that this band is exceptionally heavily used, especially during protracted sunspot minima; and that it is at present the only MF amateur radio allocation.<sup>96</sup>

36. Individual amateur radio commenters further describe how the 1900-2000 kHz band is particularly useful to the amateur operators. For example, four commenters state that because the 1800-2000 kHz band is the only MF allocation presently available to amateurs, propagation characteristics and other properties of 160 meter band make it uniquely interesting, and during periods of low solar activity, this is often the only amateur band available for night time communications over distances up to 500 miles.<sup>97</sup> Numerous commenters state that decreased sunspot activity will greatly impact HF communication in the future, and that the 160 meter band could become more important for both long and short range reliable communications.<sup>98</sup> Three commenters state that there has been increasing use of the band, due to experimentation and changes in propagation,<sup>99</sup> and another commenter states that he and his colleagues find this MF band to be of intense interest, especially relating to the study of radio wave propagation.<sup>100</sup> Because nearly all amateur HF radio equipment today includes the 160 meter band, one commenter asserts that significantly more amateur stations are operating on these frequencies than just a few short years ago.<sup>101</sup>

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<sup>92</sup> The *WRC-07 NPRM* proposed to revise Section 97.303(g). ARRL notes that Section 97.303 contains the general rule for sharing between Regions and sub-Regions (which are two or more countries) in paragraph (a) and that all other paragraphs refer to the specific sharing requirements of secondary amateur service allocations. See ARRL Comments at 25-27.

<sup>93</sup> See Carpenter Comments at 1, Klemm Comments at 1, and Ken Reid Comments at 1.

<sup>94</sup> See Courts Comments at 1, Farrell Comments at 1, and Peak Comments at 1.

<sup>95</sup> See Chester Comments at 2, Duccini Comments at 1, and Governale Comments at 2.

<sup>96</sup> See ARRL Comments at 24.

<sup>97</sup> These commenters also state that the 2 MHz range lends itself particularly well to certain forms of technical investigation and self-instruction in the radio art. For example, in the realm of antennas, amateur experimentation could lead to the development or improvement of efficient, physically low profile medium-wave transmitting antennas, anti-skywave transmitting antennas that provide local ground wave coverage while generating minimal interference at distant points, as well as effective noise cancelling and weak-signal receiving antennas. See Chester Comments at 5-6, Courts Comments at 2, Duccini Comments at 3, and Governale Comments at 3-4.

<sup>98</sup> See Bargmann Comments at 1, Cooper Comments at 1, Fitton Comments at 1, Harang Comments at 1, Olean Comments at 1, Putnam Comments at 1, Rodenkirch Comments at 1, Schultz Comments at 1, and Wormser Comments at 1.

<sup>99</sup> See Douglas Comments at 1, Harang Comments at 1, and Olean Comments at 1. ARRL discusses the propagation of RF signals at: <http://www.arrl.org/propagation-of-rf-signals>.

<sup>100</sup> See Tessitore Comments at 1.

<sup>101</sup> See Douglas Comments at 1.

37. In addition, several commenters state that amateur operators use the 1900-2000 kHz band for valuable emergency services.<sup>102</sup> Commenters further suggest that a primary allocation status would provide a measure of certainty for amateur operators, who must decide whether to invest the time and money to install an antenna of sufficiently large size to effectively communicate in the band. For example, four commenters note that, while the virtual disappearance of RLS beacons from the 1900-2000 kHz band gives amateurs unfettered use of the 1900-2000 kHz segment, the secondary status of the amateur service nevertheless leaves users vulnerable to future RLS interests that can easily be accommodated elsewhere.<sup>103</sup>

38. In its comments, ITM states that it is an importer/distributor of radiolocation devices that are commonly known as radio buoys, that these devices are “licensed” for use in the 1900-2000 kHz band, and that these devices have been used for 30-40 years by the U.S.-based “high seas migratory species fishing fleets” in the Atlantic and Pacific Oceans.<sup>104</sup> ITM estimates that there are at least 500 active vessels, and possibly 250-500 additional vessels in the United States, which use these radio buoys, and that each of these vessels carry up to 10 or more radio buoys. ITM states that the buoys assist fishermen in locating their gear and provide an important safety factor if the gear needs to be retrieved quickly to escape bad weather, and that fishing operations have been developed around the use of the buoys.<sup>105</sup> With regard to the lack of licenses issued for operation in the 1900-2000 kHz band, ITM states that since this equipment is “primarily used offshore, in international waters,” the operators did not license them for use in the USA (they are FCC approved) and that the owners already have licenses for the vessels’ “transmitting equipment,” and believe that the buoys fall under this license as “ships equipment.”<sup>106</sup> ITM requests that the Commission “keep this frequency band available for radiolocation devices,” and that, if possible, the Commission expand the band, because its customers have complained that it is getting crowded.<sup>107</sup>

39. In its reply comments, ARRL states that the buoys are illegal transmitters, regardless of where they are deployed, since there is no marine allocation in this band and no Part 80 ship license permits radiolocation in any portion of the 1900-2000 kHz band.<sup>108</sup> It also states that no United States-registered vessel may operate Part 90 equipment on any frequency for radiolocation without a license from the Commission, and that operation pursuant to Section 90.103 of the Commission’s rules in the 1900-1950 kHz and/or 1950-2000 kHz segments clearly necessitates a license.<sup>109</sup>

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<sup>102</sup> See Bethman Comments at 1, Pettit Comments at 1, Glenn Reid Comments at 1, and Schultz Comments at 1. See ARRL’s website for more information on ARES: <http://www.arrl.org/ares> and <http://www.arrl.org/amateur-radio-emergency-communication>. See also the Commission’s Public Safety and Homeland Security Bureau’s website: <http://transition.fcc.gov/pshs/services/amateur.html>.

<sup>103</sup> See Chester Comments at 5, Courts Comments at 2, Duccini Comments at 3, and Governale Comments at 3. See also Olean Comments at 1. See also Peak Comments at 1 and Pettit Comments at 1 (asserting that amateur licensees should enjoy the long term security of primary status across the entire band).

<sup>104</sup> See ITM Comments at 1-2.

<sup>105</sup> See ITM Comments at 1.

<sup>106</sup> *Id.*

<sup>107</sup> See *id.* at 2.

<sup>108</sup> Amateur operator Whedbee expresses similar sentiments. See ARRL Reply Comments at 10-12, Whedbee Reply Comments to ITM Marine (March 4, 2013) at 2-3.

<sup>109</sup> ARRL claims that amateur radio operators have suffered interference in the 1900-2000 kHz band from these buoys. It also asks us to launch an investigation of this company, and says that our WRC decision should instruct “fishing vessels using these devices without appropriate licenses to cease using them unless and until a license is obtained, and compliance with Section 90.101 *et seq.* is achieved.” *Id.*

40. Decision. We allocate the 1900-2000 kHz band to the amateur service on a primary basis, and as described below, remove the primary RLS allocation from the U.S. Table. This action supports the increased spectrum use of the 160 meter band reported by commenters and provides spectrum support for the emergency communications that the amateur radio community provides. This action also provides the amateur service with the long-term security that primary status entails, to the benefit of those licensees who seek to operate in the 160 meter band. NTIA has not informed us of any Federal RLS requirements in the 1900-2000 kHz band, and thus we take no additional action in this regard.

41. Although we had anticipated that there was no non-Federal RLS use of the 1900-2000 kHz band, the record indicates that there are maritime users, including the U.S. “high seas” migratory species fishing fleet, which make use of radio buoys in both the Atlantic and Pacific oceans as well as within 200 nautical miles of the coastline.<sup>110</sup> We did not identify these users in the *WRC-07 NPRM* because they did not appear in our licensing database. The Commission’s Part 90 rules allow any person engaged in commercial activity to obtain a license to use the 1900-2000 kHz band for radiolocation.<sup>111</sup> ITM holds a Grant of Equipment Authorization issued under the authority of the Commission to sell “radio buoys” that operate in the 1900-1999 kHz band pursuant to our Part 90 rules.<sup>112</sup> Apparently, fishing vessels have operated radio buoys in U.S. waters under the belief that a ship station license issued under Part 80 of our rules allows operation of the buoys. However, a Part 80 license only applies to stations in the maritime services and does not permit operation of radio stations that require a Part 90 license such as the radio buoys at issue here.<sup>113</sup>

42. For purposes of updating and revising the Allocation Table, we find that we should take account of radio buoy use on the open sea by continuing to provide for a significantly restricted use of the

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<sup>110</sup> The terms and definitions in 33 C.F.R. Part 2, Subpart B provide a useful context for our discussions herein: Except for certain enumerated purposes, “high seas” means all waters that are not the exclusive economic zone, territorial sea, or internal (*i.e.*, inland) waters of the United States or any other nation. The exclusive economic zone generally extends from 12 to 200 nautical miles from the territorial sea baseline (which is comprised of the low water line on National Oceanic and Atmospheric Administration (NOAA) charts plus closing lines across legally-defined bays and rivers). 33 C.F.R. §§ 2.20, 2.22(a)(1), 2.24(a), 2.26, 2.30(b), 2.32(d). *See also* [http://www.gc.noaa.gov/gcil\\_maritime.html](http://www.gc.noaa.gov/gcil_maritime.html) (for NOAA’s description of maritime zones and boundaries) and Presidential Proclamation No. 5928, December 27, 1988 (which extended the territorial sea from 3 to 12 nautical miles; available at [http://www.gc.noaa.gov/documents/terr\\_sea\\_54\\_fr\\_777.pdf](http://www.gc.noaa.gov/documents/terr_sea_54_fr_777.pdf)). As of March 31, 2015, public documents report that 367 fishing vessels are authorized by the U.S. to be used for fishing on the high seas. *See* HSVAR: High Seas Vessels Authorization Record, U.S. data last updated on Sep. 9, 2012 (available at <http://www.fao.org/figis/vrmf/hsvr/stats/coverage.jsp#table1>).

<sup>111</sup> 47 C.F.R. § 90.103(b).

<sup>112</sup> Specifically, FCC Identifier XLTKTUS-IL authorizes ITM to import and/or market equipment of the class “Licensed Non-Broadcast Station Transmitter” that is specifically identified in the Notes as a “RADIO BUOY,” which operates in the “1.9-1.999” MHz frequency range under “FCC Rule Part[] 90” using 8.0 W of conducted power, a frequency tolerance of 5.0 parts per million, and emission designator 60HA1A (*i.e.*, 60 hertz of necessary bandwidth, double-sideband carrier, single channel, telegraphy for aural reception). The name of the grantee is listed as “International Technical Mktg Inc;” however, the listed address and the attention line (“Steve Beaver, President”) are consistent with the ITM Comments. *See* FCC Identifier [XLTKTUS-IL](#). We note that at least two other companies have been issued equipment authorizations for a licensed non-broadcast station transmitter under Part 90 of our rules that appear to be offered for sale as radio buoys: 1) Ryokuseisha Corporation with 5 W of output power in the 1.606-2.85 MHz range (see FCC Identifier [EC26EISV-L3](#)); and 2) Taiyo Musen Co Ltd with 6 W of output power (emission 750HA1A) in the 1.706-1.8 MHz and 1.9-2 MHz ranges (FCC Identifiers [BAA9JKTB-548WL](#) and [BAA9JKTB-548WH](#)).

<sup>113</sup> “One ship station license will be granted for operation of all maritime services transmitting equipment on board a vessel.” 47 C.F.R. § 80.13(b). Section 80.13(c) allows certain ship stations to be licensed by rule. 47 C.F.R. § 80.13(c). In either case, the Part 80 license does not apply to Part 90 services.

current RLS allocation in the 1900-2000 kHz band. Specifically, we remove the primary RLS allocation from the U.S. Table and add new footnote NG92 to the Allocation Table, which provides for radio buoy operations in the 1900-2000 kHz band on a primary basis in Region 2 and on a secondary basis in Region 3 (which is consistent with the existing primary/secondary Regional distinction for RLS), limited to operations on the open sea.<sup>114</sup> In addition, we amend the Radiolocation Service Frequency Table in Section 90.103(b) of our rules by removing the 1900-2000 kHz band.<sup>115</sup> By doing so, we provide the amateur service with primary and exclusive use of the 1900-2000 kHz band on the land territory of the United States and its insular areas. Further, we implement our proposal to remove the 1900-2000 kHz segment from Section 97.303(c), and consistent with ARRL's comments, to remove Section 97.303(g) in its entirety from our rules.<sup>116</sup>

43. We nevertheless recognize the public benefit associated with the use of radio buoys by the U.S. commercial fishing fleet. In the companion WRC-12 Notice, we propose revisions to the Commission's rules that would provide radio buoy operators a legitimate path to operate.<sup>117</sup> In the meantime, we adopt a waiver, on our own motion, of Sections 80.375 and 90.103 of our rules to allow operation of Commission-approved 1900-2000 kHz radio buoys on the open sea by commercial fishing vessels that have a valid ship station license under Section 80.13 of our rules.<sup>118</sup> We conclude that grant of this waiver is in the public interest. Use of these radio buoys allows such commercial fishing vessels to locate their fishing lines and nets more quickly, which saves them fuel and time and reduces the likelihood that fishing lines and nets will be lost. Given that the radio buoys appear to use low power and narrow bandwidths, we believe that they can be accommodated with minimal impact on amateur users.<sup>119</sup> Based on the information we have received from ITM, we have structured the waiver to authorize offshore radio buoy use by commercial fishing vessels. If, contrary to what this record suggests, there are commercial fishermen currently using radio buoys on the Great Lakes or inland waters, those fishermen may request waivers regarding their current operations. Lastly, we grant this waiver pending the outcome of the WRC-12 Notice, and without prejudice to enforcement regarding prior unauthorized radio buoy operations.

44. Finally, in their comments, Todd Carpenter and Ken Reid suggest that since few, if any, signals of any type are heard in the 2000-3300 kHz range, secondary amateur band privileges could be authorized in this band.<sup>120</sup> Whedbee requests that we permit the amateur service to operate in the

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<sup>114</sup> See Appendix D for the text of footnote NG92.

<sup>115</sup> As of March 31, 2015, there were no active status call signs listed in the Commission's Universal Licensing System (ULS) for the 1900-2000 kHz band.

<sup>116</sup> While radio beacons will operate on a primary basis on the open sea within ITU Region 2, we believe that it is unnecessary and potentially confusing to highlight this low-power, uncoordinated use in Section 97.303 of our rules.

<sup>117</sup> See WRC-12 Notice, Section VI.A.2, "Radio Buoys Operating in the 1900-2000 kHz Bands," paras. 153-158, *infra*.

<sup>118</sup> See 47 C.F.R. § 1.3. This waiver will apply to commercial fishing vessels with a ship station license issued under Section 83.13(b) and those that are licensed by rule under Section 83.13(c). 47 C.F.R. § 80.13. This is a limited waiver. It does not apply to vessels other than commercial fishing vessels and does not authorize the use of these buoys in other locations, such as on the Great Lakes. The open sea is the water area of the open coast seaward of the ordinary low-water mark, or seaward of inland waters. 47 C.F.R. § 80.5. "Inland waters" means the waters shoreward of the territorial sea baseline. 33 C.F.R. § 2.26.

<sup>119</sup> Our actions largely accomplish our proposal to remove the RLS allocation from the band. Additionally, and as discussed in the WRC-12 Notice, we request comment on methods to minimize any interference potential associated with radio buoy use.

<sup>120</sup> See Carpenter Comments at 1; Ken Reid Comments at 1.

spectrum below 9 kHz on an unallocated basis.<sup>121</sup> These issues fall outside the scope of the *WRC-07 NPRM* and raise new technical and policy considerations. We therefore decline to address these comments in this proceeding.

## **B. Aviation Services Use of VHF, UHF, and SHF Bands**

### **1. Aeronautical Mobile (R) Service Allocation in the 108-117.975 MHz Band**

45. Background. In the U.S. Table, the 108-117.975 MHz band is allocated to the aeronautical radionavigation service (ARNS) on a primary basis for Federal and non-Federal use.<sup>122</sup> Two ARNS systems operate in this band: the VHF Omnidirectional Range (VOR) system and the Instrument Landing System (ILS).<sup>123</sup>

46. The 2003 World Radiocommunication Conference (WRC-03) adopted RR 5.197A, which provided a limited aeronautical mobile (route) service (AM(R)S) allocation in the 108-117.975 MHz band to support air navigation and surveillance functions.<sup>124</sup> The Commission did not implement this international footnote domestically. WRC-07 modified RR 5.197A to remove the limitation to only air navigation and surveillance functions. In addition, WRC-07 revised RR 5.197A to state that the 108-117.975 MHz band is allocated to the AM(R)S on a primary basis, limited to systems operating in accordance with recognized international aeronautical standards, that such use must be in accordance with Resolution 413,<sup>125</sup> and that AM(R)S use of the 108-112 MHz sub-band is limited to Ground Based Augmentation Systems (GBAS). In 2003, the Commission adopted footnote US343, which states that Differential-Global-Positioning-System (DGPS) stations, limited to ground-based transmitters (*i.e.*, GBAS), may be authorized on a primary basis in the 108-117.975 MHz band (as well as the 1559-1610 MHz band) for the specific purpose of transmitting DGPS information intended for aircraft navigation.<sup>126</sup> In its WRC-07 recommendations for domestic implementation, NTIA recommended that

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<sup>121</sup> See Request of Whedbee, titled “Informal Request and Comments, In Re: Allocation Display Changes,” (Nov. 26, 2012) at 1-3.

<sup>122</sup> The ARNS is a radionavigation service intended for the benefit and safe operation of aircraft. 47 C.F.R. § 2.1(c).

<sup>123</sup> Footnote US93 states that the frequency 108 MHz may be authorized for use by VOR test facilities, subject to the condition that no interference is caused to the reception of frequency modulation (FM) broadcasting stations.

<sup>124</sup> The AM(R)S is an aeronautical mobile service (AMS) reserved for communications relating to safety and regularity of flight, primarily along national or international civil air routes. AMS is a mobile service between aeronautical stations and aircraft stations, or between aircraft stations. An aeronautical station is defined as a land station in the AMS. An aircraft station is defined as a mobile station in the aeronautical mobile service, other than a survival craft station, located on board an aircraft. 47 C.F.R. § 2.1(c).

<sup>125</sup> WRC-07 revised Resolution 413 to resolve: (1) that any AM(R)S systems operating in the 108-117.975 MHz band shall not cause harmful interference to, nor claim protection from ARNS systems operating in accordance with international aeronautical standards; (2) that any AM(R)S systems planned to operate in the 108-117.975 MHz band shall, as a minimum, meet the FM broadcasting immunity requirements contained in Annex 10 to the ICAO Convention on International Civil Aviation for existing ARNS systems operating in this frequency band; (3) that AM(R)S systems operating in the 108-117.975 MHz band shall place no additional constraints on the broadcasting service or cause harmful interference to stations operating in the bands allocated to the broadcasting service in the 87-108 MHz band and Radio Regulation No. 5.43 does not apply to “ICAO standard ground-based systems for the transmission of radionavigation-satellite differential correction signals” [referred to in this section as Ground Based Augmentation Systems (GBAS)]; (4) that frequencies below 112 MHz shall not be used for AM(R)S systems excluding GBAS (*i.e.*, the only AM(R)S system that can operate in the 108-112 MHz segment is GBAS); and (5) that any AM(R)S operating in the 108-117.975 MHz band shall meet Standards and Recommended Practices (SARPs) requirements published in Annex 10 to the ICAO Convention on International Civil Aviation. WRC-12 deleted *resolves 6* (which pertain to whether any further regulatory measures should be adopted to facilitate introduction of new AM(R)S systems) and certain made minor changes to Resolution 413.

we add RR 5.197A to the U.S. Table and that we remove the 108-117.975 MHz band from the text of footnote US343.<sup>127</sup>

47. Proposal. The Commission proposed to add new footnote US197A to the 108-117.975 MHz band that would incorporate the text of RR 5.197A and add the following sentence: “AM(R)S use of the band 108-117.975 MHz shall not constrain the use of the band 88-108 MHz by stations in the broadcasting service operating in accordance with 47 CFR Part 73.”<sup>128</sup> The Commission made this proposal because of existing claims of harmful interference to ARNS use of the 108-117.975 MHz band from FM broadcasting stations, which operate in the adjacent 88-108 MHz band.<sup>129</sup> The Commission stated its belief that the potential for similar interference concerns to arise with an AM(R)S allocation should be addressed in this proceeding. In particular, the Commission noted that Resolution 413 states “that no compatibility criteria currently exist between FM broadcasting systems operating in the frequency band 87-108 MHz and the planned additional aeronautical systems in the adjacent band 108-117.975 MHz using aircraft transmission” and “that no compatibility criteria currently exist between digital sound broadcasting systems capable of operating in the frequency band at about 87-108 MHz and aeronautical services in the band 108-117.975 MHz.”<sup>130</sup> The Commission also stated that it was concerned that any interference resolution is further complicated by the Federal Aviation Administration’s (FAA’s) proposed frequency notification requirements for FM radio stations that are still pending,<sup>131</sup> and because the FAA has not implemented the International Civil Aviation Organization’s (ICAO’s) improved performance standards for Instrument Landing System (ILS) localizer, VOR, and VHF communications receivers.<sup>132</sup>

48. The Commission proposed to revise and renumber footnote US343 by removing the 108-117.975 MHz band and by renumbering this footnote in frequency order as US85.<sup>133</sup> The Commission stated that DGPS stations in the 108-117.975 MHz band would be authorized under the proposed AM(R)S allocation that would be codified in footnote US197A, if it is added to the U.S. Table.<sup>134</sup>

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<sup>126</sup> The Commission also authorized the use of DGPS in the 108-117.975 MHz band on a non-developmental basis and required DGPS receivers to meet the International Civil Aviation Organization’s (ICAO’s) minimum interference immunity requirements. Review of Part 87 of the Commission’s Rules Concerning the Aviation Radio Service, *Report and Order and Further Notice of Proposed Rule Making*, 18 FCC Rcd 21432, 21457-59 (2003). As of March 7, 2015, NTIA has authorized two DGPS stations to operate in the 108-117.975 MHz band. As of March 31, 2015, the Commission has issued 358 active call signs in the Aviation Radionavigation (AR) Radio Service for operations in the 108-117.975 MHz band, 7 of which authorize DGPS stations.

<sup>127</sup> See NTIA WRC-07 Recommendations at 2 (revised text of footnote US343) and 14 (modifications to the 108-117.975 MHz band). NTIA also recommends removing the last sentence from footnote US343 (*i.e.*, “Such use shall be in accordance with ITU Resolution 413 (WRC-03)”) because Resolution 413 does not apply to the 1559-1610 MHz band.

<sup>128</sup> *WRC-07 NPRM*, 27 FCC Rcd at 14611-12, para. 28.

<sup>129</sup> 47 C.F.R. § 73.201.

<sup>130</sup> See ITU *Radio Regulations*, Resolution 413 (Rev.WRC-07), titled “Use of the band 108-117.975 MHz by the aeronautical mobile (R) service” at *noting c*) and *noting d*).

<sup>131</sup> See “Safe, Efficient Use and Preservation of the Navigable Airspace,” Department of Transportation, FAA, 75 FR 42296 (July 21, 2010) (Final Rule) (stating that “the proposals on FM broadcast service transmissions in the 88.0–107.9 MHz frequency band remain pending,” and that “the FAA will address the ... proposed frequency notice requirements ... when a formal and collaborative decision is announced”).

<sup>132</sup> *WRC-07 NPRM*, 27 FCC Rcd at 14611-12, para. 28.

<sup>133</sup> *Id.* at 14612, para. 29.

<sup>134</sup> *Id.*

49. Comments. The Boeing Company (Boeing) supports the addition of a footnote implementing RR 5.197A, but opposes the additional language proposed in the *WRC-07 NPRM*. It argues that the language of RR 5.197A as agreed on at WRC-07 is the result of a carefully crafted compromise among the aviation industry, regulators, and the broadcast industry that should not be modified in a U.S. footnote. It contends that the additional language could be misconstrued to equate the AM(R)S as secondary or otherwise subordinate to broadcast operations, which was not the intent of the administrations that crafted and agreed to the new footnote.<sup>135</sup> Subsequently, the FAA informed the Commission that it is no longer pursuing its proposed frequency notification requirements for FM radio stations operating in the 88-108 MHz band.<sup>136</sup>

50. Decision. In view of the FAA's decision to not pursue its proposed frequency notification requirements for FM radio stations, we implement NTIA's recommended changes in the 108-117.975 MHz band. Specifically, we add a reference to RR 5.197A in the 108-117.975 MHz band within the U.S. Table. By this action, we allocate the 108-117.975 MHz band to the AM(R)S on a primary basis for Federal and non-Federal use, limit the use of this allocation to systems operating in accordance with recognized international aeronautical standards, require that such use be in accordance with Resolution 413 (Rev. WRC-12), and limit AM(R)S use of the 108-112 MHz sub-band to systems composed of ground-based transmitters and associated receivers that provide navigational information in support of air navigation functions. Because DGPS stations in the 108-117.975 MHz band will be authorized under the AM(R)S allocation, now codified in RR 5.197A, we revise footnote US343 to remove the reference to the 108-117.975 MHz band and renumber this footnote as US85.<sup>137</sup>

## 2. Aeronautical Mobile Service Allocation in the 5091-5150 MHz Band

51. In this section, we allocate the 5091-5150 MHz band to the aeronautical mobile service (AMS) on a primary basis, but limit the use of this allocation to surface applications at airports, commonly referred to as the Aeronautical Mobile Airport Communications System (AeroMACS), and to Aeronautical Mobile Telemetry (AMT) transmissions from aircraft.<sup>138</sup>

52. Background. In the U.S. Table, the 5091-5150 MHz band is allocated to the aeronautical radionavigation service (ARNS) on a primary basis for Federal and non-Federal use. Footnote US260 states that AMS communications that are an integral part of ARNS systems may also be satisfied in that band. In addition, there are three footnotes (RR 5.367, US444, US444A) that contain pre-WRC-12 text,

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<sup>135</sup> See Boeing Comments at 2-3.

<sup>136</sup> See Letter from Ian Atkins, Director, FAA Spectrum Engineering and Policy to Julius P. Knapp, Chief, Office of Engineering and Technology, FCC, ET Docket No. 12-338 (filed Jan. 23, 2015).

<sup>137</sup> Because ITU Resolution 413 (WRC-12) applies only the 108-117.975 MHz band, which we are removing from footnote US343, we are also removing a now unneeded second sentence (*i.e.*, "Such use shall be in accordance with ITU Resolution 413 (WRC-03).").

<sup>138</sup> AMT is a mobile service for the flight testing of aircraft in which an aircraft station transmits the results of measurements made onboard an aircraft, including those related to the functioning of the aircraft. AMT operations are primarily authorized in the 1435-1525 MHz, 2200-2290 MHz (Federal only), and 2360-2395 MHz bands. We note that the term AeroMACS refers to the emerging wireless communications networks in the 5091-5150 MHz band which operates in the airport surface domain. See "AeroMACS System Characterization and Demonstrations," March 2013, by Robert Kerczewski, *et al.*, at 1, 9 (NASA/TM—2013-216497). More specifically, AeroMACS has been developed to provide broadband wireless communications between aircraft and other ground vehicles, as well as between critical fixed assets. The potential services and applications provided by AeroMACS can be grouped into three major categories: Air Traffic Control (ATC) and Air Traffic Management (ATM) and infrastructure, airline operations, and airport and/or port authority operations. See *Future Aeronautical Communications*, Chapter 12, titled "Aeronautical Mobile Airport Communications System (AeroMACS)," by James M. Budinger and Edward Hall (2011), Section 3.2, p. 241. See also "Aeronautical Mobile Airport Communications System (AeroMACS) for Access to SWIM," by NASA/GRC/James Budinger, Nov. 3, 2010 (NASA presentation).

which pertain to the 5091-5150 MHz band and we update in this Report and Order. RR 5.367 states that the 5000-5150 MHz band is also allocated to the aeronautical mobile-satellite (R) service (AMS(R)S) on a primary basis.<sup>139</sup> Footnote US444 states that use of the 5030-5150 MHz band for Microwave Landing System (MLS) requirements takes precedence over other uses of the band. Footnote US444A states, *inter alia*, that the 5091-5150 MHz band is allocated to the fixed-satellite service (FSS) (Earth-to-space) on a primary basis for feeder links to non-geostationary satellite orbit systems in the mobile-satellite service (NGSO MSS), but prohibits new assignments after January 1, 2012.<sup>140</sup>

53. In its *Proposals for WRC-07*, the United States identified the 5091-5150 MHz band to support additional aviation communication needs. It noted that ICAO recommended 5091-5150 MHz as a suitable band for surface applications that can support high data throughput, and that studies have shown that such AM(R)S applications can share this band with both the existing FSS and new AMT systems. Consistent with these proposals, WRC-07 allocated the 5091-5150 MHz band to the AMS on a primary basis. WRC-07 also adopted RR 5.444B, which restricts AMS use of the 5091-5150 MHz band to: 1) AM(R)S systems operating in accordance with “international aeronautical standards,”<sup>141</sup> limited to surface applications at airports, and in accordance with Resolution 748 (*i.e.*, AeroMACS);<sup>142</sup> 2) AMT

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<sup>139</sup> The mobile-satellite service (MSS) is a radiocommunication service: 1) Between mobile earth stations and one or more space stations, or between space stations used by this service; or 2) Between mobile earth stations by means of one or more space stations. The MSS may also include feeder links necessary for its operation. The aeronautical mobile-satellite service (AMSS) is a MSS in which mobile earth stations are located on board aircraft; survival craft stations and emergency position-indicating radiobeacon stations may also participate in this service. The AMS(R)S is an AMSS reserved for communications relating to safety and regularity of flights, primarily along national or international civil air routes. 47 C.F.R. § 2.1(c). Prior to WRC-12, RR 5.367 stated the 1610-1626.5 MHz and 5000-5150 MHz bands are also allocated to the AMS(R)S on a primary basis, subject to agreement obtained under Radio Regulation No. 9.21. WRC-12 removed the 5000-5150 MHz band from RR 5.367, directly listed this primary AMS(R)S allocation in the International Table, and restricted the use of this allocation by adopting RR 5.443AA and RR 5.443D. In para. 61, *infra*, we maintain the *status quo* in the U.S. Table by moving the deleted text to footnote US367. In paras. 222-232, *infra*, we propose to implement these and other WRC-12 allocation changes.

<sup>140</sup> Two other U.S. footnotes apply to the 5091-5150 MHz band, but are not at issue in this proceeding. Specifically, footnote US211 addresses radio astronomy protection and footnote US344 address Federal/non-Federal coordination of NGSO MSS feeder link earth stations. The FSS is a radiocommunication service between earth stations at given positions, when one or more satellites are used; the given position may be a specified fixed point or any fixed point within specified areas; in some cases this service includes satellite-to-satellite links, which may also be operated in the inter-satellite service; the fixed-satellite service may also include feeder links for other space radiocommunication services. 47 C.F.R. § 2.1(c).

<sup>141</sup> When WRC-07 adopted Resolution 748, it recognized “that ICAO publishes recognized international standards for AM(R)S systems.” See Resolution 748 (WRC-07), *recognizing b*).

<sup>142</sup> WRC-07 stated “that this new [AM(R)S] allocation is intended to support the introduction of applications and concepts in air traffic management which are data intensive, and which will support data links that carry safety-critical aeronautical data.” WRC-07 resolved that: 1) any AM(R)S systems operating in the 5091-5150 MHz band shall not cause harmful interference to, nor claim protection from, ARNS systems; and shall meet the Standards and Recommended Practices (SARPs) requirements published in Annex 10 of the ICAO Convention on International Civil Aviation and the requirements of Recommendation ITU-R M.1827, to ensure compatibility with FSS systems operating in that band; and 2) that the coordination distance with respect to stations in the FSS operating in the band 5091-5150 MHz shall be based on ensuring that the signal received at the AM(R)S station from the FSS transmitter does not exceed -143 dB(W/MHz), where the required basic transmission loss shall be determined using the methods described in Recommendations ITU-R P.525-2 and ITU-R P.526-11. See Resolution 748 (WRC-07), *considering h*), *resolves* 1-3. We note that WRC-12 revised Resolution 748 (WRC-07) by: 1) removing “aeronautical security” from *considering f*), 2) changing the word “precedence” to “priority” in *recognizing a*), 3) updating the reference to Resolution 114 in *recognizing c*), and 4) updating the reference to Recommendation ITU-R P.526 in *resolves* 3. See Resolution 748 (Rev.WRC-12).

transmissions from aircraft stations in accordance with Resolution 418;<sup>143</sup> and 3) aeronautical security transmissions in accordance with Resolution 419.<sup>144</sup> In addition, WRC-07 revised RR 5.444 and RR 5.444A by limiting the band in which MLS use takes precedence over other uses to the 5030-5091 MHz band (*i.e.*, by deleting the requirement that MLS use takes precedence over other uses of the 5091-5150 MHz band) and revised RR 5.444A by extending the date by four years (to January 1, 2016) after which no new assignments may be made in the 5091-5150 MHz band to FSS earth stations providing feeder links for NGSO MSS systems. Subsequently, WRC-12 modified RR 5.444B by removing aeronautical security transmissions from the list of AMS applications that are authorized to operate in the 5091-5150 MHz band.<sup>145</sup> NTIA recommended that the Commission allocate the 5091-5150 MHz band to the AMS on a primary basis for Federal and non-Federal use, that RR 5.444, RR 5.444B, and footnote USXXX5[1.5] (which we tentatively numbered as US111) be added to the U.S. Table, and that RR 5.444A be added to the non-Federal Table.<sup>146</sup>

54. Proposal. In the *WRC-07 NPRM*, the Commission proposed to allocate the 5091-5150 MHz band to the AMS on a primary basis for Federal and non-Federal use, to limit the use of this AMS allocation to surface applications in the AM(R)S at airports, AMT, and aeronautical security transmissions by adding RR 5.444B to the U.S. Table, and to further limit AMT use to 52 specified flight test areas (with provisions for authorizing additional locations on a case-by-case basis) by adopting new footnote US111.<sup>147</sup> While the Commission proposed to adopt the WRC-07 version of RR 5.444B, it noted that WRC-12 had modified this footnote by removing aeronautical security transmissions from the list of AMS applications authorized to operate in the 5091-5150 MHz band, and requested comment on whether it should implement the WRC-12 version of RR 5.444B.<sup>148</sup> Finally, the Commission proposed to amend the U.S. Table by replacing footnotes US444 and US444A (which contained the pre-WRC-07 text of RR 5.444 and RR 5.444A) with the WRC-07 versions of RR 5.444 and RR 5.444A.<sup>149</sup> The Commission noted that this action would remove the precedence that MLS use currently has over other uses of the 5091-5150 MHz band and would extend the date after which no new assignments may be made to earth stations providing feeder links for NGSO MSS systems to January 1, 2016.<sup>150</sup>

55. Comments. AFTRCC and Boeing were supportive of the Commission's proposal to make the 5091-5150 MHz band available for AMT use.<sup>151</sup> AFTRCC discussed how growth in telemetry data rates has taxed the capacity of existing AMT allocations and threatened the productivity and global competitiveness of U.S. aerospace manufacturers.<sup>152</sup> Although both Boeing and AFTRCC recognize the need to limit AMT use to specified flight test areas, both request that we authorize AMT operations at

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<sup>143</sup> In Resolution 418, WRC-07 specified the conditions for flight test operations in the 5091-5150 MHz band. WRC-12 revised Resolution 418 (WRC-07) by: 1) changing the word "precedence" to "priority" in *recognizing a*), 2) deleting the reference to Resolution 419 and updating the reference to Resolution 748 in *recognizing c*), and 3) adding a missing cross-reference (*i.e.*, § 4 of Annex 1) in *resolves 2*.

<sup>144</sup> In Resolution 419, WRC-07 specified the conditions for aeronautical security operations in the 5091-5150 MHz band.

<sup>145</sup> WRC-12 also deleted Resolution 419, and reflected this change in Resolution 748 (see n.142, *supra*).

<sup>146</sup> See NTIA WRC-07 Recommendations at 4 (recommended text for new footnote USXXX5[1.5], which we are codifying as footnote US111) and 37 (modifications to the 5091-5150 MHz band).

<sup>147</sup> *WRC-07 NPRM*, 27 FCC Rcd at 14626, para. 65.

<sup>148</sup> *Id.*, 27 FCC Rcd at 14626, para. 66.

<sup>149</sup> *Id.* at 14627, para. 67.

<sup>150</sup> *Id.*

<sup>151</sup> See AFTRCC Comments at 1 and Boeing Comments at 4.

<sup>152</sup> See AFTRCC Comments at 1-4.

Boeing's new manufacturing facility in Charleston, South Carolina.<sup>153</sup> AFTRCC also supports referencing the authorized flight test areas in Part 87 of the Commission's rules (the service rules for the Aviation Services), rather than in the Allocation Table.<sup>154</sup>

56. Boeing states that the sensitivity of flight test receive equipment creates a risk of interference when flight test receivers are co-located or operate within the transmission range of the proposed AeroMACS use.<sup>155</sup> Given the critical nature of flight test communications, Boeing urges the FAA to coordinate any AeroMACS deployment with operators of flight test receivers that could suffer harmful interference from co-channel operations in the 5091-5150 MHz band, and asks that the Commission require such coordination at the St. Louis – Lambert International (STL) and Seattle-Tacoma International (SEA) airports.<sup>156</sup> In its reply comments, AFTRCC supports the Boeing request and urges that coordination also be required at four additional airports where AMT for flight testing of aircraft is conducted.<sup>157</sup> Subsequently, NTIA recommended that we urge the operators of AM(R)S and AMT systems at the following six locations to cooperate and exchange information about planned deployments of their respective systems: 1) Boeing Field/King County Intl Airport, Seattle, WA; 2) Lambert-St. Louis Intl Airport, St. Louis, MO; 3) Charleston AFB/Intl Airport, Charleston, SC; 4) Wichita Dwight D. Eisenhower National Airport, Wichita, KS; 5) Roswell Intl Air Center Airport, Roswell, NM; and 6) William P. Gwinn Airport, Jupiter, FL.<sup>158</sup> NTIA also stated that additional airport locations may be addressed on a case-by-case basis. Finally, NTIA recommended that, consistent with No. 4.10 of the ITU *Radio Regulations*, airport surface wireless systems operating in the AM(R)S (*i.e.*, AeroMACS) be given priority in the 5091-5150 MHz band over AMT systems.<sup>159</sup>

57. With regard to AeroMACS, NTIA changed its initial position and sought to have the 5091-5150 MHz band also allocated to the fixed service on a primary basis for Federal and non-Federal use “to meet the needs of airport operations.”<sup>160</sup> NTIA recommended that this fixed service allocation be limited to systems operating in conjunction with stations in the AM(R)S and in accordance with international aeronautical standards, limited to surface applications at airports.<sup>161</sup> NTIA stated that even

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<sup>153</sup> Boeing suggests that its Charleston site (32° 52' 35.85" N, 80° 01' 49.70" W) could be added to footnote US111 as either a separate or combined entry. *See* Boeing Comments at 4-5 and AFTRCC Comments at 4.

<sup>154</sup> *See* AFTRCC Comments at 4, n. 3.

<sup>155</sup> *See* Boeing Comments at 3-4.

<sup>156</sup> *See id.* at 4.

<sup>157</sup> *See* AFTRCC Reply Comments at 1; *see also* Letter from William K. Keane, Counsel for AFTRCC to Marelene S. Dortch, Secretary, FCC (ET Docket No. 12-338, filed January 21, 2015) at 1-2 (AFTRCC corrected the list of prospective AMT sites by revising the name of the Palm Beach-Dade and Seattle-Tacoma International Airport sites to the William P. Gwinn Airport and Boeing Field/King County International Airport, respectively).

<sup>158</sup> *See* NTIA Final Supplement at 2-3.

<sup>159</sup> *See* ITU *Radio Regulations*, No. 4.10 (“Member States recognize that the safety aspects of radionavigation and other safety services require special measures to ensure their freedom from harmful interference; it is necessary therefore to take this factor into account in the assignment and use of frequencies”). AM(R)S is a safety service. *See also* NTIA Final Supplement at 1-3 (NTIA states that in the preparations for WRC-07, the sharing studies between AM(R)S and AMT in the 5091-5150 MHz band were done on the basis of geographic separation, with the understanding that AMT systems would only be operating at remote test ranges. As a result, though a power flux-density limit was adopted to protect AM(R)S from airborne AMT transmissions, no constraints were placed on AM(R)S to protect AMT ground stations.).

<sup>160</sup> *See* NTIA Third Supplement at 1.

<sup>161</sup> Specifically, NTIA included a recommended U.S. footnote that also states that the requirements on, and protection of, the fixed service shall be the same as for the AM(R)S operating in accordance with Resolution 748 (Rev. WRC-12). *See* NTIA Third Supplement at 2.

though the international allocation table does not include the fixed service in this band, the work within the ITU recognized that this service was integral to the systems being studied.<sup>162</sup>

58. Decision. We allocate the 5091-5150 MHz band to the AMS on a primary basis for Federal and non-Federal use, and limit the use of this allocation by adopting new footnote US444B. This footnote restricts the use of the AMS allocation to AM(R)S systems, limited to surface applications at airports that operate in accordance with international aeronautical standards and Resolution 748, and to AMT transmissions from aircraft stations that operate in accordance with Resolution 418. These use restrictions are based on the WRC-12 version of RR 5.444B.

59. In response to NTIA's request, we expressly permit aeronautical fixed communications that are an integral part of the AeroMACS system to be authorized on a primary basis for Federal and non-Federal use.<sup>163</sup> The AeroMACS system has been designed to support both fixed and mobile applications, and is consistent with the intent of the U.S. Proposals and WRC-07's actions.<sup>164</sup> These fixed applications will be part of a larger system of surface applications at airports. Adopting NTIA's request of extending primary status to these fixed applications does not undercut, nor does it fundamentally depart from, our initial proposal. This allocation, together with the AM(R)S allocation, is expected to support the introduction of applications and concepts in air traffic management that are data intensive. This decision is also codified in new footnote US444B.

60. We also adopt our proposal to restrict AMT use of the 5091-5150 MHz band to the 52 flight test areas listed in proposed footnote US111 and to allow additional locations to be authorized for flight testing on a case-by-case basis.<sup>165</sup> At the request of commenters, we authorize the use of this AMT band at Boeing's new facility in Charleston, South Carolina as an additional location.<sup>166</sup> Also, at the request of NTIA, we urge operators of AM(R)S and AMT systems at the six requested airports to cooperate with each other and exchange information about planned deployments of their respective systems.<sup>167</sup> Such cooperation will enhance the prospects for compatible sharing of the band. We further note that other airport locations may be addressed in a similar manner on a case-by-case basis. Finally, at NTIA's request, airport surface wireless systems operating in the AM(R)S, *i.e.*, AeroMACS, will have priority over AMT systems in the 5091-5150 MHz band.

61. We take four additional actions. First, we implement WRC-07's decision to reduce the amount of spectrum in which MLS requirements take precedence over other uses by removing the 5091-5150 MHz band from footnote US444.<sup>168</sup> Second, we extend the date after which no new assignments may be made to FSS earth stations providing feeder links for NGSO MSS systems to January 1, 2016 by revising footnote US444A. Third, with the concurrence of NTIA, we decline to

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<sup>162</sup> See NTIA Third Supplement at 1.

<sup>163</sup> We have simplified NTIA's recommended footnote by paralleling the text of footnote US260.

<sup>164</sup> Specifically, the Commission explained that the proposed new AM(R)S allocation was intended to allow for operations in the 5091-5150 MHz band of "evolving navigation and surveillance applications" that might not conform to the traditional definition of a "radionavigation service." See *WRC-07 NPRM*, 27 FCC Rcd at 14626, para. 65. AeroMACS is one such "evolving navigation and surveillance application."

<sup>165</sup> As stated in para. 55, *supra*, AFTRCC supports referencing the authorized flight test areas in Part 87 of the Commission's rules, rather than in the Allocation Table. However, for administrative convenience, we decline to do so at this time. That is, because we are now considering AMT allocations in the 4400-4940 MHz and 5925-6700 MHz bands, we believe that it simplifies this proceeding to more closely follow the NTIA recommendations.

<sup>166</sup> See para. 55, *supra*.

<sup>167</sup> These locations are: 1) Boeing Field/King County Intl Airport, Seattle, WA; 2) Lambert-St. Louis Intl Airport, St. Louis, MO; 3) Charleston AFB/Intl Airport, Charleston, SC; 4) Wichita Dwight D. Eisenhower National Airport, Wichita, KS; 5) Roswell Intl Air Center Airport, Roswell, NM; and 6) William P. Gwinn Airport, Jupiter, FL.

<sup>168</sup> As a result, the requirements of the MLS will only have precedence over other uses in the 5030-5091 MHz band.

authorize aeronautical security transmissions in the 5091-5150 MHz band. These three actions conform these Commission's rules with the 2012 ITU *Radio Regulations*. Consistent with NTIA's WRC-12 Implementation Recommendations, we codify these decisions by revising the text of footnotes US444 and US444A in the Allocation Table.<sup>169</sup> Fourth, we move the portion of RR 5.367 that was deleted by WRC-12 into footnote US367. This action allows us to update the International Table within Section 2.106, while maintaining the *status quo* in the U.S. Table until such time as we can consider any pertinent comments that may be filed in response to the WRC-12 Notice.<sup>170</sup>

### 3. Deletion of the AMT Allocations from 2310-2320 MHz and 2345-2360 MHz

62. Background. The Wireless Communication Service (WCS) operates in the 2305-2320 MHz and 2345-2360 MHz bands, and the Satellite Digital Audio Radio Service (SDARS) in the 2320-2345 MHz band. Per footnote US339, the 2310-2320 MHz and 2345-2360 MHz bands are also available on a secondary basis to the WCS for Aeronautical Mobile Telemetry (AMT) and associated telecommand operations for flight testing of aircraft, missiles, and their major components. This footnote also states that two frequencies (2312.5 MHz and 2352.5 MHz) are available to Federal and non-Federal stations for telemetry and telecommand operations of expendable and reusable launch vehicles (commercial launch frequencies).

63. Proposal. In the *WRC-07 NPRM*, the Commission proposed to delete the unused non-Federal AMT allocation in the 2310-2320 MHz band from footnote US339, remove non-Federal access to the two commercial launch frequencies (which are not being used), and renumber the revised text as footnote US100.<sup>171</sup> The Commission solicited comment on whether – effective at the conclusion of an appropriate phase-in period (*e.g.*, five years) for the proposed new AMT band (5091-5150 MHz) – it should delete the non-Federal AMT allocation in the 2345-2360 MHz band from footnote US339 or, alternatively, grandfather indefinitely the three existing licenses that authorize AMT operations in that band.<sup>172</sup>

64. Comments. Both Boeing and AFTRCC support deletion of the non-Federal AMT allocations from the 2310-2320 MHz and 2345-2360 MHz bands.<sup>173</sup> Boeing states that the “use of the 2310-2320 MHz band for the Wireless Communications Service makes the band unusable for flight test operations.”<sup>174</sup> AFTRCC states that the non-Federal AMT allocation at 2345-2360 MHz:

“is of limited utility due to its secondary status which precludes its use for safety-related applications. Given that and the impending development of LTE systems in that band, AFTRCC would urge that the allocation be removed. However, recognizing that there are a few (three) licensees which still

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<sup>169</sup> In the *WRC-07 NPRM*, the Commission proposed to replace footnotes US444 and US444A with RR 5.444 and RR 5.444A, respectively. After considering the NTIA WRC-12 Implementation Recommendations, we decline to implement these proposals for administrative convenience. We note that this is not a substantive action, but merely a display change. See Letter from Karl B. Nebbia, Associate Administrator, Office of Spectrum Management, NTIA, to Julius P. Knapp, Chief, Office of Engineering and Technology, ET Docket No. 12-338, filed March 28, 2013 (NTIA WRC-12 Implementation Recommendations) at p. 15. See also Appendix D for the text of footnotes US444, US444A, and US444B.

<sup>170</sup> See Appendix D for the text of footnote US367. In the WRC-12 Notice, we propose to: 1) directly list a primary AMS(R)S allocation in the frequency range 5000-5150 MHz, 2) limit the use of that allocation by footnotes RR 5.443AA and RR 5.443D, and 3) delete footnote US367 from the Allocation Table. See paras. 231-232, *infra*.

<sup>171</sup> The Commission also proposed to remove the 2310-2320 MHz band from various sections in Part 87 of its rules. *WRC-07 NPRM*, 27 FCC Rcd at 14623, para. 57.

<sup>172</sup> *Id.* at 14623, para. 58. We note that of the three licenses identified in the *WRC-07 NPRM*, only two are still active.

<sup>173</sup> See AFTRCC Comments at 4-5 and Boeing Comments at 3.

<sup>174</sup> See Boeing Comments at 3.

hold authorizations for this spectrum, AFTRCC would urge that a reasonable period of time be allowed for a phase-out of the allocation, either five years or the end of each respective licensee's current license, whichever is longer.<sup>175</sup>

65. Decision. We remove the non-Federal AMT allocation from the 2310-2320 MHz band and restrict the availability of the non-Federal AMT allocation in 2345-2360 MHz band to incumbent licensees. We also remove the availability of two unused commercial launch frequencies. To provide for the orderly relocation of incumbent AMT operations from the 2345-2360 MHz band, we establish a transition period that will end on January 1, 2020.<sup>176</sup> We codify these decisions by modifying the text of footnote US339 and by renumbering the resultant text as footnote US100.<sup>177</sup> Because we are adopting the transition plan that is consistent with AFTRCC's recommendation, we agree with Boeing that there will likely be little to no adverse impact on AMT operations.

#### 4. Deletion of the Radionavigation Service Allocation from 24.75-25.05 GHz

66. Background. In the International Table, the 24.75-25.25 GHz band is allocated to the fixed-satellite service (FSS) (Earth-to-space) (*i.e.*, FSS uplinks) on an exclusive basis in Region 2. RR 5.535 states that feeder links for the broadcasting-satellite service (BSS feeder links) have priority over other FSS uses in the 24.75-25.25 GHz band, and that all other FSS uses in the band "shall protect and shall not claim protection from existing and future" BSS feeder link networks, *i.e.*, these additional FSS uses operate on a non-interference and unprotected basis to BSS feeder links.

67. In the U.S. Table, the 24.75-25.05 GHz and 25.05-25.25 GHz bands are allocated to the FSS (Earth-to-space) on a primary basis for non-Federal use. Footnote NG167 states that use of these FSS allocations is restricted to BSS feeder links.<sup>178</sup> The 24.75-25.05 GHz band is also allocated to the radionavigation service (RNS) on a primary basis for Federal and non-Federal use and the 25.05-25.25 GHz band is allocated to the fixed service on a primary basis for non-Federal use.<sup>179</sup>

68. To make the 24.75-25.05 GHz band available for end-user uplinks in the provision of two-way satellite broadband services by BSS licensees, Xanadoo Company and Spectrum Five LLC (Xanadoo/Spectrum Five) requested that the Commission delete the Federal and non-Federal RNS allocations from the 24.75-25.05 GHz band.<sup>180</sup>

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<sup>175</sup> AFTRCC Comments at 5.

<sup>176</sup> This date will provide for a roughly 5-year transition period and is well after the latest expiration date of any current license in the band.

<sup>177</sup> We also remove unneeded text from footnote US339 ("The broadcasting-satellite service (sound) during implementation should also take cognizance of the expendable and reusable launch vehicle frequencies 2312.5 and 2352.5 MHz, to minimize the impact on this mobile service use to the extent possible."). We note that these frequencies are both within segments of the original SDARS allocation that were reallocated for terrestrial use (2305-2320 and 2345-2360 MHz) and that are now licensed to WCS operators. Therefore, the deletion of this text clarifies the footnote without affecting any user. See Appendix D for the text of footnote US100.

<sup>178</sup> 47 C.F.R. § 2.106. There are existing satellite authorizations and pending applications in this service. See The Establishment of Policies and Service Rules for the Broadcasting-Satellite Service at the 17.3-17.7 GHz Frequency Band and at the 17.7-17.8 GHz Frequency Band Internationally, and at the 24.75-25.25 GHz Frequency Band for Fixed Satellite Services Providing Feeder Links to the Broadcasting-Satellite Service and for the Satellite Services Operating Bi-directionally in the 17.3-17.8 GHz Frequency Band, *Second Report and Order*, IB Docket No. 06-123, 26 FCC Rcd 8927, 8931 n.23 (2011).

<sup>179</sup> The radionavigation service is a radiodetermination service for the purpose of radionavigation. 47 C.F.R. § 2.1(c). On February 22, 2012, there were 109 call signs in the ULS that authorized operations in the 25.05-25.25 GHz band under Part 101 Subpart G of the Commission's rules.

<sup>180</sup> See Petition for Rulemaking to Establish Rules Permitting Blanket Licensing of Two-Way Earth Stations With End-User Uplinks in the 24.25-25.05 GHz band, IB Docket No. 06-123, filed April 16, 2010 (Xanadoo/Spectrum (continued....))

69. Proposal. In the *WRC-07 NPRM*, the Commission noted that the 24.75-25.05 GHz band is not allocated to the RNS in the International Table and that the RNS allocation in this band is unused in the United States, and solicited comment on whether there is any planned use that would justify retention of the RNS allocation in the U.S. Table.<sup>181</sup> The Commission stated that if it decides to remove the RNS allocation from the 24.75-25.05 GHz band, it would amend NG167 by employing the RR 5.535 text in the 24.75-25.05 GHz band,<sup>182</sup> remove the Part 87 cross-reference from the Allocation Table, and remove the 24.75-25.05 GHz band from Sections 87.173(b) and 87.187(x). Accordingly, the Commission sought comment on what actions it should take in this regard.

70. Comments. DirecTV, LLC (DirecTV), the only commenter on this issue, urges the Commission to implement its proposals to delete the RNS allocation from the 24.75-25.05 GHz band and make associated conforming changes to the Commission's rules.<sup>183</sup> It asserts that the additional capacity in this band that would result could be used enhance its existing direct-to-home multichannel video service, and more generally, will serve the public interest by conforming the Commission's frequency allocation to the International Table and eliminating any potential conflict with licensees in the 17 and 24 GHz BSS bands.<sup>184</sup> DirecTV further asserts that given that there are no RNS systems operating in the band today and no demonstrated need for such operations in the future, there are no offsetting costs to modifying the allocation as proposed.<sup>185</sup>

71. Decision. We are removing the RNS allocation in the 24.75-25.05 GHz band from the Federal and non-Federal Tables. As a result of this action, the 300 megahertz of RF spectrum contained within this band is allocated exclusively to the FSS (Earth-to-space) for non-Federal use.<sup>186</sup> We are also expanding the permitted uses of this FSS allocation from BSS feeder links to all FSS uses. Consistent with the international use limitation contained in RR 5.535, we are providing BSS feeder links with "priority" over all other FSS uses, *i.e.*, all other FSS uses "shall protect and shall not claim protection from existing and future" BSS feeder link networks. We codify this decision in the Allocation Table by revising the text of footnote NG167 to parallel the text of RR 5.535 for the 24.75-25.05 GHz band, and by renumbering the resulting footnote as NG535 (numbering based on RR 5.535).<sup>187</sup> In addition, we remove the 24.75-25.05 GHz band from Sections 87.173(b) and 87.187(x) of the Commission's rules, and consequently, delete the Part 87 cross-reference for this band from the Allocation Table. While we adopt

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Five Petition), available at <http://fjallfoss.fcc.gov/ecfs/document/view?id=7020409944>, at 6. In the *WRC-07 NPRM*, the Commission also noted but decided not to seek comment in this proceeding on an additional request by Xanadoo/Spectrum Five to establish rules permitting blanket licensing of two-way earth stations with end-user uplinks in the 24.75-25.05 GHz band. See *WRC-07 NPRM*, 27 FCC Rcd 14637, para. 103, n.193 (stating that "these issues can best be addressed in a focused rulemaking proceeding").

<sup>181</sup> The Commission also noted that NTIA had not identified any operational radar use in the 24.75-25.25 GHz band. *WRC-07 NPRM*, 27 FCC Rcd at 14638, para. 104.

<sup>182</sup> Under the proposed revision of footnote NG167, BSS feeder links operating on frequencies in the 24.75-25.05 GHz band would have priority over other FSS uplink uses. Any other FSS uses (*i.e.*, non-BSS feeder link uses) would be required to protect, and could not claim protection from, existing and future BSS feeder-link operations. As an administrative matter, we would also renumber footnote NG167 as NG535 (based on RR 5.535).

<sup>183</sup> See DirecTV Comments at 1-3.

<sup>184</sup> DirecTV also states that it is licensed for two BSS satellites which use the 24.75-25.25 GHz band for Earth-to-space feeder links. See DirecTV Comments at 1-2.

<sup>185</sup> *Id.*

<sup>186</sup> An additional 200 megahertz of spectrum in this range (25.05-25.25 GHz) remains allocated to the FSS and FS on a co-primary basis for non-Federal use.

<sup>187</sup> We are maintaining the existing text from footnote NG167 for the 25.05-25.5 GHz band, *i.e.*, the use of the 25.05-25.25 GHz band by the FSS (Earth-to-space) is limited to BSS feeder links. See Appendix D for the text of footnote NG535.

in part the Xanadoo/Spectrum Five proposal with respect to removal of the unused RNS allocation, we find that no further action on the other elements of their petition is warranted at this time. If, in the future, requests for licensing or other market developments suggest a demand exists for additional FSS uses of the 24.75-25.05 GHz band, we will initiate a separate rulemaking proceeding to examine whether any specific rules are necessary to support such uses consistent with the priority afforded to BSS feeder links in this band.

## 5. Updates to Part 87 Aviation Services Rules

72. Consistent with the changes proposed to the Allocation Table in the *WRC-07 NPRM*, the Commission proposed to make amendments to nine rule sections in Part 87 of its rules.<sup>188</sup> AFTRCC, the only party to comment on these proposals, supports the Commission's proposal to add AFTRCC coordination duties for the 5091-5150 MHz band.<sup>189</sup>

73. Decision. We adopt our proposals. Specifically, we amend Part 87 of the Commission's rules to bring the new AMT allocation in the 5091-5150 MHz band into immediate effect and to remove all references to the unused secondary AMT allocation in the 2310-2320 MHz band.<sup>190</sup> We also amend Part 87 by removing all references to two previously deleted AMT bands (1525-1535 MHz and 2320-2345 MHz) and by listing a previously allocated AMT band (2390-2395 MHz, generally shown as part of the larger 2345-2395 MHz band) in all appropriate rule sections.<sup>191</sup> As a result of this action, the correct AMT bands – 1435-1525 MHz, 2345-2360 MHz (until the conclusion of the transition period), 2360-2395 MHz, and 5091-5150 MHz – will be specified throughout Part 87. In addition, we amend Part 87 of the Commission's rules as follows:

- Add the term “flight telemetering mobile station” to the list of definitions in Section 87.5, use this term in the affected rules, clarify that five frequencies in the 1435-1525 MHz band (1444.5, 1453.5, 1501.5, 1515.5, and 1524.5 MHz) are shared with flight telemetering mobile stations “on a co-equal basis” with AMT operations, and renumber footnote US78 as US343.
- Amend Section 87.133(f) by specifying that the carrier frequency tolerance of all transmitters that operate in the 5091-5150 MHz band is 0.005 percent, and revise the existing text to specify that the carrier frequency tolerance of all transmitters that operate in the 1435-1525 MHz or 2345-2395 MHz band is 0.002 percent.
- Update the AMT bands listed in Section 87.137(a), note 8, Section 87.139, and Section 87.173(b).
- Amend Section 87.173(b) by revising the entry for the “5000-5250 MHz” band to read “5030-5150 MHz”<sup>192</sup> and by adding an entry for the “24450-24650 MHz” band in the frequency table. We also specify that the 24450-24650 MHz band is available under Subpart F (Aircraft Stations) and Subpart Q (Stations in the Radiodetermination Service), restrict the use of this band to aircraft stations and radionavigation land stations, and list aeronautical radionavigation under the “Remarks” heading.

<sup>188</sup> *WRC-07 NPRM*, 27 FCC Rcd at 14627-29, paras. 68-77 and Table 4.

<sup>189</sup> See AFTRCC Comments at 5.

<sup>190</sup> We delete the AMT allocation from the 2310-2320 MHz band in para. 65, *supra*.

<sup>191</sup> *WRC-07 NPRM*, 27 FCC Rcd at 14627, n.144.

<sup>192</sup> In the *WRC-07 NPRM*, 27 FCC Rcd at 14627, para. 72, the Commission proposed to Section 87.173(b) by revising the entry for the “5000-5250 MHz” band to read “5030-5091 MHz.” However, during the normal coordination process, the FAA requested that the MLS band be revised to read “5030-5150 MHz.” We note that this request is consistent with footnote US444 (*i.e.*, the 5030-5150 MHz band is to be used for the operation of the international standard system (microwave landing system) for precision approach and landing), and therefore, amend Sections 87.173(b) and 87.475(b)(11) (discussed in the last bullet within this paragraph) to provide for consistency in the rules.

- Update the AMT bands listed in Section 87.187(p), by listing the 2360-2395 MHz (primary allocation) and 2345-2360 MHz (secondary allocation) bands and the three frequencies (2364.5 MHz, 2370.5 MHz, and 2382.5 MHz) that may be assigned for telemetry and associated telecommand operations of expendable and re-usable launch vehicles, whether or not such operations involve flight testing.
- Amend Section 87.303(d) to make the 5091-5150 MHz band available for aeronautical mobile telemetry. Specifically, we insert introductory language listing the available bands; add new text to paragraph (d)(2) to specify use of the 5091-5150 MHz band and to cross-reference footnote US111; and move and update the text that is currently listed in paragraph (d)(2) to paragraph (d)(3).
- Amend Section 87.475(b)(11) by revising the frequency band that can be used for microwave landing systems (MLS) from “5000-5250 MHz” to “5030-5150 MHz”<sup>193</sup> and Section 87.475(b)(14) by revising a frequency band that can be used for land-based radionavigation aids that operate with airborne radionavigation devices from “24,250-25,250” to “24,450-24,650” MHz.<sup>194</sup>

74. The Commission certifies frequency coordinators, considers petitions seeking review of coordinator actions, and engages in oversight of coordinator actions and practices.<sup>195</sup> AFTRCC is the “frequency advisory committee” specified in Section 87.305(a)(1) of the Commission’s rules.<sup>196</sup> As a consequence of our actions in this proceeding, and at its explicit request,<sup>197</sup> we note that AFTRCC’s authority to act as the non-Federal coordinator for flight test frequencies now extends to the 1435-1525 MHz, 2360-2395 MHz, and 5091-5150 MHz bands, and until the conclusion of the transition period, to the 2345-2360 MHz band.<sup>198</sup>

### C. Protecting Passive Sensors from Unwanted Emissions and In-Band Active Services

75. WRC-07 adopted provisions to protect passive sensors from the interference caused by the operation of certain radiocommunication services that: 1) transmit in two bands (10.6-10.68 GHz and 36-37 GHz) that are allocated to the Earth exploration-satellite service (EESS) (passive) (*i.e.*, in-band active services); and 2) transmit in frequency bands that are near or adjacent to five EESS (passive) bands (1400-1427 MHz, 23.6-24 GHz, 31.3-31.5 GHz, 50.2-50.4 GHz, and 52.6-54.25 GHz).<sup>199</sup> Specifically,

<sup>193</sup> See n.192, *supra*.

<sup>194</sup> The Commission recently corrected Section 87.475 by reinserting inadvertently deleted text as paragraphs (b)(10) through (b)(14). Amendment of the Commission’s Rules Governing Certain Aviation Ground Station Equipment, WT Docket No. 10-61, *Report and Order*, 28 FCC Rcd 2693, 2702, para. 24 (2013).

<sup>195</sup> The Commission has delegated this function to the Wireless Telecommunications Bureau. 47 C.F.R. § 0.131(m).

<sup>196</sup> In 1969, the FCC recognized AFTRCC as the Frequency Coordinating Advisory Committee for non-Federal flight test telemetry station assignments in the band 1435-1525 MHz, and in 1984, extended this recognition to the 2310-2320, and 2345-2390 MHz bands. See *NTIA Manual*, Section 8.3.17. See also AFTRCC’s website for information titled “About AFTRCC,” which states that “AFTRCC is recognized by the FCC and NTIA as the non-government coordinator for assignment of flight test frequencies (by the FCC in the case of HF and VHF voice frequencies and by the FCC and NTIA in the case of the telemetry frequencies, 1435-1535 MHz and 2310-2390 MHz);” (available at <http://www.aftrcc.org/pages/organization.php>). See, e.g., 47 C.F.R. Section 27.73(a) (which names AFTRCC as the coordinator for the assignment of flight test frequencies in the 2360-2390 MHz band).

<sup>197</sup> See AFTRCC Comments at 5 (stating that it is prepared to frequency coordinate the 5091-5150 MHz band).

<sup>198</sup> See Appendix D for the text of Section 87.303(d), which we revised in para. 73, *supra*.

<sup>199</sup> The EESS is a radiocommunication service between earth stations and one or more space stations, which may include links between space stations, in which: 1) information relating to the characteristics of the Earth and its natural phenomena, including data relating to the state of the environment, is obtained from active sensors or passive sensors on Earth satellites; 2) similar information is collected from airborne or Earth-based platforms; 3) such information may be distributed to earth stations within the system concerned; and 4) platform interrogation may be (continued....)

WRC-07 added RR 5.338A to the International Table and adopted Resolution 750.<sup>200</sup> In this section, we adopt new rules to protect passive sensors from certain non-Federal services that operate in the 1435-1452 MHz, 10.6-10.68 GHz, 22.55-23.55 GHz, and 31-31.3 GHz bands.<sup>201</sup>

### 1. Aeronautical Mobile Telemetry in the 1435-1452 MHz Sub-band

76. **Background.** In the U.S. Table, the 1435-1525 MHz band is allocated to the mobile service on a primary basis for Federal and non-Federal use, restricted to aeronautical telemetry and associated telecommand operations for flight testing of aircraft and missiles, or their major components (*i.e.*, AMT).<sup>202</sup> The 1400-1427 MHz band is a passive band (*i.e.*, no transmissions are authorized in this band) that is allocated, *inter alia*, to the EESS (passive). For aeronautical telemetry stations that operate in the 1435-1452 MHz sub-band, WRC-07 adopted a recommended unwanted emissions level of -28 dBW in the 1400-1427 MHz passive band.<sup>203</sup> NTIA recommends that we urge Federal and non-Federal operators of AMT stations in the 1435-1452 MHz sub-band to take all reasonable steps to ensure that their stations' unwanted emissions power not exceed WRC-07's recommended level. Currently, the Commission's rules for Aviation Services (Part 87) require that telemetry and telecommand operations in the 1435-1525 MHz band attenuate their emissions below 1434 MHz to at least -55 dBW/3 kHz, which is equivalent to approximately -15.5 dBW/27 MHz.<sup>204</sup>

77. **Proposal.** The Commission proposed to encourage Federal and non-Federal operators of AMT stations that transmit in the 1435-1452 MHz sub-band to comply with WRC-07's recommended unwanted emissions level of -28 dBW/27 MHz in the 1400-1427 MHz band by adding footnote US338A to the U.S. Table.<sup>205</sup> The Commission stated that if it adopted footnote US338A, it would also amend Section 87.139 to reflect that decision in Part 87 of the Commission's rules. Additionally, it requested

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included. 47 C.F.R. § 2.1(c). This service has primary and secondary allocations in several higher frequency bands (UHF and above), which in some cases includes feeder links necessary for its operation.

<sup>200</sup> WRC-12 revised RR 5.338A and Resolution 750. We address the WRC-12 revisions in paras. 245-249, *infra*. Currently, RR 5.338A reads as follows: In the bands 1350-1400 MHz, 1427-1452 MHz, 22.55-23.55 GHz, 30-31.3 GHz, 49.7-50.2 GHz, 50.4-50.9 GHz, 51.4-52.6 GHz, 81-86 GHz and 92-94 GHz, Resolution 750 (Rev. WRC-12) applies. See ITU *Radio Regulations*, Resolution 750 (Rev. WRC-12).

<sup>201</sup> In Section IV.D.3, "Rulemaking Proposals that Did Not Receive Any Specific Comments," *infra*, we also adopt rules to protect passive sensors from certain non-Federal services that operate in the 1390-1395 MHz, 1427-1435 MHz, 36-37 GHz, 49.7-50.2 GHz, 50.4-50.9 GHz, and 51.4-52.6 GHz bands. See paras. 124-133 and 135-137, *infra*.

<sup>202</sup> The mobile service is a radiocommunication service between mobile and land stations or between mobile stations. (A mobile station is a station intended to be used while in motion or during halts at unspecified points and a land station is a station not intended to be used while in motion.) 47 C.F.R. § 2.1(c). Five frequencies are shared with flight telemetry mobile stations. Passive research is also conducted in this and other bands. 47 C.F.R. § 2.106, footnotes 5.341 and US78.

<sup>203</sup> *WRC-07 Final Acts*, Resolution 750, Table 1-2.

<sup>204</sup> 47 C.F.R. § 87.139(e), (f). See also 47 C.F.R. §§ 87.303(d)(2), 87.131, and 87.137(a) n.8. Because the resolution bandwidths ( $B_{RES}$ ) (*i.e.*, 27, 100, or 200 megahertz) used in the unwanted emissions limits/levels of ITU Resolution 750 are wider than the reference resolution bandwidths ( $B_{REF}$ ) used in the Commission's rules (*i.e.*, 3 kilohertz, 4 kilohertz, or 1 megahertz), to compare the Commission's existing unwanted emissions limits with WRC-07's limits/levels, we use a correction factor of  $10 \log_{10}[(B_{RES} \text{ in megahertz})/(B_{REF} \text{ in megahertz})]$  dB, which is added to the Commission's unwanted emissions limits, to express the relevant per device unwanted emissions limit in the Commission's rules over a wider bandwidth. See 47 C.F.R. § 74.637(c)(3).

<sup>205</sup> The effect of NTIA's recommendation would be that operators of AMT stations transmitting in the 1435-1452 MHz sub-band would be urged to attenuate their stations' unwanted emissions in the 1400-1427 MHz band by an additional 12.31 dB from the existing limit of -15.69 dBW/27 MHz (shown in our rules as -55 dBW/3 kHz) to -28 dBW/27 MHz.

comment on whether AMT operators that cannot meet WRC-07's recommended unwanted emissions level should be required to meet their operational requirements in the 1452-1525 MHz sub-band prior to operating in the 1435-1452 MHz sub-band.<sup>206</sup>

78. Comments. AFTRCC and Boeing, which were the only commenters to address this issue, do not oppose NTIA's recommendation to encourage AMT stations transmitting in the 1435-1525 MHz band to take all reasonable steps to limit their out-of-band emissions in the 1400-1427 MHz band to -28 dBW/27 MHz.<sup>207</sup> AFTRCC states that "[w]hile the recommended NTIA limit is intended to provide greater protection for passive services over what is currently in the rules, in many, and perhaps most, cases, AMT equipment in the field already provides this additional attenuation."<sup>208</sup> However, AFTRCC and Boeing both state that there is no justification for requiring that AMT operators access the 1435-1452 MHz sub-band only after first satisfying their spectrum requirements above 1452 MHz.<sup>209</sup> Subsequently, NTIA requested that we require that AMT stations that do not meet WRC-07's recommended unwanted emissions limit attempt to use the 1452-1525 MHz sub-band first before operating in the 1435-1452 MHz sub-band.<sup>210</sup>

79. Decision. We adopt our proposal by adding new footnote US338A to the Allocation Table. Under footnote US338A, we encourage operators of aeronautical telemetry stations in the 1435-1452 MHz sub-band to take all reasonable steps to ensure that their AMT transmitters' unwanted emissions power does not exceed -28 dBW/27 MHz in the 1400-1427 MHz band. In addition, we require operators of AMT stations that do not meet WRC-07's recommended unwanted emissions level first attempt to operate in the 1452-1525 MHz sub-band before operating in the 1435-1452 MHz sub-band. Given that the record indicates that most AMT operations now meet the WRC-07 unwanted emissions level, this requirement should not impact most AMT operations. We also amend Section 87.139 by adding paragraph (m) to reflect the text of footnote US338A.<sup>211</sup>

## 2. Fixed Stations in the 10.6-10.68 GHz Band

80. Background. In the U.S. Table, the 10.55-10.6 GHz and 10.6-10.68 GHz bands are allocated to the fixed service (FS) on a primary basis for non-Federal use. The 10.6-10.68 GHz band is also allocated to the Earth exploration-satellite service (EESS) (passive) for Federal and non-Federal use.<sup>212</sup> In order to permit both passive sensors and fixed stations to operate in the 10.6-10.68 GHz band, the Commission adopted footnote US265, which requires that fixed stations not exceed an EIRP of 40 dBW and also requires that the power delivered to the antenna of a fixed station not exceed -3 dBW

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<sup>206</sup> *WRC-07 NPRM*, 27 FCC Rcd at 14650, para. 136.

<sup>207</sup> See AFTRCC Comments at 6 and Boeing Comments at 5-6. We note that while the term "out-of-band emissions" is sometimes used when referring to emissions outside of the frequency bands in which a device transmits, we use the term "unwanted" emissions, where appropriate throughout this Report and Order, to describe the emissions outside of the necessary bandwidth of the transmitting system.

<sup>208</sup> See AFTRCC Comments at 6.

<sup>209</sup> See AFTRCC Comments at 6 and Boeing Comments at 5-6.

<sup>210</sup> See NTIA Final Supplement at 3.

<sup>211</sup> See Appendix D for the text of footnote US338A and Section 87.139(m).

<sup>212</sup> In addition, the 10.6-10.68 GHz band is allocated on a primary basis to the space research service (SRS) (passive), and per footnote US310, to the radio astronomy service (RAS), for Federal and non-Federal use. Footnote US310 also states that the RAS will not receive protection from fixed stations that are licensed to operate in the one hundred most populous urbanized areas, and that the list of observatories operating in this band is contained in footnote US131. The proposals in the *WRC-07 NPRM* do not directly impact SRS or RAS use of the 10.6-10.68 GHz band.

per 250 kilohertz.<sup>213</sup>

81. Prior to WRC-07, RR 5.482 limited fixed stations that transmit in the 10.6-10.68 GHz band to a maximum EIRP of 40 dBW and also limited the power delivered to the antenna of these fixed stations to -3 dBW.<sup>214</sup> WRC-07 revised RR 5.482 to remove the 40 dBW EIRP limit and adopted RR 5.482A, which states that Resolution 751 applies to the 10.6-10.68 GHz band. Resolution 751 urges administrations to comply with specified sharing criteria when bringing into use fixed stations and passive sensors that operate in the 10.6-10.68 GHz band.<sup>215</sup> NTIA subsequently recommended that we amend footnote US265 in furtherance of the WRC-07 actions, *e.g.*, that we urge operators of stations of point-to-point systems to limit the maximum transmitter power supplied to the input to the transmitting antenna to -15 dBW and the transmitting antenna elevation angle to a maximum of 20°, and that we remove the 40 dBW EIRP limit.<sup>216</sup>

82. Proposal. The Commission proposed to revise footnote US265 in a manner generally consistent with NTIA's recommendations.<sup>217</sup> Specifically, the Commission proposed to require that the power delivered to the antenna of a fixed stations transmitting in the 10.6-10.68 GHz band not exceed an antenna input power of -3 dBW (regardless of the bandwidth that is authorized); to add WRC-07's recommended sharing criteria for fixed point-to-point systems to this footnote;<sup>218</sup> to urge licensees to employ automatic transmitter power control (ATPC);<sup>219</sup> to permit licensees holding a valid authorization as of the effective date of the Report and Order in this proceeding to continue to operate as authorized; and to renumber footnote US265 as US482.<sup>220</sup> The Commission also stated that if it adopted proposed footnote US482, it would amend Section 101.111 of its rules to reflect that decision.<sup>221</sup>

83. The Commission also analyzed licensing records in the band and requested comment on whether it should adopt additional measures to protect passive receivers.<sup>222</sup> Specifically, the Commission

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<sup>213</sup> 47 C.F.R. § 2.106. The maximum allowable EIRP per polarization for fixed stations in the 10.6-10.68 GHz band is 40 dBW. 47 C.F.R. § 101.113(a).

<sup>214</sup> We note that RR 5.482 does not apply in certain (35) countries in ITU Regions 1 and 3 and that the text of footnote US265 contains technical restrictions that generally mirror the pre-WRC-07 text of RR 5.482.

<sup>215</sup> We note that, while WRC-12 revised Resolution 751, it did not revise the sharing criteria for the 10.6-10.68 GHz band. *See ITU Radio Regulations*, Resolution 751 (Rev. WRC-12), resolves 1. In particular, Tables 2 and 3 of Resolution 751 list the parameters and values for fixed stations of point-to-point and point-to-multipoint systems, respectively.

<sup>216</sup> *See* NTIA WRC-07 Implementation Recommendations at 2 (modification of footnote US265). Our AMT rules do not currently address transmitting antenna elevation angles.

<sup>217</sup> *WRC-07 NPRM*, 27 FCC Rcd at 14654, para. 147.

<sup>218</sup> Because the Commission relocated the only fixed point-to-multipoint use from the 10.6-10.68 GHz band in 1993, it declined to propose adding the requested advisory language for point-to-multipoint systems and instead proposed to prohibit point-to-multipoint use of the 10.6-10.68 GHz band.

<sup>219</sup> In a radio employing ATPC, the transmit power is reduced to a level needed for reliable communications. When the receiver detects a reduction in signal level, a control signal is sent to the far end transmitter, instructing it to increase the power output to compensate for the signal reduction. The power output is limited to the licensed (maximum) transmit power. 47 C.F.R. § 101.3.

<sup>220</sup> *WRC-07 NPRM*, 27 FCC Rcd at 14654, para. 147.

<sup>221</sup> *Id.*

<sup>222</sup> Recent licensing information shows that at least 96 percent of all FS stations in the 10.6-10.68 GHz band supply not more than -3 dBW of transmitter power to the antenna and that approximately 21 percent of these stations supply not more than -15 dBW (31.6 mW) of transmitter power. In addition, while only 41 percent of these transmitters list an elevation angle, essentially all of these transmitters (all but two of 2,689) have an elevation angle of 20° or less. *WRC-07 NPRM*, 27 FCC Rcd at 14654, para. 148.

asked whether it should prohibit fixed stations with main beam elevation angles greater than 20° from transmitting on frequencies in the 10.6-10.68 GHz band; require fixed stations using paired frequencies to transmit on frequencies in the 10.6-10.68 GHz band using the lower elevation angle; and require the use of ATPC.<sup>223</sup> In addition, the Commission observed that many applicants will continue to request -3 dBW as the maximum transmitter power delivered to the antenna, and it requested comment on whether it should urge licensees to limit the off-axis EIRP above 20° to -10 dBW.<sup>224</sup> Finally, the Commission requested comment on whether it should remove or revise the 40 dBW EIRP limit.<sup>225</sup>

84. **Comments.** We received comments from the National Academy of Sciences, through the National Research Council's Committee on Radio Frequencies (hereinafter, CORF) and Comsearch. CORF supports the adoption of rules that would: 1) prohibit fixed stations with main beam elevation angles greater than 20° from transmitting on frequencies in the 10.6-10.68 GHz band; 2) require fixed stations using paired frequencies to transmit on frequencies in the 10.6-10.68 GHz band using the lower elevation angle; and 3) require the use of ATPC.<sup>226</sup> CORF states that the first two proposals deal with transmit angles, which correspond to local Earth incidence angles of the main beams on most conical-scanning spaceborne microwave radiometers, and that these actions would therefore protect passive sensors that use this band. CORF states that the use of ATPC would reduce the required transmit power most of the time, and would therefore have a significant positive effect on reducing radio frequency interference. Regarding the proposal to urge licensees to limit off-axis EIRP above 20° to -10 dBW, CORF deems this level to be too high and recommends that we follow the recommendations in Report ITU-R RS.2096.<sup>227</sup>

85. Comsearch opposes the adoption of a requirement that fixed stations using paired frequencies transmit on frequencies in the 10.6-10.68 GHz band using the lower elevation angle. Comsearch argues that such a requirement would frustrate efficient frequency planning and serve to limit the capacity and growth of point-to-point microwave systems, while in return “do[ing] almost nothing to protect EESS.”<sup>228</sup> It argues that the only way to provide “significant benefit” to EESS is by prohibiting the use of elevation angles above 20 degrees.<sup>229</sup>

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<sup>223</sup> The Commission noted that interference simulations indicate that the interference power level would increase by approximately 8 dB (from -125 to -117 dBW) when the elevation angles of the main beam of fixed stations are increased from 20° to 25°. Further, we note that the ITU-R Report states that “FS elevations above 5° are rare in actual operating systems.” See Report ITU-R [RS.2096](#), figure 23, p. 38; first Note, p. 39. Licensing information also shows that 98 percent of the transmitters listing an elevation angle have an elevation angle of 5° or less. *Id.*

<sup>224</sup> *Id.* Note 3 of Resolution 751 reads as follows: “In the case of point-to-point fixed service used for unidirectional transmissions for broadcasting applications, the maximum transmitter power at the antenna port may be increased up to -3 dBW. For such applications, administrations are urged to limit the off-axis EIRP above 20° elevation to a level of -10 dBW.” See ITU Resolution 751, Annex 1, Table 2, n.3.

<sup>225</sup> *WRC-07 NPRM*, 27 FCC Rcd at 14654, para. 149.

<sup>226</sup> See CORF's *ex parte* Reply Comments (CORF Reply Comments) at 8-9.

<sup>227</sup> CORF Reply Comments at 9, *citing* Report ITU-R RS.2096 at pp. 32-35.

<sup>228</sup> Comsearch explains that, in frequency planning for point-to-point networks, it is desirable to follow a matched high/low frequency plan at each site. A matched high/low plan at a site means that all the transmitters operate in one half of the band (10.550-10.615 GHz) and all the receivers operate in the other half of the band (10.615-10.680 GHz), or vice versa. While a receiver could be exposed to a high interference level from a co-located transmitter, the matched high/low plan provides frequency separation so the transmitter and receiver filtering can mitigate the exposure and minimize the potential for interference. Following a matched high/low plan also maximizes the number of links and channels that can be used at each site thus allowing for increased capacity and growth.

<sup>229</sup> *Id.* Comsearch also notes that 10 GHz point-to-point antennas rarely use elevation angles above 5 degrees.

86. Decision. We adopt the proposed changes to footnote US265. Specifically, we restrict the transmitter power delivered to the antenna to not more than -3 dBW, add WRC-07's recommended sharing criteria for fixed point-to-point systems (and explicitly restrict use of the 10.6-10.68 GHz band to fixed point-to-point systems), urge (but not require) the use of ATPC, and permit licensees holding a valid authorization as of the effective date of this Report and Order to continue to operate as authorized. Based on the record, we find we should also restrict the elevation angle of the antenna main beam of fixed stations that transmit in the 10.6-10.68 GHz band to a maximum of 20°, instead of simply urging operators of fixed stations to apply this limit. Doing so will ensure that EESS operations are afforded protection, and does not appear to impose a significant burden on existing operations. We do not adopt the other proposals that were discussed in the *WRC-07 NPRM*. Specifically, we find that making ATPC use mandatory would impose costs that are unwarranted, given our decision to adopt a 20° elevation angle limit. We also find compelling Comsearch's arguments about the burdens associated with requiring fixed stations using paired frequencies to transmit on frequencies in the 10.6-10.68 GHz band using the lower elevation angle. By contrast, our decision to adopt of a maximum 20° elevation angle limit will provide benefits to EESS operations with little or no effect on 10.6-10.68 GHz band licensees.

87. We codify this decision by revising the text of footnote US265 and renumbering this footnote as US482. We amend Section 101.111 by adding new paragraph (d)(1) to reflect this decision in Part 101 of the Commission's rules.<sup>230</sup>

### 3. Inter-Satellite Links in the 22.55-23.55 GHz Band

88. Background. In the U.S. Table, the 22.55-23.55 GHz band is allocated to the fixed service, the mobile service, and the inter-satellite service (ISS) on a primary basis for Federal and non-Federal use. Footnote US278 states that non-geostationary satellite orbit (NGSO) ISS systems may operate in this band on a secondary basis to geostationary inter-satellite links. The 23.6-24 GHz band is allocated to the Earth exploration-satellite service (EESS) (passive), radio astronomy service, and space research service (passive) on a primary basis for Federal and non-Federal use.<sup>231</sup> In addition, Section 25.202(f)(3) sets forth the unwanted emissions limit in the 23.6-24 GHz band for satellite operations in the 22.55-23.55 GHz band.<sup>232</sup>

89. In Resolution 750, WRC-07 adopted mandatory unwanted emissions limits of -36 dBW in any 200 megahertz of the 23.6-24 GHz EESS (passive) band for NGSO ISS systems that operate in the 22.55-23.55 GHz band for which complete advance publication information is received by the ITU (*i.e.*, its Radiocommunication Bureau) before January 1, 2020, and -46 dBW in any 200 megahertz of the 23.6-24 GHz EESS (passive) band for NGSO ISS systems that operate in the 22.55-23.55 GHz band for which complete advance publication information is received by the ITU on or after January 1, 2020.<sup>233</sup> NTIA recommended that the Commission adopt these mandatory unwanted emissions limits.<sup>234</sup>

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<sup>230</sup> See Appendix D for the text of footnote US482 and Section 101.111(d)(1).

<sup>231</sup> The SRS is a radiocommunication service in which spacecraft or other objects in space are used for scientific or technological research purposes. 47 C.F.R. § 2.1(c).

<sup>232</sup> 47 C.F.R. § 25.202(f)(3). Except for SDARS terrestrial repeaters, the mean power of unwanted emissions in the passive band (23.6-24 GHz) shall be attenuated below the mean output power of the transmitter as follows:  $43 + 10 \log_{10}(\text{transmitter power in watts})$  dB in any 4 kilohertz band (-43 dBW/4 kHz), the center frequency of which is removed from the assigned frequency by more than 250 percent of the authorized bandwidth, which is equivalent to an emissions limit of approximately 4 dBW/200 MHz. *Id.* See n.204, *supra*, for the methodology used to express the existing unwanted emissions limit in Section 25.202(f)(3) over a wider bandwidth.

<sup>233</sup> See ITU Resolution 750, Table 1-1.

<sup>234</sup> See NTIA WRC-07 Recommendations at 5, footnote USXXX [1.20/ISS 23]. During the coordination process, NTIA revised its recommended text to more closely follow Resolution 750 (WRC-07).

90. Proposal. In the *WRC-07 NPRM*, the Commission proposed to implement WRC-07's mandatory unwanted emissions limits for all new NGSO ISS systems that operate in the 22.55-23.55 GHz band by adding footnote US145 to the Allocation Table. The Commission stated that if these limits are adopted, then new NGSO ISS satellites authorized to transmit in that band for which complete advance publication information is received by the ITU's Radiocommunication Bureau prior to January 1, 2020, would be required to attenuate their unwanted emissions in the 23.6-24 GHz band from the Commission's existing limit of -43 dBW/4 kHz (4 dBW/200 MHz) by an additional 40 dB (from 4 to -36 dBW/200 MHz). Thereafter, new NGSO ISS satellites authorized to transmit in the band for which complete advance publication information is received by the ITU's Radiocommunication Bureau on or after January 1, 2020, would be required to attenuate their unwanted emissions in the 23.6-24 GHz band to -46 dBW/200 MHz.<sup>235</sup> The Commission also stated that if it adopted proposed footnote US145, then it would also amend Section 25.202 to reflect that decision in Part 25 of its rules. Finally, it noted, *inter alia*, that Iridium is the only non-Federal NGSO ISS licensee currently operating in the 22.55-23.55 GHz band and that it appears that Iridium's ISS links do not exceed the permissible interference criteria of Recommendation ITU-R RS.1029 for current passive sensors, and requested comment on how the proposed limits should apply to Iridium's satellites on a going-forward basis.<sup>236</sup>

91. Comments. CORF is the only party to comment on these issues. CORF states that the NGSO ISS links in the 22.55-23.55 GHz band are of special interest to it because this band is near the 23.6-24 GHz band, which is allocated to the RAS and the EESS. CORF states that its members are not currently aware of any harm from the existing 22.55-23.55 GHz ISS links to RAS and EESS observations, and that its "understanding of the WRC-07 Recommendation is that it is not intended to apply to existing NGSO constellations."<sup>237</sup>

92. Decision. We implement WRC-07's mandatory unwanted emissions limits in the 23.6-24 GHz band for all new NGSO ISS systems that will operate in the 22.55-23.55 GHz band.<sup>238</sup> We codify this decision by adding footnote US145 to the Allocation Table and by amending Section 25.202 to reflect the text of footnote US145 in Part 25 of the Commission's rules.<sup>239</sup>

#### 4. Fixed Stations in the 31-31.3 GHz Band

93. Background. In the U.S. Table, the 31-31.3 GHz band is allocated to the fixed service (FS) and mobile service (MS) on a primary basis for non-Federal use<sup>240</sup> and this frequency band is licensed pursuant to Part 101 Subpart L of the Commission's rules – Local Multipoint Distribution

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<sup>235</sup> *WRC-07 NPRM*, 27 FCC Rcd at 14643, para. 114. As shown in n.232, *supra*, an unwanted emissions limit of -43 dBW/4 kHz is equivalent to an unwanted emissions limit of approximately 4 dBW/200 MHz. For authorized bandwidths larger than 20 megahertz, additional attenuation of unwanted emissions would be required.

<sup>236</sup> Iridium Constellation LLC (Iridium) is licensed to operate NGSO ISS links in the 23.18-23.38 GHz sub-band as part of its MSS system (Call Sign S2110). *See generally WRC-07 NPRM*, 27 FCC Rcd at 14643, para. 115.

<sup>237</sup> *See* CORF Reply Comments at 5.

<sup>238</sup> Iridium has applied to modify its NGSO MSS space station authorization to launch and operate next-generation satellites. *See* IBFS File No. SAT-MOD-20131227-00148. Any authorized next-generation Iridium satellites would be required to comply with the applicable out-of-band emissions limits in new Section 25.202(i).

<sup>239</sup> *See* Appendix D for the text of footnote US145 and Section 25.202.

<sup>240</sup> The 31-31.3 GHz band is also allocated to the standard frequency and time signal-satellite service (space-to-Earth) on a secondary basis for Federal and non-Federal use. Footnote US342 states that, in making assignments to stations of other services to which the 31.2-31.3 GHz sub-band is allocated, all practicable steps shall be taken to protect the radio astronomy service from harmful interference. Footnote US211 states that in the 31-31.3 GHz band, applicants for airborne or space station assignments are urged to take all practicable steps to protect radio astronomy observations in adjacent bands from harmful interference.

Service (LMDS).<sup>241</sup> The adjacent 31.3-31.8 GHz band is allocated to the Earth exploration-satellite service (EESS) (passive), radio astronomy service, and space research service (passive) on a primary basis, and per footnote US246, “no station shall be authorized to transmit” in this band.

94. In Resolution 750, WRC-07 adopted a mandatory unwanted emissions limit of -38 dBW in any 100 megahertz (-38 dBW/100 MHz) of the 31.3-31.5 GHz EESS (passive) band for FS stations that operate in the 31-31.3 GHz band and are brought into use after January 1, 2012.<sup>242</sup> NTIA recommends that the Commission adopt WRC-07’s mandatory unwanted emissions limit for fixed stations transmitting in the 31-31.3 GHz band.<sup>243</sup>

95. Proposal. In the *WRC-07 NPRM*, the Commission noted that WRC-07’s mandatory unwanted emissions limit of -38 dBW/100 MHz was chosen because EESS (passive) systems in the 31.3-31.5 GHz EESS (passive) band need to operate in the entire 200 megahertz bandwidth and cannot implement a guardband at the lower edge of the band.<sup>244</sup> The Commission also observed that if WRC-07’s unwanted emissions limit is adopted, fixed stations transmitting in the 31-31.3 GHz band would be required to attenuate their unwanted emissions in the 31.3-31.5 GHz EESS (passive) band as follows: By an additional 15 dB (from -23 to -38 dBW/100 MHz) for stations in the 31-31.075 GHz band (lower LMDS Block B); up to an additional 41 dB (from 3 to -38 dBW/100 MHz) for stations in the 31.075-31.225 GHz band (LMDS Block A); and up to an additional 61 dB (from 23 to -38 dBW/100 MHz) for stations in the 31.225-31.3 GHz band (upper LMDS Block B).<sup>245</sup>

96. The Commission stated that adoption of WRC-07’s mandatory unwanted emissions limit for fixed stations transmitting in the 31-31.3 GHz band may be unnecessary to satisfy the operational requirements of EESS (passive) systems in ITU Region 2, because unlike in ITU Regions 1 and 3, no station can be authorized to transmit in the 31.5-31.8 GHz band in Region 2.<sup>246</sup> Accordingly, the Commission proposed to urge licensees of fixed stations in the 31-31.3 GHz band to limit the maximum elevation angle of the antenna main beam to 20° and employ automatic transmitter power control (ATPC) to limit the power of the stations’ unwanted emissions in the 31.3-31.8 MHz band by adding footnote NG60 to the Allocation Table.<sup>247</sup> The Commission further stated that if it adopted proposed footnote NG60, it would also amend Section 101.111 to reflect that decision in Part 101 of the Commission’s rules.<sup>248</sup>

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<sup>241</sup> In 1996, the Commission designated the 27.5-28.35 and 29.1-29.25 GHz (limited to transmissions in the hub-to-subscriber direction) bands for use by LMDS systems, and in 1997, designated the 31-31.3 GHz band for LMDS use. In 1998, the Commission finalized the LMDS rules and auctioned this spectrum (see [Auction 17](#)) as Block A (27.5-28.35, 29.1-29.25, and 31.075-31.225 GHz) and Block B (31-31.075 and 31.225-31.3 GHz). These actions were taken in CC Docket No. 92-297. The rules are codified in 47 C.F.R. Part 101 Subpart L – Local Multipoint Distribution Service.

<sup>242</sup> See ITU Resolution 750, Table 1-1. This limit does not apply to such stations that have been authorized prior to January 1, 2012. *Id.*

<sup>243</sup> See NTIA WRC-07 Recommendations at 5, footnote USXXX [1.20/FS 31].

<sup>244</sup> *WRC-07 NPRM*, 27 FCC Rcd at 14646, para. 124.

<sup>245</sup> *WRC-07 NPRM*, 27 FCC Rcd at 14646, para. 123 (for the conditions assumed in developing this statement).

<sup>246</sup> *WRC-07 NPRM*, 27 FCC Rcd at 14646-47, para. 125. Because the EESS (passive) band is wider in the United States (and the rest of ITU Region 2) than it is in ITU Regions 1 and 3, the Commission anticipated that EESS systems would be capable of accepting a higher level of unwanted emissions from Commission-licensed fixed stations in the adjacent 31-31.3 GHz band than the *WRC-07 Final Acts* permit. See *id.*

<sup>247</sup> *WRC-07 NPRM*, 27 FCC Rcd at 14646-47, para. 125.

<sup>248</sup> *Id.* The Commission noted that the ITU *Radio Regulations* permit non-conforming operations on a non-interference basis. Therefore, for the United States to remain in compliance with its ITU treaty obligations without adopting WRC-07’s mandatory unwanted emission limits for any radio service and frequency band, the Commission (continued....)

97. In making this proposal, the Commission stated that it was aware that ITU Resolution 750 states that long-term protection of EESS (passive) sensors in the 31.3-31.5 GHz and other bands is vital to weather prediction and disaster management.<sup>249</sup> The Commission solicited comment on whether it should adopt WRC-07's mandatory unwanted emissions limit for the 31-31.3 GHz band or, alternatively, the Commission's widely-used unwanted emissions limit, which for comparison purposes can be stated as -23 dBW/100 MHz.<sup>250</sup> The Commission requested comment on whether there are other mitigation techniques which would be less burdensome to FS licensees and whether it should limit the non-Federal MS allocation in the 31-31.3 GHz band to the mobile service except aeronautical mobile service (*i.e.*, delete the unused aeronautical mobile service allocation).<sup>251</sup>

98. Comments. CORF is the only party to comment on this issue. CORF supports adoption of the ITU limit. It opposes the Commission's alternative proposal because it would permit higher levels of unwanted emissions in the 31.3-31.8 GHz band (*i.e.*, -23 dBW/100 MHz, which is 15 dB higher than the ITU limit of -38 dBW/100 MHz).<sup>252</sup> CORF argues that such a large increase in unwanted emissions is likely to harm passive service observations in the 31.3-31.8 GHz band. Furthermore, CORF contends that Resolution 750 reflects the understanding that relaxation of this ITU limit would harm worldwide efforts to provide reliable quantitative atmospheric, oceanic, and land measurements. CORF further notes that although ITU Resolution 750 is crafted around the EESS (passive) service, the 31.3-31.8 GHz band is also an important RAS band that is used in determining the structure and evolution of the early universe.

99. Decision. We adopt WRC-07's mandatory unwanted emissions limit for new fixed stations transmitting in the 31-31.3 GHz band. To ensure that equipment meeting this new requirement is designed, authorized, and manufactured in an orderly manner, we delay this rule from taking effect until three years from the effective date of this Report and Order. As such, this rule will not apply to previously constructed facilities or to new facilities authorized prior to that date. We codify our decision by adding new footnote NG60 to the Allocation Table. We also amend Section 101.111 by adding paragraph (d)(2) in order to reflect the text of footnote NG60 in Part 101 of the Commission's rules.<sup>253</sup>

## D. Other Issues

### 1. VHF Maritime Mobile Band (156-162 MHz)

100. In this section, we implement our proposed actions for the VHF maritime mobile band (156-162 MHz),<sup>254</sup> except that, based on our review of the NTIA WRC-12 Implementation Recommendations, we: 1) decline to adopt two of the proposed changes, as discussed below; and 2) implement the WRC-12 allocation changes in the two bands currently used by Automatic Identification

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must determine that non-Federal stations operating in accordance the Commission's rules will not cause harmful interference to passive sensors operating in accordance with the International Table and other provisions of the ITU *Radio Regulations*. See *ARINC v. FCC*, 928 F.2d 428, 443-44 (D.C. Cir., 1991). See also *Cable and Wireless v. FCC*, 166 F.3d 1224, 1230 (D.C. Cir., 1999); *Katel Limited Liability Co. v. AT&T*, 607 F.3d 60, 67 (2<sup>nd</sup> Cir., 2010) (addressing the treaty status of the ITU *Radio Regulations*). *Id.* at n. 229.

<sup>249</sup> See ITU Resolution 750 (Rev. WRC-12) at *considering f*. *WRC-07 NPRM*, 27 FCC Rcd at 14647, para. 126.

<sup>250</sup> Specifically, the Commission solicited comment on whether it should adopt following emissions limit: For all new stations in the 31-31.3 GHz band, the power of any emissions in any 1 megahertz of the 31.3-31.8 GHz band shall be attenuated below the transmitter power (P) within the licensed bands of operation, in watts, by a factor of not less than  $43 + 10 \log(P)$  dB (-43 dBW/MHz), which is equivalent to -23 dBW/100 MHz.

<sup>251</sup> *WRC-07 NPRM*, 27 FCC Rcd at 14647, para. 126.

<sup>252</sup> See CORF Reply Comments at 7-8.

<sup>253</sup> See Appendix D for the text of new footnote NG60 and Section 101.111(d)(2).

<sup>254</sup> *WRC-07 NPRM*, 27 FCC Rcd at 14612-17.

Systems (AIS).<sup>255</sup> By these actions, together with our proposals in the WRC-12 Notice, below, we fully address NTIA’s recommendations for the VHF maritime mobile band. We received no public comment on our proposals for that band. Table 1, below, provides an overview of the channels in the maritime mobile service (MMS) that we address in this proceeding.

<b>Table 1: VHF Maritime Mobile Band Channels Addressed in this Proceeding</b>			
Channel	Center Frequency	25 KiloHertz-wide Band	Action
10	156.500 MHz	156.4875-156.5125 MHz	Partially reallocate for fixed and land mobile use
70	156.525 MHz	156.5125-156.5375 MHz	Allocate the band to the MMS (distress, urgency, safety, and calling via digital selective calling) and add reference to RR 5.111 (search and rescue)
11	156.550 MHz	156.5375-156.5625 MHz	Partially reallocate for fixed and land mobile use
75	156.775 MHz	156.7625-156.7875 MHz	Propose for Satellite-AIS use (AIS 3)
16	156.800 MHz	156.7875-156.8125 MHz	Add reference to RR 5.111
76	156.825 MHz	156.8125-156.8375 MHz	Propose for Satellite-AIS use (AIS 4)
AIS 1	161.975 MHz	161.9625-161.9875 MHz	Implement the WRC-12 Final Acts
AIS 2	162.025 MHz	162.0125-162.0375 MHz	

**a. 156.2475-156.7625 MHz**

101. In this sub-section, we adopt the proposals regarding this band that the Commission made in the *WRC-07 NPRM*, except as described below.<sup>256</sup> First, we amend the U.S. Table by: 1) dividing the 156.2475-156.7625 MHz band into three bands (156.2475-156.5125 MHz, 156.5125-156.5375 MHz, and 156.5375-156.7625 MHz); 2) allocating the new 156.5125-156.5375 MHz band (channel 70 with the center frequency 156.525 MHz) to the MMS on a primary basis for Federal and non-Federal use; 3) restricting the use of the MMS allocation in the 156.5125-156.5375 MHz band to distress, urgency, safety, and calling via digital selective calling (DSC); and 4) maintaining the existing primary MSS allocation for non-Federal use in the 156.2475-156.5125 MHz and 156.5375-156.7625 MHz bands.

102. Second, we allocate the 156.4875-156.5125 MHz and 156.5375-156.5625 MHz bands (50 kilohertz in total) to the fixed and land mobile services on a primary basis for non-Federal use in VHF Public Coast Station Areas (VPCAs) 10-42.<sup>257</sup> In making these allocations, we require that the use of these bands by the fixed and land mobile services not cause harmful interference to, nor claim protection from, the maritime mobile VHF radiocommunication service. We codify these decisions by adding footnote US227 to the Allocation Table.

103. Third, we make the frequencies 156.525 MHz (channel 70) and 156.800 MHz (channel 16) available for search and rescue (SAR) operations that involve manned space vehicles by adding references to RR 5.111 in the bands within the U.S. Table that contain these frequencies, *i.e.*, the 156.5125-156.5375 MHz and 156.7625-156.8375 MHz bands.

104. Fourth, we re-insert RR 5.226 (previously numbered as RR 5.227) into the U.S. Table and delete footnote US226. Fifth, we correct two grammatical/typographical errors in the text of NG117 and renumber that footnote as NG22.<sup>258</sup>

<sup>255</sup> See NTIA WRC-12 Implementation Recommendations at p. 25, footnote US[replace US52/55] at para. (c).

<sup>256</sup> *WRC-07 NPRM*, 27 FCC Rcd at 14614-16, paras. 32-38.

<sup>257</sup> The land mobile service is a mobile service between base stations and land mobile stations or between land mobile stations. 47 C.F.R. § 2.1(c).

<sup>258</sup> Specifically, we replace the phrases “frequency 156.050 and 156.175 MHz” and “port operating” with the phrases “frequencies 156.050 and 156.175 MHz” and “port operations,” respectively.

105. Sixth, we simplify the U.S. Table by combining the text from footnotes US77 (which specified that certain channels could be assigned to Federal stations in the MMS) and US106 (which specified the frequency to be used for environmental communications) and number the resultant footnote as US52. We also permit aircraft stations to use the frequency 156.3 MHz for search and rescue operations and other safety-related communications. However, based on our review of the NTIA WRC-12 Implementation Recommendations, we decline to adopt two of the proposed changes in new footnote US52 because those modifications would be inconsistent with NTIA's recommendations. Specifically, we decline to adopt proposed paragraph (c), which pertains to MMS use of 156.775 (channel 75) and 156.825 MHz (channel 76), because WRC-12 designated these frequencies for AIS use. We also decline to adopt proposed paragraph (a), which would have limited Federal use of the frequency 156.375 MHz to the Lower Mississippi River. In the next sub-section, we address NTIA's recommended restrictions on AIS operations and codify our decision in new footnote US52.

**b. Extending Automatic Identification System (AIS) Capabilities**

106. Background. In the U.S. Table, the two existing AIS bands (AIS 1 at 161.9625-161.9875 MHz with center frequency 161.975 MHz and AIS 2 at 162.0125-162.0375 MHz with center frequency 162.025 MHz) are allocated to the MMS on a primary basis for Federal and non-Federal use. AIS is a maritime navigation safety communications system standardized by the ITU and adopted by the International Maritime Organization.<sup>259</sup> Footnote US228 specifies that the use of these bands is restricted to AIS emissions only, except that grandfathered non-Federal stations may continue to use the AIS 1 band for non-AIS purposes on a primary basis for various periods of time.<sup>260</sup>

107. WRC-07 adopted RR 5.227A, which stated that the AIS 1 and AIS 2 bands are also allocated to the mobile-satellite service (MSS) (Earth-to-space) on a secondary basis for the reception of AIS emissions from stations operating in the MMS.<sup>261</sup> In 2009, the International Maritime Organization (IMO) modified the format of AIS Class A position report messages to add a distress indicator in the navigation status field.<sup>262</sup> To support maritime safety requirements and to recognize this IMO decision, as well as to support the safety aspect of AIS use by search and rescue aircraft, the United States proposed that WRC-12 allocate the AIS 1 and AIS 2 bands to the MSS (Earth-to-space) and the aeronautical mobile (off-route) service (AM(OR)S) on a primary and co-equal basis with the MMS in all Regions.<sup>263</sup> As part of its proposal, the U.S. also recommended that: 1) use of these bands by the MMS and MSS (Earth-to-space) be restricted to AIS emissions; 2) use of these bands by the AM(OR)S be restricted to AIS emissions from search and rescue (SAR) aircraft; and 3) AIS operations "shall not constrain the operation

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<sup>259</sup> 47 C.F.R. § 80.5.

<sup>260</sup> On March 31, 2015, Commission staff conducted a ULS search of the AIS 1 band and found that two site-based private land mobile radio licensees are the only non-AIS operations currently authorized to transmit in the band. Both operate under the grandfathering provisions of footnote US228. Frontier Refining LLC is authorized to operate a mobile relay station in Cheyenne, Wyoming. See call sign WNQQ375 (expires on Sept. 4, 2021). The State of Arizona is authorized to operate 3 control stations at fixed locations, 5 control stations at temporary locations statewide, and 300 mobile units statewide. See call signs WPGA967, WPGA968, WPGA969, and WPGA970 (all of which expire on Nov. 30, 2024).

<sup>261</sup> While AIS was designed as a terrestrial system, it was later found that AIS emissions from ship stations could be received by space stations in the MSS. For background, see "Satellite AIS – Developing Technology or Existing Capability?" available at <http://ro.uow.edu.au/cgi/viewcontent.cgi?article=1543&context=lawpapers>.

<sup>262</sup> See IMO REPORT OF THE SUB-COMMITTEE ON SAFETY OF NAVIGATION ON ITS FIFTY-FIFTH SESSION, NAV 55/21/Add.1, Oct. 22, 2009, at 51 (available at <http://www.srs.sg/docs/default-source/reports-of-sub-committee-meetings/nav55-21-add1.pdf?sfvrsn=2>).

<sup>263</sup> As a consequence of its proposal to allocate these bands to the MSS (Earth-to-space) on a primary basis, the U.S. also proposed that RR 5.227A be removed from the International Table. See *U.S. Proposals for WRC-12*, First Tranche, Agenda Item 1.10.

of stations in services allocated in the adjacent bands.”<sup>264</sup>

108. WRC-12 adopted the U.S. proposals with a couple of minor differences. First, the use restrictions for the AIS 1 and AIS 2 bands in RR 5.228C – which limit use of the MMS and MSS (Earth-to-space) allocations to AIS operations only and of the AM(OR)S allocation to AIS emissions from SAR aircraft – are worded slightly different than the U.S. proposals.<sup>265</sup> Second, WRC-12 adopted a grandfathering clause for fixed and mobile services use of the AIS 1 and AIS 2 bands in RR 5.228D that the U.S. did not propose.<sup>266</sup> Specifically, RR 5.228D states that the AIS 1 and AIS 2 bands may continue to be used by the fixed and mobile services on a primary basis until January 1, 2025, at which time these allocations will no longer be valid.<sup>267</sup>

109. Proposal. In the *WRC-07 NPRM*, the Commission proposed to add RR 5.227A to the AIS 1 and AIS 2 bands in the U.S. Table, but emphasized the secondary status of satellite operations in these bands.<sup>268</sup> It also proposed to update footnote US228 by removing paragraph (c), which specifies a now-passed March 2, 2011 sunset date for certain non-Federal geographical operations, and renumbering the footnote as US228D.

110. The Commission also solicited comment in the *WRC-07 NPRM* on whether it should implement the WRC-12 allocation decisions with regard to the AIS 1 and AIS 2 bands – *i.e.*, the modifications designed to promote maritime safety interests.<sup>269</sup> It did not receive any comments that addressed this issue. However, we note that the NTIA WRC-12 Implementation Recommendations do address this issue.<sup>270</sup> First, NTIA recommends that we implement the *WRC-12 Final Acts* by allocating

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<sup>264</sup> In support of its proposal, the U.S. stated that IMO Resolution MSC 74(69) required that AIS “...improve the safety of navigation by assisting in the efficient navigation of ships, protection of the environment, and operation of Vessel Traffic Services (VTS)” and that modifying the Radio Regulations to reflect the AIS frequencies “is critical to search and rescue, safety of navigation, and the safe movement and tracking of vessels, which are vital to the future of maritime safety.” It further claimed that the proposal “specifically addresses the need to recognize the safety aspect of AIS use by search and rescue aircraft authorized by Appendix 18 of the Radio Regulations and ITU-R Recommendation M.1371-3, and recognizes the decision by the [IMO] to include a distress indicator in the navigation status field of AIS Class A position report messages.” The U.S. specified use restrictions for the AIS 1 and AIS 2 bands in two footnotes, 5.A01 and 5.A02. *Id.*

<sup>265</sup> Specifically, WRC-12 combined the text from the two footnotes that the United States proposed (5.A01 and 5.A02) and simplified the resultant text. In addition, WRC-12 did not adopt the U.S.’s proposed phrase “operating in accordance with Appendix 18,” pertaining to SAR aircraft operations, and decided that AIS operations in these bands “shall not constrain the development and use of the fixed and mobile services operating in the adjacent frequency bands” (whereas the U.S. proposed “shall not constrain operation of stations in services allocated in the adjacent frequency bands”).

<sup>266</sup> See *WRC-12 Final Acts* at p. 19 (RR 5.228C and RR 5.228D).

<sup>267</sup> RR 5.228D also states that, *inter alia*, administrations are encouraged to make all practicable efforts to discontinue the use of the AIS 1 and AIS 2 bands by the fixed and mobile services prior to the transition date. *Id.*

<sup>268</sup> In particular, the Commission stated that licensees must be prepared to accept any interference to the reception of mobile signals in the AIS 1 and AIS 2 bands from the operations of adjacent-band terrestrial services operating in accordance with the terms of their licenses. *WRC-07 NPRM*, 27 FCC Rcd at 14617, para. 41.

<sup>269</sup> *Id.*

<sup>270</sup> See NTIA WRC-12 Implementation Recommendations at p. 25, US[replace US52/55]. As background, we note that there is a significant Federal interest in the AIS 1 and AIS 2 bands. In September 2008, the Commission adopted additional measures for domestic implementation of AIS. Amendment of the Commission’s Rules Regarding Maritime Automatic Identification Systems, WT Docket No. 04-344, *Second Report and Order*, 23 FCC Rcd 13711, para. 1 (2008) (*AIS 2nd R&O*); *Erratum*, 24 FCC Rcd 3241 (2009). With regard to this proceeding, the Commission’s most significant decisions in that Order were to designate the 162.0125-162.0375 MHz band for exclusive AIS use throughout the Nation and to determine that only Federal entities can operate AIS base stations. See *AIS 2nd R&O*, 23 FCC Rcd at 13712, para. 1. In addition, in accordance with the Maritime Transportation (continued....)

the AIS 1 and AIS 2 bands to the AM(OR)S and MSS (Earth-to-space) on a primary basis for Federal and non-Federal use, that use of these bands by the MMS and the MSS (Earth-to-space) be restricted to AIS emissions only, and that use of these bands by the AM(OR)S be more specifically restricted to AIS emissions from search and rescue aircraft.<sup>271</sup> Second, NTIA recommends that we add references to RR 5.228C and RR 5.228D in the U.S. Table. Third, NTIA recommends that we extend the sunset date for the two licensees that operate non-AIS equipment in the AIS 1 band from March 2, 2024 to January 1, 2025.<sup>272</sup> Fourth, NTIA recommends that we combine the text from revised footnote US228 with the text from its proposed footnote US[replace US52/55] along with new text that pertains to other bands.<sup>273</sup>

111. Decision. Based on NTIA’s recommendations, we implement the *WRC-12 Final Acts* in the two existing AIS bands as follows. First, consistent with both the *WRC-07 NPRM* and with the *U.S. Proposals for WRC-12*, we allocate the AIS 1 and AIS 2 bands to the AM(OR)S and MSS (Earth-to-space) on a primary and co-equal basis with the MMS for Federal and non-Federal use, limited to the transmission of AIS emissions, and add a reference to RR 5.228C in the U.S. Table. This action provides the allocations that are necessary to support maritime safety requirements. Specifically, the primary AM(OR)S and MSS (Earth-to-space) allocations support the IMO’s decision to include a distress alert notification within AIS Class A position report messages.

112. Second, we revise the text of footnote US228 by applying the existing MMS restriction to AIS emissions to the new MSS (Earth-to-space) allocation.<sup>274</sup> We also restrict the use of these frequencies by the AM(OR)S to AIS emissions from search and rescue aircraft operations. We also further simplify the grandfathering text that is currently in footnote US228.<sup>275</sup> In doing so, we retain the existing March 2, 2024 sunset date by which all non-AIS operations must cease operations in the AIS 1 band because RR 5.228D encourages us “to make all practicable efforts to discontinue the use of these bands by the fixed and mobile services prior to the transition date.” We place the revised text of US228 into new footnote US52 (discussed above in paragraph 105) as new paragraph (a).<sup>276</sup> Finally, we decline to add a reference to RR 5.228D in the U.S. Table. We do not need to list this international footnote in the U.S. Table because paragraph (a) of new footnote US52 will codify our decision to grandfather the only non-AIS uses in these bands.

113. We also update Section 80.371(c) of our rules by removing the second and last sentences from note 3 (which conveys the same now-obsolete grandfathering information that was listed in

(Continued from previous page) \_\_\_\_\_

Security Act, the Commission specified that the U.S. Coast Guard regulates AIS carriage requirements for non-Federal ships. These requirements are codified at 33 C.F.R. §§ 164.46, 401.20. *See* 47 C.F.R. § 80.393.

<sup>271</sup> *See* NTIA WRC-12 Implementation Recommendations at p.12 (for U.S. Table entries) and p.25 (for recommended footnote US[replace US52/55]).

<sup>272</sup> We note that recommended footnote US[replace US52/55] includes the following sentence: “AIS 2 may continue to be used by non-federal fixed and mobile services until 1 January 2025, at which time this fixed and mobile service allocation is no longer valid.” Because there are no grandfathered operations authorized in the AIS 2 band, we believe that NTIA intended to recommend that this grandfathering provision apply to the AIS 1 band.

<sup>273</sup> The new text that NTIA recommends pertains to the 156.7625-156.7875 MHz (AIS 3) and 156.8125-156.8375 MHz (AIS 4) bands, which we seek comment on in the WRC-12 Notice. *See* paras. 198-205, *infra*.

<sup>274</sup> Specifically, the pertinent part of the opening sentence in footnote US228 reads as follows: “The use of the bands 161.9625-161.9875 MHz (AIS 1 with center frequency 161.975 MHz) and 162.0125-162.0375 MHz (AIS 2 with center frequency 162.025 MHz) by the maritime mobile service is restricted to Automatic Identification Systems (AIS)...”

<sup>275</sup> In n.260, *supra*, we described the two licensees currently operating non-AIS equipment in the AIS 1 band. Based on this review, we revise the grandfathering text in footnote US228 to read as follows: Frequencies in the AIS 1 band may continue to be used by non-Federal base, fixed, and land mobile stations until March 2, 2024.

<sup>276</sup> Consequently, we remove footnote US228 from the Allocation Table.

paragraphs (a) and (c) of footnote US228). See Appendix D for the text of footnote US52 and Section 87.371(c).

114. Table 2, below, depicts the AIS 1 and AIS 2 bands as they currently exist in U.S. Table, and as we have amended them herein. In the WRC-12 Notice, below, we seek comment on the remainder of NTIA’s recommendations that pertain to the VHF maritime mobile band.<sup>277</sup>

<b>Table 2: Implementing the WRC-12 Final Acts in the AIS 1 and AIS 2 Bands</b>	
Existing U.S. Table	Adopted U.S. Table
161.9625-161.9875 MARITIME MOBILE (AIS) US228	161.9625-161.9875 AERONAUTICAL MOBILE (OR) (AIS 1) MARITIME MOBILE (AIS 1) MOBILE-SATELLITE (Earth-to-space) (AIS 1) 5.228C US52
162.0125-162.0375 MARITIME MOBILE (AIS) US228	162.0125-162.0375 AERONAUTICAL MOBILE (OR) (AIS 2) MARITIME MOBILE (AIS 2) MOBILE-SATELLITE (Earth-to-space) (AIS 2) 5.228C US52

**2. Additional Federal Coordination Areas in the 17.7-20.2 GHz Range**

115. **Background.** In this section, we address NTIA’s request for new coordination areas in the frequency bands that comprise the 17.7-20.2 GHz range and its effect on non-Federal terrestrial users in the 17.7-19.7 GHz range.<sup>278</sup> As background, the frequency bands that comprise the smaller 17.8-20.2 GHz range are allocated to the fixed-satellite service (FSS) on a primary basis for Federal use, restricted to space-to-Earth transmissions (downlinks). In addition, non-Federal fixed stations operate throughout the 17.7-19.7 GHz range. The 17.7-17.8 GHz, 17.8-18.3 GHz, and 19.3-19.7 GHz bands (18 GHz FS bands) are allocated to the fixed service (FS) on a primary basis for non-Federal use.<sup>279</sup> Footnote NG144 provides for continued operations of previously-licensed (*i.e.*, grandfathers incumbent) fixed stations in the 18.3-19.3 GHz range, and also grandfathers incumbent fixed stations operating under an older band plan in the 18 GHz FS bands (specifically, wide-band FS operations in the 17.7-17.8 GHz, 17.8-18.3 GHz, and 19.3-19.7 GHz bands).

116. While the general practice is to coordinate all operations in Federal/non-Federal shared bands with NTIA, the Commission currently coordinates only those non-Federal terrestrial applications in the 17.7-19.7 GHz range that are within the Denver, Colorado and Washington, D.C. areas. This coordination requirement is further limited in the 17.7-17.8 GHz band, by the terms of footnote US401, to FS applications that support Multichannel Video Programming Distributor (MVPD) operations. These coordination areas are defined in Section 1.924(e) for Part 101 applicants, in Section 74.32 for Television Broadcast Auxiliary Station applicants, and in Section 78.19(f) for Cable Television Relay Service (CARS) applicants.<sup>280</sup> NTIA requests that we extend this coordination requirement to San Miguel,

<sup>277</sup> See paras. 198-205, *infra*.

<sup>278</sup> The 17.7-19.7 GHz range is displayed as six discrete frequency bands in the non-Federal Table. In the Federal Table, this range is displayed as four frequency bands (which also encompass frequencies from 19.7 GHz to 20.2 GHz).

<sup>279</sup> The 17.7-17.8 GHz band (Earth-to-space) and the 18.3-19.7 GHz range (space-to-Earth) are allocated to the FSS on a primary basis for non-Federal use. The 18.6-18.8 GHz band is also allocated to the Earth exploration-satellite service (passive) and space research service (passive) on a primary basis for Federal and non-Federal use.

<sup>280</sup> 47 C.F.R. §§ 1.924(e), 74.32, 78.19(f).

California and Guam, stating that these modifications would serve the purpose of advancing, supporting, and accommodating the national defense.<sup>281</sup>

117. Proposal. In the *WRC-07 NPRM*, the Commission proposed to amend footnote US401 and Sections 1.924(e), 74.32, and 78.19(f) of the Commission's rules. By doing so, we would add the coordination areas requested by NTIA, and update our rules to remove an unused area near Denver that could be used by CARS and otherwise more accurately reflect the limited areas where the Federal coordination requirement is now in place.<sup>282</sup> The Commission discussed the proposed locations, noted that NTIA had stated that in virtually all of the limited number of cases where interference was predicted the Federal Government worked directly with the applicant to develop a plan to mitigate interference and satisfy the applicant's communications requirements with little or no impact on the applicant, and tentatively concluded that the public interest justified the additional protected coordination areas.<sup>283</sup> The Commission also noted that there is a longstanding agreement between the Commission and NTIA that only a limited number of sites for Federal receiving earth stations will be protected from harmful interference in the 17.8-20.2 GHz range and tentatively found that no additional primary Federal earth station sites beyond the two being considered in this proceeding should be authorized in the 17.8-18.3 GHz and 19.3-19.7 GHz bands.<sup>284</sup> The Commission also proposed to amend the text of the rules to bring better consistency between them and to also update them.<sup>285</sup> This would help preserve non-Federal FS use of these frequencies. In addition, the Commission proposed to update footnote NG144 and to renumber it as US139.<sup>286</sup> It sought comment on whether the coordination requirements for MVPD operations in Section 74.32, and references in Section 1.924 to MVPD operations pursuant to Parts 74 and 78, are still relevant, and, if not, whether they should be removed from the Commission's rules.<sup>287</sup>

118. Comments. Boeing and Comsearch commented on these issues. Boeing has no objection to the proposal to include two additional two sites within the coordination requirements for the 17.7-19.7 GHz range and supports our tentative conclusion regarding no additional coordination areas.<sup>288</sup>

119. Comsearch does not explicitly object to our proposal, although it suggests that the addition of new coordination areas will serve to discourage future non-Federal FS applicants from applying for frequencies in the 18 GHz FS bands and, ultimately, will suppress FS use.<sup>289</sup> Comsearch says that we can promote more efficient use of this spectrum by seeking a commitment from DOD to respond to coordination requests in a "reasonable time frame" (which it suggests as 30 days), and by allowing for conditional authorization of applications that "include evidence of successful pre-clearance from DOD."<sup>290</sup>

120. Decision. We adopt our proposal to add the San Miguel, California and Guam coordination areas to the Allocation Table and to Sections 1.924(e), 74.32, and 78.19(f) of the

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<sup>281</sup> See Letter from Karl B. Nebbia, Associate Administrator, Office of Spectrum Management, NTIA, to Julius P. Knapp, Chief, OET, ET Docket No. 12-338, filed July 30, 2012, at 1-2.

<sup>282</sup> *WRC-07 NPRM*, 27 FCC Rcd at 14634-35, paras. 92, 94-96.

<sup>283</sup> *Id.*

<sup>284</sup> *Id.* at 14635, para. 95.

<sup>285</sup> *Id.*

<sup>286</sup> *Id.* at 14635, para. 96.

<sup>287</sup> *Id.*

<sup>288</sup> See Boeing Comments at 5.

<sup>289</sup> See Comsearch Comments at 1-7. Comsearch bases its conclusion on an analysis of existing frequency use in the Denver and Washington areas and in other areas that are not subject to coordination.

<sup>290</sup> *Id.* at 4.

Commission's rules. We also adopt our proposal to amend footnote US334 by limiting the primary allocation status of Federal earth stations to the Denver, Washington, DC, San Miguel, and Guam coordination areas; however, on our own motion, we apply these geographic restrictions across the entire 17.8-20.2 GHz range (instead of the just 17.8-18.3 GHz and 19.3-19.7 GHz bands).<sup>291</sup> In taking this action, we do not preclude the consideration of a limited number of future Federal earth stations that would support critical national security requirements.<sup>292</sup> We expect that NTIA will carefully coordinate any future sites with the Commission to ensure minimal impact to fixed stations.

121. In order to simplify and clarify our decision in the Allocation Table, we move the coordination requirement for fixed stations that support MVPD operations in the 17.7-17.8 GHz band from footnote US401 to US334. By this action, we require that if the station or proposed station is located in whole or in part within the Denver, Washington, DC, San Miguel, or Guam coordination area, any application for a new station license to provide MVPD operations in the 17.7-17.8 GHz band or to operate in the 17.8-19.7 GHz band for any service, or for modification of an existing station license in these bands that would change the frequency, power, emission, modulation, polarization, antenna height or directivity, or location of such a station, must be coordinated with NTIA before an authorization will be issued. We are convinced that this action is necessary to support important national defense interests, as described by NTIA. See Appendix D for the revised text of footnote US334.

122. We decline to make any of the coordination and authorization process changes suggested by Comsearch. We agree with NTIA that our existing procedures – in particular the FAS coordination process and its established standards for timely review – represent the most appropriate mechanism for accommodating the differing Federal/non-Federal interests in the band.<sup>293</sup> Currently, NTIA responds to an assignment request through the existing process within nine business days on average, unless the request is tabled for insufficient information.<sup>294</sup> The approach we have taken to facilitate Federal/non-Federal shared use – coordination only in limited geographic areas – allows us to balance the need to protect important national priorities with the interest in promoting robust commercial use, and there is nothing distinctive about the new San Miguel and Guam areas that would preclude the use of that approach there. While we recognize that parties may logically differentiate between deciding to pursue licensing in spectrum requiring coordination with Federal government users versus spectrum that does not have such a pre-condition to use, we cannot conclude that such differences warrant a departure from our present practices.<sup>295</sup> We think the most effective way to address Comsearch's concerns is to work to facilitate greater efficiencies within the existing coordination framework. NTIA notes that “federal agencies have worked proactively and directly with fixed station applicants to develop plans to mitigate potential interference where predicted,” and suggests that we continue to promote such dialogue at the beginning stages of the coordination process.<sup>296</sup> We agree and encourage prospective licensees to take

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<sup>291</sup> This clarification reflects the terms of the longstanding agreement with NTIA and is consistent with NTIA's request. Because of a pending NTIA request that concerns Federal earth stations that operate with non-Federal space stations in certain frequency bands, we also clarify that, in the bands between 17.8 GHz and 20.2 GHz, Federal earth stations “operating with Federal space stations” shall be authorized on a primary basis only in the four areas discussed herein.

<sup>292</sup> No other Federal receiving earth stations in the 17.8-20.2 GHz band are planned at this time.

<sup>293</sup> See NTIA Fourth Supplement at 1-3. The FAS process is the existing NTIA process for considering frequency assignment requests. Under existing procedures, there are specific timeframes by which Federal parties must respond to such requests. See *id.*

<sup>294</sup> See NTIA Manual, Chapter 9, Section 9.16.2.

<sup>295</sup> Although Comsearch suggests that this differentiation has resulted in ‘distinctly suppressed’ use of the band in the Denver and Washington areas, the current number of licenses is significantly larger than Comsearch cited in its comments. Furthermore, it appears that many licensees are in fact making productive use of the band notwithstanding any potential impediments to its use.

<sup>296</sup> See NTIA Fourth Supplement at 2-3.

NTIA up on its offer to engage in early discussions with the relevant federal agencies when they may be interested in applying for frequencies in the Denver, Washington, San Miguel and Guam coordination areas.

123. Finally, we take additional steps, consistent with the proposals set forth in the *NPRM*, to promote efficient use of the 17.7-19.7 GHz range and otherwise improve our existing rules. Specifically, we remove the unused circular area for Morrison, Colorado from Section 78.19(f). We also move the revised text in paragraph (e) of Section 1.924 to paragraph (f). We amend footnote NG144 and renumber this footnote as US139.<sup>297</sup> We also amend Section 101.31(b)(1) by removing the 11.7-12.2 GHz and 18.3-19.3 GHz bands from the list of frequency bands eligible for conditional authorization.<sup>298</sup> However, we decline to make any changes to the coordination requirements for MVPD operations in Section 74.32, or to references in Section 1.924 to MVPD operations pursuant to Parts 74 and 78. Because no commenter addressed the question raised in the *NPRM* regarding whether these references remain relevant, we find no pressing need to address these rules at this time.

### 3. Rulemaking Proposals That Did Not Receive Any Specific Comments

124. In this section, we consider those proposals that the Commission made in the *WRC-07 NPRM* on which we did not receive any specific comments. In the *WRC-07 NPRM*, the Commission set forth in detail why it believed each of the proposals discussed below would implement important U.S. policy goals and serve the public interest. As there is nothing in the record to give us cause to revise or reconsider these proposals, we amend Sections 2.1, 2.100, and 2.106 of the Commission's rules as described below. These rule changes will be codified in the Commission's rules as shown in Appendix D.

#### a. Active Service Issues

125. Radiolocation Use of 420-450 MHz. We amend the quiet zone rules in Section 1.924(f) to reflect the areas listed in paragraph (a) of footnote US270, limit the applicability of this rule to radiolocation systems, and move the revised text from paragraph (f) to paragraph (e).<sup>299</sup>

126. Mobile Meter Reading Use of 928-960 MHz. We amend NG120 by revising "band 928-960 MHz" and "mobile operations" to "bands 928-929 MHz, 932-932.5 MHz, 941-941.5 MHz, and 952-960 MHz" and "associated mobile operations," respectively, and deleting the phrase "as specified in 47 CFR part 101."<sup>300</sup> We codify this decision by renumbering the revised text from footnote NG120 as NG35 in the Allocation Table.

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<sup>297</sup> In the *WRC-07 NPRM*, the Commission stated that the fixed service allocation in the 17.7-18.3 GHz and 19.3-19.7 GHz bands appeared to obviate the need for the first sentence in NG144 ("Stations authorized as of September 9, 1983 to use frequencies in the bands 17.7-18.3 GHz and 19.3-19.7 GHz may, upon proper application, continue operations."), noted that it had previously removed Part 21 from its rules, and proposed to reclassify NG144 as a U.S. footnote (because it requires that applications for certain specified modifications to grandfathered non-Federal fixed stations be coordinated with NTIA).

<sup>298</sup> To simplify and clarify existing paragraph (b)(1) of Section 101.31 of the Commission's rules, we remove unneeded commas, list certain of the "bands" as "band segments," and list certain of the bands in "GHz" (instead of "MHz"). Because FS use of the 18.3-19.3 GHz band is now limited to grandfathered secondary operations, we revise "17,700-19,700" MHz to read "17.700-18.300, 19.300-19.700" GHz to fully implement our decision. With regard to the 11,700-12,200 MHz band, we note that the transition period has concluded, that the FS allocation was previously removed from the Allocation Table, and that there are no call signs in ULS that authorize the use of this band. See Appendix D for the revised text of Section 101.31(b)(1).

<sup>299</sup> *WRC-07 NPRM*, 27 FCC Rcd at 14617-18, paras. 42-43.

<sup>300</sup> *Id.* at 14618, para. 44.

127. Aeronautical mobile (R) service allocation in the 960-1164 MHz band. We allocate the 960-1164 MHz band to the aeronautical mobile (R) service (AM(R)S) on a primary basis for Federal and non-Federal use, and restrict the use of this allocation by adding a reference to RR 5.327A in the U.S. Table.<sup>301</sup> By adding RR 5.327A to the U.S. Table, we are requiring that any AM(R)S systems operating in the 960-1164 MHz band do so in accordance with recognized international aeronautical standards and with Resolution 417.<sup>302</sup> In Resolution 417, WRC-12 resolved, *inter alia*, that any AM(R)S systems operating in the 960-1164 MHz band shall meet standards and recommended practices (SARPs) requirements published in Annex 10 to the Convention on International Civil Aviation; and that administrations intending to implement AM(R)S in the 960-1164 MHz band, in order not to cause harmful interference to the radionavigation-satellite service in the band 1164-1215 MHz, shall utilize the specified criteria. We also remove footnote US400, which is now duplicative of the broader AM(R)S allocation, from the Allocation Table.

128. Feeder Link Allocations near 1.4 GHz. We remove the non-Federal FSS allocations from the 1390-1392 MHz and 1430-1432 MHz bands and remove footnote US368 from the list of U.S. footnotes.<sup>303</sup> As we proposed in the *WRC-07 NPRM*, we also combine the text of footnote US37 and the portion of footnote US398 that prohibits airborne and space-to-Earth operations, and number the resulting footnote as US79. In addition, we remove footnotes US37 and US398 from the list of U.S. footnotes and revise footnote US74 to remove the phrase “(see US368).”<sup>304</sup>

129. Radiolocation and Active Sensors in the 9-10 GHz Range. We upgrade the secondary Federal radiolocation service allocation in the 9000-9200 MHz and 9300-9500 MHz bands to primary status, allocate the 9300-9500 MHz band to the EESS (active) and the space research service (SRS) (active) on a primary basis for Federal use, allocate the 9800-9900 MHz band to the EESS (active) and the SRS (active) on a secondary basis for Federal use, and remove footnotes US48 and US51 from the U.S. Table.<sup>305</sup> In addition, we add RR 5.473A to the Federal Table in the 9000-9200 MHz band, RR 5.475A and RR 5.475B to the Federal Table in the 9300-9500 MHz band, and footnote US476A to the U.S. Table in the 9300-9500 MHz band.

130. We allocate the 9300-9500 MHz and 9800-9900 MHz bands to the EESS (active) and SRS (active) on a secondary basis for non-Federal use. We merge the 9500-9800 MHz and 9800-9900 MHz bands to form the 9500-9900 MHz band in the non-Federal Table.

131. So it is clear that RR 5.475 applies only to the aeronautical radionavigation service, we list RR 5.475 to the right of the radionavigation service allocation in the 9300-9500 MHz band of the International Table. To help simplify the U.S. Table, we renumber footnote US66 as US475.

132. Meteorological Satellite Use of 18-18.1 GHz. We allocate the 18-18.1 GHz band to the meteorological satellite-service (space-to-Earth) (MetSat downlink) on a primary basis for Federal and

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<sup>301</sup> *Id.* at 14618-21, paras. 45-51. The Commission discussed the scope of operations permitted under a Federal authorization and sought comment on how it could facilitate Federal Government objectives in the band. *Id.* at 14620-21, para. 51. We received no comments on this issue. Accordingly, we will look to the framework outlined in the *WRC-07 NPRM* to evaluate any future licensing or coordination issues that may arise in this band.

<sup>302</sup> We note that WRC-12 revised Resolution 417 in accordance with the *U.S. Proposals for WRC-12*. See *U.S. Proposals for WRC-12*, Third Tranche, Agenda Item 1.4.

<sup>303</sup> *WRC-07 NPRM*, 27 FCC Rcd at 14621-22, paras. 52-55.

<sup>304</sup> *Id.* at 14622, para. 55.

<sup>305</sup> *Id.* at 14629-32, paras. 78-87.

non-Federal use.<sup>306</sup> This action extends the existing 18 GHz MetSat downlink band (18.1-18.3 GHz) from 200 to 300 megahertz. We codify this decision by amending footnote US519.<sup>307</sup>

**b. Passive Service Issues**

133. Urging for 1.4 GHz Licensees. To protect passive sensors in the 1400-1427 MHz band from harmful interference, in Resolution 750, WRC-07 adopted non-mandatory unwanted emissions levels in the 1400-1427 MHz band for stations in the fixed service (FS) and mobile service (MS) that operate in the 1390-1395 MHz and 1427-1435 MHz bands.<sup>308</sup> As proposed, we urge licensees authorized under Parts 27 and 90 of the Commission's rules that operate fixed point-to-point stations or stations in the mobile service in the 1390-1395 MHz and 1427-1435 MHz bands to take all reasonable steps to ensure that their stations' unwanted emissions power does not exceed the unwanted emissions levels specified in ITU Resolution 750 in the 1400-1427 MHz band.<sup>309</sup> We codify this decision by adding footnote NG338A to the Allocation Table. To reflect the text of footnote NG338A in the Part 27 and Part 90 rules, we amend Section 27.53 by renumbering paragraph (j) as paragraph (j)(1) and adding paragraph (j)(2) and amend Section 90.210 by adding paragraph (c)(4).

134. Radio Astronomy Observatories in the 4 and 14 GHz Bands. As proposed, we update the list of radio astronomy stations observing in the 4825-4835 MHz (4 GHz) and 14.47-14.5 GHz (14 GHz) bands by revising the text of footnote US203 and renumber it as footnote US113.<sup>310</sup>

135. Sharing Criteria in the 36-37 GHz Band. To protect passive sensors in the 36-37 GHz band from harmful interference, WRC-07 adopted in Resolution 752 which has mandatory sharing criteria for the Earth exploration-satellite service (EESS) (passive), FS, and MS in that band. As proposed, we require that future MS and FS stations operating in the 36-37 GHz band do so in accordance with ITU Resolution 752. We codify this decision by adding footnote US550A to the Allocation Table. However, we decline to reflect this decision in Part 101 of the rules at this time because it appears to be more appropriate to consider this issue in the context of a service rule proceeding. We also revise footnote US263 by removing the 36-37 GHz band. We codify this decision by renumbering the revised text of footnote US263 as US532 in the Allocation Table.

136. Earth Station Restrictions in the 49.7-50.2 GHz and 50.4-50.9 GHz Band. To protect passive sensors in the 50.2-50.4 GHz band from harmful interference, WRC-07 adopted in Resolution 750 with mandatory unwanted emissions limits in the 50.2-50.4 GHz band for earth stations in the fixed-satellite service (FSS) (Earth-to-space) that transmit in the 49.7-50.2 GHz and 50.4-50.9 GHz sub-bands. As proposed, we require that licensees of these FSS earth stations comply with the mandatory unwanted emissions limits in ITU Resolution 750 in the 50.2-50.4 GHz band.<sup>311</sup> We codify this decision in the Commission's rules by adding footnote US156 to the Allocation Table. To reflect the text of footnote US156 in Part 25 of the Commission's rules, we amend Section 25.202 by revising paragraph (f) to provide for an exception to the general emission limitations and by adding the adopted emission limits

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<sup>306</sup> The meteorological satellite-service is an Earth exploration-satellite service for meteorological purposes. 47 C.F.R. § 2.1(c). *WRC-07 NPRM*, 27 FCC Rcd at 14636-37, paras. 97-100.

<sup>307</sup> Footnote US519 was adopted in the *WRC-07 Table Clean-up Order*, 25 FCC Rcd at 9724, para. 24.

<sup>308</sup> Resolution 750 also applies to the 1350-1390 MHz, 1395-1400 MHz, and 1435-1452 MHz bands. The Commission does not authorize FS and MS operations in the 1350-1390 MHz band. We are not applying the provisions of Resolution 750 to the Wireless Medical Telemetry Service, which operates in the 1395-1400 MHz and 1427-1432 MHz bands. We address Aeronautical Mobile Telemetry (AMT) use of the 1435-1525 MHz band in paras. 76-79, *supra*.

<sup>309</sup> *WRC-07 NPRM*, 27 FCC Rcd 14649, para. 133.

<sup>310</sup> *Id.* at 14624, paras. 59-60.

<sup>311</sup> *Id.* at 14644, para. 118.

to new paragraph (j).

137. Fixed Station Restrictions in the 51.4-52.6 GHz Band. To protect passive sensors in the 52.6-54.25 GHz band from harmful interference, WRC-07 adopted Resolution 750 with a mandatory unwanted emissions limit in the 52.6-54.25 GHz EESS (passive) band for fixed stations that operate in the 51.4-52.6 GHz band. As proposed, we require that future licensees of fixed stations transmitting in the 51.4-52.6 GHz band comply with the unwanted emissions limit in ITU Resolution 750 in the 52.6-54.25 GHz band.<sup>312</sup> We codify this decision by adding footnote US157 to the Allocation Table. However, we decline to reflect this decision in Part 101 of the rules at this time because it appears to be more appropriate to consider this issue in the context of a service rule proceeding.

138. Radio Astronomy Observatories in the 81-95 GHz Range. As proposed, we update footnote US388 by removing the Five Colleges Radio Observatory, adding the Heinrich Hertz Submillimeter Observatory (located at Mount Graham, Arizona), simplifying the text, and renumbering this footnote as US161.<sup>313</sup> As a result, all non-Federal applications within 150 km of the coordinates of the Heinrich Hertz Submillimeter Observatory (32° 42' 06" N, 109° 53' 28" W) must be coordinated with NTIA to protect radio astronomy observations in the 81-86 GHz, 92-94 GHz, and 94.1-95 GHz bands.

### c. Other Matters

139. We amend the definition of two terms currently in Section 2.1 of the rules and update Section 2.100 of the rules.<sup>314</sup> For the definition of Earth exploration-satellite service in Section 2.1, we make minor changes so that it agrees with the definition in the ITU *Radio Regulations*.<sup>315</sup> For the definition of equivalent isotropically radiated power in Section 2.1, we add the parenthetical statement “(absolute or isotropic gain).”

140. We amend Section 2.100 of the rules to state that the ITU *Radio Regulations*, Edition of 2008, have been incorporated to the extent practicable in Part 2, except that the International Table within § 2.106 has been updated to reflect the ITU *Radio Regulations*, Edition of 2012.

## V. ORDER (WRC-12 ORDER)

141. In this Order, we take several non-substantive, editorial actions to update the Commission’s rules. None of the rule changes discussed in this order require prior notice and an opportunity for comment under the Administrative Procedure Act (APA). Section 553(b)(B) of the APA provides exceptions to the notice-and-comment requirements for rulemakings when, among other things, the agency finds for good cause that the notice and comment procedures are “impracticable, unnecessary, or contrary to the public interest” with respect to the rules at issue. The changes we are making in the rules correct minor errors in the Allocation Table, implement revisions adopted in prior Commission orders, and otherwise entail non-substantive matters. As such, they constitute routine, “clean-up” matters that entail no substantive decisions of any consequence or significance to industry or the general public. Accordingly, we find that it is “unnecessary,” within the meaning of Section 553(b)(B), to provide notice and an opportunity for comment before adopting these rule revisions.

142. First, we update the International Table within Section 2.106 of the rules to reflect Article 5, Section IV of the ITU *Radio Regulations*, Edition of 2012, except as described herein.<sup>316</sup>

<sup>312</sup> *Id.* at 14645-48, paras. 119, 127-128.

<sup>313</sup> *Id.* at 14638-39, paras. 105-106.

<sup>314</sup> *Id.* at 14656-57, paras. 156-57.

<sup>315</sup> See ITU Radio Regulation No. 1.51 for the definition of the EESS.

<sup>316</sup> The International Table within Section 2.106 of the rules is included for informational purposes only, and thus, the changes we make to it are non-substantive. 47 C.F.R. § 2.104(a). For additional background information on the Allocation Table, see paras. 5-6, *supra*. The minor, editorial differences that are discussed in this Order between Article 5, Section IV of the ITU *Radio Regulations*, Edition of 2012, and the International Table in Section 2.106 of (continued....)

Because WRC-12 made substantive changes to RR 5.565, which is currently referenced in the U.S. Table, it is necessary for us to create new footnote US565, which replicates the pre-WRC-12 text of this international footnote. This action allows us to update the International Table within Section 2.106, while maintaining the *status quo* in the U.S. Table until such time as we can consider any pertinent comments that may be filed in response to the WRC-12 Notice.

143. During our preparation of this Order, we discovered several display errors in the International Table. Consistent with past practice, we will not replicate typographical or other errors that convey misleading information or could potentially cause reader confusion.<sup>317</sup> Accordingly, we incorporate the following corrections and updates in the International Table in Section 2.106 of the Commission's Rules: First, we remove various references to international footnotes in the Region 1 Table (*i.e.*, RR 5.72 in the 283.5-415 kHz range, RR 5.101 in the 1810-1850 kHz band, RR 5.272 and/or RR 5.273 in the 430-440 MHz range, and RR 5.397 in the 2450-2483.5 MHz band) because WRC-12 suppressed these footnotes. Second, we alphabetically list (per the French spelling) the services in the Region 3 Table for the 24.25-24.45 GHz band. We base these corrections and updates upon the format specified in the ITU *Radio Regulations*.<sup>318</sup>

144. With regard to international footnotes, we simplify ten of them (5.197A, 5.286AA, 5.351A, 5.353A, 5.384A, 5.388, 5.389A, 5.389C, 5.444A, and 5.547). Specifically, we update the cross-references to eight ITU Resolutions (Resolutions 75, 114, 222, 223, 224, 225, 413, and 716) in these footnotes to the version listed in Volume 3 of the 2012 Edition of the ITU *Radio Regulations*.<sup>319</sup> We add the notation "(FCC)" to the end of the footnotes that we have simplified. In addition, we add the abbreviation "(WRC-12)" to the end of the international footnotes that were added or revised at WRC-12 to signify the source of the current footnote text.<sup>320</sup> As a result of this action, note 1 of the FCC Online Table will be revised to read as follows: The International Table (columns 1-3 of § 2.106) reflects Article 5, Section IV of the ITU *Radio Regulations*, Edition of 2012, except for the revisions listed below:

(Continued from previous page) \_\_\_\_\_

the Commission's Rules will be listed in note 1 to the FCC Online Table of Frequency Allocations, which is available at <http://www.fcc.gov/oet/spectrum/table/fcctable.pdf>.

<sup>317</sup> See, e.g., *Third Table Clean-up Order*, 23 FCC Rcd at 3776 n.15 (correcting several display errors).

<sup>318</sup> See ITU *Radio Regulations* at Nos. 1.51, 5.24, 5.25, 5.26, 5.48, and 5.51.

<sup>319</sup> Although these ten international footnotes contain a "Note by the Secretariat" stating that a subsequent WRC updated a *Resolution*, the 2012 Edition of the ITU *Radio Regulations* contains only the current version of these Resolution(s) (see Volume 3). In order to assist readers, we revise the text of these international footnotes in Section 2.106 to directly list the version that is currently shown in the ITU *Radio Regulations*. See Appendix D for the complete text of these footnotes. We have previously made similar revisions to RR 5.345, RR 5.396, and RR 5.516B.

<sup>320</sup> In the *WRC-07 Table Clean-up Order*, the Commission partially implemented this notation scheme, which is used in the ITU *Radio Regulations*. *WRC-07 Table Clean-up Order*, 25 FCC Rcd at 9722, para. 19. WRC-12 suppressed 16 international footnotes that are not listed in the U.S. Table. Although these footnote numbers are listed in the ITU *Radio Regulations*, followed by the notation "(SUP – WRC-12)," we decline to follow this convention and will not list these footnotes in Section 2.106.

Band; Table	Action
283.5-415 kHz range; Region 1	References to 5.72 have been removed.
1810-1850 kHz; Region 1	Reference to 5.101 has been removed.
430-440 MHz range; Region 1	References to 5.272 and/or 5.273 have been removed.
2120-2170 MHz; Regions 1 & 3	The bands 2120-2160 and 2160-2170 MHz have been merged.
2450-2583.5 MHz; Region 1	Reference to 5.397 has been removed.
24.25-24.45 GHz; Region 3	The services are listed in alphabetical order according to the French language.
International Footnote	Action (The notation “(FCC)” has been added to the end of these footnote)
5.197A, 5.286AA, 5.345, 5.351A, 5.353A, 5.384A, 5.388, 5.389A, 5.389C, 5.396, 5.444A, 5.516B, 5.547	The cross-references to ITU Resolutions 33, 75, 114, 143, 222, 223, 224, 225, 413, 528, and 716 have been updated to reflect the version listed in the <i>Radio Regulations</i> .
5.208B	Note is not shown.
5.462A	Reflect ITU staff’s correction of a typographical error

145. Second, we reflect in the Allocation Table the reallocation of the 700 MHz D Block for use by public safety services.<sup>321</sup> As background, the Middle Class Tax Relief and Job Creation Act of 2012 established the First Responder Network Authority (FirstNet) to oversee the construction and operation of a nationwide public safety broadband network as licensee of both the existing public safety broadband spectrum (763-768/793-798 MHz) and the spectrally adjacent 700 MHz D Block spectrum (758-763/788-793 MHz).<sup>322</sup> Accordingly, we amend the U.S. Table by revising the upper or lower frequency limits of four frequency bands (698-763 MHz, 763-775 MHz, 775-793 MHz, and 793-805 MHz) to shift the 700 MHz D Block spectrum from the 700 MHz Band Commercial Services bands to the 700 MHz Public Safety bands.<sup>323</sup> See Appendix D where the 698-758 MHz, 758-775 MHz, 775-788 MHz, and 788-805 MHz bands are now specified in accordance with these revisions. In addition, we amend footnote NG158 by revising the “763-775 MHz and 793-805 MHz” bands to read “758-775 MHz and 788-805 MHz,” and renumber revised footnote NG158 as NG34.

146. Third, we revise Section 27.803(b)(4) to reflect two previous Commission actions.<sup>324</sup> The *WRC-07 Table Clean-up Order* revised footnote US351 to remove the expired grandfathering provision which allowed Federal operations in the 1390-1400 MHz band at 17 sites on a fully protected basis, and combined the resultant text with footnote US352 in a single new footnote US37 (renumbered as footnote US79 in paragraph 128, *supra*).<sup>325</sup> In the *WRC-07 Order*, the Commission amended footnote US361 to correct the name of a grandfathered site, to remove a different grandfathered site, to simplify the text, and renumbered the footnote as US83.<sup>326</sup> We update Section 27.803 to remove paragraph (b)(4)(i) because no protected sites are listed in footnote US37. In addition, we combine the text of Section 27.803(b)(4) with that of Section 27.803(b)(4)(ii) and renumber it as Section 27.803(b)(4).

<sup>321</sup> See Implementing Public Safety Broadband Provisions of the Middle Class Tax Relief and Job Creation Act of 2012, PS Docket No. 12-94, *Report and Order*, 27 FCC Rcd 10953, 10956-57 ¶¶ 12-15 (PSHSB, 2012).

<sup>322</sup> See “Middle Class Tax Relief and Job Creation Act of 2012,” Pub. L. No. 112-96 (2012) at §§ 6201-6213.

<sup>323</sup> Prior to the Commission’s action, the 700 MHz Public Safety band (763-775 MHz downlink and 793-805 MHz uplink bands) consisted of the following band segments: Broadband segments (763-768/793-798 MHz), guard band segments (768-769/798-799 MHz), and narrowband segments (769-775/799-805 MHz). Thus, the revised 700 MHz Commercial Services bands are 698-758/775-788 MHz, and the revised 700 MHz Public Safety bands are 758-775/788-805 MHz.

<sup>324</sup> See *WRC-07 Table Clean-up Order*, 25 FCC Rcd 9712; see also *WRC-07 Order*, 27 FCC Rcd 14598.

<sup>325</sup> *WRC-07 Table Clean-up Order*, 25 FCC Rcd at 9738, para. 70.

<sup>326</sup> *WRC-07 Order*, 27 FCC Rcd 14658, para. 163.

147. Fourth, we revise Section 2.106 to add missing cross-references to Parts 15 and 25 of the Commission's rules<sup>327</sup> and revise Section 2.101(c) to reinsert the terms for the eight named frequency ranges.<sup>328</sup>

## VI. NOTICE OF PROPOSED RULEMAKING (WRC-12 NOTICE)

148. In this WRC-12 Notice of Proposed Rulemaking (WRC-12 Notice), we propose to amend Parts 2, 15, 80, 90, 97, and 101 of the Commission's rules to implement specific allocations from the *WRC-12 Final Acts* that affect frequencies between 8.3 kHz and 3000 GHz, and to update the appropriate service rules. These proposals are based on NTIA's Recommendations for National Implementation of the *WRC-12 Final Acts*, which were submitted to the Commission on March 28, 2013.<sup>329</sup> NTIA's recommendations are generally based on the *U.S. Proposals for WRC-12*. In addition to proposing rules to implement specific allocations from the *WRC-12 Final Acts*, we address several matters that pertain to unresolved issues from WRC-07. We have organized the discussion below to first address those allocation issues that pertain to Federal/non-Federal shared bands in ascending frequency order and then to address remaining issues, all of which pertain to new Federal-only allocations.

### A. Issues Below 490 kHz

#### 1. Passive Systems for Lightning Detection (8.3-11.3 kHz)

149. In this section, we consider WRC-12's actions that protect passive lightning detection systems, which operate within the meteorological aids (MetAids) service.<sup>330</sup> These long-established, passive applications are used by meteorological organizations to provide warnings of extreme weather events to a range of organizations and customers including emergency, aviation, defense, and utility services, as well as the public.<sup>331</sup> Lightning detection systems rely on naturally occurring emissions from lightning strikes and there have been past instances of compromised data due to interference from various RF emission sources.<sup>332</sup>

150. **Background.** Prior to WRC-12, the International Table did not include any allocation below 9 kHz. Spectrum below 9 kHz was governed by two international footnotes: RR 5.53 allowed the

<sup>327</sup> We recently modified Part 15 of the Commission's rules to permit level probing radars to operate on an unlicensed basis in the 5925-7250 MHz, 24.05-29 GHz, and 75-85 GHz bands. Amendment of Part 15 of the Commission's Rules To Establish Regulations for Tank Level Probing Radars in the Frequency Band 77-81 GHz, ET Docket No. 10-23, *Report and Order and Order*, 29 FCC Rcd 247 (2014). Currently, there is a cross-reference to "RF Devices (15)" only in the 76-77 GHz band. Therefore, we revise column 7 of the Allocation Table by adding a cross-reference to Part 15 in the remaining bands. We also add missing cross-references to Part 25 (*i.e.*, "Satellite Communications (25)") in the 6425-6525 MHz and 6525-6700 MHz bands. See 47 C.F.R. § 25.202(a)(1) (where "6.425-6.525" and "6.525-6.7" are listed in the table of frequency bands that are available for use by the fixed-satellite service under the heading "Earth-to-space (GHz)").

<sup>328</sup> While we generally do not use these terms when discussing frequency matters, we believe that retaining the terms in the Commission's rules will provide useful historical context. 47 C.F.R. § 2.101.

<sup>329</sup> See Letter from Karl B. Nebbia, Associate Administrator, Office of Spectrum Management, NTIA, to Julius P. Knapp, Chief, Office of Engineering and Technology, ET Docket No. 12-338, filed March 28, 2013 ([NTIA WRC-12 Implementation Recommendations](#)). See also Letter from Paige Atkins, Associate Administrator, Office of Spectrum Management, NTIA, to Julius P. Knapp, Chief, Office of Engineering and Technology, FCC, ET Docket No. 12-338, filed February 11, 2015 (NTIA Final Supplement).

<sup>330</sup> See *CPM Report to WRC-12*, Chapter 4, Agenda Item 1.16, pp. 27-32 and WRC-12 References, Resolution 671 (WRC-07), pp. 73-75.

<sup>331</sup> See WRC-12 References, Resolution 671 (WRC-07), *considering a*), p. 73.

<sup>332</sup> We note that "to avoid interference in certain parts of the world, the centre frequency of a current international network of lightning detection stations, which had been [centered] on 9.765625 kHz since 1939, has recently had to be moved to 13.733 kHz." See Resolution 671 (WRC-07), *considering c*).

use of this unallocated spectrum conditioned upon the lack of harmful interference to the allocated services in the bands above 9 kHz; and RR 5.54 urged administrations conducting scientific research in the spectrum to advise other potentially affected administrations in order to provide such research with all practicable protection from harmful interference. The 9-14 kHz band was allocated to the radionavigation service (RNS) on a primary basis in all ITU Regions and in the U.S. Table. We note however that this RNS allocation is not currently used in the United States. In the U.S. Table, the entries below 14 kHz have generally mirrored the International Table. In addition, two U.S. footnotes also apply to the 9-14 kHz band. Footnote US18 generally limits the use of navigation aids in the 9-14 kHz band (which are authorized under the RNS allocation) and other bands to Federal agencies.<sup>333</sup> Footnote US2 authorizes power line carrier (PLC) systems to operate in the 9-490 kHz band.<sup>334</sup>

151. The United States proposed that WRC-12 allocate the 8.3-9 kHz and 9-11.3 kHz bands to the MetAids service on a primary basis in all ITU Regions and make appropriate modifications to RR 5.53 and RR 5.54. Further, the United States proposed to limit the use of these MetAids allocations to passive use, and in the 9-11.3 kHz band, to prohibit MetAids stations from claiming protection from those RNS stations that were submitted to the ITU for notification prior to the date of entry into force of the WRC-12 Final Acts.<sup>335</sup> In support of this proposal, the United States stated that recent ITU-R studies show the optimal frequency for arrival time difference (ATD) measurements is around 9.76 kHz,<sup>336</sup> and that Recommendation ITU-R RS.1881 determined that lightning detection systems are optimized with a 3 kilohertz bandwidth signal from 8.3-11.3 kHz.<sup>337</sup> The United States also noted that any interference to ATD systems in the 8.3-9 kHz band would impact such operations in the 9-11.3 kHz band as well, and thus, it is important to protect the full range of the signal to ensure that the ATD systems will be able to use their allocated band without interference.

152. Discussion. WRC-12 adopted the U.S. proposals with minor text changes.<sup>338</sup> NTIA recommends that we implement these WRC-12 allocation changes in the U.S. Table.<sup>339</sup> Based on this recommendation, we propose to allocate the 8.3-9 kHz and 9-11.3 kHz bands to the MetAids service on a primary basis for Federal and non-Federal use, and to limit this MetAids allocation to passive use by

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<sup>333</sup> More specifically, footnote US18 states that navigation aids are normally operated by the Federal Government in the 9-14 kHz, 90-110 kHz, 190-415 kHz, 510-535 kHz, and 2700-2900 MHz bands; however, authorizations may be made by the Commission for non-Federal operations in these bands, subject to the conclusion of appropriate arrangements between the Commission and the Federal agencies that normally operate these navigation aids and upon special showing of need for service which the Federal Government is not yet prepared to render.

<sup>334</sup> See para. 14, *supra*.

<sup>335</sup> See *U.S. Proposals for WRC-12*, Second Tranche, Agenda Item 1.16.

<sup>336</sup> The automated ATD system uses the time differences of signal received to derive lightning strike locations. Meteorological organizations analyze the data from the ATD system and provide forecasts to assist safety-of-life, public safety, and aviation operations. *Id.*

<sup>337</sup> See Recommendation ITU-R [RS.1881](#) (02/2011), titled “Protection criteria for arrival time difference receivers operating in the meteorological aids service in the frequency band 9-11.3 kHz,” at Table 1.

<sup>338</sup> Specifically, WRC-12 allocated the 8.3-9 kHz and 9-11.3 kHz bands to the MetAids service on a primary basis in all ITU Regions, and through its adoption of RR 5.54A limited the use of this allocation to passive use. RR 5.54A also states that, in the 9-11.3 kHz band, MetAids stations shall not claim protection from stations of the RNS submitted for notification to the ITU (*i.e.*, Radiocommunication Bureau) prior to January 1, 2013, and that, for sharing between MetAids and RNS stations submitted for notification after this date, the most recent version of Recommendation ITU-R RS.1881 should be applied. In the 8.3-9 kHz band, WRC-12 also adopted two footnotes (RR 5.54B, RR 5.54C) that provide for additional allocations in certain countries. See *WRC-12 Final Acts*, pp. 5-6.

<sup>339</sup> See NTIA WRC-12 Implementation Recommendations at p. 2.

adding RR 5.54A to the U.S. Table.<sup>340</sup> We believe that lightning detection systems provide a valuable public benefit and that the adoption of these proposals would serve the public interest by providing interference protection to these passive lightning detection systems, which operate in the MetAids service. We request comment on these proposals, noting that there is no current allocated use of the 8.3-11.3 kHz band in the United States.

## 2. Radio Buoys Operating in the 1900-2000 kHz Band

153. In the WRC-07 R&O above, we discussed use of radio buoys by the U.S. commercial fishing fleet, we observed that fishing vessels appear to have been using the radio buoys (which were approved under the Commission's Equipment Authorization program pursuant to Part 90 of the rules) under the faulty assumption that such use is permitted by their Part 80 ship station licenses, and we provided a temporary waiver of our rules to allow for radio buoy operations by commercial fishing vessels under a ship station license in the 1900-2000 kHz band. In this WRC-12 Notice we propose to amend Part 80 of the Commission's rules to authorize radio buoy operations in the 1900-2000 kHz band under a ship station license.

154. Under our Part 80 rules, a ship station license includes the authority to operate on frequencies allocated to the maritime mobile service (MMS) as well as to operate specified types of equipment.<sup>341</sup> Section 80.375 of the Commission's rules lists the carrier frequencies and frequency bands that are available for various uses in the maritime radiodetermination service.<sup>342</sup> We propose to amend Section 80.375 to make the 1900-2000 kHz band available to commercial fishing vessels for use by radio buoys on the open sea and to include them in the equipment authorized as part of a ship station license.<sup>343</sup> We seek comment on these proposals.

155. We propose to adopt technical requirements in Part 80 of the rules for the radio buoys based on the existing Part 80 rules and the characteristics of radio buoys that are currently imported and/or marketed pursuant to the Part 90 rules. Specifically, we propose to authorize buoy stations to transmit on any frequency in the 1900-2000 kHz band, provided that the output power does not exceed 10 W and that the antenna height of the buoy station does not exceed 4.6 meters (15 feet) above sea level. Next, we propose rules for the use of "sel-call buoys" (*i.e.*, radio buoys that transmit only after receiving a selective calling signal from their associated ship station).<sup>344</sup> Based on the characteristics of sel-call equipment, we propose to authorize ship stations to transmit selective calling signals on all frequencies in the 1900-2000 kHz band, provided that the output power does not exceed 10 W and that the station's

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<sup>340</sup> In the Order above, we update the International Table to reflect the 2012 ITU *Radio Regulations*. As such, the text of RR 5.54A (and other international footnotes we discuss herein) is not reprinted in the proposed rules appendix. Such footnotes can instead be found in Appendix D.

<sup>341</sup> 47 C.F.R. § 80.17(a)(4). *See also* Amendment of the Commission's Rules Concerning Maritime Communications, PR Docket No. 92-257, *Second Report and Order and Second Further Notice of Proposed Rule Making*, 12 FCC Rcd 16949, 16978 at para. 54 (1997) ("each applicant for a new ship station license will be automatically authorized to operate a marine VHF radio, a single-sideband radio, any type of radar or emergency position indicating radio beacon (EPIRB), on-board communications equipment, and satellite communications equipment"). Authorization for other types of equipment must be specifically requested.

<sup>342</sup> For example, Section 80.375(c) lists six assignable radiodetermination frequencies below 500 MHz that are "authorized for offshore radiolocation and associated telecommand operations under a ship station license provided" *inter alia*, the station antenna height does not exceed 6 meters (20 feet) above sea level in a buoy station or 6 meters above the mast of the ship on which it is installed. 47 C.F.R. § 80.375.

<sup>343</sup> Vessels that are licensed by rule would have to be individually licensed in order to use radio buoys pursuant to their ship station authorization.

<sup>344</sup> Selective calling is a means of calling in which signals are transmitted in accordance with a prearranged code to operate a particular automatic attention device at the station whose attention is sought. 47 C.F.R. § 80.5. For context, see <http://map.seafdec.org/downloads/pdf/tuna%20purse%20seine/Tuna%20purse%20seine2.pdf>.

antenna height not exceed 6 meters (20 feet) above the mast of the ship on which it is installed. Finally, we propose to amend footnote NG92 to provide for radio buoys that cannot be authorized under the radiolocation service by allocating the 1900-2000 kHz band to the maritime mobile service on a primary basis in Regions 2 and 3, restricted to radio buoy operations on the open sea, and to explicitly state that stations in the amateur, maritime mobile, and radiolocation services located in Region 2 will be protected from harmful interference only to the extent that such radiation exceeds the level which would be present if the offending station were operating in compliance with the technical standards or criteria applicable to the service in which it operates.<sup>345</sup> We have crafted the proposed footnote to restrict operations to the open sea based on the areas where radio buoys appear to be in use, and because doing so would provide greater protection for amateur stations by excluding radio buoys from “inland waters.”<sup>346</sup> Parties who believe that this geographic area should be extended to include the Chesapeake Bay, Great Lakes, or other inland waters should document why such an extension is warranted. We seek comment on these proposals. See Appendix F for the proposed text of footnote NG92 and Section 80.375(f).

156. We also seek comment on alternative approaches that would accomplish our objective of allowing continued radio buoy use by the U.S. high seas fishing fleet. For example, should we transition new radio buoy use to another MF band, and, if so, how would the costs to manufacturers and operators relate to any benefits that amateur operators may realize from such a transition?<sup>347</sup> Should we add the 1900-2000 kHz band to Section 90.248 of our rules, which already authorizes ocean buoy tracking, rather than Section 80.375?<sup>348</sup> For future radio buoy equipment, would it be beneficial to authorize different transmitter output power limits in segments of the 1900-2000 kHz band for operations near the coastline?<sup>349</sup> Finally, are there any additional considerations we should take into account regarding radio buoy use in international waters?

157. We note that, in the context of the *WRC-07* proceeding above, ITM requested that the Commission expand the frequencies available for radio buoy use, and states that its customers have

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<sup>345</sup> Under the Commission’s rules, radiodetermination is defined as the determination of the position, velocity, and/or other characteristics of an object, or the obtaining of information relating to these parameters, by means of the propagation properties of radio waves and radiolocation is defined as radiodetermination used for purposes other than those of radionavigation. Radio direction-finding is defined as radiodetermination using the reception of radio waves for the purpose of determining the direction of a station or object. 47 C.F.R. § 2.1(c). While most radio buoys currently operate in the radiolocation service, some also transmit their GPS coordinates, and thus, the associated ship station does not necessarily use radio direction-finding to locate these radio buoys. Our proposal to allocate the 1900-2000 kHz band to the maritime mobile service would support the transmission of a radio buoy’s GPS coordinates and other data, such as the identification number of the buoy and water temperature. See, e.g., [GV-58 GPS buoy system](#). We propose to add a note to Section 80.375(f) to specify that such use is permitted. See Appendix F.

<sup>346</sup> “Inland waters” means the waters shoreward of the territorial sea baseline. 33 C.F.R. § 2.26.

<sup>347</sup> In the U.S. Table, the 1705-1800 kHz band is allocated, *inter alia*, to the radiolocation and mobile services on a primary basis for Federal and non-Federal use. We note that the upper 50 kilohertz of this band (1750-1800 kHz) is lightly used. It appears that all of the MF radio buoy transmitters currently being marketed are capable of operating in the 1750-1800 kHz band. For example, the marketing material for radio buoy model “KTUS-1L” (FCC ID No. XLTKTUS-1L) (for which ITM is the grantee listed) states that “[o]ne frequency is transmitted between the ranges of 1605 to 4000 kHz (in USA, 1900-1999.9 kHz).” See [http://www.blueoceantackle.com/radio\\_buoys.htm](http://www.blueoceantackle.com/radio_buoys.htm).

<sup>348</sup> Users would be required to obtain individual licenses under our Part 90 rules. This may nevertheless represent a better approach than using Part 80, especially considering that the radio buoys are not designed to operate on the vessel like the other ships equipment that is addressed in the Part 80 rules.

<sup>349</sup> While such an action might offer additional protection for amateur service operations in the lower portion of the 1900-2000 kHz band, we would also need to consider the burdens on implementing such an arrangement on the commercial fishing industry.

complained that the 1900-2000 kHz band is getting crowded.<sup>350</sup> Based on our survey of international spectrum usage and trends, it appears that the proposed designation of 100 kilohertz of MF spectrum may be sufficient for the commercial fishing industry's requirements.<sup>351</sup> We therefore seek comment on the level of use of the 1900-2000 kHz band for radio buoys, whether additional spectrum is required for radio buoys, and if there are specific technical measures that will allow the U.S. commercial fishing fleet to make more efficient use of our limited spectrum resources. We also seek comment on whether we should establish a channeling plan or bandwidth limitations for radio buoys as these may provide for more efficient use of the limited available spectrum.

158. With regard to equipment authorization, we propose to establish a cutoff date after which new applications for equipment authorization of radio buoys must meet the new Part 80 rules in order to receive authorization and that radio buoys authorized under Section 90.103(b) prior to that date may continue to be sold and marketed, *i.e.*, this equipment would be grandfathered. We propose to establish the cutoff date as six months from the effective date of the Report and Order adopted in response to this WRC-12 Notice.<sup>352</sup> We solicit comment on our proposal.

### 3. Amateur 2200 Meter (135.7-137.8 kHz) and 630 Meter (472-479 kHz) Bands

159. In the WRC-07 R&O, we added a secondary amateur allocation to the 135.7-137.8 kHz band (2200 meter band) along with RR 5.67A, which limits amateur stations in the band to a maximum radiated power of 1 W equivalent isotropically radiated power (EIRP).<sup>353</sup> In accordance with WRC-12, we now propose to also allocate the 472-479 kHz band (630 meter band) to the amateur service on a secondary basis. We also propose adopting RR 5.80A, which would limit amateur stations located in the United States to a maximum radiated power of 5 W EIRP. We also seek comment on service rules for amateur stations in both these bands that will allow the amateur stations to coexist with Power Line Carrier (PLC) systems, which operate in these bands.

160. Background. After concluding that amateur stations may share the 135.7-137.8 kHz band with PLC systems, we added a secondary amateur service allocation to the band in the WRC-07 R&O.<sup>354</sup> As discussed in greater detail there, electric utilities operate PLC systems in the 9-490 kHz band for communications important to the reliability and security of electric service to the public.<sup>355</sup> PLC systems operate under the provisions of Section 15.113 of the Commission's rules on an unprotected and non-interference basis with respect to authorized radio users. They are restricted to operating only on

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<sup>350</sup> See ITM Comments at 2.

<sup>351</sup> We note that some buoys now transmit their GPS position to their associated fishing vessel via satellite communications, which suggests that the need for additional spectrum for traditional radio buoys may be reduced or obviated. See [Marine Star sel-call buoy \(SV-1800 Type\)](#). See also "Evolution of Radiobuoys Technology for FADS[.]: Past, Present and Future," Marine Instruments presentation, Oct. 2012 (available at <http://ebfimtuna-2012.sciencesconf.org/file/23474>). Other jurisdictions appear to offer similar resources to support radio buoy use. For example, New Zealand authorizes radio buoys to operate on 13 frequencies in the 1705-1800 kHz and 1950-2000 kHz bands with a maximum carrier power of 10 W, a 1 kilohertz bandwidth, and a transmitter tolerance of  $\pm 100$  hertz. See <http://www.rsm.govt.nz/cms/licensees/types-of-licence/general-user-licences/maritime-purposes>. See also <http://www.teleconformity.com/documents/jrr.html> and <http://www.tele.soumu.go.jp/resource/e/search/share/2013/t1.pdf> (which, together, describe Japan's regulations for sel-call buoys).

<sup>352</sup> Manufacturers who make changes to a grandfathered authorization after the cutoff date will need to be mindful that they may need to complete a new filing demonstrating compliance with the new rules.

<sup>353</sup> See paras. 22-29, *supra*.

<sup>354</sup> See para. 22, *supra*.

<sup>355</sup> 47 C.F.R. § 2.106, footnote US2.

transmission lines and therefore, in general, do not operate in residential areas.<sup>356</sup>

161. WRC-12 allocated the 472-479 kHz band to the amateur service on a secondary basis in all ITU Regions (*i.e.*, directly listed “Amateur” in the International Table),<sup>357</sup> but also adopted an international footnote that prohibited its use in 27 countries.<sup>358</sup> WRC-12 also adopted RR 5.80A, which limits the maximum equivalent isotropically radiated power EIRP of amateur stations in the 472-479 kHz to 1 W, provides that administrations may increase this EIRP limit to 5 W in those portions of their territory which are more than 800 km (497 miles) from the borders of 30 specified countries, and establishes that amateur stations operating in this band must not cause harmful interference to, nor claim protection from, stations of the aeronautical radionavigation service (ARNS).<sup>359</sup> We note that only a portion of Alaska is within 800 km of a listed country (the Russian Federation), and thus, the 1 W EIRP restriction in the ITU *Radio Regulations* applies to U.S. amateur stations only in that lightly populated area.

162. Prior to WRC-12, the 415-495 kHz band was allocated worldwide in the International Table to the maritime mobile service (MMS) on a primary basis and to the ARNS on a secondary basis in Regions 2 and 3. MMS use of the 415-495 kHz band was limited to radiotelegraph (RR 5.79) and ARNS use of the 435-495 kHz band was limited to non-directional beacons not employing voice transmission (RR 5.80). Two additional footnotes (R.R. 5.79A, RR 5.82) relate to the Navigational Telex (NAVTEX) service.<sup>360</sup> However, because all NAVTEX broadcasts in the United States are made on 518 kHz, these provisions will have minimal effect on U.S. frequency use.<sup>361</sup>

163. In the United States, the 435-495 kHz band is allocated to the MMS on a primary basis for Federal and non-Federal use and to the ARNS on a secondary basis for Federal use. The Commission has previously added references to RR 5.79, RR 5.79A, and RR 5.82 in the U.S. Table. In addition, footnote US231 states that aeronautical radiobeacons may be authorized on a secondary basis in the 435-490 kHz band under specified conditions. Electric utilities also operate PLC systems on transmission lines in the 9-490 kHz band, per footnote US2.<sup>362</sup> There are no Federal stations authorized to operate in the 472-479 kHz band and there are only three non-Federal coast stations that operate in this band using very narrow bandwidths.<sup>363</sup> Thus, it appears that only 540 hertz of the 7 kilohertz allocated by WRC-12

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<sup>356</sup> The provisions of Section 15.113 “apply only to systems operated by a power utility for general supervision of the power system and do not permit operation on electric lines which connect the distribution substation to the customer or house wiring.” 47 C.F.R. § 15.113. *See also* “How the System Works” (describing the electrical distribution system) on the Edison Electric Institute’s website (available at <http://www.eei.org/ourissues/electricitydistribution/Pages/HowWorks.aspx>).

<sup>357</sup> NTIA made no recommendation with regard to the secondary amateur service allocation in the 472-479 kHz band.

<sup>358</sup> These countries are listed in new footnote RR 5.80B.

<sup>359</sup> The 472-479 kHz band is allocated to the ARNS on a secondary basis in all ITU Regions and on a primary basis in the 18 countries/areas listed in RR 5.77. The protection requirement in RR 5.80A pertains both to primary and secondary ARNS operations.

<sup>360</sup> NAVTEX is an international automated MF direct-printing service for delivery of navigational and meteorological warnings, as well as urgent marine safety information to ships. WRC-12 revised RR 5.82 to afford protection to the NAVTEX service on 490 kHz from amateur service operations. For the revised text of RR 5.82, see Appendix D.

<sup>361</sup> The U.S. Coast Guard states that all NAVTEX broadcasts are made on 518 kHz. *See* <http://www.navcen.uscg.gov/?pageName=NAVTEX>.

<sup>362</sup> *See* para. 14, *supra*.

<sup>363</sup> Section 80.357(b) lists three working carrier frequencies for Morse code and data transmissions in the 472-479 kHz band as being assignable to coast stations located in designated geographic areas. Only one coast station is licensed to operate on each of these frequencies: The New England Historical Radio Society, Inc. on (continued....)

to the amateur service in the 630 meter band is currently being used by allocated services in the United States.

164. On November 29, 2012, ARRL filed a Petition for Rule Making requesting that the Commission allocate the 472-479 kHz band to the amateur service on a secondary basis and amend Part 97 to provide for use of this band by the Amateur Radio Service.<sup>364</sup> ARRL states that technical self-training and furtherance of radiocommunications development in the amateur service would be greatly enhanced by an allocation in the lower portion of the MF range. ARRL also states that it has sponsored an extensive course of experimentation in the MF spectrum near 500 kHz since 2006, and that no reports of interference have been received.<sup>365</sup> ARRL further states that, given typical antenna efficiencies in this frequency range, amateur stations are likely to fall well within the 5 W EIRP limit established by WRC-12.<sup>366</sup>

165. 472-479 kHz Band Allocation. We propose to allocate the 472-479 kHz band (630 meter band) to the amateur service on a secondary basis. We also propose to add RR 5.80A to the band, which would permit us to allow amateur stations to transmit with powers of up to 5 W EIRP in most areas of the United States. This proposal would bring our allocations for the band into harmony with the international allocations. As with the 135.7-137.8 kHz band, the addition of an amateur allocation to this band would provide new opportunities for amateur operators to experiment with equipment, techniques, antennas, and propagation phenomena but with signals having larger bandwidth and higher power. The fact that other allocated services make little use of the band also supports allowing amateurs to have access to this band. We seek comment on these proposals.

166. We are cognizant of the functions served by PLC systems that operate in the 472-479 kHz band on an unprotected and non-interference basis, such as tripping protection circuits if a downed power line or other fault is detected in the power grid. Nevertheless, we propose to add an amateur allocation because we are comfortable that amateur radio and utility PLC systems can successfully co-exist in the band. We note that no reports of harmful interference to the allocated radio services or to PLC systems from experimental amateur operations have been filed with the Commission or with NTIA. We therefore propose to permit amateur operations in this 472-479 kHz band in a manner that allows for shared use with PLC systems. We seek comment generally on the sharing of the 472-479 kHz band between PLC systems and the amateur service.

167. Service Rules for the 135.7-137.8 kHz and 472-479 kHz bands. We are proposing service rules for the amateur service in the 135.7-137.8 kHz and 472-479 kHz bands with the principal

(Continued from previous page) \_\_\_\_\_

carrier frequency 472 kHz using a necessary bandwidth of 160 hertz and 5 kW of output power at Stoneham, Massachusetts and Globe Wireless on both carrier frequency 476 kHz using a necessary bandwidth of 160 hertz and 30 kW of output power at Palo Alto, California and on carrier frequency 478 kHz using a necessary bandwidth of 160 hertz and 17.6 kW of output power at Pearl River, Louisiana. See call signs [WNE](#), [KFS](#), and [WNU](#).

<sup>364</sup> See Amendment of Parts 2 and 97 of the Commission's Rules to Create a New Medium-Frequency Allocation for the Amateur Radio Service, ARRL Petition for Rule Making (*ARRL MF Petition*), filed by ARRL on Nov. 29, 2012 and refiled on Dec. 17, 2012 in ET Docket No. 12-338 by James E. Whedbee along with a request that the petition be considered. We are addressing the *ARRL MF Petition* in this docket, effectively granting Whedbee's request.

<sup>365</sup> *Id.* at n.23. Call sign [WD2XSH](#) (File No. 0001-EX-ML-2011) authorizes experimental fixed stations at 42 locations and experimental mobile stations within 50 km of the fixed locations to operate in the 461-478 kHz and 495-510 kHz bands with an authorized power of 20 W ERP (32.8 W EIRP) and emission designators 150HA1A, 62H0J2B, 62H0F1B, and 62H0G1D. Participants in this ARRL experimental operation "have logged 168,472 hours on the air." See <http://www.arrl.org/news/arrl-sponsored-600-meter-experiment-approaches-170-000-hours-of-operation>. See also <http://www.500kc.com/> and <http://www.630m.net/files/TP07-2.pdf>.

<sup>366</sup> See ARRL MF Petition at 9.

goal of enabling sharing of this spectrum among licensed amateur stations and unlicensed PLC systems.<sup>367</sup> As the demand for radio spectrum has continued to increase, we have sought to make more efficient use of spectrum by providing for sharing of frequency bands for multiple purposes.<sup>368</sup> While we recognize the importance of PLC systems to the functioning of the electric power grid, we also believe that there are benefits to providing amateurs access to these bands, including providing amateurs with new opportunities for experimentation. Moreover PLC systems and the expected amateur use of these bands have characteristics which make coexistence possible. PLC systems are limited to use on transmissions lines and, consequently, are not present in most residential neighborhoods where amateur licensees live. The amateur service is expected to use the band mainly for experimental purposes and not for routine and widespread communications activities common in other bands. These attributes give us confidence that, along with appropriate technical rules, amateur stations can harmoniously operate on the same frequency bands as PLC systems.

168. The cornerstone of the technical rules we are proposing is physical separation between amateur stations and the transmission lines upon which PLC systems may be present. We propose that amateur stations be permitted to operate in these bands when separated from transmission lines by a specified distance. Such a separation, in conjunction with limits on the amateur stations' transmitted EIRP and antenna heights, will enable PLC systems and amateur stations to coexist in these bands.<sup>369</sup> In addition, we propose to limit amateur stations to operations at fixed locations only to ensure that this separation distance can be maintained reliably.<sup>370</sup> We seek comment on this overall framework.

169. In order to develop the necessary and appropriate service rules to meet our goal of providing for the coexistence of amateur services and PLC systems in these bands, we seek detailed comment on the technical characteristics of both the PLC systems and the amateur stations. This information will allow us to set an appropriate separation distance. Although the Commission in the *WRC-07 NPRM* inquired into the technical rules and methods that would assure coexistence, commenters provided little in the way of concrete information.<sup>371</sup> ARRL submitted a technical analysis based on an NTIA technical report supporting an assertion that PLC systems in the 135.7-137.8 KHz band will be sufficiently protected from amateur stations transmitting at an EIRP of 1 W with a separation distance of 1 km from the transmission lines carrying the PLC signals.<sup>372</sup> However, this NTIA technical report is from 1985 and therefore may not account for any subsequent developments.

170. To assist us in determining the optimal separation distance, we invite commenters to submit information on the technical characteristics of PLC systems that are currently being operated by utilities or likely to be deployed in the future. How tolerant are these PLC systems of signals received from other stations transmitting in the same band? What electric field strength at the location of a transmission line will cause a PLC system operating on that line to malfunction? What types of malfunctions would the electric power grid experience from electrical interference? How many PLC systems are currently operating in the 2200 and 630 Meter bands? Can these existing PLC systems be

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<sup>367</sup> PLC systems operate under Part 15 of our rules and are not permitted to cause interference and must accept interference from licensed services. 47 C.F.R. §§ 15.5, 15.113

<sup>368</sup> See n.81, *supra*.

<sup>369</sup> As we noted in the WRC-07 R&O, the existing record offers support to the imposition of power limits and other technical rules to assure compatibility with PLC systems. See para. 23, *supra*.

<sup>370</sup> As ARRL admits, it would be appropriate to place regulatory limits on amateur stations based on proximity to transmission lines carrying PLC signals and an amateur licensee has suggested limiting amateur operations to fixed locations. ARRL Comments at 17 (“Distance separation of less than one kilometer would therefore be an appropriate trigger for any regulatory limits other than EIRP.”); Davis Reply at 4.

<sup>371</sup> *WRC-07 NPRM*, 27 FCC Rcd at 14607, para. 17.

<sup>372</sup> See ARRL Comments at Annex A.

modified and could new PLC systems be designed to operate in other portions of the 9-490 kHz band, thus avoiding co-channel operation with amateur services? At what power do these PLC systems operate and how long are the transmission lines over which they send signals? At what voltage level do the transmission lines upon which these PLC systems are deployed operate and how does the PLC systems' tolerance of other signals depend on the voltage level? What electric field strengths are produced in the vicinity of transmission lines by the PLC signals traveling over the transmission lines?

171. We likewise invite information on the technical characteristics of amateur stations that are likely to be deployed or have operated under experimental licenses in these two bands. What electric field strength generated by PLC systems operating on transmission lines would impede the operation of amateur stations? A study conducted on a PLC system operating at 1 W at 152 kHz found that the PLC system generated an electric field strengths of 20 dB $\mu$ V/m at 1 km.<sup>373</sup> Would a signal with this field strength interfere with the operation of amateur stations? Given that high-voltage transmission lines generate a significant level of noise at this frequency range, how close to high-voltage transmission lines can amateur stations realistically operate? In recent years amateur stations have operated in these bands under experimental licenses with most licenses permitting powers of between 1 to 20 watts ERP.<sup>374</sup> How close did these amateur stations operate to transmission lines? Did any of these amateur stations receive signals from PLC systems operating on transmission lines? Do the experiences of amateur stations and utilities in other countries and along the United States border with Canada yield any useful information?<sup>375</sup>

172. If we were to adopt our proposal to permit amateur operations only when separated by a specified distance from transmission lines, when a new transmission line is built close by an amateur station, the station either would have to relocate farther away from the transmission line or cease operating. How should our rules address the potential for new transmission lines to be constructed closer than the specified distance to pre-existing amateur stations? We do not want to inhibit the ability of either PLC systems or amateur services to grow and expand without imposing unnecessary burdens on either. Is it possible for utilities to refrain from geographically expanding their PLC operations within the relatively small portion of the 9-490 kHz band that we are making available for amateur operations, and is this something utilities would do on their own accord, given the Part 15 status of PLC systems? Should our rules explicitly prohibit utilities from deploying new PLC systems in these bands?

173. We seek comment on how changes to the structure and design of the electric power system might affect our technical analysis. For example, the modernization of the U.S. power system to provide a more efficient and stable transmission and distribution network, which has been referred to as the "smart grid," requires wide-area monitoring of the electric grid, two-way communications, and enhanced control functions.<sup>376</sup> These communication needs may be met by increased use of PLC systems.<sup>377</sup> Are utilities likely to deploy more PLC systems in these bands in the future to meet the communication needs of the smart grid? Are the characteristics of these PLC systems likely to differ from PLC systems that have been used by utilities in the past? A recently adopted IEEE standard (1901.2-2013) is designed for smart grid applications over distribution lines below 500 kHz.<sup>378</sup> Because

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<sup>373</sup> R.C. Madge, G.K. Hatanaka, *Power Line Carrier Emissions from Transmission Lines*, 7 IEEE Transactions on Power Delivery 1775, 1776 (Oct. 1992).

<sup>374</sup> A number of licenses permitted powers of up to 1 kW.

<sup>375</sup> Canada allows amateurs to operate in the 135.7-137.8 kHz band.

<sup>376</sup> Stefano Galli, Anna Scaglione, and Zhifang Wang, *For the Grid and Through the Grid: The Role of Power Line Communications in the Smart Grid*, 99 Proceedings of the IEEE, 998, 999 (June 2011).

<sup>377</sup> *Id.* at 1010-12.

<sup>378</sup> 1901.2-2013 – IEEE Standard for Low-Frequency (less than 500 kHz) Narrowband Power Line Communications for Smart Grid Applications, available at <http://standards.ieee.org/findstds/standard/1901.2-2013.html>.

these systems operate over the distribution lines to residences and businesses rather than over transmission lines, they are considered carrier current systems rather than PLC systems under the Commission's rules. Unlike PLC systems, carrier current systems may operate on any power line and are not limited to the 9-490 kHz band. However, carrier current systems are subject to limits on radiated power that do not apply to PLC systems.<sup>379</sup> What is the likelihood that carrier current systems will be deployed over distribution lines and operate in the two frequency bands of concern in this proceeding? Will these systems be used for tasks critical to the functioning of the electric grid or will they be used for non-critical purposes such as metering? Are amateur stations operating in these bands likely to prevent these carrier current systems from operating or receive harmful interference from these systems?

174. We also seek comment on the applicability of IEEE 1613-2009 – IEEE Standard Environmental and Testing Requirements for Communications Networking Devices Installed in Electric Power Substations (IEEE 1613-2009) to our analysis.<sup>380</sup> ARRL claims that PLC systems complying with IEEE-1613 “would virtually guarantee that there would be no interaction between [a]mateur stations and PLC systems,” and that compliance with the standard has been required by the Commission's since 2002.<sup>381</sup> As background, the Commission's rules require that PLC systems conform to engineering standards promulgated by the Commission and adhere to industry approved standards designed to enhance the use of PLC systems.<sup>382</sup> Is compliance with this IEEE standard required by the Commission's rules (*i.e.* is this an industry approved standard designed to enhance the use of PLC systems)? Would compliance of PLC systems with this standard facilitate the sharing of these bands between amateur stations and PLC systems? Are there PLC systems deployed that do not comply with this standard? Would compliance with this standard obviate the need for amateur stations to maintain a specific separation distance from transmission lines?

175. We recognize that the separation distance required for PLC systems and amateur stations to coexist will depend on the power at which the amateur stations are permitted to transmit. We propose that amateur stations in the 135.7-137.8 kHz band be limited to a maximum EIRP of 1 W, as is required by footnote RR 5.67A, and which we adopted in the WRC-07 R&O. Is this EIRP limit appropriate for facilitating sharing between PLC systems and amateur stations? For the 472-479 kHz band, we propose to adopt transmitted power limits consistent with RR 5.80A. Amateur stations will be limited to an EIRP of 1 W in the portion of Alaska within 800 km of the Russian Federation and will be permitted to transmit at up to 5 W EIRP elsewhere. Is this EIRP limit appropriate for PLC systems and amateur stations to share this band? Should amateur stations be required to reduce their EIRP below 5 W when close to transmission lines and at what distances? We seek comment on these proposals.

176. We also seek comment on the practical application of a separation distance requirement, and, specifically, what resources and information amateur radio operators will need to comply with our rules. Amateur licensees will have to determine the location of transmission lines in their vicinity to determine if they are permitted to operate stations using these frequency bands. The amateur licensees will need to differentiate transmission lines from the electric distribution lines that connect distribution substations to customer or house wiring. High voltage transmission lines are typically attached to large steel towers that are easy to identify. However, lower voltage transmission lines are typically attached to wooden poles. Although the wooden poles used for transmission lines are usually taller than the wooden poles used for distribution lines,<sup>383</sup> we recognize that distinguishing the two types may not always be

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<sup>379</sup> 47 C.F.R. §§ 15.3(f), 15.107(c), 15.109(e).

<sup>380</sup> This standard is available at <https://standards.ieee.org/findstds/standard/1613-2009.html>

<sup>381</sup> *ARRL MF Petition* at 11.

<sup>382</sup> 47 C.F.R. § 15.113(e).

<sup>383</sup> Because low-voltage transmission lines operate at higher voltages than distribution lines, the wooden poles they are attached to are usually taller to prevent arching of the electric current to nearby trees, structures, and people.

straightforward. We seek comment on whether amateur licensees will be able to identify the transmission lines in their locality. If amateur licensees are not able to reliably identify transmission lines, should we require amateurs or ARRL to affirmatively verify the locations of transmission lines with utilities or UTC before an amateur station begins transmitting?<sup>384</sup>

177. There are several different ways that we could specify the separation distance between the amateur stations and the transmission lines. We could specify the slant-range distance as is defined in our Part 15 rules.<sup>385</sup> The slant range distance is the diagonal distance measured from the center of the measurement antenna to the nearest point of the overhead power line. However, calculation of the slant range distance is complicated by the need to know the height of the transmission line at the point closest to the measurement antenna as well as the height of the center of the measurement antenna. For simplicity we propose instead to specify the separation distance in terms of the horizontal distance between the transmission line and the amateur station antenna. This is the horizontal (lateral) distance between the center of the amateur station antenna and a vertical projection of the overhead transmission line down to the height of the center of the amateur station antenna. This distance could be calculated from the coordinates (*i.e.* latitude and longitude) of the amateur station antenna and the coordinates of the nearest point on the transmission line without having to know the heights of the antenna or the transmission line. We seek comment on this proposal.

178. Lastly, we seek comment on additional service and operational rules that would be appropriate for amateur operations in these bands. According to ARRL, the tallest antenna that should reasonably be considered for an amateur station is 200 feet, because antennas with greater heights would be required to obtain prior FAA approval and have to comply with FAA painting and lighting requirements.<sup>386</sup> We note that adopting a maximum antenna height for amateur stations in these bands will aid in sharing of the spectrum with PLC systems by limiting the number of transmission lines that would potentially be in direct line-of-sight of amateur station antennas. We seek comment on what maximum antenna height, if any, we should adopt for amateur stations in these bands.

179. We also invite comment on whether to adopt transmitter power limits for amateur stations, in addition to the EIRP limits we are proposing. If so, we seek comment on what the power limits should be. We observe that, in the *2002 Amateur Radio NPRM*, the Commission proposed to limit the maximum transmitter power in the 135.7-137.8 kHz band to 100 W PEP because of the possible difficulty of measuring the EIRP of an amateur station in this frequency range.<sup>387</sup> Also, in 1998, ARRL submitted data for the 135.7-137.8 kHz band showing that relatively short antennas can only produce ranges of EIRP that are well below the ITU's 1 W EIRP limit (*i.e.*, 10-40 mW for a 100 foot antenna and 1-4 mW for a 50 foot antenna) with a transmitter power output of 200 W PEP.<sup>388</sup> The Commission did not consider either power limit at that time, because, as noted above, it decided not to adopt an allocation for amateur operations in this band.<sup>389</sup> Given that we have adopted such an allocation in the WRC-07

<sup>384</sup> ARRL has indicated a willingness to act as a clearinghouse and single point of contact for amateurs to notify UTC or another coordinating entity. See ARRL Reply Comments at 6; *ARRL MF Petition* at 10.

<sup>385</sup> 47 C.F.R. § 15.3(hh).

<sup>386</sup> See ARRL Erratum, RM-9404, received Nov. 18, 1998 (ARRL LF Erratum) at 13. Although ARRL made this statement in the petition regarding the 2200 meter band, the rationale applies equally for the 630 meter band. 47 C.F.R. § 17.7(a).

<sup>387</sup> *2002 Amateur Radio NPRM*, 17 FCC Rcd at 8963, para. 25.

<sup>388</sup> See ARRL LF Erratum at 13. We note that a recent ITU-R recommendation states that a representative system for the 2200 meter band would have a transmitter output power of 23 dBW (200 W), a transmitter (transmission) line loss of 0 dB, and a (*transmitting*) antenna gain of -22 dBi. This would result in an EIRP of 1 dBW [*i.e.*, 23 dBW + 0 dB + (-22 dBi) = 1 dBW = 1.259 W], which exceeds the WRC-07 EIRP limit of 0 dBW (1 W). See Recommendation ITU-R [M.1732-1](#) (03/2012), p. 3, Table 1.

<sup>389</sup> *2003 Amateur Radio R&O*, 18 FCC Rcd at 10263-64, paras. 16-20, *cited in* para. 15, *supra*.

R&O above,<sup>390</sup> do either the 2002 *Amateur Radio NPRM* or ARRL's 1998 study provide a basis for determining transmitter power limits now? Should these transmitter power limits vary depending on antenna height – e.g. we could allow a 200 W PEP limit for antenna heights not exceeding 30.5 meters while permitting only 100 W PEP for taller antennas. Should the transmitter power limits differ between the 135.7-137.8 kHz band and the 472-479 kHz bands?

180. In response to the *WRC-07 NPRM*, commenters addressed a number of steps that could facilitate amateur use of the 135.7-137.8 kHz band. Amateur operator John H. Davis (Davis) proposed that no amateur station should be automatically controlled to ensure that the amateur operator is able to quickly terminate transmissions if necessary.<sup>391</sup> Davis also suggested that it may be appropriate to also prohibit software-driven modes that determine their own operating frequency without human intervention. Should we adopt Davis's suggestions? ARRL's states that there is no rationale for limiting the occupied bandwidth in the 135.7-137.8 kHz band to less than the full 2.1 kilohertz, and that a stricter limit would not be conducive to experimentation with narrowband data emission modes in the future.<sup>392</sup> Should we adopt any bandwidth limitation for either of the frequency bands? In the *WRC-07 NPRM*, the Commission requested comment on whether it should limit operating privileges in the 135.7-137.8 kHz band, e.g., to Amateur Extra Class licensees.<sup>393</sup> None of the commenters believe that such a restriction would better facilitate Amateur/PLC sharing of the band.<sup>394</sup> In particular, we note that ARRL states that it would be consistent with Commission policy to make this frequency band available to Amateur Extra, Advanced, and General Class licensees.<sup>395</sup> Should we limit operating privileges for these bands in accordance with ARRL's statement? Should we propose to authorize CW (international Morse code telegraphy), RTTY (narrow-band direct-printing telegraphy), and data emissions throughout the 630 and 2200 meter bands as we did for our 2200 meter band proposal in 2002?<sup>396</sup> We also seek comment on amending Section 97.3 by adding definitions for the terms effective radiated power, isotropically radiated power, and LF.<sup>397</sup>

181. Other Allocated Uses. Other radio services use the 135.7-137.8 kHz band. In the U.S. Table, the 130-160 kHz band is allocated to the fixed service (FS) and maritime mobile service (MMS) on a primary basis for Federal and non-Federal use.<sup>398</sup> While there are no non-Federal stations in

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<sup>390</sup> Para. 22, *supra*.

<sup>391</sup> See Davis Comments at 8. Davis made this proposal for the 135.7-137.8 kHz, but we see no reason why it does not equally apply to both bands.

<sup>392</sup> See ARRL Comments at 21. We note, however, that the IARU Region 1 band plan limits the maximum bandwidth in the 2200 meter band to 200 hertz. See [http://iaru-r1.org/index.php?option=com\\_content&view=article&id=175&Itemid=127](http://iaru-r1.org/index.php?option=com_content&view=article&id=175&Itemid=127).

<sup>393</sup> *WRC-07 NPRM*, 27 FCC Rcd at 14607, para. 19.

<sup>394</sup> See, e.g., Whedbee LF Petition, n.43, *supra*, at 2.

<sup>395</sup> See ARRL Comments at 17.

<sup>396</sup> Amateur stations would be permitted to utilize CW (continuous wave) emissions in the band per existing Section 97.305(a), and thus, our proposed rules list only RTTY (radio teletype) and data in Section 97.305(c). For the definitions of CW, data, and RTTY, see Section 97.3 at paragraphs (c)(1), (c)(2), and (c)(7), respectively. This proposal is consistent with the Whedbee LF Petition. See n.43, *supra*, p. 4.

<sup>397</sup> The proposal to add the definition of the term "LF" to Section 97.3 is consistent with the Whedbee LF Petition. See n.43, *supra*, p. 3. To add these terms in alphabetical order, our proposed rules reproduce the text of the existing definitions in Section 97.3(b).

<sup>398</sup> The FS is a radiocommunication service between specified fixed points, and the MMS is a mobile service between coast stations and ship stations, or between ship stations, or between associated on-board communication stations; survival craft stations and emergency position-indicating radiobeacon stations may also participate in this service. 47 C.F.R. § 2.1(c).

the FS and MMS that are licensed to operate in the 135.7-137.8 kHz band, there is limited Federal use of this band.<sup>399</sup> Specifically, a Federal coast station located in Dixon, California transmits to ships in the Pacific Ocean on two frequencies that overlap portions of this band. Given that this coast station also transmits on 19 other LF frequencies, we have requested that NTIA consider whether Federal requirements can be met without operating in this narrow (2.1 kilohertz) band. The 126.7-141.7 kHz band is also used to track tagged salmon in the Pacific watershed. We seek comment on whether we need to adopt exclusion zones or use other methods to protect these Federal uses of the band.<sup>400</sup> Should we delete the unused non-Federal allocations from this band? To be consistent with the International Table, we also propose to require that amateur fixed stations operating in the 2200 meter band not cause harmful interference to stations in the FS and MMS that are authorized by other nations and require that these amateur stations take any and all corrective action, if harmful interference is reported to us.<sup>401</sup> We seek comment on these proposals.

182. Finally, we note that the 472-479 kHz band has unused Federal MMS and ARNS allocations. Should we remove these allocations from the Federal Table? To be consistent with the International Table, we propose that amateur stations transmitting in the 630 meter band not cause harmful interference to, and must accept interference from, stations authorized by other nations in the ARNS and MMS and that the amateur stations must cause no harmful interference to 490 kHz.<sup>402</sup> Should we take any action with regard to the non-Federal MMS allocation in the band? We seek comment on these proposals.

## **B. Maritime Issues and Oceanographic Radars**

### **1. Maritime Mobile Service Use of the Frequency 500 kHz**

183. Background. Prior to WRC-12, the 495-505 kHz band was allocated to the mobile service on a primary basis in all ITU Regions, and two international footnotes (RR 5.82A, RR 5.82B) applied to this band. RR 5.82A stated that the use of this band was limited to radiotelegraphy. RR 5.82B required that the use of the 495-505 kHz band by services other than the maritime mobile service (MMS) not cause harmful interference to the MMS. In the United States, the 495-505 kHz band is allocated to the mobile service on a primary basis for Federal and non-Federal use, restricted to distress and calling operations.<sup>403</sup>

184. The United States proposed that WRC-12 restrict the use of the mobile service allocation in the 495-505 kHz band to the MMS.<sup>404</sup> In support of this proposal, the United States stated that the broadcast of safety and security information to and from ships is vital for maritime safety. Due to further

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<sup>399</sup> On March 31, 2015, the staff conducted a study of the 135.7-137.8 kHz band using the Commission's Universal Licensing System (ULS) and found no active call signs.

<sup>400</sup> If we adopt exclusion zones, ARRL could prevent amateur licensees from registering amateur fixed stations in the exclusion zones when amateur licensees register with ARRL.

<sup>401</sup> The 135.7-137.8 kHz band is allocated on a primary basis to these services in all Regions in the International Table. 47 C.F.R. § 2.106.

<sup>402</sup> The 472-479 kHz band is allocated on a primary basis to the MMS in all Regions in the International Table. 47 C.F.R. § 2.106. RR 5.80A provides that amateur stations shall not cause harmful interference to nor claim protection from stations in the ARNS. RR 5.82 provides that amateur stations in the band cause no interference to 490 kHz. See revised text of RR 5.80A and RR 5.82 in Appendix D.

<sup>403</sup> WRC-12 also adopted a related U.S. proposal to restrict the primary mobile service allocation in the 510-525 kHz band to the MMS in ITU Region 2. This allocation has already been implemented in the U.S. Table.

<sup>404</sup> See *U.S. Proposals for WRC-12*, First Tranche, Agenda Item 1.10. See also *CPM Report to WRC-12*, Chapter 1, Agenda Item 1.10, 1/1.10/3.3 (Broadcasts of safety and security information for ships and ports), pp. 83; Report ITU-R [M.2201](#) (Utilization of the 495-505 kHz band by the maritime mobile service for the digital broadcasting of safety and security related information from shore-to-ships), 11/2010.

requirements for spectrum to accommodate existing and new maritime systems, the United States stated that an exclusive primary MMS allocation in the 495-505 kHz band is vital for the maritime community to have a globally harmonized primary MMS allocation for maritime safety information (MSI), security-related broadcasts, and data communication systems.<sup>405</sup> The United States also proposed that WRC-12 delete RR 5.82A and RR 5.82B, which would become unnecessary as a consequence of this proposal.

185. Proposal. WRC-12 adopted the U.S. proposal<sup>406</sup> and NTIA recommends that we implement these WRC-12 allocation changes in the U.S. Table.<sup>407</sup> Accordingly, we propose to reallocate the 495-505 kHz band to the MMS on a primary basis for Federal and non-Federal use. This action is expected to provide spectrum for digital broadcasting of maritime safety and security related information via automated broadcasts in a manner that can coexist with existing services.<sup>408</sup> We request comment on this proposal.

## 2. Oceanographic Radar Applications in the 4-44 MHz Range

186. Background. Oceanographic radar systems measure the speed and direction of ocean surface currents in near-real time. The ability to collect this data supports pollutant tracking, search and rescue, harmful algal bloom monitoring, navigation, and ecosystem assessment. The U.S. currently operates 143 oceanographic radars and plans to install 208 additional such radars.<sup>409</sup>

187. In preparation for WRC-12, the United States observed that these oceanographic radars have been operating for more than 30 years on an experimental, non-interference basis, and that uncoordinated global frequency use has resulted in band congestion.<sup>410</sup> At the same time, parties are increasing their reliance on the data from these systems for maritime safety, oceanographic, climatological, meteorological, and disaster response purposes.<sup>411</sup> Use of frequencies higher than 50 MHz limits the ability of oceanographic radar systems to provide useful data. Furthermore, oceanographic radars have a relatively large operational range (on the order of 200 km).

188. The U.S. proposed that WRC-12 provide spectrum for the operation of oceanographic radars in the 3-44 MHz range while minimizing the impact on incumbent fixed and mobile service

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<sup>405</sup> When considered along with the change noted in n.403, *supra*, the addition of the MMS allocation in the 495-505 kHz band would result in a continuous MMS allocation from 415 kHz to 525 kHz in Region 2 (extending to 526.5 kHz in Regions 1 and 3).

<sup>406</sup> Specifically, WRC-12 allocated the 495-505 kHz band to the MMS on a primary basis in all ITU Regions and deleted RR 5.82A and RR 5.82B. *See WRC-12 Final Acts*, p. 9.

<sup>407</sup> *See* NTIA WRC-12 Implementation Recommendations, p. 3.

<sup>408</sup> The U.S. proposal also noted that maritime communication systems in the 415-526.5 kHz band include transmissions in accordance with Recommendations ITU-R [M.540](#) (Operational and technical characteristics for an automated direct-printing telegraph system for promulgation of navigational and meteorological warnings and urgent information to ships), ITU-R [M.1677](#) (International Morse code), and ITU-R [M.1798](#) (Characteristics of HF radio equipment for the exchange of digital data and electronic mail in the maritime mobile service); that these systems currently operate in support of maritime applications other than those used for radiotelegraphy; and that based on current worldwide operational experience, other maritime applications are compatible with radiotelegraphy. *See also* Report ITU-R M.2201, n.404, *supra*, p. 2.

<sup>409</sup> *See* "A Plan to Meet the Nation's Needs for Surface Current Mapping," Updated – April 2013, Prepared for the Interagency Working Group on Ocean Observations ([National Surface Current Plan](#)), pp. i-ii.

<sup>410</sup> *See U.S. Proposals for WRC-12*, Second Tranche, Agenda Item 1.15.

<sup>411</sup> For example, the global oceanography community is planning for the implementation of coastal oceanographic radar networks. Oceanographic radar measurements of the sea surface provide support to meteorological operations through the collection of sea state and dominant ocean wave data. In addition, HF surface wave radar technology has applications in global maritime domain awareness by allowing the long-range sensing of surface vessels.

users.<sup>412</sup> Specifically, the U.S. proposed that WRC-12 allocate seven HF bands and two VHF bands to the radiolocation service (RLS) on a primary basis in all Regions, with the following international footnote limitation: “Stations in the radiolocation service shall not cause harmful interference to, nor claim protection from, stations operating in the fixed and mobile services. Resolution 612 (Rev.WRC-12) shall apply.” Additionally, the U.S. proposed that WRC-12 revise Resolution 612, which specifies the operating parameters for oceanographic radars. Given the increased use of oceanographic radars and their unique technical requirements, the U.S. suggested that the proposal would improve the regulatory status of oceanographic radars without sacrificing the protection of existing allocated services.<sup>413</sup>

189. WRC-12 allocated six HF bands and two VHF bands to the RLS for use by oceanographic radars in Region 2. Specifically, WRC-12 allocated a total of 695 kilohertz of HF spectrum as follows: five of these bands (4.438-4.488 MHz, 5.25-5.275 MHz, 16.1-16.2 MHz, 24.45-24.65 MHz, and 26.2-26.42 MHz) are allocated on a primary basis in Region 2 (and on a secondary basis in Regions 1 and 3),<sup>414</sup> and one band (13.45-13.55 MHz) is allocated on a secondary basis in all Regions. WRC-12 allocated the 1.3 megahertz of VHF spectrum (41.015-41.665 MHz and 43.35-44 MHz) proposed by the U.S. on a primary basis, but limited the use of these allocations to the United States and South Korea.<sup>415</sup>

190. In the International Table, all of the bands that WRC-12 allocated to the RLS are also allocated to the fixed service on a primary basis and seven of these bands are also allocated to the mobile service or to a subset of the mobile service.<sup>416</sup> In order to protect these incumbent services, WRC-12 adopted three international footnotes (RR 5.132A, RR 5.145A, and RR 5.161A), which limit the use of these RLS allocations to oceanographic radars operating in accordance with Resolution 612 (Rev.WRC-12) and require that these oceanographic radars not cause harmful interference to, or claim protection from, stations operating in the fixed or mobile services. We also note that WRC-12 updated Resolution 612.<sup>417</sup>

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<sup>412</sup> See *U.S. Proposals for WRC-12*, Second Tranche, Agenda Item 1.15.

<sup>413</sup> *Id.*

<sup>414</sup> In Regions 1 and 3, WRC-12 allocated only the narrower 24.45-24.60 MHz band, *i.e.*, the 24.60-24.65 MHz sub-band is not allocated for oceanographic radar use in Regions 1 and 3.

<sup>415</sup> See RR 5.161A.

<sup>416</sup> In Region 2, the 4.438-4.488 MHz band is allocated to the mobile except aeronautical mobile (R) service (MS except AM(R)S) on a primary basis, the 5.25-5.275 MHz and 26.2-26.42 MHz bands are allocated to the mobile except aeronautical mobile service (*i.e.*, the land mobile service (LMS) and the maritime mobile service (MMS)) on a primary basis, the 13.45-13.55 MHz band is allocated to the MS except AM(R)S on a secondary basis, the 24.45-24.65 MHz band is allocated to the LMS on a primary basis, and the 41.015-41.665 MHz and 43.35-44 MHz bands are allocated to the MS on a primary basis. (The 16.1-16.2 MHz band is allocated only to the FS.)

<sup>417</sup> In its revision of Resolution 612, WRC-12 resolved that: 1) when oceanographic radars are brought into use after February 17, 2012, and notified to the ITU's Radiocommunication Bureau, the notification must be in accordance with Radio Regulation No. 11.2 and must contain the station identification (call sign); 2) the peak EIRP of an oceanographic radar must not exceed 25 dBW (316 W); 3) each oceanographic radar station must transmit a station identification (call sign) on the assigned frequency, in international Morse code at manual speed, at the end of each data acquisition cycle, but at an interval of no more than 20 minutes; 4) oceanographic radars should, where applicable, use techniques that allow multiples of such radars to operate on the same frequency, reducing to a minimum the spectral occupancy of a Regional or global deployment of radars; 5) oceanographic radars should use directional antennas, where applicable and as required, to facilitate sharing, thereby reducing the EIRP in the direction of the transmit antenna backlobe; and 6) the separation distances between an oceanographic radar and the border of other countries must be greater than the distances specified in the following table, unless prior explicit agreements from affected administrations are obtained:

(continued....)

191. NTIA recommends that we implement in the U.S. Table all the RLS allocations WRC-12 adopted for oceanographic radar applications in ITU Region 2.<sup>418</sup> NTIA also recommends that we add references to the appropriate international footnote in the bands allocated for Federal/non-Federal shared use (*i.e.*, RR 5.132A in the 4.438-4.488 MHz, 5.25-5.275 MHz, 13.45-13.55 MHz, and 24.45-24.65 MHz bands, and RR 5.145A in the 16.1-16.2 MHz band), and that we adopt four U.S. footnotes that would apply to the bands allocated exclusively for Federal use (41.015-41.665 MHz) or for non-Federal use (26.2-26.42 MHz, 43.35-43.69 MHz, and 43.69-44 MHz).<sup>419</sup> Additionally, NTIA recommends that we raise the secondary mobile except aeronautical mobile service allocation in the 5.25-5.275 MHz band to primary status.

192. Proposal. We support the U.S. objective to provide allocated spectrum for the operation of oceanographic radars, while minimizing their impact on incumbent fixed and mobile service users. We also agree that allocating the WRC-12 oceanographic radar bands would better organize and reduce spectrum requirements for these operations. We therefore propose to allocate the eight WRC-12 frequency bands in the 4-44 MHz range to the RLS for Federal and non-Federal use, limited to oceanographic radar applications.

193. Specifically, we propose to allocate seven frequency bands (4.438-4.488 MHz, 5.25-5.275 MHz, 16.1-16.2 MHz, 24.45-24.65 MHz, 26.2-26.42 MHz, 41.015-41.665 MHz, and 43.35-44 MHz) to the RLS on a primary basis for Federal and non-Federal use and to allocate the 13.45-13.55 MHz band to the RLS on a secondary basis for Federal and non-Federal use.

194. To minimize the impact on the incumbent fixed and mobile services, we propose that oceanographic radars may not cause harmful interference to, or claim protection from, existing and future stations in the incumbent fixed and mobile services. As requested by NTIA, we seek to implement this proposal in the U.S. Table by adding RR 5.132A to four HF bands (4.438-4.488 MHz, 5.25-5.275 MHz, 13.45-13.55 MHz, and 24.45-24.65 MHz), RR 5.145A to the 16.1-16.2 MHz band, and a U.S. footnote (tentatively numbered as US132A) to the 26.2-26.42 MHz, 41.015-41.665 MHz, and 43.35-44 MHz bands.<sup>420</sup> Further, we propose to raise the secondary mobile except aeronautical mobile service allocation in the 5.25-5.275 MHz band to primary status, so that existing and future stations in this service can also be protected from interference from oceanographic radars.

195. We are most concerned about the potential for interference from oceanographic radars in the 4.438-4.488 MHz and 26.2-26.42 MHz bands. Several university-operated stations authorized on frequencies in the 4-44 MHz range under experimental licenses were required to adjust their operations

(Continued from previous page)

Frequency (MHz)	Land path (km)		Sea or mixed path (km)	
	Rural	Quiet rural	Rural	Quiet rural
5 (± 1 MHz)	120	170	790	920
13 (± 1 MHz)	100	110	480	520
16 (± 1 MHz)	80	100	390	450
25 (± 3 MHz)	80	100	280	320
42 (± 3 MHz)	80	100	200	230

See ITU *Radio Regulations*, Volume III, Resolution 612 (Rev. WRC-12), titled “Use of the radiolocation service between 3 and 50 MHz to support oceanographic radar operations,” pages RES612-1 through RES612-2.

<sup>418</sup> See NTIA WRC-12 Implementation Recommendations, table entries on pp. 4-9.

<sup>419</sup> See NTIA WRC-12 Implementation Recommendations, footnotes US[26.2MHz], US[41.015MHz], US[43.35MHz], and US[43.69MHz] on p. 25.

<sup>420</sup> In order to simplify the codification of oceanographic radar use in the U.S. Table, we have combined NTIA’s recommended footnotes (US[26.2MHz], US[41.015MHz], US[43.35MHz], and US[43.69MHz]) into a single new U.S. footnote. See Appendix F for the text of proposed footnote US132A.

because of interference caused to incumbent stations authorized in the fixed and mobile services.<sup>421</sup> Given these incidents, we note that operators of oceanographic radars would be required to cease operations if notified that they are causing harmful interference, and operations will not resume until the cause of the harmful interference is corrected.

196. Our proposed rules are based on the conditions specified in Resolution 612 (Rev.WRC-12). We propose to amend Part 90 of the Commission's rules to bring the oceanographic radar allocations into immediate effect. Specifically, we propose to amend Section 90.103 by listing the eight oceanographic radar bands in the table within paragraph (b), to limit station class of these radars to radiolocation land stations, and to restrict the use of these bands by adding new Limitation 3, which would be codified in new paragraph (c)(3). Specifically, we propose that new paragraph (c)(3) read as follows:

Operations in this band are limited to oceanographic radars using transmitters with a peak equivalent isotropically radiated power (EIRP) not to exceed 25 dBW. Oceanographic radars must not cause harmful interference to, nor claim protection from interference caused by, stations in the fixed or mobile services as specified in § 2.106, footnotes 5.132A, 5.145A, and US132A. See Resolution 612 of the ITU Radio Regulations for international coordination requirements. Operators of oceanographic radars are urged to use directional antennas and techniques that allow multiples of such radars to operate on the same frequency.

Because the power limitation in Resolution 612 is specified in peak EIRP, we also propose to reflect the Part 2 definition of this term in Section 90.7 of the Commission's rules.<sup>422</sup>

197. Finally, we propose to require that licensees of oceanographic radars that currently operate under Part 5 of the rules transition their operations to frequencies within an allocated band within five years of the adoption of final rules in this proceeding. We request comment on all of our proposals.

### 3. Improved Satellite-AIS Capability

198. Background. In the WRC-07 R&O, we implemented several WRC-12 allocation actions that were taken to support maritime safety requirements in the two existing bands (AIS 1 and AIS 2) used by maritime Automatic Identification Systems.<sup>423</sup> In this section, we address the new mobile-satellite service (MSS) allocations that WRC-12 adopted for the purpose of improving satellite detection of AIS messages.

199. In the U.S. Table, the 156.7625-156.8375 MHz band (75 kilohertz) is currently allocated on a primary basis to the maritime mobile service (MMS) (distress, urgency, safety, and calling) for Federal and non-Federal use. Prior to WRC-12, this band was allocated in the International Table to the MMS (distress and calling) on a primary basis in all Regions.<sup>424</sup> The United States proposed that WRC-12 adopt a new international footnote, which would state that the frequencies 156.775 MHz (channel 75) and 156.825 MHz (channel 76) are also allocated to the MSS (Earth-to-space) for the reception of AIS emissions from stations operating in the MMS, solely using message 27 as specified in

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<sup>421</sup> Our Enforcement Bureau has investigated numerous interference complaints related to the operation of experimental coastal radars dating back to at least the year 2000.

<sup>422</sup> For consistency within Part 90 of the rules, we use the abbreviation "EIRP" (instead of "e.i.r.p.," which is the abbreviation used in the ITU *Radio Regulations* and in Part 2 of the rules).

<sup>423</sup> See paras. 106-114, *supra*.

<sup>424</sup> In the case where there is a parenthetical addition to an allocation in the International Table, that service allocation is restricted to the type of operation so indicated. 47 C.F.R. § 2.104(h)(4). RR 5.226 states, *inter alia*, that the frequency 156.8 MHz is the international distress, safety and calling frequency for the maritime mobile VHF radiotelephone service and that the conditions for the use of this frequency and the 156.7625-156.8375 MHz band are contained in Article 31 and Appendix 18.

Recommendation ITU-R M.1371.<sup>425</sup> In its support for the new allocations, the U.S. stated that satellite monitoring of AIS equipped vessels is critical to search and rescue, safety of navigation, and the safe movement and tracking of vessels.<sup>426</sup> Further, the U.S. cited recent ITU-R studies which indicate that the recommended allocations are well-suited to allow for the use of satellite-AIS messages in a manner compatible with the existing allocations.<sup>427</sup>

200. WRC-12 divided the 156.7625-156.8375 MHz band into three 25 kilohertz-wide bands: 156.7625-156.7875 MHz (AIS 3 with a center frequency of 156.775 MHz), 156.7875-156.8125 MHz (channel 16 with a center frequency of 156.800 MHz), and 156.8125-156.8375 MHz (AIS 4 with a center frequency of 156.825 MHz), so that the bands on either side of channel 16 (*i.e.*, AIS 3 and AIS 4) could also be allocated to the MSS (Earth-to-space) on primary basis in Region 2 and on a secondary basis in Regions 1 and 3.<sup>428</sup> WRC-12 also adopted RR 5.228, which limits MSS (Earth-to-space) use of the AIS 3 and AIS 4 bands “to the reception” of emissions of long-range AIS broadcast messages (Message 27), and – with the exception of AIS emissions – requires that the emissions in these bands by MMS systems “shall not exceed 1 W.”

201. NTIA recommends that we implement the WRC-12 decision by reallocating the AIS 3 and AIS 4 bands to the MSS (Earth-to-space) on a primary basis for Federal and non-Federal use, limited to AIS operations only.<sup>429</sup> Further, NTIA recommends that we limit the use of these MSS allocations by adding the following use limitation to footnote US52: “The frequencies 156.775 MHz (AIS 3) and 156.825 MHz (AIS 4) are allocated exclusively to the MSS (Earth-to-space) for the reception of long-range broadcast messages from ships (Message 27; see most recent version of ITU-R M.1371).” In addition, NTIA’s WRC-12 Implementation Recommendations included deleting the MMS allocations from the AIS 3 and AIS 4 bands.<sup>430</sup>

202. Proposal. We propose to implement NTIA’s recommendations regarding satellite monitoring of AIS equipped ships as follows. First, we propose to allocate the 156.7625-156.7875 MHz

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<sup>425</sup> The United States also proposed that a similar note be added to Appendix 18 (channels 75 and 76 are allocated to the MSS (Earth-to-space) “for the transmission of AIS message 27 from ships”). See *U.S. Proposals to WRC-12*, First Tranche, Agenda Item 1.10, pp. 2 and 4.

<sup>426</sup> See, e.g., IMO Resolution MSC 74(69) (requiring that AIS improve the safety of navigation by assisting in the efficient navigation of ships, protection of the environment, and operation of Vessel Traffic Services (VTS)).

<sup>427</sup> “The ITU-R completed studies to identify VHF channels in Appendix 18 for improved AIS satellite detection and recently updated Recommendation ITU-R M.1371-3, “Technical characteristics for an automatic identification system using time division multiple access in the VHF maritime mobile band,” to reflect specialized message 27 for long-range AIS broadcast messages of AIS Class A equipped vessels. This proposed MSS (Earth-to-space) allocation for satellite AIS is compatible with the existing navigation-related communications of the frequencies as designated in Appendix 18, note n). ITU-R Report M.2169, “Improved satellite detection of AIS,” and the recently updated ITU-R Recommendation M.1371-3 confirm the compatibility and show that the transmission of new AIS message 27 contains navigational information including position, speed over ground, course over ground, and navigational status. The proposed MSS (Earth-to-space) frequencies (channels 75 and 76) are for navigation and serve as guard-bands for channel 16 – the safety and distress frequency.” See *U.S. Proposals to WRC-12*, First Tranche, Agenda Item 1.10. See also ITU-R Report [M.2169](#) and Recommendation ITU-R [M.1371-3](#). We note, in particular, that: “Transmission of Message 27 at 12.5 W only once every 3 min for 17 ms, alternating between channels 75 and 76 together with the restriction to not transmit when the ship is within range of an AIS base station, would not interfere with voice communications on any of these channels 16, 75 and 76...” See ITU-R Report M.2169, Section 4 (Operating frequencies for satellite detection of AIS), p. 6.

<sup>428</sup> See *CPM Report to WRC-12*, Chapter 1, Agenda Item 1.10, pp. 83, 85-86, 88-89, 93, 97-99; and *WRC-12 Final Acts*, Appendix 18 at 148.

<sup>429</sup> See NTIA WRC-12 Implementation Recommendations at pp. 12 (for NTIA’s recommended Table entries) and 25 (for NTIA’s recommended footnote US[replace US52/55]).

<sup>430</sup> *Id.*

(AIS 3) and 156.8125-156.8375 MHz (AIS 4) bands to the MSS (Earth-to-space) on a primary basis for Federal and non-Federal use. The table entries for the MSS allocations would include the parenthetical additions “(Earth-to-space) (AIS 3)” and “(Earth-to-space) (AIS 4),” which would restrict the use of these MSS allocations to AIS emissions and operations in the Earth-to-space direction. This action would make 50 kilohertz of spectrum available for ship earth stations to transmit maritime AIS messages to space stations in the MSS (Earth-to-space). Designating these additional channels for satellite detection of AIS messages from ship earth stations would improve vessel tracking and thereby enhance maritime safety and security.

203. Second, as requested by NTIA, we propose to remove the primary maritime mobile service allocation from the AIS 3 and AIS 4 bands. Consequently, we propose to remove all references to the frequencies 156.775 MHz and 156.825 MHz from Part 80 of our rules.<sup>431</sup> We note that there is a single licensee, BKEP Materials, LLC, authorized to operate private coast stations at three locations using these frequencies with an output power of 10 watts.<sup>432</sup> During our normal coordination process, the U.S. Coast Guard noted that ITU studies show that even a 1 watt station could cause interference to satellite reception in these bands. We propose to grandfather this existing MMS use in proposed footnote US52 until the expiration date of these authorizations, set for August 26, 2019. Therefore, we propose to require that operations on the frequencies 156.775 MHz and 156.825 MHz be terminated upon the expiration of the licenses, and to prohibit the license renewal of operations on these frequencies. We note that there are an unknown number of ship stations that also operate on these frequencies. We request comment on ship station usage, and on whether we should alternatively permit this limited MMS use to continue for a longer phase-out period. If so, we alternatively propose to limit ship and coast stations operating on these channels to a transmitter output power of 1 W. We request comment on these proposals. In particular, we request comment on whether these private coast station operations should be relocated to other maritime mobile frequencies no later than August 26, 2019. If such relocation is not attainable by August 26, 2019, what would be the appropriate transition period?

204. Third, we propose to revise footnote US52 by adding new paragraph (b) to restrict the use of the proposed MSS uplink allocations to long-range AIS broadcast messages from ship earth stations and to codify in the U.S. Table the grandfathering provisions discussed above.<sup>433</sup> Specifically, we propose that new paragraph (b) read as follows:

Except as provided for below, the use of the bands 156.7625-156.7875 MHz (AIS 3 with center frequency 156.775 MHz) and 156.8125-156.8375 MHz (AIS 4 with center frequency 156.825 MHz) by the mobile-satellite service (Earth-to-space) is restricted to the reception of long-range AIS broadcast messages from ships (Message 27; see most recent version of Recommendation ITU-R M.1371). The frequencies 156.775 MHz and 156.825 MHz may continue to be used by non-Federal ship and coast stations for navigation-related port operations or ship movement until August 26, 2019.

205. We also note that satellite reception in the AIS 1 and AIS 2 bands is not protected from adjacent-band terrestrial stations operating in accordance with the terms of their licenses. We seek comment on whether we should add such a requirement to the AIS 3 and AIS 4 bands.<sup>434</sup> Table 3, below, reflects the 156.7625-156.8375 MHz band as it currently exist in the U.S. Table and as we propose to

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<sup>431</sup> Specifically, we propose to amend: 1) Section 80.215 by removing note 13 from para. (c)(1) and by removing paragraph (g)(3); 2) Section 80.373 by removing these frequencies from the table in para. (f) and by removing note 18; and 3) Section 80.871 by removing these frequencies from the table in para. (d).

<sup>432</sup> Specifically, the Commission has issued five licenses that authorize private coast stations to transmit on the frequencies 156.775 MHz and 156.825 MHz using a bandwidth of 16 kilohertz and 10 watts of output power at three locations: Catoosa, Oklahoma (WQKR767, WQKR768); Newport News, Virginia (WQKR769); and Saint Louis, Missouri (WQKR770, WQKR771). The expiration date for all of these licenses is August 26, 2019.

<sup>433</sup> Existing paragraphs (b) and (c) would be renumbered as (c) and (d), respectively.

<sup>434</sup> See Appendix F for the proposed revised text of footnote US52.

modify the band.

<b>Table 3: Implementing the WRC-12 Final Acts in the AIS 3 and AIS 4 Bands</b>			
Existing U.S. Table (adopted in the WRC-07 R&O)		Proposed U.S. Table	
Federal Table	Federal Table	Non-Federal Table	Federal Table
156.7625-156.8375 MARITIME MOBILE (distress, urgency, safety and calling)		156.7625-156.7875 MOBILE-SATELLITE (Earth-to-space) (AIS 3) 5.226 US52 US266	
		156.7875-156.8125 MARITIME MOBILE (distress, urgency, safety and calling) 5.111 5.226 US266	
		156.8125-156.8375 MOBILE-SATELLITE (Earth-to-space) (AIS 4) 5.226 US52 US266	
5.111 5.226 US266			

**C. Sharing Between AMT and Incumbent Services in the 4400-4940 MHz and 5925-6700 MHz Bands**

206. In this section, we examine an allocation issue that was not resolved through the WRC-07 rulemaking process. Aeronautical mobile telemetry for flight testing of aircraft (hereinafter, AMT) is an aeronautical mobile service (AMS) that transmits from an aircraft station to a receiving station the results of measurements made onboard an aircraft, including those related to the functioning of the aircraft.<sup>435</sup> Examples of AMT data include engine temperature, fluid pressure, and readings from control surface strain gauges. In the United States, AMT operations are most often authorized in the 1435-1525 MHz, 2200-2290 MHz, and 2360-2395 MHz bands.<sup>436</sup>

207. At WRC-07, the United States was a leading proponent of global or Regional AMT allocations. In its WRC-07 proposals, the United States stated that with the increasing complexity of aircraft design, pressure to shorten timescales for the development of new aircraft, and telemetry spectrum being diverted to other uses, there was a large and growing shortfall in the spectrum available for AMT use.<sup>437</sup> Further, due to rapidly increasing data rates associated with the testing of new and emerging technologies, “as much as an additional 650 megahertz may be required for aeronautical flight test telemetry.”<sup>438</sup>

<sup>435</sup> The AMS is a radiocommunication service between aeronautical (ground) stations and aircraft stations, or between aircraft stations. 47 C.F.R. § 2.1(c). Major AMT test ranges are capable of supporting at least 2-6 simultaneous tests. A major test flight can involve as many as ten separate aircraft generating telemetry on many data and video channels that require nearly the entire available spectrum (*i.e.*, 125 megahertz of primary MS spectrum), using current technologies. The majority of AMT ground station antennas range in size from 2.4 to 5 meters for operating distances less than 350 km. Larger antennas are used only on ranges requiring extreme operating distances (350 km or more). AMT relay platforms, such as a second aircraft, are often used to extend coverage over water and when over land, to other ranges. It is not unusual for manned aircraft to traverse thousands of kilometers in test flights lasting 10-12 hours. AMT relay stations can also be shipborne when long-range tests are conducted over water. See United States of America, Draft New Report ITU-R M.[AMT], “Operational Description of Aeronautical Mobile Telemetry (AMT),” Document 8B/58-E, Aug. 19, 2004, at 2-4, 11.

<sup>436</sup> The 2200-2290 MHz band is not available for non-Federal AMT use.

<sup>437</sup> See United States of America Proposals for the Work of the Conference, plenary meeting, Document 5-E, February 9, 2007 (*U.S. Proposals for WRC-07*), Agenda Item 1.5, at 9-23. See also *CPM-07 Report*, Chapter 1, at 43-88.

<sup>438</sup> The U.S. Proposals noted that newer technologies are relying increasingly on high-resolution video for monitoring aircraft functions or increased use of computer-based aircraft systems. Under the U.S. position, without (continued....)

208. In the companion WRC-07 R&O we are allocating 59 megahertz for AMT use, with the adoption of the allocation for the 5091-5150 MHz band. In this section, we are addressing two additional frequency bands that WRC-07 identified for AMT use. Specifically, WRC-07 decided that the mobile service (MS) allocation in the 4400-4940 MHz and 5925-6700 MHz bands may be used for AMT flight test transmissions from aircraft stations in much of ITU Region 2 by adopting RR 5.440A and RR 5.457C.<sup>439</sup> In addition, these international footnotes state that AMT use shall be in accordance with Resolution 416 (WRC-07)<sup>440</sup> and shall not cause harmful interference to, nor claim protection from, the fixed-satellite and fixed services.<sup>441</sup> Resolution 416 places the following operational restrictions on AMT use of the 4400-4940 MHz and 5925-6700 MHz bands: 1) emissions are limited to transmissions from aircraft stations only; 2) AMT is not considered an application of a safety service as per ITU Radio Regulations, Article No. 1.59;<sup>442</sup> 3) the peak EIRP density of a telemetry transmitter antenna shall not exceed  $-2.2$  dB(W/MHz); 4) transmissions are limited to designated flight test areas, where flight test areas are airspace designated by administrations for flight testing; 5) bilateral coordination of transmitting AMT aircraft stations with respect to receiving fixed or mobile stations is required if the AMT aircraft station will operate within 450 km of the receiving fixed or mobile stations of another administration,<sup>443</sup> and 6) require the use of technical and/or operational measures where appropriate to facilitate sharing with other services and applications in these bands.<sup>444</sup>

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access to additional spectrum, aeronautical development could be subject to escalating delays and costs and the growth of aerospace industry would be significantly impaired (including equipment manufacturers, civilian programs and test ranges, and airlines). *See U.S. Proposals for WRC-07*, Agenda Item 1.5, at 9.

<sup>439</sup> Prior to WRC-07, the basic allocation structure in the International Table was as follows. The 4400-4940 MHz and 5925-6700 MHz bands were allocated to the fixed and mobile services, and the 4500-4800 MHz and 5925-6700 MHz bands were also allocated to the fixed-satellite service (Earth-to-space), on a primary basis in all ITU Regions. At that time, however, RR 5.442 stated that in the 4825-4835 MHz band, the allocation to the mobile service was restricted to the mobile, except aeronautical mobile, service. WRC-07 revised RR 5.442 to allocate the 4825-4835 MHz band to the aeronautical mobile service on a primary basis in ITU Region 2, limited to AMT for flight test transmissions from aircraft stations.

<sup>440</sup> *See* ITU Radio Regulations, Volume III, Resolution 416 (WRC-07), titled “Use of the bands 4400-4940 MHz and 5925-6700 MHz by an aeronautical mobile telemetry application in the mobile service.”

<sup>441</sup> Further, these footnotes state that AMT use does not preclude the use of the 4400-4940 MHz and 5925-6700 MHz bands by other mobile service applications or by other services to which these bands are allocated on a co-primary basis and does not establish priority in the Radio Regulations.

<sup>442</sup> ITU Radio Regulations, Article No. 1.59 defines a safety service as “any radiocommunication service used permanently or temporarily for the safeguarding of human life and property.” *See U.S. Proposals for WRC-07*, Agenda Item 1.5, pp. 14-15 (draft Resolution [AMT4-6 GHz]). We note that Resolution 416 generally mirrors the U.S. proposed resolution, except that WRC-07 resolved that AMT use in the two bands referenced above “is not considered an application of a safety service as per No. 1.59.”

<sup>443</sup> Resolution 416 describes the following procedures for establishing whether a fixed or mobile service receiver in a neighboring administration and within 450 km of the flight test area will not receive an unacceptable level of interference: 1) determine if the receiving fixed or mobile station’s antenna main-beam axis, out to a distance of 450 km, passes within 12 km of the designated area used by transmitting AMT aircraft stations, where this distance is measured orthogonally from the main-beam axis projection on the Earth’s surface to the nearest boundary of the projection of the flight test area on the Earth’s surface; 2) if the main-beam axis does not intersect the flight test area or any point within the 12 km offset, the interference could be accepted. Otherwise, further bilateral coordination discussions would be needed.

<sup>444</sup> *See* ITU Radio Regulations, Resolution 416 (WRC-07), *resolves* 1 and 2. *See also* NTIA Final Supplement at 4-5 (NTIA states that the operational restrictions contained in Resolution 416 were a result of cooperation and collaboration between the Department of Defense (DoD), the National Aeronautics and Space Administration (NASA), and FSS industry representatives, which the U.S. agreed as being able to protect FSS uplink satellite receivers and result in minimal interference to the FSS (*e.g.*, less than a 3 percent increase in the satellite receiver (continued....))

209. Though the Commission did not propose in the *WRC-07 NPRM* to allocate spectrum for AMT use in the nearly exclusive Federal band at 4400-4940 MHz,<sup>445</sup> or in the exclusive non-Federal band at 5925-6700 MHz, we are now seeking comment on the ability of Federal/non-Federal AMT stations to share spectrum with the incumbent services in these bands.<sup>446</sup> We believe that it is appropriate to examine the sharing potential in these bands based on input from NTIA regarding the interference mitigation techniques that could be used to promote such sharing.<sup>447</sup> In doing so, we note that NTIA intended for the 4400-4940 MHz and 5925-6700 MHz bands to be considered together as a “package” proposal.<sup>448</sup> By making this additional spectrum available for both Federal and non-Federal AMT use, NTIA believes enough spectrum could be coordinated with the existing allocated services throughout all the bands to support additional AMT operations.<sup>449</sup> In its supplement, NTIA clarified that if the 5925-6700 MHz band was not allocated for AMT use, then nearly all additional Federal AMT operations would be forced to use any capacity available in the 4400-4940 MHz band.<sup>450</sup> As a result, the 4400-4940 MHz band would be fully utilized by Federal AMT operations, and NTIA indicated that it would no longer support a non-Federal AMT allocation in the 4400-4940 MHz band.<sup>451</sup>

210. In light of NTIA’s concerns and recommendations, we specifically request comment on the proposed allocations for both the 4400-4940 MHz and 5925-6700 MHz bands. In particular, are there technical approaches, coordination procedures, or analytical techniques that would ensure compatibility with existing services in these bands? What are the costs and benefits and advantages or disadvantages of adding AMT allocations to these bands? Is sharing with AMT the highest valued use of this spectrum or should we consider other potential licensed or unlicensed uses on a shared basis?

### 1. 5925-6700 MHz

211. In the U.S. Table, the 5925-6700 MHz band is allocated exclusively for non-Federal use. This 775 megahertz of spectrum is allocated to the fixed-satellite service (FSS) (Earth-to-space) on a primary basis.<sup>452</sup> In addition, the 5925-6425 MHz and 6525-6700 MHz bands are allocated to the fixed

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noise level). NTIA further states that the operational restrictions in Resolution 416, in conjunction with measures that can be employed by AMT operators, were developed in cooperation with FS industry participants in the ITU-R, and the U.S. agreed these measures should enable sharing between AMT and the FS users in the band. NTIA recognizes that the burden of avoiding interference to the existing FS stations would primarily be on the AMT users, but anticipates that both AMT and FS operators would work together to resolve compatibility challenges.).

<sup>445</sup> See n.471, *infra*.

<sup>446</sup> *WRC-07 NPRM*, 27 FCC Rcd at 14604, para. 11, n.29.

<sup>447</sup> See NTIA Final Supplement at 5 (NTIA states that analysis conducted by the DoD and NASA prior to WRC-07 demonstrated that through a combination of co-frequency avoidance and spatial isolation, it would be possible to find significant amounts of useable spectrum for AMT operations even in heavily congested areas of FS use. Furthermore, interstitial use of unused spectrum between FS channels may enable access to additional spectrum for AMT use. Although the first two techniques are commonplace interference avoidance technologies, interstitial use of spectrum between FS channels may require development of AMT systems that employ more advanced technologies and capabilities so that enough spectrum could be consolidated to allow AMT access to spectrum with sufficient bandwidth. While NTIA believes co-channel avoidance and spatial isolation techniques would initially be the primary means to achieve compatible operations between AMT and FS operations, as more advanced AMT technologies are developed, it may be possible to coordinate interstitial AMT operation between the FS channels.).

<sup>448</sup> See [NTIA Second Supplement](#) at 1-2.

<sup>449</sup> *Id.* at 1.

<sup>450</sup> *Id.* at 2.

<sup>451</sup> *Id.*

<sup>452</sup> Footnote NG181 states that, in the 5925-6425 MHz band, earth stations on vessels (ESVs) are an application of the FSS (Earth-to-space) and are authorized to communicate with space stations of the FSS on a primary basis.

service (FS) on a primary basis, and the 6425-6525 MHz band is allocated to MS on a primary basis.

212. Frequencies in the 5925-6700 MHz band are available for assignment to transmitting earth stations<sup>453</sup> and to the Part 101 Fixed Microwave Services.<sup>454</sup> Part 101 uses include common carrier, business, industrial, police, fire, utility, and transportation system operations. In addition, frequencies in this band are used to provide wireless backhaul capacity, which is vital for the deployment of competitive wireless broadband services.<sup>455</sup> Specifically, these frequencies are available under Part 101 to eligible entities in the: 1) Private Operational Fixed Point-to-Point Microwave Service (OFS) (5925-6875 MHz); 2) Common Carrier Fixed Point-to-Point Microwave Service (CC) (5925-6425 MHz and 6525-6875 MHz); and 3) Local Television Transmission Service (LTTS) (5925-6525 MHz).<sup>456</sup> In addition, frequencies in the 6425-6525 MHz band may be licensed to television broadcast auxiliary service (BAS) and cable television relay service (CARS) stations.<sup>457</sup>

213. The 5925-6700 MHz band is used extensively for FS, FSS, and MS operations, including earth stations on vessels.<sup>458</sup> Table 4, below, lists the number of FS and MS transmitter and receiver pairs (links) and transmitting fixed earth stations that were authorized to operate in the 5925-6700 MHz band as of March 2015.<sup>459</sup> Since May 2011, the total number of fixed and mobile links has increased by approximately 60 percent, which is about a 13 percent annual growth.<sup>460</sup>

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<sup>453</sup> 47 C.F.R. § 25.202(a)(1), (b).

<sup>454</sup> Section 101.147(j) limits the use of the 6425-6525 MHz band to stations in the mobile service. This band is co-equally shared with mobile stations licensed under Parts 74 and 78 of the Commission's rules.

<sup>455</sup> See, e.g., Amendment of Part 101 of the Commission's Rules to Facilitate the Use of Microwave for Wireless Backhaul and Other Uses and to Provide Additional Flexibility to Broadcast Auxiliary Service and Operational Fixed Microwave Licensees, *et al.*, WT Docket No. 10-153, *et al.*, *Second Report and Order, Second Further Notice of Proposed Rulemaking, Second Notice of Inquiry, Order on Reconsideration, and Memorandum Opinion and Order*, 27 FCC Rcd 9735 (2012). In that action, the Commission, *inter alia*, modified the antenna standards set forth in its rules to permit the use of smaller antennas in the 5925-6875 MHz band, resulting in wider beamwidth signals. In addition, the Commission revised its rules to permit FS operators to combine adjacent channels in the 5925-6425 MHz band to form 60 megahertz wide channels (instead of the previous limit of 30 megahertz). We note that the studies undertaken to support the U.S. position for WRC-07 regarding AMT operations may show different results if they are performed using these new parameters as inputs. 27 FCC Rcd at 9745, para. 18, and 9756, para. 52.

<sup>456</sup> 47 C.F.R. Part 101, Subparts C & H (OFS), Subparts C & I (CC), and Subpart J (LTTS). For frequency assignments, including authorized bandwidth and channel pairings, see 47 C.F.R. §101.147(i), (j), and (l).

<sup>457</sup> 47 C.F.R. Part 74, Subpart F (BAS); Part 78 (CARS). Use of the 6425-6525 MHz band for direct delivery of video programs to the general public or multi-channel cable distribution is not permitted. Broadcast network-entities may use this band only for mobile television pickup stations. 47 C.F.R. §§ 74.602(a) and (i), 78.18(a)(5).

<sup>458</sup> Earth stations on vessels (ESVs) are an application of the FSS and are authorized to communicate with space stations of the FSS on a primary basis in the 5925-6425 MHz band.

<sup>459</sup> The link count for Parts 101 and 74 is from the ULS\_Micro data set (March 1, 2015), the link count for Part 78 is from the COALS data set (August 7, 2014), and the number of transmitting fixed earth stations authorized pursuant to Part 25 is from the IBFS data set (March 2, 2015). The COALS data set is no longer being updated.

<sup>460</sup> In May 2011, the total number of fixed and mobile links in the 5925-6875 MHz band was 61,604.

Band	Allocations	Parts 101 and 74	Part 78	Part 25
5925-6425 MHz	FS and FSS (Earth-to-space)	77,829	4	7,534
6425-6525 MHz	MS and FSS (Earth-to-space)	2,862	89	312
6525-6700 MHz <sup>461</sup>	FS and FSS (Earth-to-space)	17,584	0	87
Grand total for the 5925-6700 MHz band = 106,301		98,275	93	7,933

214. NTIA recommends that we allocate the 5925-6700 MHz band to the AMS on a primary basis for Federal use; allocate the 5925-6425 MHz and 6525-6700 MHz bands to the AMS on a primary basis for non-Federal use;<sup>462</sup> and add the 5925-6700 MHz band to footnote US111.<sup>463</sup> NTIA also recommends that we adopt the following U.S. footnote for operational criteria:<sup>464</sup>

USXX3 [1.5] Use of the band 5925-6700 MHz by aeronautical mobile telemetry (AMT) for flight testing by aircraft stations (see No. 1.83) shall be in accordance with Resolution 416 (WRC 07). Any such use does not preclude the use of these bands by other non-federal mobile service applications or by other services to which these bands are allocated on a co-primary basis and does not establish priority. Federal use of the aeronautical mobile service allocation in the band 5925-6700 MHz is limited to aeronautical mobile telemetry for flight test telemetry transmissions by aircraft stations within designated test areas (See US111).

New footnote US111, adopted in the companion WRC-07 R&O, identifies the designated flight test areas.

215. The U.S. Proposals noted that there is a growing need for access to spectrum to support AMT operations.<sup>465</sup> They recognized that the increased complexity and sophistication of modern aircraft necessitates monitoring an ever growing array of sensors and transmitting their data in real time for both safety purposes and helping to control the high costs of conducting flight tests. Working collaboratively with the federal government and AMT stakeholders will allow for identifying various ways to support these needs, including exploring possible future use of other wireless services to augment the U.S.'s existing AMT capabilities.

216. We note that the underlying assumptions in the *U.S. Proposals for WRC-07* included frequency avoidance or other measures to ensure compatible operations between AMT and incumbent services, such as requiring use of technical and/or operational measures on AMT.<sup>466</sup> Accordingly, it would be incumbent on the AMT community to develop techniques that will enable sharing without

<sup>461</sup> We note that, under the Part 101 rules, channels in the 6525-6700 MHz band (175 megahertz of spectrum) are paired with channels in the 6700-6825 MHz band (175 megahertz). Thus, the requested AMT allocation (*i.e.*, co-primary status) would impact future fixed stations in 350 megahertz of spectrum, not just the requested 175 megahertz.

<sup>462</sup> The 6425-6525 MHz band is already allocated to the non-Federal MS on a primary basis.

<sup>463</sup> NTIA's recommended version of footnote US111 pertains to the 4400-4940 MHz, 5091-5150 MHz, and 5925-6700 MHz bands. However, as adopted in the companion WRC-07 R&O, this U.S. footnote pertains only to AMT use of the 5091-5150 MHz band. *See* NTIA WRC-07 Recommendations at p. 4, footnote USXX5 [1.5], for NTIA's recommended text.

<sup>464</sup> *See* NTIA WRC-07 Recommendations at pp. 3-4 for the text of footnote USXX3 [1.5]. We have updated NTIA's recommended text by replacing the cross reference to footnote "USXX5[1.5]" with "US111."

<sup>465</sup> *U.S. Proposals for WRC-07*, Agenda Item 1.5 at 9.

<sup>466</sup> *See* ITU *Radio Regulations*, Resolution 416 (WRC-07), *resolves* 2. *See also* *U.S. Proposals for WRC-07*, Agenda Item 1.5, at 10 ("It is expected that the implementation of telemetry may require avoiding co-frequency operations with local services in some of the bands. This will likely mean that the spectrum requirement for AMT would be satisfied using portions of each of the bands studied and deemed suitable for AMT implementation.").

causing harmful interference to existing stations. These techniques could include frequency coordination, shared network architectures, dynamic selection of operating frequencies, or spectrum use only in specific geographic areas. It is not necessary at this time to determine the technical details for such sharing. It is only necessary that we determine whether sharing is feasible. To that end, we seek comment on the underlying assumptions made in Report ITU-R M.2119 which concluded that sharing is feasible.<sup>467</sup> Also, we solicit comment as to what measures might be necessary to ensure the protection from harmful interference of incumbent non-Federal stations in the band.<sup>468</sup> How may we best facilitate collaboration between Federal and non-Federal AMT users and incumbent services to determine appropriate technical conditions for sharing? We also seek comment on whether increased sharing among non-Federal and Federal fixed microwave users in the 6-7 GHz range of spectrum could provide greater spectral efficiencies that would enable more usable bandwidth for both categories of fixed microwave users and for AMT. We observe that other industry-government collaboration efforts have led to highly successful outcomes, such as in the recent reallocation and sharing of spectrum to support Advanced Wireless Service operations in the 1695-1710 MHz and 1755-1780 MHz bands.<sup>469</sup>

217. The NTIA recommendations do not specify how AMT operations would share the 6425-6525 MHz band with the non-Federal mobile service. We seek comment on whether sharing this band with AMT is feasible. In considering whether to allocate the 6425-6525 MHz band for AMT use, we solicit comment on how the current mobile service assignments in this band are used. For example, is land mobile use of this band generally limited to metropolitan areas? Are there any aeronautical mobile applications, *e.g.*, electronic newsgathering (ENG) operations from helicopters, in this band?

218. Finally, we request comment on several coordination issues. First, should the Commission use the existing process for coordinating federal authorizations for service with the FCC or should the Commission and NTIA jointly designate a third party coordinator to be responsible for coordinating AMT operations in the 5925-6700 MHz band? Use of a third party coordinator may better protect incumbent operations, increase the speed of service, and provide non-Federal incumbents with an enhanced level of transparency during the coordination process. Second, is the information provided in footnote US111 with the coordinates for the 17 locations where flight testing would occur sufficient to ensure that AMT coordination with existing services in the 5925-6700 MHz band would be successful or is additional information needed?

## 2. 4400-4940 MHz

219. In the U.S. Table, the 4400-4940 MHz band is allocated to the FS and MS on a primary basis for Federal use.<sup>470</sup> The 4500-4800 MHz band is also allocated to the FSS (space-to-Earth) on a primary basis for non-Federal use<sup>471</sup> and the 4825-4835 MHz sub-band may be used for radio astronomy

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<sup>467</sup> See Report ITU-R M.2119 (2007), titled “Sharing between aeronautical mobile telemetry systems for flight testing and other systems operating in the 4 400-4 940 and 5 925-6 700 MHz bands.”

<sup>468</sup> For example, Report ITU-R M.2119 states that for protection of FSS space station receivers in the 5925-6700 MHz band, AMT use of this band should be limited to a maximum of 21 simultaneous co-frequency transmissions, including those from AMT stations authorized by other administrations. In addition, this report found that “[p]ermissible levels of interference to FS/MS stations are not exceeded when the distance along the main-beam axis from the FS/MS antenna to the AMT area of operation is larger than 450 km or when the main-beam axis of the FS/MS antenna is separated from the aircraft flight zone by 12 km or more.” See Report ITU-R M.2119 at 2, 4.

<sup>469</sup> See Amendment of the Commission’s Rules with Regard to Commercial Operations in the 1695-1710 MHz, 1755-1780 MHz, and 2155-2180 MHz Bands, GN Docket No. 13-185, *Report and Order*, 28 FCC Rcd 4610 (2014).

<sup>470</sup> Typical Federal uses include, but are not limited to, point-to-point microwave, drone vehicle control, and telemetry.

<sup>471</sup> Although the 4500-4800 MHz band has also been allocated in the U.S. Table to the FSS (space-to-Earth) on a primary basis for non-Federal use since 1984, this FSS allocation has never been used. Footnote US245 states that (continued....)

observations.<sup>472</sup>

220. NTIA recommends that we allocate the 4400-4940 MHz band to the AMS on a primary basis for non-Federal use, amend footnote US111 to add the 4400-4940 MHz band, and add the two footnotes shown below to the Allocation Table to ensure compatible operations between non-Federal and Federal users in the band.

USXX2 [1.5] Use of the band 4400-4940 MHz by aeronautical mobile telemetry (AMT) for flight testing by aircraft stations (see No. 1.83) shall be in accordance with Resolution 416 (WRC 07). Any such AMT use does not preclude the use of these bands by other federal mobile service applications or by other services to which these bands are allocated on a co-primary basis and does not establish priority. Non-federal use of the aeronautical mobile service allocation in the band 4400-4940 MHz is limited to aeronautical mobile telemetry for flight test telemetry transmissions by aircraft stations within designated test areas (See US111).

USXX4 [1.5] Aeronautical Mobile Telemetry (AMT) operations will, as much as practicable, avoid transmitting in the band 4825-4835 MHz, used for radio astronomy observations of the formaldehyde line, when within line-of-sight of radio astronomy observatories included in the Table below. AMT operations, conducted within 500 km of a radio astronomy observatory other than a Very Long Baseline Array (VLBA) station, or within 200 km of a VLBA station will, as much as practicable, share their schedule and consult with affected radio astronomy observatories through the Electromagnetic Spectrum Management office of the National Science Foundation ([esm@nsf.gov](mailto:esm@nsf.gov)).

Observatory	Latitude (N)	Longitude (W)
National Astronomy and Ionosphere Center, Arecibo, Puerto Rico	18° 21'	66° 45'
National Radio Astronomy Observatory, Green Bank, W.Va.	38° 26'	79° 50'
National Radio Astronomy Observatory, Socorro, New Mexico	34° 05'	107° 37'
Allen Telescope Array, Hat Creek, Cal.	40° 49'	121° 28'
Owens Valley Radio Observatory (Cal. Tech.), Big Pine, Cal.	37° 14'	118° 17'
Very Long Baseline Array Stations (VLBA), NRAO:		
Brewster, WA	48° 08'	119° 41'
Fort Davis, TX	30° 38'	103° 57'
Hancock, NH	42° 56'	71° 59'
Kitt Peak, AZ	31° 57'	111° 37'
Los Alamos, NM	35° 47'	106° 15'
Mauna Kea, HI	19° 48'	155° 27'
North Liberty, IA	41° 46'	91° 34'
Owens Valley, CA	37° 14'	118° 17'
Pie Town, NM	34° 18'	108° 07'
Saint Croix, VI	17° 45'	64° 35'

221. We seek comment on NTIA's proposals for the 4400-4940 MHz band. In particular, are there any additional measures that we should consider to ensure that AMT stations in the 4400-4940 MHz band would operate compatibly with public safety fixed and mobile operations in the adjacent 4940-4990 MHz band? Finally, if the 4400-4940 MHz band were allocated for use by non-Federal AMT licensees, any non-Federal AMT use would be coordinated with Federal agencies through NTIA's Frequency Assignment Subcommittee process. We seek comment on this assumption.

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the non-Federal FSS (space-to-Earth) operations in the 4500-4800 MHz are limited to international inter-continental systems and are subject to case-by-case electromagnetic compatibility analysis.

<sup>472</sup> Specifically, footnote US113 identifies the radio astronomy stations that observe in the 4825-4835 MHz band and states that every practicable effort will be made to avoid the assignment of frequencies to stations in the fixed or mobile services in this band. In the companion WRC-07 R&O, we revised footnote US203 and renumbered it as US113. See para. 134, *supra*.

#### D. Additional Aviation Services Uses in the 5000-5150 MHz Band

222. In this section, we propose to take actions in support of aeronautical mobile (R) service (AM(R)S) surface applications at airports in the 5000-5030 MHz band and unmanned aircraft systems (UAS) in the 5030-5091 MHz band.<sup>473</sup>

223. Background. Prior to WRC-12, the bands comprising the 5000-5150 MHz range were allocated in the International Table to the aeronautical mobile-satellite (R) service (AMS(R)S) on a primary basis, per RR 5.367.<sup>474</sup> Additional allocations include the aeronautical radionavigation service (ARNS) (5000-5150 MHz, primary in all Regions) and the radionavigation-satellite service (RNSS) (5000-5030 MHz, primary in all Regions).<sup>475</sup> In addition, RR 5.444 states that the 5030-5150 MHz band is to be used for the operation of the Microwave Landing System (MLS) for precision approach and landing.<sup>476</sup> The 5091-5150 MHz band was also allocated to the aeronautical mobile service, limited by RR 5.444B, and the fixed-satellite service (Earth-to-space) (FSS) on a primary basis (RR 5.444A).<sup>477</sup>

224. In the United States, the allocations in the bands comprising the 5000-5150 MHz range generally mirror the International Table as it existed prior to WRC-12. All of these radio services, except the FSS, are allocated for Federal and non-Federal use. The FSS is allocated exclusively for non-Federal use.

225. The United States proposed that WRC-12 allocate the 5030-5091 MHz band to the AM(R)S on a primary basis in order to support line-of-sight control links for unmanned aircraft. In support of its proposal, the U.S. described the anticipated growth of unmanned aircraft systems (UAS) to include flight operations that will take place outside of segregated airspace. It also discussed how the 5030-5091 MHz band is an appropriate band to satisfy the terrestrial, line-of-sight, spectrum requirements for the command and control of UAS in non-segregated airspace given that there is minimum use in this band worldwide and because the lack of an existing or planned microwave landing system deployment in the United States at 5030-5091 MHz ensures availability of appropriate aeronautical spectrum for terrestrial line-of-sight UAS in the band.<sup>478</sup>

226. Consistent with the U.S. proposal, WRC-12 allocated the 5030-5091 MHz band to the AM(R)S on a primary basis in all Regions. WRC-12 also adopted RR 5.443C, which limits the use of this AM(R)S allocation to internationally standardized aeronautical systems and which also limits unwanted emissions from stations in the AM(R)S that transmit in the 5030-5091 MHz band to an interim EIRP density value in the 5010-5030 MHz band.<sup>479</sup>

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<sup>473</sup> See *CPM Report to WRC-12*, Chapter 1, Agenda Items 1.3 and 1.4, pp. 3-14, 20-23, 25, and 33-39; and WRC-12 References, Resolutions 420 and 421 (WRC-07), pp. 54-59.

<sup>474</sup> Prior to WRC-12, RR 5.367 read as follows: “*Additional allocation:* The bands 1610-1626.5 MHz and 5000-5150 MHz are also *allocated* to the aeronautical mobile-satellite (R) service on a primary basis, subject to agreement obtained under No. 9.21.”

<sup>475</sup> In the 5000-5010 MHz band, the use of the RNSS allocation was limited to Earth-to-space transmissions, *i.e.*, RNSS (Earth-to-space), and in the 5010-5130 MHz band, use was limited to space-to-Earth and space-to-space transmissions, *i.e.*, RNSS (space-to-Earth) (space-to-space).

<sup>476</sup> In the 5030-5091 MHz band, MLS requirements take precedence over other uses of this band.

<sup>477</sup> We provide additional background on the 5091-5150 MHz band in the WRC-07 R&O, above.

<sup>478</sup> See *U.S. Proposals for WRC-12*, First Tranche, Agenda Item 1.3.

<sup>479</sup> RR 5.443C reads as follows: “The use of the frequency band 5030-5091 MHz by the aeronautical mobile (R) service is limited to internationally standardized aeronautical systems. Unwanted emissions from the aeronautical mobile (R) service in the frequency band 5030-5091 MHz shall be limited to protect RNSS system downlinks in the adjacent 5010-5030 MHz band. Until such time that an appropriate value is established in a relevant ITU-R (continued....)

227. WRC-12 moved the primary AMS(R)S allocation in the 5000-5150 MHz band from RR 5.367 and directly listed this allocation in the International Table. WRC-12 limited the use of this AMS(R)S allocation to internationally standardized aeronautical systems by adopting two international footnotes (RR 5.443AA and RR 5.443D), which also specify coordination requirements. Specifically, WRC-12 maintained the existing coordination requirement for AMS(R)S systems operating in the 5000-5030 MHz and 5091-5150 MHz bands (RR 5.443AA),<sup>480</sup> and revised the coordination requirement in the 5030-5091 MHz band to “give a balanced status between the two aviation services [*i.e.*, AMS(R)S and AM(R)S] in this band” (RR 5.443D).<sup>481</sup> NTIA recommends that we implement this action by directly listing a primary AMS(R)S allocation for Federal and non-Federal use in the 5000-5150 MHz bands, and that we limit the use of these allocations by adding the references to RR 5.443AA and RR 5.443D.<sup>482</sup> NTIA also recommends that we implement WRC-12’s AM(R)S allocation in the 5030-5091 MHz band on a primary basis for Federal and non-Federal use, and that we add a reference to RR 5.443C to the U.S. Table.

228. NTIA further recommends that we also allocate the 5000-5010 MHz and 5010-5030 MHz bands to the AM(R)S on a primary basis for Federal and non-Federal use. Specifically, NTIA recommends that we add an entry for the AM(R)S in the 5000-5010 MHz band of the U.S. Table. For the 5010-5030 MHz band, it recommends that we adopt a new U.S. footnote allocating the band to the AM(R)S for requirements that cannot be met in the 5000-5010 MHz and 5091-5150 MHz bands.<sup>483</sup> NTIA’s recommendations are consistent with a recent ICAO document, which states that “[t]he aeronautical mobile (R) service in the band 5091-5150 MHz is reserved for airport surface communication systems (AeroMACS) which are currently being developed. A tuning range of 5000-5150 MHz for AeroMACS is being considered to support either Regional or sub-Regional requirements.”<sup>484</sup> Subsequently, NTIA revised its recommendations to include a U.S. footnote that would

(Continued from previous page) \_\_\_\_\_

Recommendation, the e.i.r.p. density limit of -75 dBW/MHz in the frequency band 5010-5030 MHz for any AM(R)S station unwanted emission should be used.”

<sup>480</sup> RR 5.443AA reads as follows: “In the frequency bands 5000-5030 MHz and 5091-5150 MHz, the aeronautical mobile-satellite (R) service is subject to agreement obtained under No. 9.21. The use of these bands by the aeronautical mobile-satellite (R) service is limited to internationally standardized aeronautical systems.”

<sup>481</sup> Specifically, WRC-12 replaced the coordination requirement for AMSRS systems in the 5030-5091 MHz band from No. 9.21 by No. 9.11A. For a discussion of this issue, *see* ICAO Working Paper, [ACP-WGF24/WP-06](#), 21 March 2011, Agenda Item 1.3 and Annex. RR 5.443D reads as follows: “In the frequency band 5030-5091 MHz, the aeronautical mobile-satellite (R) service is subject to coordination under No. 9.11A. The use of this frequency band by the aeronautical mobile-satellite (R) service is limited to internationally standardized aeronautical systems.”

<sup>482</sup> *See* NTIA WRC-12 Implementation Recommendations, p. 15 (table entries and footnotes in the 5000-5010 MHz, 5010-5030 MHz, 5030-5091 MHz, and 5091-5150 MHz bands) and p. 26 (footnote US[5010-5030 MHz]).

<sup>483</sup> NTIA’s recommended footnote (US[5010-5030 MHz]) reads as follows: The band 5010-5030 MHz is also allocated to the aeronautical mobile (R) service (AM(R)S) limited to stations operating in accordance with international civil aviation standards and supporting surface applications at airports. In making assignments for this band, attempts shall first be made to satisfy the AM(R)S requirements in the bands 5000-5010 MHz and 5091-5150 MHz. AM(R)S systems used in the band 5010-5030 MHz shall be designed and implemented to be capable of operational modification if receiving harmful interference from the radionavigation-satellite service. Finally, notwithstanding Article 4, No. 4.10, stations in the AM(R)S operating in this band shall be designed and implemented to be capable of operational modification to reduce throughput and/or preclude the use of specific frequencies in order to ensure protection of radionavigation-satellite service systems operating in the band 5010-5030 MHz. During the coordination process, NTIA informed us that its recommended text should be clarified to state that the AM(R)S in the 5010-5030 MHz would be allocated on a primary basis.

<sup>484</sup> *See* ICAO’s “Draft Handbook on Radio Frequency Spectrum Requirements for Civil Aviation,” Volume I, ICAO Spectrum Strategy, Policy Statements, and related information, Rev. 30 September 2012, Doc 9718-AN/957, draft Sixth Edition, page 7-122. For a FAA presentation on AeroMACS, *see* (continued....)

authorize on a primary basis fixed communications that are an integral part of the AeroMACS system in the 5000-5010 MHz and 5010-5030 MHz bands.<sup>485</sup> Finally, we note that the FAA recently proposed to amend its regulations to allow the operation of small UAS in the National Airspace System.<sup>486</sup>

229. Proposal. Consistent with NTIA's request, we propose to allocate spectrum to the AM(R)S to support line-of-sight control links for unmanned aircraft and, as discussed below, to provide additional spectrum for AeroMACS.<sup>487</sup> First, we propose to add a primary AM(R)S allocation in the 5030-5091 MHz band for Federal and non-Federal use, and to add a reference to RR 5.443C in the U.S. Table as NTIA requested. We expect that addition of this AM(R)S allocation will help support the anticipated growth of UAS and promote the safe operation of UAS. Further, adding RR 5.443C will limit AM(R)S use of the 5030-5091 MHz band to internationally standardized aeronautical systems and help protect adjacent-band RNSS downlinks by limiting the unwanted emissions of AM(R)S stations authorized under this allocation to an EIRP density of -75 dBW/MHz in the 5010-5030 MHz band.

230. Second, we propose to allocate the 5000-5030 MHz bands to the AM(R)S on a primary basis for Federal and non-Federal use, limited to surface applications at airports that operate in accordance with international aeronautical standards (*i.e.*, AeroMACS). Consistent with our action in the 5091-5150 MHz band, we propose to permit aeronautical fixed communications that are an integral part of the AM(R)S system to be authorized in the 5000-5030 MHz band on a primary basis. We would implement these proposals by adding an entry for the primary AM(R)S allocation to the 5000-5010 MHz band within the U.S. Table and by adding a new U.S. footnote, which we tentatively number as US115, to the 5000-5010 MHz and 5010-5030 MHz bands. Proposed footnote US115 contains the primary AM(R)S allocation for the 5010-5030 MHz band, limits the use of this allocation to those AeroMACS requirements that cannot be satisfied in the 5000-5010 MHz and 5091-5150 MHz bands, specifies the additional limitations, and authorizes the primary fixed use discussed above.<sup>488</sup> In the WRC-07 R&O, above, we made the 5091-5150 MHz band available for AeroMACS. The 5091-5150 MHz band is globally harmonized and it is expected to be the main frequency band for deployment of AeroMACS. Today's proposals would extend the tuning range for AeroMACS to include the 5000-5010 MHz and 5010-5030 MHz bands in the United States. Given that "ITU-R studies conclude that the total identified spectrum requirement to support surface applications at airports is 130 MHz,"<sup>489</sup> we believe that there is a need for this additional spectrum.

231. Third, we propose to add entries in the U.S. Table for the primary AMS(R)S allocation in the frequency range 5000-5150 MHz. Because these bands are already allocated to the AMS(R)S through footnote US367, we would only be acting to highlight an existing allocation.<sup>490</sup> We also propose to add (Continued from previous page) \_\_\_\_\_

[http://www.faa.gov/about/office\\_org/headquarters\\_offices/ato/service\\_units/techops/atc\\_comms\\_services/swim/documentation/media/demo\\_tim\\_6/10\\_TIM6%20AeroMACS%20Budinger%20Rev1%2003-Nov-2010.pdf](http://www.faa.gov/about/office_org/headquarters_offices/ato/service_units/techops/atc_comms_services/swim/documentation/media/demo_tim_6/10_TIM6%20AeroMACS%20Budinger%20Rev1%2003-Nov-2010.pdf)

<sup>485</sup> See NTIA Final Supplement at 3.

<sup>486</sup> See "Press Release – DOT and FAA Propose New Rules for Small Unmanned Aircraft Systems" (available at [http://www.faa.gov/news/press\\_releases/news\\_story.cfm?newsId=18295](http://www.faa.gov/news/press_releases/news_story.cfm?newsId=18295)).

<sup>487</sup> We do not propose to adopt service rules for AeroMACS and UAS operations herein; such actions are best considered in a future proceeding.

<sup>488</sup> For the full text of proposed footnote US115, see Appendix F.

<sup>489</sup> See *CPM Report to WRC-12*, Chapter 1, Agenda Item 1.4, p. 35, at 1/1.4/3.4.1 (Spectrum requirements for surface applications at airports around 5 GHz).

<sup>490</sup> Consequently, footnote US367 would be removed from the Allocation Table. See para. 61, *supra*. We note that an ICAO report has stated that "AMS(R)S is the appropriate type of service allocation to support the satellite component for UAS command and control and ATC relay in non-segregated airspace." We also note that an ICAO report has stated no AMS(R)S satellite system currently operates in the 5000-5150 MHz range to support current/near-term UAS CNPC. See ICAO Report, dated Sept. 26, 2012, from the "Aeronautical Communications Panel (ACP), Twenty Seventh Meeting of Working Group F" ([ACP-WGF27 Report](#)) at 27-28.

references to two international footnotes (RR 5.443AA, RR 5.443D) in the U.S. Table.<sup>491</sup> We note that both of these footnotes also contain a new requirement: the use of the AMS(R)S in the 5000-5150 MHz range would be limited to internationally standardized aeronautical systems.

232. We seek comment on our proposals. Table 5, below, reflects the 5000-5150 MHz range as it will exist in the U.S. Table as a result of our actions herein, and our proposed amendments to these bands.<sup>492</sup>

<b>Table 5: Proposals for the 5000-5150 MHz Band</b>			
Existing U.S. Table (or adopted herein)		Proposed U.S. Table	
Federal Table	Non-Federal Table	Federal Table	Non-Federal Table
5000-5010 AERONAUTICAL RADIONAVIGATION US260 RADIONAVIGATION-SATELLITE (Earth-to-space)		5000-5010 AERONAUTICAL MOBILE (R) US115 AERONAUTICAL MOBILE-SATELLITE (R) 5.443AA AERONAUTICAL RADIONAVIGATION US260 RADIONAVIGATION-SATELLITE (Earth-to-space)	
US211 US367		US211	
5010-5030 AERONAUTICAL RADIONAVIGATION US260 RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) 5.443B		5010-5030 AERONAUTICAL MOBILE-SATELLITE (R) 5.443AA AERONAUTICAL RADIONAVIGATION US260 RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) 5.443B	
US211 US367		US115 US211	
5030-5091 AERONAUTICAL RADIONAVIGATION US260		5030-5091 AERONAUTICAL MOBILE (R) 5.443C AERONAUTICAL MOBILE-SATELLITE (R) 5.443D AERONAUTICAL RADIONAVIGATION US260	
US211 US367 US444		US211 US444	
5091-5150 AERONAUTICAL MOBILE US111 US444B AERONAUTICAL RADIONAVIGATION US260		5091-5150 AERONAUTICAL MOBILE US111 US444B AERONAUTICAL MOBILE-SATELLITE (R) 5.443AA AERONAUTICAL RADIONAVIGATION US260	
US211 US367 US344 US444 US444A		US211 US344 US444 US444A	

**E. Allocating the 22.55-23.15 GHz and 25.5-27 GHz Bands to the Space Research Service**

233. In this section, we consider WRC-12’s decision to allocate the 22.55-23.15 GHz band to the space research service (SRS) on a primary basis, restricted to operations in the Earth-to-space (uplink) direction.<sup>493</sup>

<sup>491</sup> The addition of RR 5.443AA to the right of the AMS(R)S allocation in the 5000-5010 MHz, 5010-5030 MHz, and 5091-5150 MHz bands would serve to maintain the existing coordination requirements in these bands; the addition of RR 5.443D to the right of the AMS(R)S allocation in the 5030-5091 MHz band would serve to change the coordination requirements in that band from ITU Radio Regulation No. 9.21 to 9.11A.

<sup>492</sup> The entries under the heading “Existing U.S. Table” reflect these bands as shown in 47 C.F.R. § 2.106, Edition of 2012, plus the following amendments that we make herein: 1) Replaced RR 5.367 with footnote US367 in para. 61, *supra*; and 2) Added the primary AMS allocation to the 5091-5150 MHz band, limited by footnotes US111 and US444B, in paras. 58-59.

<sup>493</sup> See *CPM Report to WRC-12*, Chapter 4, Agenda Item 1.11, pp. 13-20; and WRC-12 References, Resolution 753 (WRC-07), pp. 89-91.

234. Background. Prior to WRC-12, the 22.55-23.55 GHz band was allocated to the fixed, mobile, and inter-satellite services on a primary basis in all ITU Regions. RR 5.338A states that Resolution 750 (WRC-07) applies to the use of the 22.55-23.55 GHz band by the inter-satellite service (ISS). RR 5.149 states that, in making assignments to stations of other services to which the 22.81-22.86 GHz and 23.07-23.12 GHz bands are allocated, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference, and that emissions from spaceborne or airborne stations can be particularly serious sources of interference to the radio astronomy service.

235. In the United States, the 22.55-23.55 GHz band is Federal/non-Federal shared spectrum that is allocated to the fixed, mobile, and inter-satellite services on a primary basis. Footnote US278 states that non-geostationary inter-satellite links may operate on a secondary basis to geostationary inter-satellite links in this band. The United States has implemented RR 5.149 as footnote US342. In the WRC-07 R&O, we adopted new footnote US145 (in lieu of RR 5.338A).<sup>494</sup>

236. The United States proposed that WRC-12 allocate the 22.55-23.15 GHz band to the space research service (Earth-to-space) on a primary basis, and provided a footnote regarding the location of SRS earth stations to protect the existing and future deployment of fixed and mobile services of neighboring administrations.<sup>495</sup> In support of its proposal, the U.S. stated that there is a need for a companion uplink (Earth-to-space) band to pair with the existing downlink 25.5-27 GHz SRS allocation that can provide the mission data, voice/video communications, and command and control links to support manned and unmanned missions. It stated that the proposed SRS allocation at 23 GHz will fulfill this need for the global space science community.<sup>496</sup> Finally, the U.S. noted that, considering the inherently limited number of these large SRS earth stations and their remote locations, ITU-R sharing studies determined that sharing between the proposed SRS (Earth-to-space) allocation and the existing services in the 22.55-23.55 GHz band is feasible and would not cause harmful interference to their existing operations.

237. WRC-12 allocated the 22.55-23.15 GHz band to the SRS (Earth-to-space) on a primary basis in all Regions. WRC-12 also adopted RR 5.532A, which protects the existing and future deployment of the fixed and mobile services using similar text to that proposed by the United States. NTIA recommends that we allocate the 22.55-23.15 GHz band to the SRS (Earth-to-space) on a primary basis for Federal use, and that we also add a reference to RR 5.532A in the Federal Table.<sup>497</sup>

238. Proposal. Consistent with WRC-12 and NTIA's recommendation, we propose to modify the U.S. Table to allocate the 22.55-23.15 GHz band to the SRS (Earth-to-space) on a primary basis for both Federal and non-Federal use and to add a reference to RR 5.532A in the U.S. Table. In addition, we

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<sup>494</sup> See Section IV.C.3, para. 92, *supra*.

<sup>495</sup> See *U.S. Proposals for WRC-12*, First Tranche, Agenda Item 1.11.

<sup>496</sup> The U.S. also made the following points: First, space agencies require their own segments of spectrum for lunar and many Lagrangian missions since antenna discrimination is not possible. Any spacecraft around the moon and some of those with small orbit apogees around the L1 or L2 points can be situated within the main-beam lobe of other space agency antennas. Second, the specific RF carrier frequencies selected will often be coupled with internationally agreed channels for data relay systems in order to provide global support either via an earth station or via a data relay satellite. These data relay channels have a spacing of 60 megahertz, irrespective of the actual bandwidth. Third, there is a fixed turn-around ratio required between the Earth-to-space link around 23 GHz and the corresponding space-to-Earth link in the 25.5-27 GHz band. This is required for ranging purposes and further limits the choice of available frequencies as it requires a suitable available companion frequency around 26 GHz.

<sup>497</sup> See NTIA WRC-12 Implementation Recommendations, p. 18 (where the common U.S. Table entry for the 22.55-23.55 GHz band is subdivided into the Federal and non-Federal Tables, so that "SPACE RESEARCH (Earth-to-space) 5.532A" can be added to the Federal Table).

propose to add a primary non-Federal SRS (space-to-Earth) allocation to the companion 25.5-27 GHz band, which currently is allocated to the SRS (space-to-Earth) only for Federal use. We are proposing non-Federal SRS allocations to both of these bands in support of the National Space Policy, which encourages the development of a robust and competitive commercial space sector.<sup>498</sup> This action is consistent with the Commission's proposal to make spectrum allocated for Federal exclusive use available for use by commercial space launch operators.<sup>499</sup> Finally, we solicit comment on whether there is a need for us to expressly state that the use of the proposed allocations would be "at a limited number of sites."<sup>500</sup> We request comment on these proposals.

## **F. Passive and Weak Signal Issues**

### **1. Deletion of Aeronautical Mobile Service from the 37-38 GHz Band**

239. In this section, we consider WRC-12's decision to limit the mobile service in the 37-38 GHz band to the mobile except aeronautical mobile service.<sup>501</sup>

240. Background. Prior to WRC-12, the 37-38 GHz bands were allocated to the fixed service (FS), mobile service (MS), and space research service (SRS) (space-to-Earth) (downlink) on a primary basis in all ITU Regions. The 37.5-40 GHz band was also allocated to the fixed-satellite service (FSS) (space-to-Earth) on a primary basis and to the Earth exploration-satellite service (space-to-Earth) on a secondary basis. RR 5.547 states that the 37-40 GHz band is available for high-density applications in the fixed service (HDFS).

241. In the United States, the 37-38 GHz band is allocated to the FS and MS on a primary basis for Federal and non-Federal use and to the SRS (space-to-Earth) on a primary basis for Federal use. The 37.5-38 GHz band is also allocated to the FSS (space-to-Earth) on a primary basis for non-Federal use.

242. In its preparations for WRC-12, the United States observed that Administrations are implementing SRS earth station receivers in the band 37-38 GHz to support manned missions for both near Earth and deep space missions, and that use of the wider bandwidth available in the 37-38 GHz band is necessary to support the increasing data requirements of these planned manned missions. Accordingly, the U.S. proposed that WRC-12 adopt an international footnote that would protect SRS and FSS earth stations and fixed stations in the 37-38 GHz band by the application of a power flux-density (PFD) limit at the surface of the Earth on the emissions radiated by any device on an aircraft in flight or on the ground.<sup>502</sup>

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<sup>498</sup> See National Space Policy of the United States of America (June 28, 2010) at 3, 10-11 (available at [http://www.whitehouse.gov/sites/default/files/national\\_space\\_policy\\_6-28-10.pdf](http://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf)). The National Space Policy expresses the President's direction for the nation's space activities.

<sup>499</sup> Amendment of Part 2 of the Commission's Rules for Federal Earth Stations Communicating with Non-Federal Fixed Satellite Service Space Stations; Federal Space Station Use of the 399.9-400.05 MHz Band; and Allocation of Spectrum for Non-Federal Space Launch Operations, ET Docket No. 13-115, *Notice of Proposed Rulemaking and Notice of Inquiry*, 28 FCC Rcd 6698 (2013). This *Notice* also proposes to add Federal allocations to a number of commercial fixed-satellite service bands.

<sup>500</sup> See, e.g., 47 C.F.R. § 2.106, footnote G116.

<sup>501</sup> See *CPM Report to WRC-12*, Chapter 4, Chapter 2, Agenda Item 1.12, pp. 21-27; and WRC-12 References, Resolution 754 (WRC-07), pp. 92-94.

<sup>502</sup> See *U.S. Proposals for WRC-12*, First Tranche, Agenda Item 1.12. The U.S.-proposed footnote read as follows: In the band 37-38 GHz, the power flux-density at the Earth's surface produced by emissions from an aircraft station shall not exceed -227 dB(W/m<sup>2</sup>) in any 1 Hz bandwidth, using free space propagation conditions as applied from the exterior of the aircraft.

243. The ITU studied sharing between systems in the SRS, FS, and FSS and potential systems in the aeronautical mobile service (AMS) in the 37-38 GHz band. The sharing studies indicate that high power emissions from typical aeronautical mobile transmitters would pose a high probability for causing harmful interference to receiving SRS and FSS earth stations, but that lower powered aircraft stations could be compatible, if they meet a specified PFD mask. These studies also found that transmissions from HDFS systems could interfere with the airborne receivers of the AMS. WRC-12 addressed use of the 37-38 GHz band by revising the primary mobile service allocation to exclude the AMS. It did so by revising the “MOBILE” entry in the International Table to read “MOBILE except aeronautical mobile.” NTIA recommends that we implement WRC-12’s decision by amending the Federal and non-Federal Tables to replace the primary mobile service allocation in the 37-38 GHz band with a primary mobile except aeronautical mobile service allocation.<sup>503</sup>

244. Proposal. As requested by NTIA, we propose to amend the U.S. Table by excluding the AMS from the 37-38 GHz band. We request comment on this proposal.

**2. Protecting Passive Sensors in the 86-92 GHz Band**

245. In this section, we consider WRC-12’s actions relative to the fixed service in the 81-86 GHz and 92-94 GHz bands.<sup>504</sup>

246. Background. The United States proposed that WRC-12 make no changes to the fixed service in the bands between 71 GHz and 238 GHz because insufficient information is available to substantiate specific out-of-band emission limits to protect the passive sensors that operate in the Earth exploration-satellite service (EESS) (passive) in the 86-92 GHz band and because the technologies employed by the active services in these bands are still in the early stages of development.<sup>505</sup>

247. While WRC-12 did not adopt mandatory protection requirements in the band, it did take steps to afford protection to passive services. Specifically, WRC-12 revised Resolution 750 to urge administrations to take all reasonable steps to ensure that unwanted emissions of fixed stations in the 81-86 GHz and 92-94 GHz bands do not exceed the recommended maximum levels contained in Table 1-2, and revised RR 5.338A by adding the 81-86 GHz and 92-94 GHz bands to the list of band to which Resolution 750 applies. The recommended maximum level of unwanted emissions power (measured at the antenna port) is listed in Table 6, below:

<b>Table 6: WRC-12’s Non-Mandatory Unwanted Emissions Levels for Fixed Stations</b>	
Active Service Band	Recommended maximum level of unwanted emissions power from fixed stations in a specified bandwidth within the EESS (passive) band
81-86 GHz	-41 - 14(f - 86) dBW/100 MHz for 86.05 ≤ f ≤ 87 GHz and -55 dBW/100 MHz for 87 ≤ f ≤ 91.95 GHz
92-94 GHz	-41 - 14(92 - f) dBW/100 MHz for 91 ≤ f ≤ 91.95 GHz and -55 dBW/100 MHz for 86.05 ≤ f ≤ 91 GHz
where f is the center frequency of the 100 megahertz reference bandwidth expressed in GHz	

<sup>503</sup> See NTIA WRC-12 Implementation Recommendations, p. 19 (where “MOBILE except aeronautical mobile” is shown in the 37-38 GHz band within the Federal Table and in the 37-37.5 GHz and 37.5-38 GHz bands within the non-Federal Table).

<sup>504</sup> See CPM Report to WRC-12, Chapter 3, Agenda Item 1.8, pp. 23-32; and WRC-12 References, Resolutions 731 (WRC-2000) and 732 (WRC-2000), pp. 78-80 and 81-82, respectively.

<sup>505</sup> See U.S. Proposals for WRC-12, First Tranche, Agenda Item 1.8. The term “passive sensor” is defined in n.5, *supra*.

248. NTIA recommends that we adopt two U.S. footnotes that replicate the WRC-12 unwanted emissions levels for the 81-86 GHz and 92-94 GHz bands.<sup>506</sup>

249. Proposal. We propose to encourage operators of fixed stations transmitting in the 81-86 GHz and 92-94 GHz bands to take all reasonable steps to ensure that their unwanted emissions power in the 86-92 GHz passive band does not exceed WRC-12's non-mandatory unwanted emissions levels. We also propose combining the text of NTIA's recommended U.S. footnotes into a single footnote, which we tentatively number as US162. See Appendix F for the text of proposed footnote US162. We request comment on these proposals.

### 3. Passive Use of Bands Above 275 GHz

250. In Agenda Item 1.6, WRC-12 reviewed RR 5.565 to update the spectrum use by the passive services between 275 GHz and 3000 GHz.<sup>507</sup> This international footnote provides a list of frequency bands throughout the 275-1000 GHz range that have been identified for observations of spectral line emissions and spectral windows for the passive services. Prior to WRC-12, the last entry in the International Table read as follows: "275-1000 [GHz] (Not allocated) 5.565."

251. Background. In its proposals to WRC-12, the United States asserted that passive and active services can share frequencies above 1000 GHz without constraints.<sup>508</sup> It noted that passive services such as the Earth exploration-satellite service (EESS), space research service (SRS), and radio astronomy service (RAS) already utilize portions of the 275-3000 GHz range for scientific observation, and that "it is important to recognize that this frequency range concurrently is used for experimentation with, and development of, an array of emerging active service applications."<sup>509</sup> It also noted the technical factors that influence use of the 275-3000 GHz range, such as how the Earth's atmosphere absorbs signals at these frequencies, especially in the 1000-3000 GHz range, and that antenna beamwidths are extremely narrow at such high frequencies. It concluded that interference from non-geostationary satellites into terrestrial stations is highly unlikely, and that coordination of geostationary satellites would resolve any potential interference issues that might arise.

252. WRC-12 revised RR 5.565 to make changes to the bands identified for passive sensor use.<sup>510</sup> RR 5.565 states that "Administrations wishing to make frequencies in the 275-1000 GHz range available for active service applications are urged to take all practicable steps to protect these passive services from harmful interference until the date when the Table of Frequency Allocations is established in the above-mentioned 275-1000 GHz frequency range," but does not impose mandatory protection criteria. In addition, WRC-12 extended the International Table from 1000 GHz to 3000 GHz, and applied RR 5.565 to this larger frequency range. NTIA recommends that we revise the text of RR 5.565 to reflect the revised list of bands identified for passive sensor use and that we extend the "not allocated" portion of the Table to 3000 GHz.<sup>511</sup> Because WRC-12's revision of RR 5.565's text is a significant change that

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<sup>506</sup> See NTIA WRC-12 Implementation Recommendations, p. 26 (footnotes US[FS81-86GHz] and US[FS92-94GHz]) and p. 20 (references to these recommended U.S. footnotes in the 81-84 GHz, 84-84 GHz, and 92-94 GHz band).

<sup>507</sup> See *CPM Report to WRC-12*, Chapter 4, Agenda Item 1.6, 3-8; and WRC-12 References, Resolution 950 (Rev. WRC-07) and Resolution 955 (WRC-07), pp. 95-97.

<sup>508</sup> See U.S. Proposals for WRC-12, First Tranche, Agenda Item 1.6, paragraph 4 of the Background Information.

<sup>509</sup> *Id.* at paragraph 2 of the Background Information.

<sup>510</sup> We note that while WRC-12 identified no additional spectrum for RAS applications, it did identify an additional 226 gigahertz of spectrum for passive spaceborne sensors in the 275-990 GHz range.

<sup>511</sup> See NTIA WRC-12 Implementation Recommendations, p. 21 (depicting the expansion of the "not allocated" portion of the Allocation Table from 275-1000 GHz to 275-3000 GHz) and p. 24 (RR 5.565).

requires public comment, we have moved the pre-WRC-12 text of RR 5.565 into new footnote US565.<sup>512</sup>

253. Proposal. As requested by NTIA, we propose to extend the “not allocated” portion of the U.S. Table to 3000 GHz and to add a reference to the WRC-12 version of RR 5.565 to the new 275-3000 GHz band.<sup>513</sup> This action would update the spectrum identified for use by passive spaceborne sensors in the 275-1000 GHz range.

254. We observe that, as a result of WRC-12’s action, 565 gigahertz – or 78 percent – of the 725 gigahertz of spectrum in the 275-1000 GHz range has been identified for passive service applications in the International Table.<sup>514</sup> However, we believe that it is important to recognize that this frequency range is used and may be used more extensively in the future for experimentation with, and development of, an array of active service applications. We note that RR 5.565 should not be misconstrued as placing a “reservation” for future passive service allocations in the U.S. Table, which would inhibit commercial development of this spectrum. We encourage the development of active services in the 275-3000 GHz range under Part 5 of the rules. While we continue to believe that it is premature to establish an allocation in the U.S. Table in this frequency range, we tentatively conclude that it is necessary to avoid spectrum use restrictions and maintain flexibility in our spectrum allocation decisions to support the development of new uses in the future. Accordingly, we propose to adopt the following U.S. footnote:

US565 International footnote 5.565 does not establish priority of use in the United States Table of Frequency Allocations, and does not preclude or constrain the allocation of frequency bands in the range 275-3000 GHz to active services at a future date.

We seek comment on these proposals.

## **G. Proposals for New Federal Government Allocations**

### **1. Allocating the 7850-7900 MHz Band to the Meteorological-Satellite Service**

255. Background. Prior to WRC-12, the 7750-7850 MHz and 7850-7900 MHz bands were allocated to the fixed and mobile except aeronautical mobile services on a primary basis in all ITU Regions. The 7750-7850 MHz band was also allocated the meteorological-satellite (MetSat) service for space-to-Earth transmissions (downlink use) on a primary basis in all Regions, limited to non-geostationary satellite orbit (NGSO) systems.<sup>515</sup>

256. In the U.S. Table, these bands are allocated for exclusive Federal use. Specifically, the 7750-7850 MHz and 7850-7900 MHz bands are allocated to the Federal fixed service on a primary basis and the 7750-7850 MHz band is also allocated for primary Federal MetSat downlink use, limited to NGSO systems.

257. The United States proposed that WRC-12 add 50 megahertz to the current MetSat downlink allocation, with the existing NGSO system limitation extended throughout the resultant band (7750-7900 MHz).<sup>516</sup> In support of its proposal, the U.S. stated that additional spectrum will be needed to provide the necessary bandwidth for the next generation of NGSO meteorological satellites.

<sup>512</sup> See WRC-12 Order, para. 142, *supra*.

<sup>513</sup> In the WRC-12 Order, we replaced the reference to RR 5.565 in the U.S. Table with new footnote US565. Because we are proposing to reinsert the reference to RR 5.565 in the U.S. Table, we are reusing footnote US565 for the proposed U.S. footnote in the following paragraph.

<sup>514</sup> The following twelve bands (which total 160 gigahertz) are not identified for passive service applications: 510-523 GHz, 527-538 GHz, 581-611 GHz, 711-713 GHz, 718-729 GHz, 733-750 GHz, 754-771 GHz, 776-795 GHz, 945-951 GHz, 956-968 GHz, 973-985 GHz, and 990-1000 GHz.

<sup>515</sup> See RR 5.461B.

<sup>516</sup> See *U.S. Proposals to WRC-12*, First Tranche, Agenda Item 1.24. See also *CPM Report to WRC-12*, Chapter 4, Agenda Item 1.24, pp. 35-41; and WRC-12 References, Resolution 672 (WRC-07), pp. 76-77.

Furthermore, the U.S. stated that the compatibility analyses between MetSat and the fixed services concluded that the potential extension 7850-7900 MHz band can be shared under the same conditions as the current 7750-7850 MHz allocation.

258. WRC-12 adopted this U.S. proposal. Thus, in the International Table, the 7750-7900 MHz band is allocated to the fixed, MetSat (space-to-Earth), and mobile except aeronautical mobile services on a primary basis. The use of the MetSat allocation is restricted to NGSO systems by RR 5.461B, which WRC-12 applied to the new band.

259. Proposal. NTIA recommends that the 7750-7900 MHz band be allocated to the fixed and MetSat (space-to-Earth) services on a primary basis for Federal use, and that RR 5.461B be listed in the Federal Table, thereby limiting MetSat use of this band to NGSO systems.<sup>517</sup> We propose to modify the U.S. Table to reflect this approach.

## 2. Allocating the 15.4-15.7 GHz Band to the Radiolocation Service

260. Background. Prior to WRC-12, the 15.4-15.43 GHz, 15.43-15.63 GHz, and 15.63-15.7 GHz bands were allocated to the aeronautical radionavigation service (ARNS) on a primary basis in all ITU Regions. The 15.43-15.63 GHz band was also allocated to the fixed-satellite service (FSS) (Earth-to-space) on a primary basis, and per RR 5.11A, FSS use was limited to feeder links of non-geostationary systems in the mobile-satellite service (NGSO MSS feeder links). FSS use is also permitted in the 15.4-15.43 GHz and 15.63-15.7 GHz bands for grandfathered systems (RR 5.511D). Sharing criteria for ARNS stations and NGSO MSS feeder link earth stations is specified in RR 5.511C.

261. In the United States, the 15.4-15.7 GHz band is allocated to ARNS on a primary basis for Federal and non-Federal use, and pursuant to footnote US260, aeronautical mobile communications that are an integral part of ARNS systems may also operate in the 15.4-15.7 GHz band. The 15.43-15.63 GHz band is also allocated to the FSS (Earth-to-space) on a primary basis for non-Federal use, and, per footnote US359, FSS use is limited to NGSO MSS feeder links. The sharing criteria in RR 5.511C applies.

262. The United States proposed that WRC-12 allocate the 15.4-15.7 GHz band to the radiolocation service (RLS) on a primary basis in all ITU Regions, on the basis that such an allocation would provide an increase in image resolution and range accuracy.<sup>518</sup> In support of its proposal, the U.S. noted that Resolution 614 (WRC-07) called for WRC-12 to consider a new primary RLS allocation in the 15.4-15.7 GHz band to provide additional spectrum for new radar systems to increase image resolution and range accuracy, and that these advanced radars require wider emission bandwidths than are currently available. The U.S. also proposed that WRC-12 limit the use of the RLS allocation to protect other primary services in the band and the radio astronomy service in the adjacent 15.35-15.4 GHz band by adopting two international footnotes (later numbered as RR 5.511E and RR 5.511F) that protect incumbent services.<sup>519</sup> RR 5.511E requires that RLS stations operating in the

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<sup>517</sup> See NTIA Recommendations, p. 16 (where the 7750-7850 MHz and 7850-7900 MHz bands in the Federal Table have been merged to form the 7750-7900 MHz band).

<sup>518</sup> See *U.S. Proposals for WRC-12*, Second Tranche, Agenda Item 1.21. See also *CPM Report to WRC-12*, Chapter 2, Agenda Item 1.21, pp. 27-36; and WRC-12 References, Resolution 614 (WRC-07), pp. 70-72.

<sup>519</sup> The U.S. also stated that ITU-R studies demonstrated compatibility between the RLS and other services allocated in the 15.4-15.7 GHz band, noting that Report ITU-R M.2170 addresses compatibility between RLS and radionavigation, FSS systems in this band and radio astronomy in the adjacent 15.3-15.4 GHz band. The ITU-R studies used technical characteristics and protection criteria of System 6 in Recommendation ITU-R M.1730 to represent the radiolocation radars proposed for the 15.4-17.3 GHz band. Recommendation ITU-R M.1372 identifies interference mitigation techniques that ensure compatibility among radar systems operating in different radiodetermination services. Additionally, Report ITU-R M.2076 contains further mitigation techniques for interference from radiolocation radars into radionavigation radars operating in the 9 GHz band.

15.4-15.7 GHz band not cause harmful interference to, or claim protection from, ARNS stations. RR 5.511F requires that RLS stations operating in the 15.4-15.7 GHz band not exceed the power flux-density level of  $-156 \text{ dB(W/m}^2\text{)}$  in any 50 megahertz within the 15.35-15.4 GHz band, at any radio astronomy observatory site for more than 2 percent of the time.

263. WRC-12 adopted these U.S. proposals with only minor text changes to the proposed footnotes.<sup>520</sup> NTIA recommends that the 15.4-15.7 GHz band be allocated to the RLS on a primary basis for Federal use and that RR 5.511E and RR 5.511F be added to the Federal Table.<sup>521</sup> In addition, NTIA recommends that the following footnote be added to the Federal Table:

G135 The use of the band 15.4-15.7 GHz by the radiolocation service is limited to systems requiring necessary bandwidth of greater than 1600 MHz that cannot be fully accommodated within the band 15.7-17.3 GHz except as described below. In the band 15.4-15.7 GHz, stations operating in the radiolocation service shall not cause harmful interference to, nor claim protection from, radars operating in the aeronautical radionavigation service. Radar systems operating in the radiolocation service shall not be developed solely for operation in the band 15.4-15.7 GHz. However, radar systems that require testing, training, and exercises in the band 15.4-15.7 GHz shall be accommodated on a case-by-case basis.

264. Proposal. As requested by NTIA, we propose to allocate the 15.4-15.7 GHz band to the RLS on a primary basis for Federal use and to add references to RR 5.511E and RR 5.511F to the Federal Table. However, because the 15.4-15.7 GHz band is allocated for Federal/non-Federal shared use, and in particular because the new Federal RLS allocation would be required to protect existing and future non-Federal stations in the ARNS from harmful interference, we have reclassified footnote G135 as a U.S. footnote, which we tentatively numbered as US511E.<sup>522</sup> We have also made minor changes to the text of proposed footnote US511E to improve its readability. See Appendix F for the text of proposed footnote US511E. If adopted, this proposal will provide the additional spectrum needed for new advanced radar systems and increase the image resolution and range accuracy of such systems. We request comment on these proposals.

## H. Other Matters

265. The 72-73 MHz and 75.4-76 MHz bands are allocated to the fixed and mobile services on a primary basis for non-Federal use. Footnote NG49 identifies 30 frequencies from 72.02 MHz to 75.60 MHz as being available to former Part 90 radio services, subject to the condition that no interference is caused to TV channels 4 and 5 reception.<sup>523</sup> These radio services are now part of the consolidated Industrial/Business Radio Pool.<sup>524</sup> Moreover, all 30 frequencies are listed in the

<sup>520</sup> See *WRC-12 Final Acts*, pp. 39-40.

<sup>521</sup> See NTIA WRC-12 Implementation Recommendations, p. 12 (where “RADIOLOCATION 5.511E 5.511F G135” have been added to the 15.4-15.43 GHz, 15.43-15.63 GHz, and 15.63-15.7 GHz bands within the Federal Table) and p. 27 (recommended footnote G135).

<sup>522</sup> A “G” footnote by definition “denotes a stipulation applicable only to the Federal Government.” 47 C.F.R. § 2.105(d)(5)(iv).

<sup>523</sup> Footnote NG49 lists 20 frequencies from 72.02 MHz to 72.40 MHz that may be authorized for mobile operations in the Manufacturers Radio Service and limits their use to a manufacturing facility. It also lists 10 frequencies from 72.44 MHz to 75.60 MHz that may be authorized for mobile operations in the Special Industrial Radio Service, Manufacturers Radio Service, Railroad Radio Service and Forest Products Radio Service and limits their use to a railroad yard, manufacturing plant, logging site, mill, or similar industrial facility. We note that the 10 frequencies from 72.44 MHz to 75.60 MHz are also available to Public Safety Radio Pool licensees for fire call box operations. 47 C.F.R. 90.20(d)(25).

<sup>524</sup> This consolidation stems from the Commission’s ‘refarming’ proceeding (PR Docket No. 92-235), which combined the various Industrial Radio Services and Land Transportation Radio Services into a single Industrial/Business Radio Pool.

Industrial/Business Pool Frequency Table, which is codified in Section 90.35 of the Commission's rules.<sup>525</sup> We propose to update and simplify footnote NG49 and to renumber this footnote as NG16. Specifically, we propose to no longer list the individual frequencies within the footnote. In addition, while the footnote describes pool-specific geographic limitations for all 30 frequencies (*e.g.*, manufacturing facilities, railroad yards and mills), the Industrial/Business Pool Frequency Table only places geographic limits on the 10 frequencies from 72.44 MHz to 75.60 MHz, and uses the more generalized concept of "the licensee's business premises."<sup>526</sup> We propose to remove the geographic restriction from footnote NG49 but retain the existing Part 90 rules. Thus, the effect of our proposal is to make the Allocation Table consistent with the existing service rules. The revised footnote, NG16, would read as follows: In the bands 72-73 MHz and 75.4-76 MHz, frequencies may be authorized for mobile operations in the Industrial/Business Radio Pool, subject to the condition that no interference is caused to the reception of television stations operating on channels 4 and 5. We seek comment on this proposal.

266. We propose to amend Section 2.100 of the rules to state that the ITU *Radio Regulations*, Edition of 2012, have been incorporated to the extent practicable in Part 2.

## VII. PROCEDURAL MATTERS

### A. Report and Order

267. **Final Regulatory Flexibility Analysis.** As required by Section 603 of the Regulatory Flexibility Act, 5 U.S.C. § 603, the Commission has prepared a Final Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact on small entities of the changes adopted in this document. The FRFA is set forth in Appendix E.

268. **Paperwork Reduction Analysis.** This document contains no new or modified information collection requirements subject to the Paperwork Reduction Act of 1995 (PRA), Public Law 104-13. In addition, therefore, it does not contain any new or modified "information collection burden for small business concerns with fewer than 25 employees," pursuant to the Small Business Paperwork Relief Act of 2002, Public Law 107-198, *see* 44 U.S.C. 3506(c)(4).

269. **Congressional Review Act.** The Commission will send a copy of this Report and Order, Order, and WRC-12 Notice of Proposed Rulemaking to Congress and the Government Accountability Office pursuant to the Congressional Review Act, *see* 5 U.S.C. 801(a)(1)(A).

### B. WRC-12 Notice of Proposed Rulemaking

#### 1. Ex Parte

270. This proceeding shall be treated as a "permit-but-disclose" proceeding in accordance with the Commission's *ex parte* rules.<sup>527</sup> Persons making *ex parte* presentations must file a copy of any written presentation or a memorandum summarizing any oral presentation within two business days after the presentation (unless a different deadline applicable to the Sunshine period applies). Persons making oral *ex parte* presentations are reminded that memoranda summarizing the presentation must: (1) list all persons attending or otherwise participating in the meeting at which the *ex parte* presentation was made; and (2) summarize all data presented and arguments made during the presentation. If the presentation consisted in whole or in part of the presentation of data or arguments already reflected in the presenter's written comments, memoranda, or other filings in the proceeding, the presenter may provide citations to

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<sup>525</sup> The Industrial/Business Pool Frequency Table further identifies the 30 frequencies as being available for mobile stations, and states that all operations are subject to the provisions of another Part 90 rule (§ 90.257(b)) that sets forth criteria for protecting TV channel 4 and 5 reception.

<sup>526</sup> This is specified by assignment limitation 77, reads as follows: All communications on this frequency must be conducted within the boundaries or confines of the licensee's business premises. 47 C.F.R. § 90.35(b)(3), (c)(77).

<sup>527</sup> 47 C.F.R. §§ 1.1200 *et seq.*

such data or arguments in his or her prior comments, memoranda, or other filings (specifying the relevant page and/or paragraph numbers where such data or arguments can be found) in lieu of summarizing them in the memorandum. Documents shown or given to Commission staff during *ex parte* meetings are deemed to be written *ex parte* presentations and must be filed consistent with rule 1.1206(b). In proceedings governed by rule 1.49(f) or for which the Commission has made available a method of electronic filing, written *ex parte* presentations and memoranda summarizing oral *ex parte* presentations, and all attachments thereto, must be filed through the electronic comment filing system available for that proceeding and must be filed in their native format (e.g., .doc, .xml, .ppt, searchable .pdf). Participants in this proceeding should familiarize themselves with the Commission's *ex parte* rules.

## 2. Initial Regulatory Flexibility Analysis

271. Pursuant to the Regulatory Flexibility Act (RFA),<sup>528</sup> the Commission has prepared an Initial Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact on small entities by the proposals considered in this WRC-12 Notice. The text of the IRFA is set forth in Appendix G. Written public comments are requested on this IRFA. Comments must be filed in accordance with the same filing deadlines as for comments on the WRC-12 Notice, and they should have a separate and distinct heading designating them as responses to the IRFA. The Commission will send a copy of the WRC-12 Notice, including the IRFA, to the Chief Counsel for Advocacy of the Small Business Administration.<sup>529</sup>

## 3. Paperwork Reduction Act Analysis

272. This document does not contain proposed information collection(s) subject to the Paperwork Reduction Act of 1995 (PRA), Public Law 104-13. In addition, therefore, it does not contain any new or modified "information collection burden for small business concerns with fewer than 25 employees," pursuant to the Small Business Paperwork Relief Act of 2002, Public Law 107-198, *see* 44 U.S.C. 3506(c)(4).

## 4. Filing Requirements

273. Pursuant to Sections 1.415 and 1.419 of the Commission's rules, 47 CFR §§ 1.415, 1.419, interested parties may file comments and reply comments on or before the dates indicated on the first page of this document. Comments may be filed using the Commission's Electronic Comment Filing System (ECFS). *See Electronic Filing of Documents in Rulemaking Proceedings*, 63 FR 24121 (1998).

- Electronic Filers: Comments may be filed electronically using the Internet by accessing the ECFS: <http://fjallfoss.fcc.gov/ecfs2/>.
- Paper Filers: Parties that choose to file by paper must file an original and one copy of each filing. If more than one docket or rulemaking number appears in the caption of this proceeding, filers must submit two additional copies for each additional docket or rulemaking number.
- Filings can be sent by hand or messenger delivery, by commercial overnight courier, or by first-class or overnight U.S. Postal Service mail. All filings must be addressed to the Commission's Secretary, Office of the Secretary, Federal Communications Commission.
- All hand-delivered or messenger-delivered paper filings for the Commission's Secretary must be delivered to FCC Headquarters at 445 12<sup>th</sup> St., SW, Room TW-A325, Washington, DC 20554. The filing hours are 8:00 a.m. to 7:00 p.m. All hand deliveries must be held together with rubber bands or fasteners. Any envelopes and boxes must be disposed of before entering the building.

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<sup>528</sup> *See* 5 U.S.C. § 603. The RFA has been amended by the Contract with America Advancement Act of 1996, Pub. L. No. 104-121, 110 Stat. 847 (1996) (CWAAA). Title II of the CWAAA is the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA).

<sup>529</sup> 5 U.S.C. § 603(a)

- Commercial overnight mail (other than U.S. Postal Service Express Mail and Priority Mail) must be sent to 9300 East Hampton Drive, Capitol Heights, MD 20743.
- U.S. Postal Service first-class, Express, and Priority mail must be addressed to 445 12<sup>th</sup> Street, SW, Washington DC 20554.

274. People with Disabilities: To request materials in accessible formats for people with disabilities (braille, large print, electronic files, audio format), send an e-mail to [fcc504@fcc.gov](mailto:fcc504@fcc.gov) or call the Consumer & Governmental Affairs Bureau at 202-418-0530 (voice), 202-418-0432 (tty).

275. For further information, contact Tom Mooring, Office of Engineering and Technology, (202) 418-2450, or via the Internet at [tom.mooring@fcc.gov](mailto:tom.mooring@fcc.gov).

### VIII. ORDERING CLAUSES

276. Accordingly, IT IS ORDERED that pursuant to Sections 1, 4, 301, 302, and 303 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 151, 154, 301, 302a, and 303, and Section 553(b)(B) of the Administrative Procedure Act, 5 U.S.C. § 553(b)(B), this REPORT AND ORDER, ORDER, and NOTICE OF PROPOSED RULEMAKING is hereby ADOPTED and the Commission's rules ARE AMENDED as set forth in Appendix D.

277. IT IS ALSO ORDERED, pursuant to Section 1.3 of the Commission's rules, 47 C.F.R. § 1.3, that Sections 80.375 and 90.103 of the Commission's rules are WAIVED to allow operation of FCC authorized radio buoys in the 1900-2000 kHz band on the open sea by commercial fishing vessels that have a valid ship station license or are licensed by rule under Section 80.13 of the Commission's rules.

278. IT IS FURTHER ORDERED that the Petition for Rulemaking of ARRL filed on Nov. 29, 2012 is GRANTED.

279. IT IS FURTHER ORDERED that the Joint Petition for Rulemaking of Xanadoo Company and Spectrum Five LLC in IB Docket No. 06-123 is DENIED IN PART as described herein.

280. IT IS ALSO ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of this REPORT AND ORDER, ORDER, AND NOTICE OF PROPOSED RULEMAKING, including the Final and Initial Regulatory Flexibility Analyses, to the Chief Counsel for Advocacy of the Small Business Administration.

281. IT IS FURTHER ORDERED that the rule amendments adopted herein SHALL BE EFFECTIVE 30 days after publication of a summary of the *Report and Order* and *Order* in the Federal Register and ET Docket No. 12-338 SHALL BE TERMINATED, unless one or more petitions for reconsideration are filed in response to the *Report and Order*.

282. IT IS FURTHER ORDERED that the Commission SHALL SEND a copy of this *Report and Order* and *Order* in a report to be sent to Congress and the General Accounting Office pursuant to the Congressional Review Act, see 5 U.S.C. § 801(a)(1)(A).

283. IT IS FURTHER ORDERED that pursuant to applicable procedures set forth in Sections 1.415 and 1.419 of the Commission's rules, 47 C.F.R §§ 1.415, 1.419, interested parties may file comments on this WRC-12 Notice of Proposed Rulemaking on or before 60 days after publication of a summary in the Federal Register, and interested parties may file reply comments on or before 90 days after publication of a summary in the Federal Register.

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch  
Secretary

## APPENDIX A

## Glossary of Frequently Used Terms

Symbol (term)	Frequency Range (lower limit exclusive, upper limit inclusive)
LF (low frequency)	30 to 300 kHz
MF (medium frequency)	300 to 3000 kHz
HF (high frequency)	3 to 30 MHz
VHF (very high frequency)	30 to 300 MHz
UHF (ultra high frequency)	300 to 3000 MHz
SHF (super high frequency)	3 to 30 GHz
EHF (extremely high frequency)	30 to 300 GHz

Term	Abbreviation	Discussed at Note:
<b>I. Space Radiocommunication Services</b>	-	-
Earth exploration-satellite service	EESS	199
• meteorological-satellite service	MetSat	306
fixed-satellite service	FSS	140
mobile-satellite service	MSS	139
• aeronautical mobile-satellite (route) service	AMS(R)S	139
space research service	SRS	231
<b>II. Terrestrial Radiocommunication Services</b>	-	-
fixed service	FS	35
mobile service	MS	202
• aeronautical mobile service	AMS	124
➤ aeronautical mobile (route) service	AM(R)S	124
➤ aeronautical mobile service (telemetry) or aeronautical mobile telemetry	AMT	138
• land mobile service	LMS	257
• maritime mobile service	MMS	35
radiodetermination service	RDS	345
• radiolocation service	RLS	345
• radionavigation service	RNS	179
➤ aeronautical radionavigation service	ARNS	122

## APPENDIX B

## New and Renumbered Domestic Footnotes

<b>Table 1A: Footnotes Added or Renumbered in the WRC-07 Report and Order</b>			
New	Action*	Issue/Reason for Action	Para.
US52	US77 US106 US228	Combine the text of US77, US106 and US228; and also add AIS 1 and AIS 2 restrictions.	105 and 112
US79	US37 US398	Revise US37 and US398 (remove Little LEO exception); combine the text of these footnotes into a single footnote	128
US85	US343	Remove the 108-117.975 MHz band.	50
US100	US339	Delete non-Federal AMT use of the 2310-2320 MHz band, permit incumbent non-Federal AMT users to operate in the 2345-2360 MHz band for about 5 years, and delete two unused two frequencies that are available for non-Federal use	65
US111	NTIA	List 52 flight test areas where AMT would be conducted	60
US113	US203	Update US203 per CORF's comments in VMES proceeding	134
US139	NG144	Simplify, update, and reclassify as a U.S. footnote	123
US145	NTIA	Mandatory unwanted emissions limits for NGSO ISS satellites transmitting in the 22.55-23.55 GHz band	92
US156	NTIA	Mandatory unwanted emissions limits for earth stations transmitting in the 49.7-50.2 and 50.4-50.9 GHz bands	136
US157	NTIA	Mandatory unwanted emissions limit for fixed stations transmitting in the 51.4-52.6 GHz band	137
US161	US388	Update RAS stations observing in the 80/90 GHz bands	138
US343	US78	Change "telemetry" to "telemetering" and add "on a co-equal basis"	73
US367	5.367	Maintain the existing AMS(R)S allocation in the 5000-5150 MHz band	61
US475	US66	Renumber US66 as US475 in order to simplify the U.S. Table	131
US476A	NTIA	Federal active sensors in the 9300-9500 MHz band must not cause harmful interference to radionavigation or Federal radiolocation	129
US482	US265	Restrict use of FS in the 10.6-10.68 GHz band to point-to-to-point stations, with each station supplying not more than -3 dBW to the antenna, producing not more than 40 dBW of EIRP, and radiating at an main beam elevation angle of 20° or less. Grandfather existing stations and urge FS licensees to comply with WRC-07's non-mandatory transmitter power and to employ ATPC	87
US532	US263	Remove the 36-37 GHz band from US263 and renumber based on RR 5.532	135
US550A	NTIA	Combine FS and MS sharing requirements into a single footnote	
US565	5.565	Maintain the pre-WRC-12 text of RR 5.565	142
NG22	NG117	Correct two grammatical and/or typographical errors	104
NG34	NG158	Revise the existing 700 MHz Public Safety bands by adding D Block	145
NG35	NG120	Update text to reflect MAS bands specified in Section 101.101	126
NG60	NTIA	Implement WRC-07's mandatory unwanted emissions limit for fixed stations transmitting in the 31-31.3 GHz band	99
NG92	FCC	Authorize radio buoys to continue to operate in the 1900-2000 kHz band	42
NG338A	NTIA	Encourage Part 27 and 90 licensees in the 1390-1395 MHz and 1427-1435 MHz bands to take all reasonable steps to ensure that their stations' unwanted emissions power does not exceed WRC-07's non-mandatory level	133
NG535	NG167	Apply the text of RR 5.535 to the 24.75-25.05 GHz band	71
<b>Table 1B: Footnotes Proposed to be Added or Renumbered in the WRC-12 Notice</b>			
New	Action*	Issue/Reason for Action	Para.
US115	NTIA	Authorize AeroMACS use of the 5000-5030 MHz band.	230
US162	NTIA	Encourage FS operators to limit unwanted emissions power in 86-92 GHz	249
US511E	NTIA	Modification and reclassification of NTIA's recommended footnote G135	264
NG16	NG49	Update and simplify NG49	265
*The current footnote number is shown for footnotes that are being re-numbered in the WRC-07 R&O or proposed to be renumbered in the WRC-12 Notice; the source of new footnotes is listed as FCC or NTIA.			

**APPENDIX C****Commenters**

**Comments** (65 parties filed on or before February 25, 2013):

Aerospace and Flight Test Radio Coordinating Council (AFTRCC)  
American Electric Power Company  
American Radio Relay League (ARRL), or ARRL, the national association for Amateur Radio  
American Transmission Company LLC  
Andrews, John K.  
Atkinson, Robert L.  
Bargmann, Nathan  
Berg, Lloyd  
Bethman, Robert  
Boeing Company, The  
Carpenter, Todd  
CenterPoint Energy Houston Electric, LLC  
Chester, Donald B.  
Compton, David L.  
Comsearch  
Cooper, Roger  
Courts, Steve  
Davis, John H. (Davis)  
Dayton Power and Light Company, The (includes reply comments)  
DIRECTV, LLC (DirecTV)  
Douglas, Danny  
Dubovsky, George  
Duccini, Richard  
Duncan, Thomas K.  
Entergy Services, Inc. (listed in the docket as David Fishel)  
Exelon Corporation  
Farrell, Brad  
Fitton, James M.  
Governale, Benjamin A.  
Great River Energy  
Hanlon, James T.  
Harang, Michael M.  
Hicks, Hamilton  
Hoffman, Robert G.  
Holloway, Brian  
Holmes, John R.  
Jankowiak, Patrick  
Jensen, Richard W.  
Kincaid, Michael R. (listed in the docket as Michael)  
Klemm, Jerry  
Leggett, Nickolaus E. (Leggett)  
Michener, James  
Muttillio, Anthony  
Naumann, Robert E.  
NextEra Energy, Inc.  
Olean, David C.  
Osler, William F.  
Peak, Michael L.

Pettit, Richard L.  
PPL Electric Utilities Corporation  
Putnam, Dale  
Reid, Glen  
Reid, Ken  
Rodenkirch, James  
Rusgrove, Jay  
Scandurra, Anthony  
Schultz, Greg  
Sheppard, Albert  
Smith, Peter G.  
Tessitore, David  
Utilities Telecom Council (UTC)  
Whedbee, James E. (Whedbee) (received on November 26, 2012 (3 filings) and November 28, 2012)  
Wormser, Owen (filed on behalf of the “The 1865 Morning Group”)  
Wright, William C., III  
Ziegler, Warren H. (Ziegler)

**Late-Filed Comments** (3 parties first filed initial comments between February 26 and March 27, 2013):

Howell, Laurence J.  
ITM Marine (listed in the docket as Steve Beaver)  
Klagge, Neil

**Reply Comments** (11 parties filed reply comments on or before March 27, 2013):

AFTRCC  
ARRL  
Ballinger, Perry D.  
Bunn, Hugh P.  
Davis  
Leggett  
Raab, Frederick H.  
UTC and the Edison Electric Institute  
Wasson, Craig  
Whedbee (received on December 27, 2012, and on February 15 and March 4, 2013)  
Ziegler

**Ex Parte Submissions** (7 parties filed after March 27, 2013):

AFTRCC  
Crowe, Brian (for WiMax Forum)  
DirecTV  
Leggett  
National Academy of Sciences’ Committee on Radio Frequencies (CORF)  
Whedbee (received on March 28 and 29, 2013)  
WiMax Forum

## APPENDIX D

## Final Rules

For the reasons discussed in the preamble, the Federal Communications Commission amends 47 C.F.R. parts 1, 2, 25, 27, 74, 78, 80, 87, 90, 97, and 101 as follows:

## PART 1 – PRACTICE AND PROCEDURE

1. The authority citation for part 1 continues to read as follows:

AUTHORITY: 15 U.S.C. 79 *et seq.*; 47 U.S.C. 151, 154(i), 154(j), 155, 157, 160, 201, 225, 227, 303, 309, 332, 1403, 1404, 1451, 1452, and 1455.

2. Section 1.924 is amended by revising paragraphs (e) and (f) to read as follows:

**§ 1.924 Quiet zones.**

\* \* \* \* \*

(e) 420-450 MHz band. Applicants for pulse-ranging radiolocation systems operating in the 420-450 MHz band along the shoreline of the conterminous United States and Alaska, and for spread spectrum radiolocation systems operating in the 420-435 MHz sub-band within the conterminous United States and Alaska, should not expect to be accommodated if their area of service is within:

- (1) Arizona, Florida, or New Mexico;
- (2) Those portions of California and Nevada that are south of latitude 37° 10' N;
- (3) That portion of Texas that is west of longitude 104° W; or
- (4) The following circular areas:
  - (i) 322 kilometers (km) of 30° 30' N, 86° 30' W
  - (ii) 322 km of 28° 21' N, 80° 43' W
  - (iii) 322 km of 34° 09' N, 119° 11' W
  - (iv) 240 km of 39° 08' N, 121° 26' W
  - (v) 200 km of 31° 25' N, 100° 24' W
  - (vi) 200 km of 32° 38' N, 83° 35' W
  - (vii) 160 km of 64° 17' N, 149° 10' W
  - (viii) 160 km of 48° 43' N, 97° 54' W
  - (ix) 160 km of 41° 45' N, 70° 32' W.

(f) 17.7-19.7 GHz band. The following exclusion areas and coordination areas are established to minimize or avoid harmful interference to Federal Government earth stations receiving in the 17.7-19.7 GHz band:

(1) No application seeking authority for fixed stations, under parts 74, 78, or 101 of this chapter, supporting the operations of Multichannel Video Programming Distributors (MVPD) in the 17.7-17.8 GHz band or to operate in the 17.8-19.7 GHz band for any service will be accepted for filing if the proposed station is located within 20 km (or within 55 km if the modification application is for an outdoor low power operation pursuant to §101.147(r)(14) of this chapter) of Denver, CO (39° 43' N, 104° 46' W) or Washington, DC (38° 48' N, 76° 52' W).

(2) Any application for a new station license to provide MVPD operations in the 17.7-17.8 GHz band or to operate in the 17.8-19.7 GHz band for any service, or for modification of an existing station license in these bands which would change the frequency, power, emission, modulation, polarization, antenna height or directivity, or location of such a station, must be coordinated with the Federal Government by the Commission before an authorization will be issued, if the station or proposed station is located in whole or in part within any of the following areas:

(i) Denver, CO area:

- (A) Between latitudes 41° 30' N and 38° 30' N and between longitudes 103° 10' W and 106° 30' W.
- (B) Between latitudes 38° 30' N and 37° 30' N and between longitudes 105° 00' W and 105° 50' W.

(C) Between latitudes 40° 08' N and 39° 56' N and between longitudes 107° 00' W and 107° 15' W.

(ii) Washington, DC area:

(A) Between latitudes 38° 40' N and 38° 10' N and between longitudes 78° 50' W and 79° 20' W.

(B) Within 178 km of 38° 48' N, 76° 52' W.

(iii) San Miguel, CA area:

(A) Between latitudes 34° 39' N and 34° 00' N and between longitudes 118° 52' W and 119° 24' W.

(B) Within 200 km of 35° 44' N, 120° 45' W.

(iv) Guam area: Within 100 km of 13° 35' N, 144° 51' E.

NOTE TO § 1.924(E): The coordinates cited in this section are specified in terms of the “North American Datum of 1983 (NAD 83).”

\* \* \* \* \*

## **PART 2 – FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS**

3. The authority citation for part 2 continues to read as follows:

AUTHORITY: 47 U.S.C. 154, 302a, 303, and 336, unless otherwise noted.

4. Section 2.1 is amended by revising the definition of the following terms in paragraph (c) to read as follows:

### **§ 2.1 Terms and definitions.**

\* \* \* \* \*

(c) \* \* \*

Earth Exploration-Satellite Service. A radiocommunication service between earth stations and one or more space stations, which may include links between space stations, in which: (1) information relating to the characteristics of the Earth and its natural phenomena, including data relating to the state of the environment, is obtained from active sensors or passive sensors on Earth satellites; (2) similar information is collected from airborne or Earth-based platforms; (3) such information may be distributed to earth stations within the system concerned; and (4) platform interrogation may be included. This service may also include feeder links necessary for its operation. (RR)

\* \* \* \* \*

Equivalent Isotropically Radiated Power (e.i.r.p.). The product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna (absolute or isotropic gain). (RR)

\* \* \* \* \*

5. Section 2.100 is amended to read as follows:

### **§ 2.100 International regulations in force.**

The ITU Radio Regulations, Edition of 2008, have been incorporated to the extent practicable in this part, except that the International Table within § 2.106 has been updated to reflect the ITU Radio Regulations, Edition of 2012.

6. Section 2.101 is amended by revising paragraph (c) to read as follows:

### **§ 2.101 Frequency and wavelength bands.**

\* \* \* \* \*

(c) In communications between administrations and the ITU, no names, symbols or abbreviations should be used for the various frequency bands other than those specified in this section.

Band number	Symbols (terms) <sup>2</sup>	Frequency range (lower limit exclusive, upper limit inclusive)	Corresponding metric subdivision	Metric abbreviations for the bands
4	VLF (very low frequency)	3 to 30 kHz	Myriametric waves	B.Mam
5	LF (low frequency)	30 to 300 kHz	Kilometric waves	B.km
6	MF (medium frequency)	300 to 3 000 kHz	Hectometric waves	B.hm
7	HF (high frequency)	3 to 30 MHz	Decametric waves	B.dam
8	VHF (very high frequency)	30 to 300 MHz	Metric waves	B.m
9	UHF (ultra high frequency)	300 to 3 000 MHz	Decimetric waves	B.dm
10	SHF (super high frequency)	3 to 30 GHz	Centimetric waves	B.cm
11	EHF (extremely high frequency)	30 to 300 GHz	Millimetric waves	B.mm
12		300 to 3 000 GHz	Decimillimetric waves	

NOTE 1: “Band N” (N = band number) extends from  $0.3 \times 10^N$  Hz to  $3 \times 10^N$  Hz.

NOTE 2: Prefix: k = kilo ( $10^3$ ), M = mega ( $10^6$ ), G = giga ( $10^9$ ).

7. Section 2.106, the Table of Frequency Allocations, is amended as follows:

a. All pages are revised.

b. In the list of International Footnotes, footnotes 5.53, 5.54, 5.56, 5.67B, 5.68, 5.70, 5.77, 5.82, 5.87, 5.93, 5.98, 5.99, 5.107, 5.112, 5.114, 5.117, 5.128, 5.133, 5.140, 5.141, 5.141B, 5.142, 5.143A, 5.143B, 5.143C, 5.143D, 5.160, 5.162, 5.162A, 5.163, 5.164, 5.165, 5.166, 5.169, 5.171, 5.178, 5.179, 5.197, 5.197A, 5.201, 5.202, 5.211, 5.212, 5.214, 5.221, 5.231, 5.237, 5.259, 5.262, 5.274, 5.275, 5.276, 5.277, 5.286AA, 5.288, 5.290, 5.293, 5.294, 5.296, 5.300, 5.312, 5.313A, 5.314, 5.315, 5.316, 5.316A, 5.316B, 5.317A, 5.322, 5.323, 5.327A, 5.330, 5.331, 5.335, 5.338, 5.338A, 5.342, 5.351A, 5.352A, 5.353A, 5.355, 5.357A, 5.359, 5.362B, 5.362C, 5.367, 5.369, 5.371, 5.381, 5.382, 5.384A, 5.387, 5.388, 5.388A, 5.388B, 5.389A, 5.389C, 5.399, 5.410, 5.412, 5.418, 5.422, 5.428, 5.429, 5.430, 5.430A, 5.431A, 5.432B, 5.433A, 5.439, 5.440A, 5.443B, 5.444, 5.444A, 5.444B, 5.446, 5.446A, 5.446C, 5.447, 5.447A, 5.448, 5.450, 5.453, 5.454, 5.457B, 5.457C, 5.461B, 5.462A, 5.466, 5.468, 5.469, 5.471, 5.477, 5.481, 5.482, 5.483, 5.494, 5.495, 5.499, 5.500, 5.501, 5.504C, 5.505, 5.508, 5.508A, 5.509A, 5.511, 5.512, 5.514, 5.522C, 5.524, 5.536A, 5.536B, 5.536C, 5.537A, 5.542, 5.543A, 5.545, 5.546, 5.547, 5.549, 5.550, and 5.565 are revised; footnotes 5.54A, 5.54B, 5.54C, 5.80A, 5.80B, 5.132A, 5.132B, 5.133A, 5.145A, 5.145B, 5.149A, 5.158, 5.159, 5.161A, 5.161B, 5.225A, 5.228, 5.228A, 5.228B, 5.228C, 5.228D, 5.228E, 5.228F, 5.312A, 5.401, 5.443AA, 5.443C, 5.443D, 5.457, 5.511E, 5.511F, 5.530A, 5.530B, 5.530C, 5.530D, 5.532A, and 5.532B are added; and footnotes 5.72, 5.82A, 5.82B, 5.101, 5.138A, 5.139, 5.141C, 5.143E, 5.227A, 5.272, 5.273, 5.302, 5.397, 5.400, 5.405, and 5.530 are removed.

c. In the list of United States (US) Footnotes, footnotes US37, US48, US51, US66, US77, US78, US106, US203, US226, US228, US263, US265, US290, US339, US368, US388, US398, US400, and US401 are removed; footnotes US52, US79, US85, US100, US111, US113, US139, US145, US156, US157, US161, US227, US338A, US367, US444B, US475, US476A, US482, US532, US550A, and US565 are added; and footnotes US74, US334, US343, US444, US444A, and US519 are revised.

d. In the list of non-Federal Government (NG) Footnotes, footnotes NG22, NG34, NG35, NG60, NG92, NG338A, and NG535 are added; and footnotes NG117, NG120, NG144, NG158, and NG167 are removed.

### **§ 2.106 Table of Frequency Allocations.**

The revisions and additions read as follows:

\* \* \* \* \*

<sup>2</sup> The terms are no longer shown in the ITU *Radio Regulations*, and thus, they should not be used in communications with the ITU.

International Table			United States Table		FCC Rule Part(s)
Region 1 Table	Region 2 Table	Region 3 Table	Federal Table	Non-Federal Table	
Below 8.3 (Not Allocated)			Below 9 (Not Allocated)		
5.53 5.54			5.53 5.54		
8.3-9 METEOROLOGICAL AIDS 5.54A 5.54B 5.54C			9-14 RADIONAVIGATION US18		
9-11.3 METEOROLOGICAL AIDS 5.54A RADIONAVIGATION			US2		
11.3-14 RADIONAVIGATION			14-19.95 FIXED		
14-19.95 FIXED MARITIME MOBILE 5.57			14-19.95 Fixed		
5.55 5.56			US2		
19.95-20.05 STANDARD FREQUENCY AND TIME SIGNAL (20 kHz)			19.95-20.05 STANDARD FREQUENCY AND TIME SIGNAL (20 kHz)		
20.05-70			US2		
FIXED MARITIME MOBILE 5.57			20.05-59 FIXED MARITIME MOBILE 5.57		
			20.05-59 FIXED		
			US2		
			US2		
			59-61 STANDARD FREQUENCY AND TIME SIGNAL (60 kHz)		
			US2		
			61-70 FIXED MARITIME MOBILE 5.57		
			61-70 FIXED		
			US2		
5.56 5.58			US2		
70-72 RADIONAVIGATION 5.60	70-90 FIXED MARITIME MOBILE 5.57 MARITIME RADIONAVIGATION 5.60 Radiolocation	70-72 RADIONAVIGATION 5.60 Fixed Maritime mobile 5.57 5.59	70-90 FIXED MARITIME MOBILE 5.57 Radiolocation	70-90 FIXED Radiolocation	Private Land Mobile (90)
72-84 FIXED MARITIME MOBILE 5.57 RADIONAVIGATION 5.60		72-84 FIXED MARITIME MOBILE 5.57 RADIONAVIGATION 5.60			
5.56 84-86 RADIONAVIGATION 5.60		84-86 RADIONAVIGATION 5.60 Fixed Maritime mobile 5.57 5.59			

86-90 FIXED MARITIME MOBILE 5.57 RADIONAVIGATION 5.56	5.61	86-90 FIXED MARITIME MOBILE 5.57 RADIONAVIGATION 5.60	US2	US2	
90-110 RADIONAVIGATION 5.62 Fixed 5.64			90-110 RADIONAVIGATION 5.62 US18 US2 US104		Aviation (87) Private Land Mobile (90)
110-112 FIXED MARITIME MOBILE RADIONAVIGATION 5.64	110-130 FIXED MARITIME MOBILE MARITIME RADIONAVIGATION 5.60 Radiolocation	110-112 FIXED MARITIME MOBILE RADIONAVIGATION 5.60 5.64	110-130 FIXED MARITIME MOBILE Radiolocation		Private Land Mobile (90)
112-115 RADIONAVIGATION 5.60		112-117.6 RADIONAVIGATION 5.60			
115-117.6 RADIONAVIGATION 5.60 Fixed Maritime mobile		Fixed Maritime mobile			
5.64 5.66 117.6-126 FIXED MARITIME MOBILE RADIONAVIGATION 5.60		5.64 5.65 117.6-126 FIXED MARITIME MOBILE RADIONAVIGATION 5.60			
5.64 126-129 RADIONAVIGATION 5.60		5.64 126-129 RADIONAVIGATION 5.60 Fixed Maritime mobile			
129-130 FIXED MARITIME MOBILE RADIONAVIGATION 5.60		5.64 5.65 129-130 FIXED MARITIME MOBILE RADIONAVIGATION 5.60			
5.64 130-135.7 FIXED MARITIME MOBILE	5.61 5.64 130-135.7 FIXED MARITIME MOBILE	5.64 130-135.7 FIXED MARITIME MOBILE RADIONAVIGATION	5.64 US2 130-135.7 FIXED MARITIME MOBILE		Maritime (80)
5.64 5.67 135.7-137.8 FIXED MARITIME MOBILE Amateur 5.67A	5.64 135.7-137.8 FIXED MARITIME MOBILE Amateur 5.67A	5.64 135.7-137.8 FIXED MARITIME MOBILE RADIONAVIGATION Amateur 5.67A	5.64 US2 135.7-137.8 FIXED MARITIME MOBILE	135.7-137.8 FIXED MARITIME MOBILE Amateur 5.67A	Maritime (80)
5.64 5.67 5.67B	5.64	5.64 5.67B	5.64 US2	5.64 US2	

International Table			United States Table		FCC Rule Part(s)
Region 1 Table	Region 2 Table	Region 3 Table	Federal Table	Non-Federal Table	
137.8-148.5 FIXED MARITIME MOBILE 5.64 5.67	137.8-160 FIXED MARITIME MOBILE	137.8-160 FIXED MARITIME MOBILE RADIONAVIGATION	137.8-160 FIXED MARITIME MOBILE		Maritime (80)
148.5-255 BROADCASTING	5.64	5.64	5.64 US2		
	160-190 FIXED	160-190 FIXED Aeronautical radionavigation	160-190 FIXED MARITIME MOBILE US2	160-190 FIXED US2	
	190-200 AERONAUTICAL RADIONAVIGATION		190-200 AERONAUTICAL RADIONAVIGATION US18 US2		Aviation (87)
5.68 5.69 5.70 255-283.5 BROADCASTING AERONAUTICAL RADIONAVIGATION	200-275 AERONAUTICAL RADIONAVIGATION Aeronautical mobile	200-285 AERONAUTICAL RADIONAVIGATION Aeronautical mobile	200-275 AERONAUTICAL RADIONAVIGATION US18 Aeronautical mobile US2		
5.70 5.71 283.5-315 AERONAUTICAL RADIONAVIGATION MARITIME RADIONAVIGATION (radiobeacons) 5.73	275-285 AERONAUTICAL RADIONAVIGATION Aeronautical mobile Maritime radionavigation (radiobeacons)		275-285 AERONAUTICAL RADIONAVIGATION Aeronautical mobile Maritime radionavigation (radiobeacons) US2 US18		
5.74	285-315 AERONAUTICAL RADIONAVIGATION MARITIME RADIONAVIGATION (radiobeacons) 5.73		285-325 MARITIME RADIONAVIGATION (radiobeacons) 5.73 Aeronautical radionavigation (radiobeacons)		
315-325 AERONAUTICAL RADIONAVIGATION Maritime radionavigation (radiobeacons) 5.73	315-325 MARITIME RADIONAVIGATION (radiobeacons) 5.73 Aeronautical radionavigation	315-325 AERONAUTICAL RADIONAVIGATION MARITIME RADIONAVIGATION (radiobeacons) 5.73	US2 US18 US364		
5.75 325-405 AERONAUTICAL RADIONAVIGATION	325-335 AERONAUTICAL RADIONAVIGATION Aeronautical mobile Maritime radionavigation (radiobeacons)	325-405 AERONAUTICAL RADIONAVIGATION Aeronautical mobile	325-335 AERONAUTICAL RADIONAVIGATION (radiobeacons) Aeronautical mobile Maritime radionavigation (radiobeacons) US2 US18		Aviation (87)
	335-405 AERONAUTICAL RADIONAVIGATION Aeronautical mobile		335-405 AERONAUTICAL RADIONAVIGATION (radiobeacons) US18 Aeronautical mobile US2		
405-415 RADIONAVIGATION 5.76	405-415 RADIONAVIGATION 5.76 Aeronautical mobile		405-415 RADIONAVIGATION 5.76 US18 Aeronautical mobile US2		Maritime (80) Aviation (87)
415-435 MARITIME MOBILE 5.79 AERONAUTICAL RADIONAVIGATION	415-472 MARITIME MOBILE 5.79 Aeronautical radionavigation 5.77 5.80		415-435 MARITIME MOBILE 5.79 AERONAUTICAL RADIONAVIGATION US2		

435-472 MARITIME MOBILE 5.79 Aeronautical radionavigation 5.77 5.82	5.78 5.82		435-495 MARITIME MOBILE 5.79 5.79A Aeronautical radionavigation	435-495 MARITIME MOBILE 5.79 5.79A	
472-479 MARITIME MOBILE 5.79 Amateur 5.80A Aeronautical radionavigation 5.77 5.80 5.80B 5.82					
479-495 MARITIME MOBILE 5.79 5.79A Aeronautical radionavigation 5.77 5.82	479-495 MARITIME MOBILE 5.79 5.79A Aeronautical radionavigation 5.77 5.80 5.82		5.82 US2 US231	5.82 US2 US231	
495-505 MARITIME MOBILE			495-505 MOBILE (distress and calling)		
505-526.5 MARITIME MOBILE 5.79 5.79A 5.84 AERONAUTICAL RADIONAVIGATION	505-510 MARITIME MOBILE 5.79	505-526.5 MARITIME MOBILE 5.79 5.79A 5.84 AERONAUTICAL RADIONAVIGATION Aeronautical mobile Land mobile	505-510 MARITIME MOBILE 5.79		Maritime (80)
	510-525 MARITIME MOBILE 5.79A 5.84 AERONAUTICAL RADIONAVIGATION		510-525 MARITIME MOBILE (ships only) 5.79A 5.84 AERONAUTICAL RADIONAVIGATION (radiobeacons) US18 US14 US225		Maritime (80) Aviation (87)
526.5-1606.5 BROADCASTING	525-535 BROADCASTING 5.86 AERONAUTICAL RADIONAVIGATION	526.5-535 BROADCASTING Mobile 5.88	525-535 MOBILE US221 AERONAUTICAL RADIONAVIGATION (radiobeacons) US18 US239		Aviation (87) Private Land Mobile (90)
	535-1605 BROADCASTING	535-1606.5 BROADCASTING	535-1605	535-1605 BROADCASTING NG1 NG5	Radio Broadcast (AM)(73) Private Land Mobile (90)
5.87 5.87A 1606.5-1625 FIXED MARITIME MOBILE 5.90 LAND MOBILE 5.92	1605-1625 BROADCASTING 5.89  5.90	1606.5-1800 FIXED MOBILE RADIOLOCATION RADIONAVIGATION	1605-1615 MOBILE US221 G127 1615-1705	1605-1705 BROADCASTING 5.89	Radio Broadcast (AM)(73) Alaska Fixed (80) Private Land Mobile (90)
1625-1635 RADIOLOCATION 5.93	1625-1705 FIXED MOBILE BROADCASTING 5.89 Radiolocation 5.90		US299	US299 NG1 NG5	
1635-1800 FIXED MARITIME MOBILE 5.90 LAND MOBILE  5.92 5.96	1705-1800 FIXED MOBILE RADIOLOCATION AERONAUTICAL RADIONAVIGATION	5.91	1705-1800 FIXED MOBILE RADIOLOCATION  US240		Alaska Fixed (80) Private Land Mobile (90)



2194-2300 FIXED MOBILE except aeronautical mobile (R)  5.92 5.103 5.112	2194-2300 FIXED MOBILE  5.112	2194-2495 FIXED MOBILE	2194-2495 FIXED MOBILE except aeronautical mobile	Maritime (80) Private Land Mobile (90)
2300-2498 FIXED MOBILE except aeronautical mobile (R) BROADCASTING 5.113  5.103 2498-2501 STANDARD FREQUENCY AND TIME SIGNAL (2500 kHz)	2300-2495 FIXED MOBILE BROADCASTING 5.113  2495-2501 STANDARD FREQUENCY AND TIME SIGNAL (2500 kHz)	US22 US340	US22 US340 NG7	
2501-2502 STANDARD FREQUENCY AND TIME SIGNAL Space research				
2502-2625 FIXED MOBILE except aeronautical mobile (R)  5.92 5.103 5.114	2502-2505 STANDARD FREQUENCY AND TIME SIGNAL  2505-2850 FIXED MOBILE	US1 US340		
2625-2650 MARITIME MOBILE MARITIME RADIONAVIGATION  5.92 2650-2850 FIXED MOBILE except aeronautical mobile (R)  5.92 5.103		2505-2850 FIXED MOBILE US285	2505-2850 FIXED MOBILE except aeronautical mobile US285	Maritime (80) Aviation (87) Private Land Mobile (90)
2850-3025 AERONAUTICAL MOBILE (R)  5.111 5.115		US22 US340	US22 US340	
3025-3155 AERONAUTICAL MOBILE (OR)		2850-3025 AERONAUTICAL MOBILE (R)		Aviation (87)
3155-3200 FIXED MOBILE except aeronautical mobile (R)  5.116 5.117		5.111 5.115 US283 US340		
3200-3230 FIXED MOBILE except aeronautical mobile (R) BROADCASTING 5.113  5.116		3025-3155 AERONAUTICAL MOBILE (OR)  US340		
		3155-3230 FIXED MOBILE except aeronautical mobile (R)		Maritime (80) Private Land Mobile (90)
		US22 US340		

International Table			United States Table		FCC Rule Part(s)
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3.23-3.4 FIXED MOBILE except aeronautical mobile BROADCASTING 5.113 5.116 5.118			3.23-3.4 FIXED MOBILE except aeronautical mobile Radiolocation US340		Maritime (80) Aviation (87) Private Land Mobile (90)
3.4-3.5 AERONAUTICAL MOBILE (R)			3.4-3.5 AERONAUTICAL MOBILE (R) US283 US340		Aviation (87)
3.5-3.8 AMATEUR FIXED MOBILE except aeronautical mobile 5.92	3.5-3.75 AMATEUR 5.119 3.75-4 AMATEUR FIXED MOBILE except aeronautical mobile (R)	3.5-3.9 AMATEUR FIXED MOBILE 3.9-3.95 AERONAUTICAL MOBILE BROADCASTING 3.95-4 FIXED BROADCASTING 5.126	3.5-4 US340	3.5-4 AMATEUR US340	Amateur Radio (97)
3.8-3.9 FIXED AERONAUTICAL MOBILE (OR) LAND MOBILE 3.9-3.95 AERONAUTICAL MOBILE (OR) 5.123 3.95-4 FIXED BROADCASTING	5.122 5.125				
4.4.063 FIXED MARITIME MOBILE 5.127 5.126			4.4.063 FIXED MARITIME MOBILE US340		Maritime (80)
4.063-4.438 MARITIME MOBILE 5.79A 5.109 5.110 5.130 5.131 5.132 5.128			4.063-4.438 MARITIME MOBILE 5.79A 5.109 5.110 5.130 5.131 5.132 US82 US296 US340		Maritime (80) Aviation (87)
4.438-4.488 FIXED MOBILE except aeronautical mobile (R) Radiolocation 5.132A 5.132B	4.438-4.488 FIXED MOBILE except aeronautical mobile (R) RADIOLOCATION 5.132A	4.438-4.488 FIXED MOBILE except aeronautical mobile Radiolocation 5.132A	4.438-4.65 FIXED MOBILE except aeronautical mobile (R)		Maritime (80) Aviation (87) Private Land Mobile (90)
4.488-4.65 FIXED MOBILE except aeronautical mobile (R)		4.488-4.65 FIXED MOBILE except aeronautical mobile	US22 US340		
4.65-4.7 AERONAUTICAL MOBILE (R)			4.65-4.7 AERONAUTICAL MOBILE (R) US282 US283 US340		Aviation (87)

4.7-4.75 AERONAUTICAL MOBILE (OR)			4.7-4.75 AERONAUTICAL MOBILE (OR) US340		
4.75-4.85 FIXED AERONAUTICAL MOBILE (OR) LAND MOBILE BROADCASTING 5.113	4.75-4.85 FIXED MOBILE except aeronautical mobile (R) BROADCASTING 5.113	4.75-4.85 FIXED BROADCASTING 5.113 Land mobile	4.75-4.85 FIXED MOBILE except aeronautical mobile (R) US340	Maritime (80) Private Land Mobile (90)	
4.85-4.995 FIXED LAND MOBILE BROADCASTING 5.113			4.85-4.995 FIXED MOBILE US340	4.85-4.995 FIXED US340	Aviation (87) Private Land Mobile (90)
4.995-5.003 STANDARD FREQUENCY AND TIME SIGNAL (5 MHz)			4.995-5.005 STANDARD FREQUENCY AND TIME SIGNAL (5 MHz)		
5.003-5.005 STANDARD FREQUENCY AND TIME SIGNAL Space research			US1 US340		
5.005-5.06 FIXED BROADCASTING 5.113			5.005-5.06 FIXED US22 US340	Aviation (87) Private Land Mobile (90)	
5.06-5.25 FIXED Mobile except aeronautical mobile 5.133			5.06-5.45 FIXED US22 Mobile except aeronautical mobile		Maritime (80) Aviation (87) Private Land Mobile (90) Amateur Radio (97)
5.25-5.275 FIXED MOBILE except aeronautical mobile Radiolocation 5.132A	5.25-5.275 FIXED MOBILE except aeronautical mobile RADIOLOCATION 5.132A	5.25-5.275 FIXED MOBILE except aeronautical mobile Radiolocation 5.132A			
5.133A 5.275-5.45 FIXED MOBILE except aeronautical mobile			US23 US212 US340		
5.45-5.48 FIXED AERONAUTICAL MOBILE (OR) LAND MOBILE	5.45-5.48 AERONAUTICAL MOBILE (R)	5.45-5.48 FIXED AERONAUTICAL MOBILE (OR) LAND MOBILE	5.45-5.68 AERONAUTICAL MOBILE (R)		Aviation (87)
5.48-5.68 AERONAUTICAL MOBILE (R)					
5.111 5.115 5.68-5.73 AERONAUTICAL MOBILE (OR)			5.111 5.115 US283 US340		
5.111 5.115			5.68-5.73 AERONAUTICAL MOBILE (OR)		
5.111 5.115			5.111 5.115 US340		
5.73-5.9 FIXED LAND MOBILE	5.73-5.9 FIXED MOBILE except aeronautical mobile (R)	5.73-5.9 FIXED Mobile except aeronautical mobile (R)	5.73-5.9 FIXED MOBILE except aeronautical mobile (R) US340	Maritime (80) Aviation (87) Private Land Mobile (90)	

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5.136			US136 US340		
5.95-6.2 BROADCASTING			6.2-6.525 MARITIME MOBILE 5.109 5.110 5.130 5.132 US82		Maritime (80)
6.2-6.525 MARITIME MOBILE 5.109 5.110 5.130 5.132			US296 US340		
5.137 6.525-6.685 AERONAUTICAL MOBILE (R)			6.525-6.685 AERONAUTICAL MOBILE (R)		Aviation (87)
6.685-6.765 AERONAUTICAL MOBILE (OR)			6.685-6.765 AERONAUTICAL MOBILE (OR)		
6.765-7 FIXED MOBILE except aeronautical mobile (R)			6.765-7 FIXED US22 MOBILE except aeronautical mobile (R)		ISM Equipment (18) Private Land Mobile (90)
5.138			5.138 US340		
7-7.1 AMATEUR AMATEUR-SATELLITE			7-7.2	7-7.1 AMATEUR AMATEUR-SATELLITE	Amateur Radio (97)
5.140 5.141 5.141A				US340	
7.1-7.2 AMATEUR 5.142			US340	7.1-7.2 AMATEUR	Amateur Radio (97)
5.141A 5.141B				US340	
7.2-7.3 BROADCASTING	7.2-7.3 AMATEUR	7.2-7.3 BROADCASTING	7.2-7.3	7.2-7.3 AMATEUR	International Broadcast Stations (73F) Amateur Radio (97)
	5.142		US142 US340	US142 US340	
7.3-7.4 BROADCASTING 5.134			7.3-7.4 BROADCASTING 5.134		International Broadcast Stations (73F) Maritime (80) Private Land Mobile (90)
5.143 5.143A 5.143B 5.143C 5.143D			US136 US340		
7.4-7.45 BROADCASTING	7.4-7.45 FIXED MOBILE except aeronautical mobile (R)	7.4-7.45 BROADCASTING	7.4-7.45 FIXED MOBILE except aeronautical mobile (R)		Maritime (80) Aviation (87) Private Land Mobile (90)
5.143B 5.143C		5.143A 5.143C	US142 US340		
7.45-8.1 FIXED MOBILE except aeronautical mobile (R)			7.45-8.1 FIXED US22 MOBILE except aeronautical mobile (R)		Maritime (80) Aviation (87) Private Land Mobile (90)
5.144			US340		

8.1-8.195 FIXED MARITIME MOBILE		8.1-8.195 FIXED MARITIME MOBILE US340		Maritime (80)
8.195-8.815 MARITIME MOBILE 5.109 5.110 5.132 5.145 5.111		8.195-8.815 MARITIME MOBILE 5.109 5.110 5.132 5.145 US82 5.111 US296 US340		Maritime (80) Aviation (87)
8.815-8.965 AERONAUTICAL MOBILE (R)		8.815-8.965 AERONAUTICAL MOBILE (R) US340		Aviation (87)
8.965-9.04 AERONAUTICAL MOBILE (OR)		8.965-9.04 AERONAUTICAL MOBILE (OR) US340		
9.04-9.305 FIXED	9.04-9.4 FIXED	9.04-9.305 FIXED	9.04-9.4 FIXED  US340	Maritime (80) Private Land Mobile (90)
9.305-9.355 FIXED Radiolocation 5.145A 5.145B		9.305-9.355 FIXED Radiolocation 5.145A		
9.355-9.4 FIXED		9.355-9.4 FIXED		
9.4-9.5 BROADCASTING 5.134 5.146		9.4-9.9 BROADCASTING 5.134		
9.5-9.9 BROADCASTING 5.147		US136 US340		International Broadcast Stations (73F)
9.9-9.995 FIXED		9.9-9.995 FIXED US340		Private Land Mobile (90)
9.995-10.003 STANDARD FREQUENCY AND TIME SIGNAL (10 MHz) 5.111		9.995-10.005 STANDARD FREQUENCY AND TIME SIGNAL (10 MHz)  5.111 US1 US340		
10.003-10.005 STANDARD FREQUENCY AND TIME SIGNAL Space research 5.111				
10.005-10.1 AERONAUTICAL MOBILE (R) 5.111		10.005-10.1 AERONAUTICAL MOBILE (R) 5.111 US283 US340		Aviation (87)
10.1-10.15 FIXED Amateur		10.1-10.15 US247 US340	10.1-10.15 AMATEUR US247 US340	Amateur Radio (97)
10.15-11.175 FIXED Mobile except aeronautical mobile (R)		10.15-11.175 FIXED Mobile except aeronautical mobile (R) US340		Private Land Mobile (90)

International Table			United States Table		FCC Rule Part(s)
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11.275-11.4 AERONAUTICAL MOBILE (R)			11.275-11.4 AERONAUTICAL MOBILE (R)  US283 US340		Aviation (87)
11.4-11.6 FIXED			11.4-11.6 FIXED  US340		Private Land Mobile (90)
11.6-11.65 BROADCASTING 5.134			11.6-12.1 BROADCASTING 5.134		International Broadcast Stations (73F)
5.146 11.65-12.05 BROADCASTING					
5.147 12.05-12.1 BROADCASTING 5.134					
5.146 12.1-12.23 FIXED					
12.23-13.2 MARITIME MOBILE 5.109 5.110 5.132 5.145			12.23-13.2 MARITIME MOBILE 5.109 5.110 5.132 5.145 US82  US296 US340		Maritime (80)
13.2-13.26 AERONAUTICAL MOBILE (OR)			13.2-13.26 AERONAUTICAL MOBILE (OR)  US340		
13.26-13.36 AERONAUTICAL MOBILE (R)			13.26-13.36 AERONAUTICAL MOBILE (R)  US283 US340		Aviation (87)
13.36-13.41 FIXED RADIO ASTRONOMY			13.36-13.41 RADIO ASTRONOMY	13.36-13.41 RADIO ASTRONOMY	
5.149 13.41-13.45 FIXED Mobile except aeronautical mobile (R)			US342 G115 13.41-13.57 FIXED Mobile except aeronautical mobile (R)	US342 13.41-13.57 FIXED	ISM Equipment (18) Private Land Mobile (90)

13.45-13.55 FIXED Mobile except aeronautical mobile (R) Radiolocation 5.132A 5.149A	13.45-13.55 FIXED Mobile except aeronautical mobile (R) Radiolocation 5.132A		
13.55-13.57 FIXED Mobile except aeronautical mobile (R) 5.150		5.150 US340	5.150 US340
13.57-13.6 BROADCASTING 5.134 5.151 13.6-13.8 BROADCASTING 13.8-13.87 BROADCASTING 5.134		13.57-13.87 BROADCASTING 5.134	International Broadcast Stations (73F)
5.151 13.87-14 FIXED Mobile except aeronautical mobile (R)		US136 US340 13.87-14 FIXED Mobile except aeronautical mobile (R)	13.87-14 FIXED
		US340	US340
14-14.25 AMATEUR AMATEUR-SATELLITE		14-14.35	14-14.25 AMATEUR AMATEUR-SATELLITE
			US340
14.25-14.35 AMATEUR			14.25-14.35 AMATEUR
5.152 14.35-14.99 FIXED Mobile except aeronautical mobile (R)		US340 14.35-14.99 FIXED Mobile except aeronautical mobile (R)	14.35-14.99 FIXED
		US340	US340
14.99-15.005 STANDARD FREQUENCY AND TIME SIGNAL (15 MHz) 5.111 15.005-15.01 STANDARD FREQUENCY AND TIME SIGNAL Space research		14.99-15.01 STANDARD FREQUENCY AND TIME SIGNAL (15 MHz)	
15.01-15.1 AERONAUTICAL MOBILE (OR)		5.111 US1 US340 15.01-15.1 AERONAUTICAL MOBILE (OR)	
		US340	

International Table			United States Table		FCC Rule Part(s)
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15.6-15.8 BROADCASTING 5.134			US136 US340		
5.146			15.8-16.36 FIXED		Private Land Mobile (90)
15.8-16.1 FIXED					
5.153					
16.1-16.2 FIXED Radiolocation 5.145A	16.1-16.2 FIXED RADIOLOCATION 5.145A	16.1-16.2 FIXED Radiolocation 5.145A			
5.145B			US340		
16.2-16.36 FIXED					
16.36-17.41 MARITIME MOBILE 5.109 5.110 5.132 5.145			16.36-17.41 MARITIME MOBILE 5.109 5.110 5.132 5.145 US82 US296 US340		Maritime (80)
17.41-17.48 FIXED			17.41-17.48 FIXED US340		Private Land Mobile (90)
17.48-17.55 BROADCASTING 5.134			17.48-17.9 BROADCASTING 5.134		International Broadcast Stations (73F)
5.146			US136 US340		
17.55-17.9 BROADCASTING			17.9-17.97 AERONAUTICAL MOBILE (R)		Aviation (87)
17.9-17.97 AERONAUTICAL MOBILE (R)			US283 US340		
17.97-18.03 AERONAUTICAL MOBILE (OR)			17.97-18.03 AERONAUTICAL MOBILE (OR) US340		
18.030-18.052 FIXED			18.03-18.068 FIXED		Maritime (80) Private Land Mobile (90)
18.052-18.068 FIXED Space research			US340		
18.068-18.168 AMATEUR AMATEUR-SATELLITE			18.068-18.168	18.068-18.168 AMATEUR AMATEUR-SATELLITE	Amateur Radio (97)
5.154			US340	US340	
18.168-18.78 FIXED Mobile except aeronautical mobile			18.168-18.78 FIXED Mobile US340		Maritime (80) Private Land Mobile (90)

18.78-18.9 MARITIME MOBILE	18.78-18.9 MARITIME MOBILE US82 US296 US340	Maritime (80)	
18.9-19.02 BROADCASTING 5.134 5.146	18.9-19.02 BROADCASTING 5.134 US136 US340	International Broadcast Stations (73F)	
19.02-19.68 FIXED	19.02-19.68 FIXED US340	Private Land Mobile (90)	
19.68-19.8 MARITIME MOBILE 5.132	19.68-19.8 MARITIME MOBILE 5.132 US340	Maritime (80)	
19.8-19.99 FIXED	19.8-19.99 FIXED US340	Private Land Mobile (90)	
19.99-19.995 STANDARD FREQUENCY AND TIME SIGNAL Space research 5.111	19.99-20.01 STANDARD FREQUENCY AND TIME SIGNAL (20 MHz)  5.111 US1 US340		
19.995-20.01 STANDARD FREQUENCY AND TIME SIGNAL (20 MHz) 5.111			
20.01-21 FIXED Mobile	20.01-21 FIXED Mobile US340	20.01-21 FIXED US340	Private Land Mobile (90)
21-21.45 AMATEUR AMATEUR-SATELLITE	21-21.45 US340	21-21.45 AMATEUR AMATEUR-SATELLITE US340	Amateur Radio (97)
21.45-21.85 BROADCASTING	21.45-21.85 BROADCASTING US340		International Broadcast Stations (73F)
21.85-21.87 FIXED 5.155A 5.155	21.85-21.924 FIXED US340		Aviation (87) Private Land Mobile (90)
21.87-21.924 FIXED 5.155B			
21.924-22 AERONAUTICAL MOBILE (R)	21.924-22 AERONAUTICAL MOBILE (R) US340		Aviation (87)
22-22.855 MARITIME MOBILE 5.132 5.156	22-22.855 MARITIME MOBILE 5.132 US82 US296 US340		Maritime (80)

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22.855-23 FIXED 5.156			22.855-23 FIXED US340		Private Land Mobile (90)
23-23.2 FIXED Mobile except aeronautical mobile (R) 5.156			23-23.2 FIXED Mobile except aeronautical mobile (R) US340	23-23.2 FIXED US340	
23.2-23.35 FIXED 5.156A AERONAUTICAL MOBILE (OR)			23.2-23.35 AERONAUTICAL MOBILE (OR) US340		
23.35-24 FIXED MOBILE except aeronautical mobile 5.157			23.35-24.89 FIXED MOBILE except aeronautical mobile  US340	23.35-24.89 FIXED  US340	Private Land Mobile (90)
24-24.45 FIXED LAND MOBILE					
24.45-24.6 FIXED LAND MOBILE Radiolocation 5.132A	24.45-24.65 FIXED LAND MOBILE RADIOLOCATION 5.132A	24.45-24.6 FIXED LAND MOBILE Radiolocation 5.132A			
5.158 24.6-24.89 FIXED LAND MOBILE		24.6-24.89 FIXED LAND MOBILE			
	24.65-24.89 FIXED LAND MOBILE				
24.89-24.99 AMATEUR AMATEUR-SATELLITE			24.89-24.99  US340	24.89-24.99 AMATEUR AMATEUR-SATELLITE  US340	Amateur Radio (97)
24.99-25.005 STANDARD FREQUENCY AND TIME SIGNAL (25 MHz)			24.99-25.01 STANDARD FREQUENCY AND TIME SIGNAL (25 MHz)  US1 US340		
25.005-25.01 STANDARD FREQUENCY AND TIME SIGNAL Space research					
25.01-25.07 FIXED MOBILE except aeronautical mobile			25.01-25.07  US340	25.01-25.07 LAND MOBILE US340 NG112	Private Land Mobile (90)
25.07-25.21 MARITIME MOBILE			25.07-25.21 MARITIME MOBILE US82 US281 US296 US340	25.07-25.21 MARITIME MOBILE US82 US281 US296 US340 NG112	Maritime (80) Private Land Mobile (90)

25.21-25.55 FIXED MOBILE except aeronautical mobile			25.21-25.33  US340	25.21-25.33 LAND MOBILE  US340	Private Land Mobile (90)
			25.33-25.55 FIXED MOBILE except aeronautical mobile  US340	25.33-25.55  US340	
25.55-25.67 RADIO ASTRONOMY  5.149			25.55-25.67 RADIO ASTRONOMY US74  US342		
25.67-26.1 BROADCASTING			25.67-26.1 BROADCASTING  US25 US340		International Broadcast Stations (73F) Remote Pickup (74D)
26.1-26.175 MARITIME MOBILE 5.132			26.1-26.175 MARITIME MOBILE 5.132  US25 US340		Remote Pickup (74D) Low Power Auxiliary (74H) Maritime (80)
26.175-26.2 FIXED MOBILE except aeronautical mobile			26.175-26.48          US340	26.175-26.48 LAND MOBILE          US340	Remote Pickup (74D) Low Power Auxiliary (74H)
26.2-26.35 FIXED MOBILE except aeronautical mobile Radiolocation 5.132A 5.133A	26.2-26.42 FIXED MOBILE except aeronautical mobile RADIOLOCATION 5.132A	26.2-26.35 FIXED MOBILE except aeronautical mobile Radiolocation 5.132A			
26.35-27.5 FIXED MOBILE except aeronautical mobile	26.42-27.5 FIXED MOBILE except aeronautical mobile	26.35-27.5 FIXED MOBILE except aeronautical mobile			
5.150	5.150	5.150			
			26.48-26.95 FIXED MOBILE except aeronautical mobile  US340	26.48-26.95  US340	
			26.95-27.41          5.150 US340	26.95-26.96 FIXED  5.150 US340	ISM Equipment (18)
				26.96-27.23 MOBILE except aeronautical mobile  5.150 US340	ISM Equipment (18) Personal Radio (95)
				27.23-27.41 FIXED MOBILE except aeronautical mobile  5.150 US340	ISM Equipment (18) Private Land Mobile (90) Personal Radio (95)

International Table			United States Table		FCC Rule Part(s)
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27.5-28 METEOROLOGICAL AIDS FIXED MOBILE			US340	US340	
			27.54-28 FIXED MOBILE US298 US340	27.54-28 US298 US340	
28-29.7 AMATEUR AMATEUR-SATELLITE			28-29.7 US340	28-29.7 AMATEUR AMATEUR-SATELLITE US340	Amateur Radio (97)
29.7-30.005 FIXED MOBILE			29.7-29.89 US340	29.7-29.8 LAND MOBILE US340	Private Land Mobile (90)
				29.8-29.89 FIXED US340	
			29.89-29.91 FIXED MOBILE US340	29.89-29.91 US340	
			29.91-30 US340	29.91-30 FIXED US340	
30.005-30.01 SPACE OPERATION (satellite identification) FIXED MOBILE SPACE RESEARCH			30-30.56 FIXED MOBILE	30-30.56	
30.01-37.5 FIXED MOBILE			30.56-32	30.56-32 FIXED LAND MOBILE NG124	Private Land Mobile (90)
			32-33 FIXED MOBILE	32-33	
			33-34	33-34 FIXED LAND MOBILE NG124	Private Land Mobile (90)

			34-35 FIXED MOBILE	34-35	
			35-36	35-36 FIXED LAND MOBILE	Public Mobile (22) Private Land Mobile (90)
			36-37 FIXED MOBILE	36-37	
			US220	US220	
			37-37.5	37-37.5 LAND MOBILE	Private Land Mobile (90)
				NG124	
37.5-38.25 FIXED MOBILE Radio astronomy			37.5-38 Radio astronomy	37.5-38 LAND MOBILE Radio astronomy	
			US342	US342 NG59 NG124	
			38-38.25 FIXED MOBILE RADIO ASTRONOMY	38-38.25 RADIO ASTRONOMY	
5.149			US81 US342	US81 US342	
38.25-39 FIXED MOBILE	38.25-39.986 FIXED MOBILE	38.25-39.5 FIXED MOBILE	38.25-39 FIXED MOBILE	38.25-39	
39-39.5 FIXED MOBILE Radiolocation 5.132A			39-40	39-40 LAND MOBILE	Private Land Mobile (90)
5.159					
39.5-39.986 FIXED MOBILE		39.5-39.986 FIXED MOBILE RADIOLOCATION 5.132A			
39.986-40.02 FIXED MOBILE Space research		39.986-40 FIXED MOBILE RADIOLOCATION 5.132A Space research		NG124	
		40-40.02 FIXED MOBILE Space research	40-42 FIXED MOBILE	40-42	ISM Equipment (18) Private Land Mobile (90)
40.02-40.98 FIXED MOBILE					
5.150			5.150 US210 US220	5.150 US210 US220	

International Table			United States Table		FCC Rule Part(s)
Region 1 Table	Region 2 Table	Region 3 Table	Federal Table	Non-Federal Table	
40.98-41.015 FIXED MOBILE Space research			(See previous page)		
5.160 5.161 41.015-42 FIXED MOBILE					
5.160 5.161 5.161A 42-42.5 FIXED MOBILE Radiolocation 5.132A			42-46.6	42-43.69 FIXED LAND MOBILE	Public Mobile (22) Private Land Mobile (90)
5.160 5.161B 42.5-44 FIXED MOBILE				NG124 NG141 43.69-46.6 LAND MOBILE	Private Land Mobile (90)
5.160 5.161 5.161A 44-47 FIXED MOBILE				NG124 NG141	
5.162 5.162A 47-68 BROADCASTING			46.6-47 FIXED MOBILE	46.6-47	
47-50 FIXED MOBILE			47-49.6	47-49.6 LAND MOBILE NG124	Private Land Mobile (90)
			49.6-50 FIXED MOBILE	49.6-50	
50-54 AMATEUR			50-73	50-54 AMATEUR	Amateur Radio (97)
5.162A 5.166 5.167 5.167A 5.168 5.170 54-68 BROADCASTING Fixed Mobile				54-72 BROADCASTING	Broadcast Radio (TV)(73) LPTV, TV Translator/ Booster (74G) Low Power Auxiliary (74H)
5.162A 5.163 5.164 5.165 5.169 5.171					
68-74.8 FIXED MOBILE except aeronautical mobile			68-74.8 FIXED MOBILE		
68-72 BROADCASTING Fixed Mobile				NG5 NG14 NG115 NG149	
5.173					

	72-73 FIXED MOBILE			72-73 FIXED MOBILE  NG3 NG49 NG56	Public Mobile (22) Maritime (80) Aviation (87) Private Land Mobile (90) Personal Radio (95)
	73-74.6 RADIO ASTRONOMY			73-74.6 RADIO ASTRONOMY US74	
	5.178			US246	
	74.6-74.8 FIXED MOBILE			74.6-74.8 FIXED MOBILE	Private Land Mobile (90)
5.149 5.175 5.177 5.179		5.149 5.176 5.179		US273	
74.8-75.2 AERONAUTICAL RADIONAVIGATION				74.8-75.2 AERONAUTICAL RADIONAVIGATION	Aviation (87)
5.180 5.181				5.180	
75.2-87.5 FIXED MOBILE except aeronautical mobile	75.2-75.4 FIXED MOBILE			75.2-75.4 FIXED MOBILE	Private Land Mobile (90)
	5.179			US273	
	75.4-76 FIXED MOBILE	75.4-87 FIXED MOBILE		75.4-88	75.4-76 FIXED MOBILE  NG3 NG49 NG56
	76-88 BROADCASTING Fixed Mobile	5.182 5.183 5.188			76-88 BROADCASTING
5.175 5.179 5.187		87-100 FIXED MOBILE BROADCASTING			Broadcast Radio (TV)(73) LPTV, TV Translator/ Booster (74G) Low Power Auxiliary (74H)
87.5-100 BROADCASTING	5.185				NG5 NG14 NG115 NG149
5.190	88-100 BROADCASTING			88-108	88-108 BROADCASTING NG2
100-108 BROADCASTING					Broadcast Radio (FM)(73) FM Translator/Booster (74L)
5.192 5.194				US93	US93 NG5
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5.111 5.200 5.201 5.202 137-137.025 SPACE OPERATION (space-to-Earth) METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE-SATELLITE (space-to-Earth) 5.208A 5.208B 5.209 SPACE RESEARCH (space-to-Earth) Fixed Mobile except aeronautical mobile (R)			137-137.025 SPACE OPERATION (space-to-Earth) METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE-SATELLITE (space-to-Earth) US319 US320 SPACE RESEARCH (space-to-Earth)		Satellite Communications (25)
5.204 5.205 5.206 5.207 5.208 137.025-137.175 SPACE OPERATION (space-to-Earth) METEOROLOGICAL-SATELLITE (space-to-Earth) SPACE RESEARCH (space-to-Earth) Fixed Mobile-satellite (space-to-Earth) 5.208A 5.208B 5.209 Mobile except aeronautical mobile (R)			5.208 137.025-137.175 SPACE OPERATION (space-to-Earth) METEOROLOGICAL-SATELLITE (space-to-Earth) SPACE RESEARCH (space-to-Earth) Mobile-satellite (space-to-Earth) US319 US320		
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137.825-138 SPACE OPERATION (space-to-Earth) METEOROLOGICAL-SATELLITE (space-to-Earth) SPACE RESEARCH (space-to-Earth) Fixed Mobile-satellite (space-to-Earth) 5.208A 5.208B 5.209 Mobile except aeronautical mobile (R) 5.204 5.205 5.206 5.207 5.208			137.825-138 SPACE OPERATION (space-to-Earth) METEOROLOGICAL-SATELLITE (space-to-Earth) SPACE RESEARCH (space-to-Earth) Mobile-satellite (space-to-Earth) US319 US320 5.208		
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143.6-143.65 AERONAUTICAL MOBILE (OR) SPACE RESEARCH (space-to-Earth)  5.211 5.212 5.214	143.6-143.65 FIXED MOBILE RADIOLOCATION SPACE RESEARCH (space-to-Earth)	143.6-143.65 FIXED MOBILE SPACE RESEARCH (space-to-Earth) 5.207 5.213			
143.65-144 AERONAUTICAL MOBILE (OR)  5.210 5.211 5.212 5.214	143.65-144 FIXED MOBILE RADIOLOCATION Space research (space-to-Earth)	143.65-144 FIXED MOBILE Space research (space-to-Earth) 5.207 5.213	G30		
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153-154 FIXED MOBILE except aeronautical mobile (R) Meteorological aids			US73	US73 NG124	
			152.855-156.2475	152.855-154 LAND MOBILE NG4	Remote Pickup (74D) Private Land Mobile (90)
				NG124	
154-156.4875 FIXED MOBILE except aeronautical mobile (R)	154-156.4875 FIXED MOBILE	154-156.4875 FIXED MOBILE		154-156.2475 FIXED LAND MOBILE NG112 5.226 NG22 NG124 NG148	Maritime (80) Private Land Mobile (90) Personal Radio (95)
5.225A 5.226 156.4875-156.5625 MARITIME MOBILE (distress and calling via DSC)	5.226	5.225A 5.226	156.2475-156.5125	156.2475-156.5125 MARITIME MOBILE NG22	Maritime (80) Aviation (87)
			5.226 US52 US227 US266	5.226 US52 US227 US266 NG124	
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			5.111 5.226 US266		
5.111 5.226 5.227 156.5625-156.7625 FIXED MOBILE except aeronautical mobile (R)	156.5625-156.7625 FIXED MOBILE		156.5375-156.7625	156.5375-156.7625 MARITIME MOBILE	
5.226	5.226		5.226 US52 US227 US266	5.226 US52 US227 US266	
156.7625-156.7875 MARITIME MOBILE Mobile-satellite (Earth-to-space)	156.7625-156.7875 MARITIME MOBILE MOBILE-SATELLITE (Earth-to-space)	156.7625-156.7875 MARITIME MOBILE Mobile-satellite (Earth-to-space)	156.7625-156.8375 MARITIME MOBILE (distress, urgency, safety and calling)		
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156.7875-156.8125 MARITIME MOBILE (distress and calling)					
5.111 5.226					
156.8125-156.8375 MARITIME MOBILE Mobile-satellite (Earth-to-space)	156.8125-156.8375 MARITIME MOBILE MOBILE-SATELLITE (Earth-to-space)	156.8125-156.8375 MARITIME MOBILE Mobile-satellite (Earth-to-space)			
5.111 5.226 5.228	5.111 5.226 5.228	5.111 5.226 5.228	5.111 5.226 US266		
156.8375-161.9625 FIXED MOBILE except aeronautical mobile	156.8375-161.9625 FIXED MOBILE		156.8375-157.0375	156.8375-157.0375 MARITIME MOBILE	
			5.226 US52 US266	5.226 US52 US266	
			157.0375-157.1875 MARITIME MOBILE US214	157.0375-157.1875	Maritime (80)
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			157.1875-161.575	157.1875-157.45 MOBILE except aeronautical mobile US266 5.226 NG111	Maritime (80) Aviation (87) Private Land Mobile (90)
				157.45-161.575 FIXED LAND MOBILE NG28 NG111 NG112 5.226 NG6 NG70 NG124 NG148 NG155	Public Mobile (22) Remote Pickup (74D) Maritime (80) Private Land Mobile (90)
			161.575-161.625	161.575-161.625 MARITIME MOBILE	Public Mobile (22) Maritime (80)
			5.226 US52	5.226 US52 NG6 NG17	
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				161.775-161.9625 MOBILE except aeronautical mobile US266 NG6	Maritime (80) Private Land Mobile (90)
5.226	5.226		US266	5.226	
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5.226 5.228A 5.228B	5.228C 5.228D	5.226	5.228C US52		
161.9875-162.0125 FIXED MOBILE except aeronautical mobile 5.226 5.229	161.9875-162.0125 FIXED MOBILE 5.226		161.9875-162.0125	161.9875-162.0125 MOBILE except aeronautical mobile 5.226	
162.0125-162.0375 FIXED MOBILE except aeronautical mobile Mobile-satellite (Earth-to-space) 5.228F	162.0125-162.0375 AERONAUTICAL MOBILE (OR) MARITIME MOBILE MOBILE-SATELLITE (Earth-to-space)	162.0125-162.0375 MARITIME MOBILE Aeronautical mobile (OR) 5.228E Mobile-satellite (Earth-to-space) 5.228F	162.0125-162.0375 AERONAUTICAL MOBILE (OR) (AIS 2) MARITIME MOBILE (AIS 2) MOBILE-SATELLITE (Earth-to-space) (AIS 2)		
5.226 5.228A 5.228B 5.229	5.228C 5.228D	5.226	5.228C US52		
162.0375-174 FIXED MOBILE except aeronautical mobile	162.0375-174 FIXED MOBILE		162.0375-173.2 FIXED MOBILE US8 US11 US13 US73 US300 US312 G5	162.0375-173.2 US8 US11 US13 US73 US300 US312	Remote Pickup (74D) Private Land Mobile (90)
			173.2-173.4	173.2-173.4 FIXED Land mobile	Private Land Mobile (90)
			173.4-174 FIXED MOBILE	173.4-174	
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	216-220 FIXED MARITIME MOBILE Radiolocation 5.241		216-217 FIXED Land mobile US210 US241 G2	216-219 FIXED MOBILE except aeronautical mobile  US210 US241 NG173	Maritime (80) Private Land Mobile (90) Personal Radio (95)
	5.242		217-220 FIXED Mobile  US210 US241	219-220 FIXED MOBILE except aeronautical mobile Amateur NG152  US210 US241 NG173	Maritime (80) Private Land Mobile (90) Amateur Radio (97)
	220-225 AMATEUR FIXED MOBILE Radiolocation 5.241		220-222 FIXED LAND MOBILE US241 US242		Private Land Mobile (90)
5.235 5.237 5.243		5.233 5.238 5.240 5.245	222-225	222-225 AMATEUR	Amateur Radio (97)
223-230 BROADCASTING Fixed Mobile		223-230 FIXED MOBILE BROADCASTING			
	225-235 FIXED MOBILE	AERONAUTICAL RADIONAVIGATION Radiolocation	225-235 FIXED MOBILE	225-235	
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230-235 FIXED MOBILE		230-235 FIXED MOBILE AERONAUTICAL RADIONAVIGATION			
5.247 5.251 5.252		5.250	G27		
235-267 FIXED MOBILE			235-267 FIXED MOBILE	235-267	
5.111 5.252 5.254 5.256 5.256A			5.111 5.256 G27 G100	5.111 5.256	
267-272 FIXED MOBILE Space operation (space-to-Earth)			267-322 FIXED MOBILE	267-322	
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322-328.6 FIXED MOBILE RADIO ASTRONOMY	322-328.6 FIXED MOBILE	322-328.6	
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335.4-387 FIXED MOBILE	335.4-399.9 FIXED MOBILE	335.4-399.9	
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387-390 FIXED MOBILE Mobile-satellite (space-to-Earth) 5.208A 5.208B 5.254 5.255			
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399.9-400.05 MOBILE-SATELLITE (Earth-to-space) 5.209 5.224A RADIONAVIGATION-SATELLITE 5.222 5.224B 5.260	399.9-400.05 MOBILE-SATELLITE (Earth-to-space) US319 US320 RADIONAVIGATION-SATELLITE 5.260		Satellite Communications (25)
5.220			
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5.262 5.264			5.264	5.264	
401-402 METEOROLOGICAL AIDS SPACE OPERATION (space-to-Earth) EARTH EXPLORATION-SATELLITE (Earth-to-space) METEOROLOGICAL-SATELLITE (Earth-to-space) Fixed Mobile except aeronautical mobile			401-402 METEOROLOGICAL AIDS (radiosonde) US70 SPACE OPERATION (space-to-Earth) EARTH EXPLORATION- SATELLITE (Earth-to-space) METEOROLOGICAL-SATELLITE (Earth-to-space) US64 US384	401-402 METEOROLOGICAL AIDS (radiosonde) US70 SPACE OPERATION (space-to-Earth) Earth exploration-satellite (Earth-to-space) Meteorological-satellite (Earth-to-space) US64 US384	MedRadio (95I)
402-403 METEOROLOGICAL AIDS EARTH EXPLORATION-SATELLITE (Earth-to-space) METEOROLOGICAL-SATELLITE (Earth-to-space) Fixed Mobile except aeronautical mobile			402-403 METEOROLOGICAL AIDS (radiosonde) US70 EARTH EXPLORATION- SATELLITE (Earth-to-space) METEOROLOGICAL-SATELLITE (Earth-to-space) US64 US384	402-403 METEOROLOGICAL AIDS (radiosonde) US70 Earth exploration-satellite (Earth-to-space) Meteorological-satellite (Earth-to-space) US64 US384	
403-406 METEOROLOGICAL AIDS Fixed Mobile except aeronautical mobile			403-406 METEOROLOGICAL AIDS (radiosonde) US70 US64 G6	403-406 METEOROLOGICAL AIDS (radiosonde) US70 US64	
406-406.1 MOBILE-SATELLITE (Earth-to-space) 5.266 5.267			406-406.1 MOBILE-SATELLITE (Earth-to-space) 5.266 5.267		Maritime (EPIRBs) (80V) Aviation (ELTs) (87F) Personal Radio (95)
406.1-410 FIXED MOBILE except aeronautical mobile RADIO ASTRONOMY 5.149			406.1-410 FIXED MOBILE RADIO ASTRONOMY US74 US13 US117 G5 G6	406.1-410 RADIO ASTRONOMY US74 US13 US117	Private Land Mobile (90)
410-420 FIXED MOBILE except aeronautical mobile SPACE RESEARCH (space-to-space) 5.268			410-420 FIXED MOBILE SPACE RESEARCH (space-to-space) 5.268 US13 US64 G5	410-420 US13 US64	Private Land Mobile (90) MedRadio (95I)

420-430 FIXED MOBILE except aeronautical mobile Radiolocation 5.269 5.270 5.271			420-450 RADIOLOCATION G2 G129	420-450 Amateur US270	Private Land Mobile (90) MedRadio (95) Amateur Radio (97)
430-432 AMATEUR RADIOLOCATION	430-432 RADIOLOCATION Amateur				
5.271 5.274 5.275 5.276 5.277	5.271 5.276 5.277 5.278 5.279				
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438-440 AMATEUR RADIOLOCATION	438-440 RADIOLOCATION Amateur				
5.271 5.274 5.275 5.276 5.277 5.283	5.271 5.276 5.277 5.278 5.279				
440-450 FIXED MOBILE except aeronautical mobile Radiolocation 5.269 5.270 5.271 5.284 5.285 5.286			5.286 US64 US87 US230 US269 US270 US397 G8	5.282 5.286 US64 US87 US230 US269 US397	
450-455 FIXED MOBILE 5.286AA			450-454	450-454 LAND MOBILE	Remote Pickup (74D) Low Power Auxiliary (74H) Private Land Mobile (90) MedRadio (95)
5.209 5.271 5.286 5.286A 5.286B 5.286C 5.286D 5.286E			5.286 US64 US87	5.286 US64 US87 NG112 NG124	
454-456			454-455	454-455 FIXED LAND MOBILE US64 NG32 NG112 NG148	Public Mobile (22) Maritime (80) MedRadio (95)
455-456 FIXED MOBILE 5.286AA	455-456 FIXED MOBILE 5.286AA MOBILE-SATELLITE (Earth-to-space) 5.286A 5.286B 5.286C	455-456 FIXED MOBILE 5.286AA		455-456 LAND MOBILE	Remote Pickup (74D) Low Power Auxiliary (74H) MedRadio (95)
5.209 5.271 5.286A 5.286B 5.286C 5.286E	5.209	5.209 5.271 5.286A 5.286B 5.286C 5.286E	US64	US64	

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459-460 FIXED MOBILE 5.286AA  5.209 5.271 5.286A 5.286B 5.286C 5.286E	459-460 FIXED MOBILE 5.286AA MOBILE-SATELLITE (Earth-to-space) 5.286A 5.286B 5.286C 5.209	459-460 FIXED MOBILE 5.286AA  5.209 5.271 5.286A 5.286B 5.286C 5.286E	459-460	5.287 US64 US288 NG32 NG112 NG124 NG148	
460-470 FIXED MOBILE 5.286AA Meteorological-satellite (space-to-Earth)			460-470 Meteorological-satellite (space-to-Earth)	460-462.5375 FIXED LAND MOBILE US209 US289 NG124	Private Land Mobile (90)
				462.5375-462.7375 LAND MOBILE US289	Personal Radio (95)
				462.7375-467.5375 FIXED LAND MOBILE 5.287 US73 US209 US288 US289 NG124	Maritime (80) Private Land Mobile (90)
				467.5375-467.7375 LAND MOBILE 5.287 US288 US289	Maritime (80) Personal Radio (95)
				467.7375-470 FIXED LAND MOBILE US73 US288 US289 NG124	Maritime (80) Private Land Mobile (90)
5.287 5.288 5.289 5.290			5.287 US73 US209 US288 US289		
470-790 BROADCASTING	470-512 BROADCASTING Fixed Mobile 5.292 5.293	470-585 FIXED MOBILE BROADCASTING 5.291 5.298	470-608	470-512 FIXED LAND MOBILE BROADCASTING NG5 NG14 NG66 NG115 NG149	Public Mobile (22) Broadcast Radio (TV)(73) LPTV, TV Translator/Booster (74G) Low Power Auxiliary (74H) Private Land Mobile (90)
	512-608 BROADCASTING  5.297	585-610 FIXED MOBILE BROADCASTING RADIONAVIGATION		512-608 FIXED MOBILE BROADCASTING NG5 NG14 NG115 NG149	Wireless Communications (27) Broadcast Radio (TV)(73) LPTV, TV Translator/Booster (74G) Low Power Auxiliary (74H)
	608-614 RADIO ASTRONOMY Mobile-satellite except aeronautical mobile-satellite (Earth-to-space)	5.149 5.305 5.306 5.307 610-890 FIXED MOBILE 5.313A 5.317A BROADCASTING	608-614 LAND MOBILE (medical telemetry and medical telecommand) RADIO ASTRONOMY US74  US246		Personal Radio (95)



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	902-928 FIXED Amateur Mobile except aeronautical mobile 5.325A Radiolocation 5.150 5.325 5.326		US116 US268 G2 902-928 RADIOLOCATION G59	901-902 FIXED MOBILE US116 US268 902-928	Personal Communications (24)  ISM Equipment (18) Private Land Mobile (90) Amateur Radio (97)
	928-942 FIXED MOBILE except aeronautical mobile 5.317A Radiolocation		5.150 US218 US267 US275 G11 928-932	5.150 US218 US267 US275 928-929 FIXED US116 US268 NG35 929-930 FIXED LAND MOBILE US116 US268 930-931 FIXED MOBILE US116 US268 931-932 FIXED LAND MOBILE US116 US268	Public Mobile (22) Private Land Mobile (90) Fixed Microwave (101)  Private Land Mobile (90)  Personal Communications (24)  Public Mobile (22)
			US116 US268 G2 932-935 FIXED US268 G2 935-941	932-935 FIXED US268 NG35 935-940 FIXED LAND MOBILE US116 US268 940-941 FIXED MOBILE US116 US268	Public Mobile (22) Fixed Microwave (101)  Private Land Mobile (90)  Personal Communications (24)
			US116 US268 G2	US116 US268	

5.323 942-960 FIXED MOBILE except aeronautical mobile 5.317A BROADCASTING 5.322	5.325 942-960 FIXED MOBILE 5.317A	5.327 942-960 FIXED MOBILE 5.317A BROADCASTING	941-944 FIXED US268 US301 G2 944-960	941-944 FIXED US268 US301 NG30 NG35 944-960 FIXED NG35	Public Mobile (22) Aural Broadcast Auxiliary (74E) Fixed Microwave (101) Public Mobile (22) Aural Broadcast Auxiliary (74E) Low Power Auxiliary (74H) Fixed Microwave (101)
5.323 960-1164 AERONAUTICAL MOBILE (R) 5.327A AERONAUTICAL RADIONAVIGATION 5.328		5.320	960-1164 AERONAUTICAL MOBILE (R) 5.327A AERONAUTICAL RADIONAVIGATION 5.328 US224		Aviation (87)
1164-1215 AERONAUTICAL RADIONAVIGATION 5.328 RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) 5.328B 5.328A			1164-1215 AERONAUTICAL RADIONAVIGATION 5.328 RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) 5.328A US224		
1215-1240 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) 5.328B 5.329 5.329A SPACE RESEARCH (active)			1215-1240 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION G56 RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) G132 SPACE RESEARCH (active) 5.332	1215-1240 Earth exploration-satellite (active) Space research (active)	
5.330 5.331 5.332 1240-1300 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) 5.328B 5.329 5.329A SPACE RESEARCH (active) Amateur			1240-1300 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION G56 SPACE RESEARCH (active) AERONAUTICAL RADIONAVIGATION 5.332 5.335	1240-1300 AERONAUTICAL RADIONAVIGATION Amateur Earth exploration-satellite (active) Space research (active) 5.282	Amateur Radio (97)
5.282 5.330 5.331 5.332 5.335 5.335A 1300-1350 RADIOLOCATION AERONAUTICAL RADIONAVIGATION 5.337 RADIONAVIGATION-SATELLITE (Earth-to-space) 5.149 5.337A			1300-1350 AERONAUTICAL RADIONAVIGATION 5.337 Radiolocation G2 US342	1300-1350 AERONAUTICAL RADIONAVIGATION 5.337 US342	Aviation (87)
1350-1400 FIXED MOBILE RADIOLOCATION	1350-1400 RADIOLOCATION 5.338A		1350-1390 FIXED MOBILE RADIOLOCATION G2 5.334 5.339 US342 US385 G27 G114 1390-1395 5.339 US79 US342 US385 1395-1400 LAND MOBILE (medical telemetry and medical telecommand) 5.339 US79 US342 US385	1350-1390 5.334 5.339 US342 US385 1390-1395 FIXED MOBILE except aeronautical mobile 5.339 US79 US342 US385 NG338A	Wireless Communications (27)
5.149 5.338 5.338A 5.339	5.149 5.334 5.339				Personal Radio (95)

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1427-1429 SPACE OPERATION (Earth-to-space) FIXED MOBILE except aeronautical mobile 5.338A 5.341			1427-1429.5 LAND MOBILE (medical telemetry and medical telecommand) US350	1427-1429.5 LAND MOBILE (telemetry and telecommand) Fixed (telemetry)	Private Land Mobile (90) Personal Radio (95)
1429-1452 FIXED MOBILE except aeronautical mobile	1429-1452 FIXED MOBILE 5.343		5.341 US79 1429.5-1432	5.341 US79 US350 NG338A 1429.5-1432 FIXED (telemetry and telecommand) LAND MOBILE (telemetry and telecommand)	
5.338A 5.341 5.342	5.338A 5.341		5.341 US79 US350 1432-1435	5.341 US79 US350 NG338A 1432-1435 FIXED MOBILE except aeronautical mobile	Wireless Communications (27)
1452-1492 FIXED MOBILE except aeronautical mobile BROADCASTING BROADCASTING-SATELLITE 5.208B	1452-1492 FIXED MOBILE 5.343 BROADCASTING 5.345 BROADCASTING-SATELLITE 5.208B		5.341 US83 1435-1525	5.341 US83 NG338A MOBILE (aeronautical telemetry) US338A	
5.341 5.342 5.345	5.341 5.344 5.345				Aviation (87)
1492-1518 FIXED MOBILE except aeronautical mobile	1492-1518 FIXED MOBILE 5.343	1492-1518 FIXED MOBILE			
5.341 5.342	5.341 5.344	5.341			
1518-1525 FIXED MOBILE except aeronautical mobile MOBILE-SATELLITE (space-to-Earth) 5.348 5.348A 5.348B 5.351A	1518-1525 FIXED MOBILE 5.343 MOBILE-SATELLITE (space-to-Earth) 5.348 5.348A 5.348B 5.351A	1518-1525 FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.348 5.348A 5.348B 5.351A			
5.341 5.342	5.341 5.344	5.341	5.341 US343		



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5.341 5.351 5.353A 5.354 5.355 5.357A 5.359 5.362A 5.374 5.375 5.376			5.341 5.351 5.375		
1660-1660.5 MOBILE-SATELLITE (Earth-to-space) 5.351A RADIO ASTRONOMY			1660-1660.5 MOBILE-SATELLITE (Earth-to-space) US308 US309 US380 RADIO ASTRONOMY		Satellite Communications (25) Aviation (87)
5.149 5.341 5.351 5.354 5.362A 5.376A			5.341 5.351 US342		
1660.5-1668 RADIO ASTRONOMY SPACE RESEARCH (passive) Fixed Mobile except aeronautical mobile			1660.5-1668.4 RADIO ASTRONOMY US74 SPACE RESEARCH (passive)		
5.149 5.341 5.379 5.379A					
1668-1668.4 MOBILE-SATELLITE (Earth-to-space) 5.351A 5.379B 5.379C RADIO ASTRONOMY SPACE RESEARCH (passive) Fixed Mobile except aeronautical mobile			5.341 US246		
5.149 5.341 5.379 5.379A					
1668.4-1670 METEOROLOGICAL AIDS FIXED MOBILE except aeronautical mobile MOBILE-SATELLITE (Earth-to-space) 5.351A 5.379B 5.379C RADIO ASTRONOMY			1668.4-1670 METEOROLOGICAL AIDS (radiosonde) RADIO ASTRONOMY US74		
5.149 5.341 5.379D 5.379E			5.341 US99 US342		
1670-1675 METEOROLOGICAL AIDS FIXED METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE MOBILE-SATELLITE (Earth-to-space) 5.351A 5.379B			1670-1675	1670-1675 FIXED MOBILE except aeronautical mobile	Wireless Communications (27)
5.341 5.379D 5.379E 5.380A			5.341 US211 US362	5.341 US211 US362	
1675-1690 METEOROLOGICAL AIDS FIXED METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile			1675-1695 METEOROLOGICAL AIDS (radiosonde) METEOROLOGICAL-SATELLITE (space-to-Earth) US88		
5.341			5.341 US211 US289		
1690-1700 METEOROLOGICAL AIDS METEOROLOGICAL-SATELLITE (space-to-Earth) Fixed Mobile except aeronautical mobile	1690-1700 METEOROLOGICAL AIDS METEOROLOGICAL-SATELLITE (space-to-Earth)		1695-1710 METEOROLOGICAL-SATELLITE (space-to-Earth) US88	1695-1710 FIXED MOBILE except aeronautical mobile	Wireless Communications (27)
5.289 5.341 5.382	5.289 5.341 5.381				

1700-1710 FIXED METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile	1700-1710 FIXED METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile			
5.289 5.341	5.289 5.341 5.384	5.341	5.341 US88	
1710-1930 FIXED MOBILE 5.384A 5.388A 5.388B		1710-1761 5.341 US91 US378 US385	1710-1780 FIXED MOBILE	
		1761-1780 SPACE OPERATION (Earth-to-space) G42 US91	5.341 US91 US378 US385	
		1780-1850 FIXED MOBILE SPACE OPERATION (Earth-to-space) G42	1780-1850	
5.149 5.341 5.385 5.386 5.387 5.388		1850-2025	1850-2000 FIXED MOBILE	RF Devices (15) Personal Communications (24) Wireless Communications (27) Fixed Microwave (101)
1930-1970 FIXED MOBILE 5.388A 5.388B	1930-1970 FIXED MOBILE 5.388A 5.388B Mobile-satellite (Earth-to-space)	1930-1970 FIXED MOBILE 5.388A 5.388B		
5.388	5.388	5.388		
1970-1980 FIXED MOBILE 5.388A 5.388B				
5.388				
1980-2010 FIXED MOBILE MOBILE-SATELLITE (Earth-to-space) 5.351A				
5.388 5.389A 5.389B 5.389F				
2010-2025 FIXED MOBILE 5.388A 5.388B	2010-2025 FIXED MOBILE MOBILE-SATELLITE (Earth-to-space)	2010-2025 FIXED MOBILE 5.388A 5.388B	2000-2020 FIXED MOBILE MOBILE-SATELLITE (Earth-to-space)	Satellite Communications (25) Wireless Communications (27)
5.388	5.388 5.389C 5.389E	5.388	2020-2025 FIXED MOBILE	
2025-2110 SPACE OPERATION (Earth-to-space) (space-to-space) EARTH EXPLORATION-SATELLITE (Earth-to-space) (space-to-space) FIXED MOBILE 5.391 SPACE RESEARCH (Earth-to-space) (space-to-space)			2025-2110 FIXED NG118 MOBILE 5.391	TV Auxiliary Broadcasting (74F) Cable TV Relay (78) Local TV Transmission (101J)
5.392		5.392 US90 US92 US222 US346 US347	5.392 US90 US92 US222 US346 US347	

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2110-2120 FIXED MOBILE 5.388A 5.388B SPACE RESEARCH (deep space) (Earth-to-space) 5.388			2110-2120	2110-2120 FIXED MOBILE	Public Mobile (22) Wireless Communications (27) Fixed Microwave (101)
2120-2170 FIXED MOBILE 5.388A 5.388B	2120-2160 FIXED MOBILE 5.388A 5.388B Mobile-satellite (space-to-Earth) 5.388	2120-2170 FIXED MOBILE 5.388A 5.388B	US252	US252	
2120-2170 FIXED MOBILE 5.388A 5.388B	2160-2170 FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.388 5.389C 5.389E	5.388	2120-2200	2120-2180 FIXED MOBILE	
5.388				NG41	
2170-2200 FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.351A 5.388 5.389A 5.389F				2180-2200 FIXED MOBILE MOBILE-SATELLITE (space-to-Earth)	Satellite Communications (25)
2200-2290 SPACE OPERATION (space-to-Earth) (space-to-space) EARTH EXPLORATION-SATELLITE (space-to-Earth) (space-to-space) FIXED MOBILE 5.391 SPACE RESEARCH (space-to-Earth) (space-to-space)			2200-2290 SPACE OPERATION (space-to-Earth) (space-to-space) EARTH EXPLORATION-SATELLITE (space-to-Earth) (space-to-space) FIXED (line-of-sight only) MOBILE (line-of-sight only including aeronautical telemetry, but excluding flight testing of manned aircraft) 5.391 SPACE RESEARCH (space-to-Earth) (space-to-space)	2200-2290	
5.392			5.392 US303	US303	
2290-2300 FIXED MOBILE except aeronautical mobile SPACE RESEARCH (deep space) (space-to-Earth)			2290-2300 FIXED MOBILE except aeronautical mobile SPACE RESEARCH (deep space) (space-to-Earth)	2290-2300 SPACE RESEARCH (deep space) (space-to-Earth)	
2300-2450 FIXED MOBILE 5.384A Amateur Radiolocation	2300-2450 FIXED MOBILE 5.384A RADIOLOCATION Amateur		2300-2305 G122 2305-2310	2300-2305 Amateur	Amateur Radio (97)
			US97 G122	2305-2310 FIXED MOBILE except aeronautical mobile RADIOLOCATION Amateur US97	Wireless Communications (27) Amateur Radio (97)

		2310-2320 Fixed Mobile US100 Radiolocation G2  US97 US327	2310-2320 FIXED MOBILE BROADCASTING-SATELLITE RADIOLOCATION  5.396 US97 US100 US327	Wireless Communications (27)
		2320-2345 Fixed Radiolocation G2  US327	2320-2345 BROADCASTING-SATELLITE  5.396 US327	Satellite Communications (25)
		2345-2360 Fixed Mobile US100 Radiolocation G2  US327	2345-2360 FIXED MOBILE US100 BROADCASTING-SATELLITE RADIOLOCATION  5.396 US327	Wireless Communications (27)
		2360-2390 MOBILE US276 RADIOLOCATION G2 G120 Fixed US101	2360-2390 MOBILE US276  US101	Aviation (87) Personal Radio (95)
		2390-2395 MOBILE US276  US101	2390-2395 AMATEUR MOBILE US276 US101	Aviation (87) Personal Radio (95) Amateur Radio (97)
		2395-2400  US101 G122	2395-2400 AMATEUR US101	Personal Radio (95) Amateur Radio (97)
		2400-2417  5.150 G122	2400-2417 AMATEUR 5.150 5.282	ISM Equipment (18) Amateur Radio (97)
		2417-2450 Radiolocation G2 5.150	2417-2450 Amateur 5.150 5.282	
5.150 5.282 5.395	5.150 5.282 5.393 5.394 5.396	2450-2483.5 FIXED MOBILE Radiolocation 5.150	2450-2483.5 FIXED MOBILE Radiolocation 5.150 US41	ISM Equipment (18) TV Auxiliary Broadcasting (74F) Private Land Mobile (90) Fixed Microwave (101)

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2483.5-2500 FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.351A RADIODETERMINATION- SATELLITE (space-to-Earth) 5.398 Radiolocation 5.398A	2483.5-2500 FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.351A RADIOLOCATION RADIODETERMINATION- SATELLITE (space-to-Earth) 5.398	2483.5-2500 FIXED MOBILE MOBILE-SATELLITE (space-to-Earth) 5.351A RADIOLOCATION RADIODETERMINATION-SATELLITE (space-to-Earth) 5.398	2483.5-2500 MOBILE-SATELLITE (space-to- Earth) US319 US380 US391 RADIODETERMINATION- SATELLITE (space-to-Earth) 5.398	2483.5-2495 MOBILE-SATELLITE (space-to- Earth) US380 RADIODETERMINATION-SATEL- LITE (space-to-Earth) 5.398 5.150 5.402 US41 US319 NG147 2495-2500 FIXED MOBILE except aeronautical mobile MOBILE-SATELLITE (space-to- Earth) US380 RADIODETERMINATION-SATEL- LITE (space-to-Earth) 5.398 5.150 5.402 US41 US319 US391 NG147	ISM Equipment (18) Satellite Communi- cations (25)
5.150 5.399 5.401 5.402	5.150 5.402	5.150 5.401 5.402	5.150 5.402 US41		
2500-2520 FIXED 5.410 MOBILE except aeronautical mobile 5.384A	2500-2520 FIXED 5.410 FIXED-SATELLITE (space-to- Earth) 5.415 MOBILE except aeronautical mobile 5.384A	2500-2520 FIXED 5.410 FIXED-SATELLITE (space-to-Earth) 5.415 MOBILE except aeronautical mobile 5.384A MOBILE-SATELLITE (space-to-Earth) 5.351A 5.407 5.414 5.414A	2500-2655	2500-2655 FIXED US205 MOBILE except aeronautical mobile	Wireless Communi- cations (27)
5.412	5.404	5.404 5.415A			
2520-2655 FIXED 5.410 MOBILE except aeronautical mobile 5.384A BROADCASTING-SATELLITE 5.413 5.416	2520-2655 FIXED 5.410 FIXED-SATELLITE (space-to-Earth) 5.415 MOBILE except aeronautical mobile 5.384A BROADCASTING-SATELLITE 5.413 5.416	2520-2535 FIXED 5.410 FIXED-SATELLITE (space-to-Earth) 5.415 MOBILE except aeronautical mobile 5.384A BROADCASTING-SATELLITE 5.413 5.416 5.403 5.414A 5.415A 2535-2655 FIXED 5.410 MOBILE except aeronautical mobile 5.384A BROADCASTING-SATELLITE 5.413 5.416			
5.339 5.412 5.417C 5.417D 5.418B 5.418C	5.339 5.417C 5.417D 5.418B 5.418C	5.339 5.417A 5.417B 5.417C 5.417D 5.418 5.418A 5.418B 5.418C	5.339 US205	5.339	
2655-2670 FIXED 5.410 MOBILE except aeronautical mobile 5.384A BROADCASTING-SATELLITE 5.208B 5.413 5.416 Earth exploration-satellite (passive) Radio astronomy Space research (passive)	2655-2670 FIXED 5.410 FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.415 MOBILE except aeronautical mobile 5.384A BROADCASTING-SATELLITE 5.413 5.416 Earth exploration-satellite (passive) Radio astronomy Space research (passive)	2655-2670 FIXED 5.410 FIXED-SATELLITE (Earth-to-space) 5.415 MOBILE except aeronautical mobile 5.384A BROADCASTING-SATELLITE 5.413 5.416 Earth exploration-satellite (passive) Radio astronomy Space research (passive)	2655-2690 Earth exploration-satellite (passive) Radio astronomy US385 Space research (passive)	2655-2690 FIXED US205 MOBILE except aeronautical mobile Earth exploration-satellite (passive) Radio astronomy Space research (passive)	
5.149 5.412	5.149 5.208B	5.149 5.208B 5.420			

2670-2690 FIXED 5.410 MOBILE except aeronautical mobile 5.384A Earth exploration-satellite (passive) Radio astronomy Space research (passive)	2670-2690 FIXED 5.410 FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.208B 5.415 MOBILE except aeronautical mobile 5.384A Earth exploration-satellite (passive) Radio astronomy Space research (passive)	2670-2690 FIXED 5.410 FIXED-SATELLITE (Earth-to-space) 5.415 MOBILE except aeronautical mobile 5.384A MOBILE-SATELLITE (Earth-to-space) 5.351A 5.419 Earth exploration-satellite (passive) Radio astronomy Space research (passive)			
5.149 5.412	5.149	5.149	US205	US385	
2690-2700 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive)			2690-2700 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY US74 SPACE RESEARCH (passive)		
5.340 5.422			US246		
2700-2900 AERONAUTICAL RADIONAVIGATION 5.337 Radiolocation			2700-2900 METEOROLOGICAL AIDS AERONAUTICAL RADIONAVIGATION 5.337 US18 Radiolocation G2	2700-2900	Aviation (87)
5.423 5.424			5.423 G15	5.423 US18	
2900-3100 RADIOLOCATION 5.424A RADIONAVIGATION 5.426			2900-3100 RADIOLOCATION 5.424A G56 MARITIME RADIONAVIGATION	2900-3100 MARITIME RADIONAVIGATION Radiolocation US44	Maritime (80) Private Land Mobile (90)
5.425 5.427			5.427 US44 US316	5.427 US316	
3100-3300 RADIOLOCATION Earth exploration-satellite (active) Space research (active)			3100-3300 RADIOLOCATION G59 Earth exploration-satellite (active) Space research (active)	3100-3300 Earth exploration-satellite (active) Space research (active) Radiolocation	Private Land Mobile (90)
5.149 5.428			US342	US342	
3300-3400 RADIOLOCATION	3300-3400 RADIOLOCATION Amateur Fixed Mobile	3300-3400 RADIOLOCATION Amateur	3300-3500 RADIOLOCATION US108 G2	3300-3500 Amateur Radiolocation US108	Private Land Mobile (90) Amateur Radio (97)
5.149 5.429 5.430	5.149	5.149 5.429			
3400-3600 FIXED FIXED-SATELLITE (space-to-Earth) Mobile 5.430A Radiolocation	3400-3500 FIXED FIXED-SATELLITE (space-to-Earth) Amateur Mobile 5.431A Radiolocation 5.433	3400-3500 FIXED FIXED-SATELLITE (space-to-Earth) Amateur Mobile 5.432B Radiolocation 5.433			
5.431	5.282	5.282 5.432 5.432A	US342	5.282 US342	

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3600-4200 FIXED FIXED-SATELLITE (space-to-Earth) Mobile	Radiolocation 5.433	3600-3700 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile Radiolocation 5.433	US245	3600-3650 FIXED-SATELLITE (space-to-Earth) US245 Radiolocation	Satellite Communications (25) Private Land Mobile (90)
		5.435	3650-3700	3650-3700 FIXED FIXED-SATELLITE (space-to-Earth) NG169 NG185 MOBILE except aeronautical mobile US109 US349	
	3700-4200 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile		3700-4200	3700-4200 FIXED FIXED-SATELLITE (space-to-Earth) NG180	Satellite Communications (25) Fixed Microwave (101)
4200-4400 AERONAUTICAL RADIONAVIGATION 5.438 5.439 5.440			4200-4400 AERONAUTICAL RADIONAVIGATION 5.440 US261		Aviation (87)
4400-4500 FIXED MOBILE 5.440A			4400-4940 FIXED MOBILE	4400-4500	
4500-4800 FIXED FIXED-SATELLITE (space-to-Earth) 5.441 MOBILE 5.440A				4500-4800 FIXED-SATELLITE (space-to-Earth) 5.441 US245	
4800-4990 FIXED MOBILE 5.440A 5.442 Radio astronomy			US113 US245 US342	4800-4940	
5.149 5.339 5.443			4940-4990	4940-4990 FIXED MOBILE except aeronautical mobile 5.339 US342 US385	Public Safety Land Mobile (90Y)
4990-5000 FIXED MOBILE except aeronautical mobile RADIO ASTRONOMY Space research (passive) 5.149			5.339 US342 US385 G122		
			4990-5000 RADIO ASTRONOMY US74 Space research (passive)		
			US246		

5000-5010 AERONAUTICAL MOBILE-SATELLITE (R) 5.443AA AERONAUTICAL RADIONAVIGATION RADIONAVIGATION-SATELLITE (Earth-to-space)	5000-5010 AERONAUTICAL RADIONAVIGATION US260 RADIONAVIGATION-SATELLITE (Earth-to-space)  US211 US367	Aviation (87)
5010-5030 AERONAUTICAL MOBILE-SATELLITE (R) 5.443AA AERONAUTICAL RADIONAVIGATION RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) 5.328B 5.443B	5010-5030 AERONAUTICAL RADIONAVIGATION US260 RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) 5.443B  US211 US367	
5030-5091 AERONAUTICAL MOBILE (R) 5.443C AERONAUTICAL MOBILE-SATELLITE (R) 5.443D AERONAUTICAL RADIONAVIGATION	5030-5091 AERONAUTICAL RADIONAVIGATION US260	
5.444 5091-5150 AERONAUTICAL MOBILE 5.444B AERONAUTICAL MOBILE-SATELLITE (R) 5.443AA AERONAUTICAL RADIONAVIGATION	5.444 US211 US367 5091-5150 AERONAUTICAL MOBILE US111 US444B AERONAUTICAL RADIONAVIGATION US260	Satellite Communications (25) Aviation (87)
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5850-5925 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE	5850-5925 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Amateur Radiolocation	5850-5925 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Radiolocation		5850-5925 FIXED-SATELLITE (Earth-to-space) US245 MOBILE NG160 Amateur	ISM Equipment (18) Private Land Mobile (90) Personal Radio (95) Amateur Radio (97)
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			6425-6525	6425-6525 FIXED-SATELLITE (Earth-to-space) MOBILE	RF Devices (15) Satellite Communications (25) TV Broadcast Auxiliary (74F) Cable TV Relay (78) Fixed Microwave (101)
			5.440 5.458	5.440 5.458	
			6525-6700	6525-6700 FIXED FIXED-SATELLITE (Earth-to-space)	RF Devices (15) Satellite Communications (25) Fixed Microwave (101)
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56.9-57 EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE 5.558A MOBILE 5.558 SPACE RESEARCH (passive) 5.547 5.557	56.9-57 EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE G128 MOBILE 5.558 SPACE RESEARCH (passive) US532	56.9-57 EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE 5.558 SPACE RESEARCH (passive) US532	
57-58.2 EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE 5.556A MOBILE 5.558 SPACE RESEARCH (passive) 5.547 5.557	57-58.2 EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE 5.556A MOBILE 5.558 SPACE RESEARCH (passive) US532		RF Devices (15) Satellite Communications (25)
58.2-59 EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE SPACE RESEARCH (passive) 5.547 5.556	58.2-59 EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE SPACE RESEARCH (passive) US353 US354		RF Devices (15)

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59.3-64 FIXED INTER-SATELLITE MOBILE 5.558 RADIOLOCATION 5.559 5.138			59.3-64 FIXED INTER-SATELLITE MOBILE 5.558 RADIOLOCATION 5.559 5.138 US353	59.3-64 FIXED MOBILE 5.558 RADIOLOCATION 5.559 5.138 US353	RF Devices (15) ISM Equipment (18)
64-65 FIXED INTER-SATELLITE MOBILE except aeronautical mobile 5.547 5.556			64-65 FIXED INTER-SATELLITE MOBILE except aeronautical mobile	64-65 FIXED MOBILE except aeronautical mobile	
65-66 EARTH EXPLORATION-SATELLITE FIXED INTER-SATELLITE MOBILE except aeronautical mobile SPACE RESEARCH 5.547			65-66 EARTH EXPLORATION-SATELLITE FIXED MOBILE except aeronautical mobile SPACE RESEARCH	65-66 EARTH EXPLORATION-SATELLITE FIXED INTER-SATELLITE MOBILE except aeronautical mobile SPACE RESEARCH	Satellite Communications (25)
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71-74 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE MOBILE-SATELLITE (space-to-Earth)			71-74 FIXED FIXED-SATELLITE (space-to-Earth)MOBILE MOBILE-SATELLITE (space-to-Earth) US389		Fixed Microwave (101)
74-76 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE BROADCASTING BROADCASTING-SATELLITE Space research (space-to-Earth) 5.561			74-76 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE Space research (space-to-Earth) US389	74-76 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE BROADCASTING BROADCASTING-SATELLITE Space research (space-to-Earth) US389	RF Devices (15) Fixed Microwave (101)

76-77.5 RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite Space research (space-to-Earth)	76-77.5 RADIO ASTRONOMY RADIOLOCATION Space research (space-to-Earth)	76-77 RADIO ASTRONOMY RADIOLOCATION Amateur Space research (space-to-Earth) US342	RF Devices (15)
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77.5-78 AMATEUR AMATEUR-SATELLITE Radio astronomy Space research (space-to-Earth)	77.5-78 Radio astronomy Space research (space-to-Earth)	77.5-78 AMATEUR AMATEUR-SATELLITE Radio astronomy Space research (space-to-Earth)	
5.149	US342	US342	
78-79 RADIOLOCATION Amateur Amateur-satellite Radio astronomy Space research (space-to-Earth)	78-79 RADIO ASTRONOMY RADIOLOCATION Space research (space-to-Earth)	78-79 RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite Space research (space-to-Earth)	
5.149 5.560	5.560 US342	5.560 US342	
79-81 RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite Space research (space-to-Earth)	79-81 RADIO ASTRONOMY RADIOLOCATION Space research (space-to-Earth)	79-81 RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite Space research (space-to-Earth)	
5.149	US342	US342	
81-84 FIXED 5.338A FIXED-SATELLITE (Earth-to-space) MOBILE MOBILE-SATELLITE (Earth-to-space) RADIO ASTRONOMY Space research (space-to-Earth)	81-84 FIXED FIXED-SATELLITE (Earth-to-space) US297 MOBILE MOBILE-SATELLITE (Earth-to-space) RADIO ASTRONOMY Space research (space-to-Earth)		RF Devices (15) Fixed Microwave (101)
5.149 5.561A	US161 US342 US389		
84-86 FIXED 5.338A FIXED-SATELLITE (Earth-to-space) 5.561B MOBILE RADIO ASTRONOMY	84-86 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE RADIO ASTRONOMY		
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5.340			US246		
92-94 FIXED 5.338A MOBILE RADIO ASTRONOMY RADIOLOCATION			92-94 FIXED MOBILE RADIO ASTRONOMY RADIOLOCATION		RF Devices (15) Fixed Microwave (101)
5.149			US161 US342		
94-94.1 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION SPACE RESEARCH (active) Radio astronomy			94-94.1 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION SPACE RESEARCH (active) Radio astronomy	94-94.1 RADIOLOCATION Radio astronomy	RF Devices (15)
5.562 5.562A			5.562 5.562A	5.562A	
94.1-95 FIXED MOBILE RADIO ASTRONOMY RADIOLOCATION			94.1-95 FIXED MOBILE RADIO ASTRONOMY RADIOLOCATION		RF Devices (15) Fixed Microwave (101)
5.149			US161 US342		
95-100 FIXED MOBILE RADIO ASTRONOMY RADIOLOCATION RADIONAVIGATION RADIONAVIGATION-SATELLITE			95-100 FIXED MOBILE RADIO ASTRONOMY RADIOLOCATION RADIONAVIGATION RADIONAVIGATION-SATELLITE		
5.149 5.554			5.554 US342		
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5.340 5.341			5.341 US246		
102-105 FIXED MOBILE RADIO ASTRONOMY			102-105 FIXED MOBILE RADIO ASTRONOMY		
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105-109.5 FIXED MOBILE RADIO ASTRONOMY SPACE RESEARCH (passive) 5.562B 5.149 5.341	105-109.5 FIXED MOBILE RADIO ASTRONOMY SPACE RESEARCH (passive) 5.562B 5.341 US342	
109.5-111.8 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 5.340 5.341	109.5-111.8 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY US74 SPACE RESEARCH (passive) 5.341 US246	
111.8-114.25 FIXED MOBILE RADIO ASTRONOMY SPACE RESEARCH (passive) 5.562B 5.149 5.341	111.8-114.25 FIXED MOBILE RADIO ASTRONOMY SPACE RESEARCH (passive) 5.562B 5.341 US342	
114.25-116 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 5.340 5.341	114.25-116 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY US74 SPACE RESEARCH (passive) 5.341 US246	
116-119.98 EARTH EXPLORATION-SATELLITE (passive) INTER-SATELLITE 5.562C SPACE RESEARCH (passive) 5.341	116-122.25 EARTH EXPLORATION-SATELLITE (passive) INTER-SATELLITE 5.562C SPACE RESEARCH (passive)	ISM Equipment (18)
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122.25-123 FIXED INTER-SATELLITE MOBILE 5.558 Amateur 5.138	122.25-123 FIXED INTER-SATELLITE MOBILE 5.558 5.138	122.25-123 FIXED INTER-SATELLITE MOBILE 5.558 Amateur 5.138
123-130 FIXED-SATELLITE (space-to-Earth) MOBILE-SATELLITE (space-to-Earth) RADIONAVIGATION RADIONAVIGATION-SATELLITE Radio astronomy 5.562D 5.149 5.554	123-130 FIXED-SATELLITE (space-to-Earth) MOBILE-SATELLITE (space-to-Earth) RADIONAVIGATION RADIONAVIGATION-SATELLITE Radio astronomy 5.554 US211 US342	

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134-136 AMATEUR AMATEUR-SATELLITE Radio astronomy			134-136 Radio astronomy	134-136 AMATEUR AMATEUR-SATELLITE Radio astronomy	Amateur Radio (97)
136-141 RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite 5.149			136-141 RADIO ASTRONOMY RADIOLOCATION US342	136-141 RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite US342	
141-148.5 FIXED MOBILE RADIO ASTRONOMY RADIOLOCATION 5.149			141-148.5 FIXED MOBILE RADIO ASTRONOMY RADIOLOCATION US342		
148.5-151.5 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 5.340			148.5-151.5 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY US74 SPACE RESEARCH (passive) US246		
151.5-155.5 FIXED MOBILE RADIO ASTRONOMY RADIOLOCATION 5.149			151.5-155.5 FIXED MOBILE RADIO ASTRONOMY RADIOLOCATION US342		
155.5-158.5 EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE RADIO ASTRONOMY SPACE RESEARCH (passive) 5.562B 5.149 5.562F 5.562G			155.5-158.5 EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE RADIO ASTRONOMY SPACE RESEARCH (passive) 5.562B 5.562F 5.562G US342		

158.5-164 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE MOBILE-SATELLITE (space-to-Earth)	158.5-164 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE MOBILE-SATELLITE (space-to-Earth)  US211	
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5.340 167-174.5 FIXED FIXED-SATELLITE (space-to-Earth) INTER-SATELLITE MOBILE 5.558	US246 167-174.5 FIXED FIXED-SATELLITE (space-to-Earth) INTER-SATELLITE MOBILE 5.558	
5.149 5.562D 174.5-174.8 FIXED INTER-SATELLITE MOBILE 5.558	US211 US342 174.5-174.8 FIXED INTER-SATELLITE MOBILE 5.558	
174.8-182 EARTH EXPLORATION-SATELLITE (passive) INTER-SATELLITE 5.562H SPACE RESEARCH (passive)	174.8-182 EARTH EXPLORATION-SATELLITE (passive) INTER-SATELLITE 5.562H SPACE RESEARCH (passive)	
182-185 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive)	182-185 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive)	
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190-191.8 EARTH EXPLORATION-SATELLITE (passive) SPACE RESEARCH (passive)	190-191.8 EARTH EXPLORATION-SATELLITE (passive) SPACE RESEARCH (passive)	
5.340 191.8-200 FIXED INTER-SATELLITE MOBILE 5.558 MOBILE-SATELLITE RADIONAVIGATION RADIONAVIGATION-SATELLITE	US246 191.8-200 FIXED INTER-SATELLITE MOBILE 5.558 MOBILE-SATELLITE RADIONAVIGATION RADIONAVIGATION-SATELLITE	
5.149 5.341 5.554	5.341 5.554 US211 US342	

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209-217 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE RADIO ASTRONOMY 5.149 5.341			209-217 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE RADIO ASTRONOMY 5.341 US342		
217-226 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE RADIO ASTRONOMY SPACE RESEARCH (passive) 5.562B 5.149 5.341			217-226 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE RADIO ASTRONOMY SPACE RESEARCH (passive) 5.562B 5.341 US342		
226-231.5 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 5.340			226-231.5 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) US246		
231.5-232 FIXED MOBILE Radiolocation			231.5-232 FIXED MOBILE Radiolocation		
232-235 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE Radiolocation			232-235 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE Radiolocation		
235-238 EARTH EXPLORATION-SATELLITE (passive) FIXED-SATELLITE (space-to-Earth) SPACE RESEARCH (passive) 5.563A 5.563B			235-238 EARTH EXPLORATION-SATELLITE (passive) FIXED-SATELLITE (space-to-Earth) SPACE RESEARCH (passive) 5.563A 5.563B		
238-240 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE RADIOLOCATION RADIONAVIGATION RADIONAVIGATION-SATELLITE			238-240 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE RADIOLOCATION RADIONAVIGATION RADIONAVIGATION-SATELLITE		

240-241 FIXED MOBILE RADIOLOCATION	240-241 FIXED MOBILE RADIOLOCATION		
241-248 RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite	241-248 RADIO ASTRONOMY RADIOLOCATION	241-248 RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite	ISM Equipment (18) Amateur Radio (97)
5.138 5.149 248-250 AMATEUR AMATEUR-SATELLITE Radio astronomy	5.138 US342 248-250 Radio astronomy	5.138 US342 248-250 AMATEUR AMATEUR-SATELLITE Radio astronomy	Amateur Radio (97)
5.149 250-252 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive)	US342	US342	
5.340 5.563A 252-265 FIXED MOBILE MOBILE-SATELLITE (Earth-to-space) RADIO ASTRONOMY RADIONAVIGATION RADIONAVIGATION-SATELLITE	250-252 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY US74 SPACE RESEARCH (passive)		
5.149 5.554 265-275 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE RADIO ASTRONOMY	5.563A US246 252-265 FIXED MOBILE MOBILE-SATELLITE (Earth-to-space) RADIO ASTRONOMY RADIONAVIGATION RADIONAVIGATION-SATELLITE		
5.149 5.563A 275-3000 (Not allocated)	5.554 US211 US342 265-275 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE RADIO ASTRONOMY		
5.565	5.563A US342 275-1000 (Not allocated) US565		Amateur Radio (97)

## INTERNATIONAL FOOTNOTES

5.53 Administrations authorizing the use of frequencies below 8.3 kHz shall ensure that no harmful interference is caused to services to which the bands above 8.3 kHz are allocated. (WRC-12)

5.54 Administrations conducting scientific research using frequencies below 8.3 kHz are urged to advise other administrations that may be concerned in order that such research may be afforded all practicable protection from harmful interference. (WRC-12)

5.54A Use of the 8.3-11.3 kHz frequency band by stations in the meteorological aids service is limited to passive use only. In the band 9-11.3 kHz, meteorological aids stations shall not claim protection from stations of the radionavigation service submitted for notification to the Bureau prior to 1 January 2013. For sharing between stations of the meteorological aids service and stations in the radionavigation service submitted for notification after this date, the most recent version of Recommendation ITU-R RS.1881 should be applied. (WRC-12)

5.54B Additional allocation: in Algeria, Saudi Arabia, Egypt, the United Arab Emirates, the Russian Federation, Iraq, Lebanon, Morocco, Qatar, the Syrian Arab Republic, Sudan and Tunisia, the frequency band 8.3-9 kHz is also allocated to the radionavigation, fixed and mobile services on a primary basis. (WRC-12)

5.54C Additional allocation: in China, the frequency band 8.3-9 kHz is also allocated to the maritime radionavigation and maritime mobile services on a primary basis. (WRC-12)

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5.56 The stations of services to which the bands 14-19.95 kHz and 20.05-70 kHz and in Region 1 also the bands 72-84 kHz and 86-90 kHz are allocated may transmit standard frequency and time signals. Such stations shall be afforded protection from harmful interference. In Armenia, Azerbaijan, Belarus, the Russian Federation, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan and Turkmenistan, the frequencies 25 kHz and 50 kHz will be used for this purpose under the same conditions. (WRC-12)

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5.67B The use of the band 135.7-137.8 kHz in Algeria, Egypt, Iran (Islamic Republic of), Iraq, Lebanon, Syrian Arab Republic, Sudan, South Sudan and Tunisia is limited to the fixed and maritime mobile services. The amateur service shall not be used in the above-mentioned countries in the band 135.7-137.8 kHz, and this should be taken into account by the countries authorizing such use. (WRC-12)

5.68 Alternative allocation: in Angola, Congo (Rep. of the), the Dem. Rep. of the Congo and South Africa, the band 160-200 kHz is allocated to the fixed service on a primary basis. (WRC-12)

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5.70 Alternative allocation: in Angola, Botswana, Burundi, the Central African Rep., Congo (Rep. of the), Ethiopia, Kenya, Lesotho, Madagascar, Malawi, Mozambique, Namibia, Nigeria, Oman, the Dem. Rep. of the Congo, South Africa, Swaziland, Tanzania, Chad, Zambia and Zimbabwe, the band 200-283.5 kHz is allocated to the aeronautical radionavigation service on a primary basis. (WRC-12)

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5.77 Different category of service: in Australia, China, the French overseas communities of Region 3, Korea (Rep. of), India, Iran (Islamic Republic of), Japan, Pakistan, Papua New Guinea and Sri Lanka, the allocation of the frequency band 415-495 kHz to the aeronautical radionavigation service is on a primary basis. In Armenia, Azerbaijan, Belarus, the Russian Federation, Kazakhstan, Latvia, Uzbekistan and Kyrgyzstan, the allocation of the frequency band 435-495 kHz to the aeronautical radionavigation service is on a primary basis. Administrations in all the aforementioned countries shall take all practical steps necessary to ensure that aeronautical radionavigation stations in the frequency band 435-495 kHz do not cause interference to reception by coast stations of transmissions from ship stations on frequencies designated for ship stations on a worldwide basis. (WRC-12)

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5.80A The maximum equivalent isotropically radiated power (e.i.r.p.) of stations in the amateur service using frequencies in the band 472-479 kHz shall not exceed 1 W. Administrations may increase this limit of e.i.r.p. to 5 W in portions of their territory which are at a distance of over 800 km from the borders of Algeria, Saudi Arabia, Azerbaijan, Bahrain, Belarus, China, Comoros, Djibouti, Egypt, United Arab Emirates, the Russian Federation, Iran (Islamic Republic of), Iraq, Jordan, Kazakhstan, Kuwait, Lebanon, Libya, Morocco, Mauritania, Oman, Uzbekistan, Qatar, Syrian Arab Republic, Kyrgyzstan, Somalia, Sudan, Tunisia, Ukraine and Yemen. In this frequency band, stations in the amateur service shall not cause harmful interference to, or claim protection from, stations of the aeronautical radionavigation service. (WRC-12)

5.80B The use of the frequency band 472-479 kHz in Algeria, Saudi Arabia, Azerbaijan, Bahrain, Belarus, China, Comoros, Djibouti, Egypt, United Arab Emirates, the Russian Federation, Iraq, Jordan, Kazakhstan, Kuwait, Lebanon, Libya, Mauritania, Oman, Uzbekistan, Qatar, Syrian Arab Republic, Kyrgyzstan, Somalia, Sudan, Tunisia and Yemen is limited to the maritime mobile and aeronautical radionavigation services. The amateur service shall not be used in the above-mentioned countries in this frequency band, and this should be taken into account by the countries authorizing such use. (WRC-12)

5.82 In the maritime mobile service, the frequency 490 kHz is to be used exclusively for the transmission by coast stations of navigational and meteorological warnings and urgent information to ships, by means of narrow-band direct-printing telegraphy. The conditions for use of the frequency 490 kHz are prescribed in Articles 31 and 52. In using the frequency band 415-495 kHz for the aeronautical radionavigation service, administrations are requested to ensure that no harmful interference is caused to the frequency 490 kHz. In using the frequency band 472-479 kHz for the amateur service, administrations shall ensure that no harmful interference is caused to the frequency 490 kHz. (WRC-12)

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5.87 Additional allocation: in Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, Niger and Swaziland, the band 526.5-535 kHz is also allocated to the mobile service on a secondary basis. (WRC-12)

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5.93 Additional allocation: in Angola, Armenia, Azerbaijan, Belarus, the Russian Federation, Georgia, Hungary, Kazakhstan, Latvia, Lithuania, Mongolia, Nigeria, Uzbekistan, Poland, Kyrgyzstan, Slovakia, Tajikistan, Chad, Turkmenistan and Ukraine, the bands 1625-1635 kHz, 1800-1810 kHz and 2160-2170 kHz are also allocated to the fixed and land mobile services on a primary basis, subject to agreement obtained under No. 9.21. (WRC-12)

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5.98 Alternative allocation: in Angola, Armenia, Azerbaijan, Belarus, Belgium, Cameroon, Congo (Rep. of the), Denmark, Egypt, Eritrea, Spain, Ethiopia, the Russian Federation, Georgia, Greece, Italy, Kazakhstan, Lebanon, Lithuania, the Syrian Arab Republic, Kyrgyzstan, Somalia, Tajikistan, Tunisia, Turkmenistan, Turkey and Ukraine, the band 1810-1830 kHz is allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. (WRC-12)

5.99 Additional allocation: in Saudi Arabia, Austria, Iraq, Libya, Uzbekistan, Slovakia, Romania, Slovenia, Chad, and Togo, the band 1810-1830 kHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. (WRC-12)

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5.107 Additional allocation: in Saudi Arabia, Eritrea, Ethiopia, Iraq, Libya, Somalia and Swaziland, the band 2160-2170 kHz is also allocated to the fixed and mobile, except aeronautical mobile (R), services on a primary basis. The mean power of stations in these services shall not exceed 50 W. (WRC-12)

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5.112 Alternative allocation: in Denmark and Sri Lanka, the band 2194-2300 kHz is allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. (WRC-12)

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5.114 Alternative allocation: in Denmark and Iraq, the band 2502-2625 kHz is allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. (WRC-12)

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5.117 Alternative allocation: in Côte d'Ivoire, Denmark, Egypt, Liberia, Sri Lanka and Togo, the band 3155-3200 kHz is allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. (WRC-12)

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5.128 Frequencies in the bands 4063-4123 kHz and 4130-4438 kHz may be used exceptionally by stations in the fixed service, communicating only within the boundary of the country in which they are located, with a mean power not exceeding 50 W, on condition that harmful interference is not caused to the maritime mobile service. In addition, in Afghanistan, Argentina, Armenia, Azerbaijan, Belarus, Botswana, Burkina Faso, the Central African Rep., China, the Russian Federation, Georgia, India, Kazakhstan, Mali, Niger, Pakistan, Kyrgyzstan, Tajikistan, Chad, Turkmenistan and Ukraine, in the bands 4063-4123 kHz, 4130-4133 kHz and 4408-4438 kHz, stations in the fixed service, with a mean power not exceeding 1 kW, can be operated on condition that they are situated at least 600 km from the coast and that harmful interference is not caused to the maritime mobile service. (WRC-12)

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5.132A Stations in the radiolocation service shall not cause harmful interference to, or claim protection from, stations operating in the fixed or mobile services. Applications of the radiolocation service are limited to oceanographic radars operating in accordance with Resolution 612 (Rev. WRC-12). (WRC-12)

5.132B Alternative allocation: in Armenia, Austria, Belarus, Moldova, Uzbekistan and Kyrgyzstan, the frequency band 4438-4488 kHz is allocated to the fixed and mobile, except aeronautical mobile (R), services on a primary basis. (WRC-12)

5.133 Different category of service: in Armenia, Azerbaijan, Belarus, the Russian Federation, Georgia, Kazakhstan, Latvia, Lithuania, Niger, Uzbekistan, Kyrgyzstan, Tajikistan, Turkmenistan and Ukraine, the allocation of the band 5130-5250 kHz to the mobile, except aeronautical mobile, service is on a primary basis (see No. 5.33). (WRC-12)

5.133A Alternative allocation: in Armenia, Austria, Belarus, Moldova, Uzbekistan and Kyrgyzstan, the frequency bands 5250-5275 kHz and 26200-26350 kHz are allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. (WRC-12)

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5.140 Additional allocation: in Angola, Iraq, Kenya, Somalia and Togo, the band 7000-7050 kHz is also allocated to the fixed service on a primary basis. (WRC-12)

5.141 Alternative allocation: in Egypt, Eritrea, Ethiopia, Guinea, Libya, Madagascar and Niger, the band 7000-7050 kHz is allocated to the fixed service on a primary basis. (WRC-12)

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5.141B Additional allocation: in Algeria, Saudi Arabia, Australia, Bahrain, Botswana, Brunei Darussalam, China, Comoros, Korea (Rep. of), Diego Garcia, Djibouti, Egypt, United Arab Emirates, Eritrea, Indonesia, Iran (Islamic Republic of), Japan, Jordan, Kuwait, Libya, Morocco, Mauritania, Niger, New Zealand, Oman, Papua New Guinea, Qatar, the Syrian Arab Republic, Singapore, Sudan, South

Sudan, Tunisia, Viet Nam and Yemen, the band 7100-7200 kHz is also allocated to the fixed and the mobile, except aeronautical mobile (R), services on a primary basis. (WRC-12)

5.142 The use of the band 7200-7300 kHz in Region 2 by the amateur service shall not impose constraints on the broadcasting service intended for use within Region 1 and Region 3. (WRC-12)

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5.143A In Region 3, frequencies in the band 7350-7450 kHz may be used by stations in the fixed service on a primary basis and land mobile service on a secondary basis, communicating only within the boundary of the country in which they are located, on condition that harmful interference is not caused to the broadcasting service. When using frequencies for these services, administrations are urged to use the minimum power required and to take account of the seasonal use of frequencies by the broadcasting service published in accordance with the Radio Regulations. (WRC-12)

5.143B In Region 1, frequencies in the band 7350-7450 kHz may be used by stations in the fixed and land mobile services communicating only within the boundary of the country in which they are located on condition that harmful interference is not caused to the broadcasting service. The total radiated power of each station shall not exceed 24 dBW. (WRC-12)

5.143C Additional allocation: in Algeria, Saudi Arabia, Bahrain, Comoros, Djibouti, Egypt, United Arab Emirates, Iran (Islamic Republic of), Jordan, Kuwait, Libya, Morocco, Mauritania, Niger, Oman, Qatar, the Syrian Arab Republic, Sudan, South Sudan, Tunisia and Yemen, the bands 7350-7400 kHz and 7400-7450 kHz are also allocated to the fixed service on a primary basis. (WRC-12)

5.143D In Region 2, frequencies in the band 7350-7400 kHz may be used by stations in the fixed service and in the land mobile service, communicating only within the boundary of the country in which they are located, on condition that harmful interference is not caused to the broadcasting service. When using frequencies for these services, administrations are urged to use the minimum power required and to take account of the seasonal use of frequencies by the broadcasting service published in accordance with the Radio Regulations. (WRC-12)

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5.145A Stations in the radiolocation service shall not cause harmful interference to, or claim protection from, stations operating in the fixed service. Applications of the radiolocation service are limited to oceanographic radars operating in accordance with Resolution 612 (Rev.WRC-12). (WRC-12)

5.145B Alternative allocation: in Armenia, Austria, Belarus, Moldova, Uzbekistan and Kyrgyzstan, the frequency bands 9305-9355 kHz and 16100-16200 kHz are allocated to the fixed service on a primary basis. (WRC-12)

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5.149A Alternative allocation: in Armenia, Austria, Belarus, Moldova, Uzbekistan and Kyrgyzstan, the frequency band 13450-13550 kHz is allocated to the fixed service on a primary basis and to the mobile, except aeronautical mobile (R), service on a secondary basis. (WRC-12)

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5.158 Alternative allocation: in Armenia, Austria, Belarus, Moldova, Uzbekistan and Kyrgyzstan, the frequency band 24450-24600 kHz is allocated to the fixed and land mobile services on a primary basis. (WRC-12)

5.159 Alternative allocation: in Armenia, Austria, Belarus, Moldova, Uzbekistan and Kyrgyzstan, the frequency band 39-39.5 MHz is allocated to the fixed and mobile services on a primary basis. (WRC-12)

5.160 Additional allocation: in Botswana, Burundi, Dem. Rep. of the Congo and Rwanda, the band 41-44 MHz is also allocated to the aeronautical radionavigation service on a primary basis. (WRC-12)

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5.161A Additional allocation: in Korea (Rep. of) and the United States, the frequency bands 41.015-41.665 MHz and 43.35-44 MHz are also allocated to the radiolocation service on a primary basis. Stations in the radiolocation service shall not cause harmful interference to, or claim protection from, stations operating in the fixed or mobile services. Applications of the radiolocation service are limited to oceanographic radars operating in accordance with Resolution 612 (Rev. WRC-12). (WRC-12)

5.161B Alternative allocation: in Albania, Germany, Armenia, Austria, Belarus, Belgium, Bosnia and Herzegovina, Bulgaria, Cyprus, Vatican, Croatia, Denmark, Spain, Estonia, Finland, France, Greece, Hungary, Ireland, Iceland, Italy, Latvia, The Former Yugoslav Rep. of Macedonia, Liechtenstein, Lithuania, Luxembourg, Malta, Moldova, Monaco, Montenegro, Norway, Uzbekistan, Netherlands, Poland, Portugal, Kyrgyzstan, Slovakia, Czech Rep., Romania, United Kingdom, San Marino, Slovenia, Sweden, Switzerland, Turkey and Ukraine, the frequency band 42-42.5 MHz is allocated to the fixed and mobile services on a primary basis. (WRC-12)

5.162 Additional allocation: in Australia, the band 44-47 MHz is also allocated to the broadcasting service on a primary basis. (WRC-12)

5.162A Additional allocation: in Germany, Austria, Belgium, Bosnia and Herzegovina, China, Vatican, Denmark, Spain, Estonia, the Russian Federation, Finland, France, Ireland, Iceland, Italy, Latvia, The Former Yugoslav Republic of Macedonia, Liechtenstein, Lithuania, Luxembourg, Monaco, Montenegro, Norway, the Netherlands, Poland, Portugal, the Czech Rep., the United Kingdom, Serbia, Slovenia, Sweden and Switzerland the band 46-68 MHz is also allocated to the radiolocation service on a secondary basis. This use is limited to the operation of wind profiler radars in accordance with Resolution 217 (WRC-97). (WRC-12)

5.163 Additional allocation: in Armenia, Belarus, the Russian Federation, Georgia, Hungary, Kazakhstan, Latvia, Moldova, Uzbekistan, Kyrgyzstan, Tajikistan, Turkmenistan and Ukraine, the bands 47-48.5 MHz and 56.5-58 MHz are also allocated to the fixed and land mobile services on a secondary basis. (WRC-12)

5.164 Additional allocation: in Albania, Algeria, Germany, Austria, Belgium, Bosnia and Herzegovina, Botswana, Bulgaria, Côte d'Ivoire, Denmark, Spain, Estonia, Finland, France, Gabon, Greece, Ireland, Israel, Italy, Jordan, Lebanon, Libya, Liechtenstein, Lithuania, Luxembourg, Madagascar, Mali, Malta, Morocco, Mauritania, Monaco, Montenegro, Nigeria, Norway, the Netherlands, Poland, Syrian Arab Republic, Slovakia, Czech Rep., Romania, the United Kingdom, Serbia, Slovenia, Sweden, Switzerland, Swaziland, Chad, Togo, Tunisia and Turkey, the band 47-68 MHz, in South Africa the band 47-50 MHz, and in Latvia the band 48.5-56.5 MHz, are also allocated to the land mobile service on a primary basis. However, stations of the land mobile service in the countries mentioned in connection with each band referred to in this footnote shall not cause harmful interference to, or claim protection from, existing or planned broadcasting stations of countries other than those mentioned in connection with the band. (WRC-12)

5.165 Additional allocation: in Angola, Cameroon, Congo (Rep. of the), Madagascar, Mozambique, Niger, Somalia, Sudan, South Sudan, Tanzania and Chad, the band 47-68 MHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. (WRC-12)

5.166 Alternative allocation: in New Zealand, the band 50-51 MHz is allocated to the fixed and mobile services on a primary basis; the band 53-54 MHz is allocated to the fixed and mobile services on a primary basis. (WRC-12)

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5.169 Alternative allocation: in Botswana, Lesotho, Malawi, Namibia, the Dem. Rep. of the Congo, Rwanda, South Africa, Swaziland, Zambia and Zimbabwe, the band 50-54 MHz is allocated to the amateur service on a primary basis. In Senegal, the band 50-51 MHz is allocated to the amateur service on a primary basis. (WRC-12)

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5.171 Additional allocation: in Botswana, Lesotho, Malawi, Mali, Namibia, Dem. Rep. of the Congo, Rwanda, South Africa, Swaziland, Zambia and Zimbabwe, the band 54-68 MHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. (WRC-12)

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5.178 Additional allocation: in Colombia, Cuba, El Salvador, Guatemala, Guyana, Honduras and Nicaragua, the band 73-74.6 MHz is also allocated to the fixed and mobile services on a secondary basis. (WRC-12)

5.179 Additional allocation: in Armenia, Azerbaijan, Belarus, China, the Russian Federation, Georgia, Kazakhstan, Lithuania, Mongolia, Kyrgyzstan, Tajikistan, Turkmenistan and Ukraine, the bands 74.6-74.8 MHz and 75.2-75.4 MHz are also allocated to the aeronautical radionavigation service, on a primary basis, for ground-based transmitters only. (WRC-12)

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5.197 Additional allocation: in the Syrian Arab Republic, the band 108-111.975 MHz is also allocated to the mobile service on a secondary basis, subject to agreement obtained under No. 9.21. In order to ensure that harmful interference is not caused to stations of the aeronautical radionavigation service, stations of the mobile service shall not be introduced in the band until it is no longer required for the aeronautical radionavigation service by any administration which may be identified in the application of the procedures invoked under No. 9.21. (WRC-12)

5.197A Additional allocation: the band 108-117.975 MHz is also allocated on a primary basis to the aeronautical mobile (R) service, limited to systems operating in accordance with recognized international aeronautical standards. Such use shall be in accordance with Resolution 413 (Rev.WRC-12). The use of the band 108-112 MHz by the aeronautical mobile (R) service shall be limited to systems composed of ground-based transmitters and associated receivers that provide navigational information in support of air navigation functions in accordance with recognized international aeronautical standards. (FCC)

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5.201 Additional allocation: in Angola, Armenia, Azerbaijan, Belarus, Bulgaria, Estonia, the Russian Federation, Georgia, Hungary, Iran (Islamic Republic of), Iraq (Republic of), Japan, Kazakhstan, Latvia, Moldova, Mongolia, Mozambique, Uzbekistan, Papua New Guinea, Poland, Kyrgyzstan, Romania, Tajikistan, Turkmenistan and Ukraine, the band 132-136 MHz is also allocated to the aeronautical mobile (OR) service on a primary basis. In assigning frequencies to stations of the aeronautical mobile (OR) service, the administration shall take account of the frequencies assigned to stations in the aeronautical mobile (R) service. (WRC-12)

5.202 Additional allocation: in Saudi Arabia, Armenia, Azerbaijan, Belarus, Bulgaria, the United Arab Emirates, the Russian Federation, Georgia, Iran (Islamic Republic of), Jordan, Latvia, Oman, Uzbekistan, Poland, the Syrian Arab Republic, Kyrgyzstan, Romania, Tajikistan, Turkmenistan and Ukraine, the band 136-137 MHz is also allocated to the aeronautical mobile (OR) service on a primary basis. In assigning frequencies to stations of the aeronautical mobile (OR) service, the administration shall take account of the frequencies assigned to stations in the aeronautical mobile (R) service. (WRC-12)

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5.211 Additional allocation: in Germany, Saudi Arabia, Austria, Bahrain, Belgium, Denmark, the United Arab Emirates, Spain, Finland, Greece, Ireland, Israel, Kenya, Kuwait, The Former Yugoslav Republic of Macedonia, Lebanon, Liechtenstein, Luxembourg, Mali, Malta, Montenegro, Norway, the Netherlands, Qatar, Slovakia, the United Kingdom, Serbia, Slovenia, Somalia, Sweden, Switzerland, Tanzania, Tunisia and Turkey, the band 138-144 MHz is also allocated to the maritime mobile and land mobile services on a primary basis. (WRC-12)

5.212 Alternative allocation: in Angola, Botswana, Cameroon, the Central African Rep., Congo

(Rep. of the), Gabon, Gambia, Ghana, Guinea, Iraq, Jordan, Lesotho, Liberia, Libya, Malawi, Mozambique, Namibia, Niger, Oman, Uganda, Syrian Arab Republic, the Dem. Rep. of the Congo, Rwanda, Sierra Leone, South Africa, Swaziland, Chad, Togo, Zambia and Zimbabwe, the band 138-144 MHz is allocated to the fixed and mobile services on a primary basis. (WRC-12)

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5.214 Additional allocation: in Eritrea, Ethiopia, Kenya, The Former Yugoslav Republic of Macedonia, Montenegro, Serbia, Somalia, Sudan, South Sudan and Tanzania, the band 138-144 MHz is also allocated to the fixed service on a primary basis. (WRC-12)

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5.221 Stations of the mobile-satellite service in the band 148-149.9 MHz shall not cause harmful interference to, or claim protection from, stations of the fixed or mobile services operating in accordance with the Table of Frequency Allocations in the following countries: Albania, Algeria, Germany, Saudi Arabia, Australia, Austria, Bahrain, Bangladesh, Barbados, Belarus, Belgium, Benin, Bosnia and Herzegovina, Botswana, Brunei Darussalam, Bulgaria, Cameroon, China, Cyprus, Congo (Rep. of the), Korea (Rep. of), Côte d'Ivoire, Croatia, Cuba, Denmark, Djibouti, Egypt, the United Arab Emirates, Eritrea, Spain, Estonia, Ethiopia, the Russian Federation, Finland, France, Gabon, Ghana, Greece, Guinea, Guinea Bissau, Hungary, India, Iran (Islamic Republic of), Ireland, Iceland, Israel, Italy, Jamaica, Japan, Jordan, Kazakhstan, Kenya, Kuwait, The Former Yugoslav Republic of Macedonia, Lesotho, Latvia, Lebanon, Libya, Liechtenstein, Lithuania, Luxembourg, Malaysia, Mali, Malta, Mauritania, Moldova, Mongolia, Montenegro, Mozambique, Namibia, Norway, New Zealand, Oman, Uganda, Uzbekistan, Pakistan, Panama, Papua New Guinea, Paraguay, the Netherlands, the Philippines, Poland, Portugal, Qatar, the Syrian Arab Republic, Kyrgyzstan, Dem. People's Rep. of Korea, Slovakia, Romania, the United Kingdom, Senegal, Serbia, Sierra Leone, Singapore, Slovenia, Sudan, Sri Lanka, South Africa, Sweden, Switzerland, Swaziland, Tanzania, Chad, Thailand, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkey, Ukraine, Viet Nam, Yemen, Zambia and Zimbabwe. (WRC-12)

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5.225A Additional allocation: in Algeria, Armenia, Azerbaijan, Belarus, China, the Russian Federation, France, Iran (Islamic Republic of), Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, Turkmenistan, Ukraine and Viet Nam, the frequency band 154-156 MHz is also allocated to the radiolocation service on a primary basis. The usage of the frequency band 154-156 MHz by the radiolocation service shall be limited to space-object detection systems operating from terrestrial locations. The operation of stations in the radiolocation service in the frequency band 154-156 MHz shall be subject to agreement obtained under No. 9.21. For the identification of potentially affected administrations in Region 1, the instantaneous field-strength value of 12 dB( $\mu$ V/m) for 10% of the time produced at 10 m above ground level in the 25 kHz reference frequency band at the border of the territory of any other administration shall be used. For the identification of potentially affected administrations in Region 3, the interference-to-noise ratio ( $I/N$ ) value of  $-6$  dB ( $N = -161$  dBW/4 kHz), or  $-10$  dB for applications with greater protection requirements, such as public protection and disaster relief (PPDR ( $N = -161$  dBW/4 kHz)), for 1% of the time produced at 60 m above ground level at the border of the territory of any other administration shall be used. In the frequency bands 156.7625-156.8375 MHz, 156.5125-156.5375 MHz, 161.9625-161.9875 MHz, 162.0125-162.0375 MHz, out-of-band e.i.r.p. of space surveillance radars shall not exceed  $-16$  dBW. Frequency assignments to the radiolocation service under this allocation in Ukraine shall not be used without the agreement of Moldova. (WRC-12)

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5.228 The use of the frequency bands 156.7625-156.7875 MHz and 156.8125-156.8375 MHz by the mobile-satellite service (Earth-to-space) is limited to the reception of automatic identification system (AIS) emissions of long-range AIS broadcast messages (Message 27, see the most recent version of Recommendation ITU-R M.1371). With the exception of AIS emissions, emissions in these frequency bands by systems operating in the maritime mobile service for communications shall not exceed 1 W.

(WRC-12)

5.228A The frequency bands 161.9625-161.9875 MHz and 162.0125-162.0375 MHz may be used by aircraft stations for the purpose of search and rescue operations and other safety-related communications. (WRC-12)

5.228B The use of the frequency bands 161.9625-161.9875 MHz and 162.0125-162.0375 MHz by the fixed and land mobile services shall not cause harmful interference to, or claim protection from, the maritime mobile service. (WRC-12)

5.228C The use of the frequency bands 161.9625-161.9875 MHz and 162.0125-162.0375 MHz by the maritime mobile service and the mobile-satellite (Earth-to-space) service is limited to the automatic identification system (AIS). The use of these frequency bands by the aeronautical mobile (OR) service is limited to AIS emissions from search and rescue aircraft operations. The AIS operations in these frequency bands shall not constrain the development and use of the fixed and mobile services operating in the adjacent frequency bands. (WRC-12)

5.228D The frequency bands 161.9625-161.9875 MHz (AIS 1) and 162.0125-162.0375 MHz (AIS 2) may continue to be used by the fixed and mobile services on a primary basis until 1 January 2025, at which time this allocation shall no longer be valid. Administrations are encouraged to make all practicable efforts to discontinue the use of these bands by the fixed and mobile services prior to the transition date. During this transition period, the maritime mobile service in these frequency bands has priority over the fixed, land mobile and aeronautical mobile services. (WRC-12)

5.228E The use of the automatic identification system in the frequency bands 161.9625-161.9875 MHz and 162.0125-162.0375 MHz by the aeronautical mobile (OR) service is limited to aircraft stations for the purpose of search and rescue operations and other safety-related communications. (WRC-12)

5.228F The use of the frequency bands 161.9625-161.9875 MHz and 162.0125-162.0375 MHz by the mobile-satellite service (Earth-to-space) is limited to the reception of automatic identification system emissions from stations operating in the maritime mobile service. (WRC-12)

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5.231 Additional allocation: in Afghanistan and China, the band 167-174 MHz is also allocated to the broadcasting service on a primary basis. The introduction of the broadcasting service into this band shall be subject to agreement with the neighbouring countries in Region 3 whose services are likely to be affected. (WRC-12)

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5.237 Additional allocation: in Congo (Rep. of the), Egypt, Eritrea, Ethiopia, Gambia, Guinea, Libya, Mali, Sierra Leone, Somalia and Chad, the band 174-223 MHz is also allocated to the fixed and mobile services on a secondary basis. (WRC-12)

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5.259 Additional allocation: in Egypt and the Syrian Arab Republic, the band 328.6-335.4 MHz is also allocated to the mobile service on a secondary basis, subject to agreement obtained under No. 9.21. In order to ensure that harmful interference is not caused to stations of the aeronautical radionavigation service, stations of the mobile service shall not be introduced in the band until it is no longer required for the aeronautical radionavigation service by any administration which may be identified in the application of the procedure invoked under No. 9.21. (WRC-12)

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5.262 Additional allocation: in Saudi Arabia, Armenia, Azerbaijan, Bahrain, Belarus, Botswana, Colombia, Cuba, Egypt, the United Arab Emirates, Ecuador, the Russian Federation, Georgia, Hungary, Iran (Islamic Republic of), Iraq, Israel, Jordan, Kazakhstan, Kuwait, Liberia, Malaysia, Moldova, Oman, Uzbekistan, Pakistan, the Philippines, Qatar, the Syrian Arab Republic, Kyrgyzstan, Singapore, Somalia,

Tajikistan, Chad, Turkmenistan and Ukraine, the band 400.05-401 MHz is also allocated to the fixed and mobile services on a primary basis. (WRC-12)

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5.274 Alternative allocation: in Denmark, Norway, Sweden and Chad, the bands 430-432 MHz and 438-440 MHz are allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. (WRC-12)

5.275 Additional allocation: in Croatia, Estonia, Finland, Libya, The Former Yugoslav Republic of Macedonia, Montenegro, Serbia and Slovenia, the bands 430-432 MHz and 438-440 MHz are also allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. (WRC-07)

5.276 Additional allocation: in Afghanistan, Algeria, Saudi Arabia, Bahrain, Bangladesh, Brunei Darussalam, Burkina Faso, Djibouti, Egypt, the United Arab Emirates, Ecuador, Eritrea, Ethiopia, Greece, Guinea, India, Indonesia, Iran (Islamic Republic of), Iraq, Israel, Italy, Jordan, Kenya, Kuwait, Libya, Malaysia, Niger, Nigeria, Oman, Pakistan, the Philippines, Qatar, the Syrian Arab Republic, the Dem. People's Rep. of Korea, Singapore, Somalia, Sudan, Switzerland, Tanzania, Thailand, Togo, Turkey and Yemen, the band 430-440 MHz is also allocated to the fixed service on a primary basis and the bands 430-435 MHz and 438-440 MHz are also allocated to the mobile, except aeronautical mobile, service on a primary basis. (WRC-12)

5.277 Additional allocation: in Angola, Armenia, Azerbaijan, Belarus, Cameroon, Congo (Rep. of the), Djibouti, the Russian Federation, Georgia, Hungary, Israel, Kazakhstan, Mali, Mongolia, Uzbekistan, Poland, the Dem. Rep. of the Congo, Kyrgyzstan, Slovakia, Romania, Rwanda, Tajikistan, Chad, Turkmenistan and Ukraine, the band 430-440 MHz is also allocated to the fixed service on a primary basis. (WRC-12)

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5.286AA The band 450-470 MHz is identified for use by administrations wishing to implement International Mobile Telecommunications (IMT). See Resolution 224 (Rev.WRC-12). This identification does not preclude the use of this band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. (FCC)

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5.288 In the territorial waters of the United States and the Philippines, the preferred frequencies for use by on-board communication stations shall be 457.525 MHz, 457.550 MHz, 457.575 MHz and 457.600 MHz paired, respectively, with 467.750 MHz, 467.775 MHz, 467.800 MHz and 467.825 MHz. The characteristics of the equipment used shall conform to those specified in Recommendation ITU-R M.1174-2. (WRC-03)

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5.290 Different category of service: in Afghanistan, Azerbaijan, Belarus, China, the Russian Federation, Japan, Kyrgyzstan, Tajikistan and Turkmenistan, the allocation of the band 460-470 MHz to the meteorological-satellite service (space-to-Earth) is on a primary basis (see No. 5.33), subject to agreement obtained under No. 9.21. (WRC-12)

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5.293 Different category of service: in Canada, Chile, Cuba, the United States, Guyana, Honduras, Jamaica, Mexico, Panama and Peru, the allocation of the bands 470-512 MHz and 614-806 MHz to the fixed service is on a primary basis (see No. 5.33), subject to agreement obtained under No. 9.21. In Canada, Chile, Cuba, the United States, Guyana, Honduras, Jamaica, Mexico, Panama and Peru, the allocation of the bands 470-512 MHz and 614-698 MHz to the mobile service is on a primary basis (see No. 5.33), subject to agreement obtained under No. 9.21. In Argentina and Ecuador, the allocation of the band 470-512 MHz to the fixed and mobile services is on a primary basis (see No. 5.33), subject to

agreement obtained under No. 9.21. (WRC-12)

5.294 Additional allocation: in Saudi Arabia, Cameroon, Côte d'Ivoire, Egypt, Ethiopia, Israel, Kenya, Libya, the Syrian Arab Republic, South Sudan, Chad and Yemen, the band 470-582 MHz is also allocated to the fixed service on a secondary basis. (WRC-12)

5.296 Additional allocation: in Albania, Germany, Saudi Arabia, Austria, Bahrain, Belgium, Benin, Bosnia and Herzegovina, Burkina Faso, Cameroon, Congo (Rep. of the), Côte d'Ivoire, Croatia, Denmark, Djibouti, Egypt, United Arab Emirates, Spain, Estonia, Finland, France, Gabon, Ghana, Iraq, Ireland, Iceland, Israel, Italy, Jordan, Kuwait, Latvia, The Former Yugoslav Republic of Macedonia, Libya, Liechtenstein, Lithuania, Luxembourg, Mali, Malta, Morocco, Moldova, Monaco, Niger, Norway, Oman, the Netherlands, Poland, Portugal, Qatar, the Syrian Arab Republic, Slovakia, the Czech Republic, the United Kingdom, Sudan, Sweden, Switzerland, Swaziland, Chad, Togo, Tunisia and Turkey, the band 470-790 MHz, and in Angola, Botswana, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Nigeria, South Africa, Tanzania, Zambia and Zimbabwe, the band 470-698 MHz are also allocated on a secondary basis to the land mobile service, intended for applications ancillary to broadcasting. Stations of the land mobile service in the countries listed in this footnote shall not cause harmful interference to existing or planned stations operating in accordance with the Table in countries other than those listed in this footnote. (WRC-12)

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5.300 Additional allocation: in Saudi Arabia, Cameroon, Egypt, United Arab Emirates, Israel, Jordan, Libya, Oman, Qatar, the Syrian Arab Republic, Sudan and South Sudan, the band 582-790 MHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a secondary basis. (WRC-12)

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5.312 Additional allocation: in Armenia, Azerbaijan, Belarus, the Russian Federation, Georgia, Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, Turkmenistan and Ukraine, the band 645-862 MHz, in Bulgaria the bands 646-686 MHz, 726-758 MHz, 766-814 MHz and 822-862 MHz, in Romania the band 830-862 MHz, and in Poland, the band 830-860 MHz until 31 December 2012 and the band 860-862 MHz until 31 December 2017, are also allocated to the aeronautical radionavigation service on a primary basis. (WRC-12)

5.312A In Region 1, the use of the band 694-790 MHz by the mobile, except aeronautical mobile, service is subject to the provisions of Resolution 232 (WRC-12). See also Resolution 224 (Rev.WRC-12). (WRC-12)

5.313A The band, or portions of the band 698-790 MHz, in Bangladesh, China, Korea (Rep. of), India, Japan, New Zealand, Pakistan, Papua New Guinea, Philippines and Singapore are identified for use by these administrations wishing to implement International Mobile Telecommunications (IMT). This identification does not preclude the use of these bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. In China, the use of IMT in this band will not start until 2015. (WRC-12)

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5.314 Additional allocation: in Austria, Italy, Moldova, Uzbekistan, Kyrgyzstan and the United Kingdom, the band 790-862 MHz is also allocated to the land mobile service on a secondary basis. (WRC-12)

5.315 Alternative allocation: in Greece, the band 790-838 MHz is allocated to the broadcasting service on a primary basis. (WRC-12)

5.316 Additional allocation: in Germany, Saudi Arabia, Bosnia and Herzegovina, Burkina Faso, Cameroon, Côte d'Ivoire, Croatia, Denmark, Egypt, Finland, Greece, Israel, Jordan, Kenya, Libya, The Former Yugoslav Republic of Macedonia, Liechtenstein, Mali, Monaco, Montenegro, Norway, the

Netherlands, Portugal, the United Kingdom, the Syrian Arab Republic, Serbia, Sweden and Switzerland, the band 790-830 MHz, and in these same countries and in Spain, France, Gabon and Malta, the band 830-862 MHz, are also allocated to the mobile, except aeronautical mobile, service on a primary basis. However, stations of the mobile service in the countries mentioned in connection with each band referred to in this footnote shall not cause harmful interference to, or claim protection from, stations of services operating in accordance with the Table in countries other than those mentioned in connection with the band. This allocation is effective until 16 June 2015. (WRC-07)

5.316A Additional allocation: in Spain, France, Gabon and Malta, the band 790-830 MHz, in Albania, Angola, Bahrain, Benin, Botswana, Burundi, Congo (Rep. of the), Egypt, United Arab Emirates, Estonia, Gambia, Ghana, Guinea, Guinea-Bissau, Hungary, Iraq, Kuwait, Lesotho, Latvia, Lebanon, Lithuania, Luxembourg, Malawi, Morocco, Mauritania, Mozambique, Namibia, Niger, Nigeria, Oman, Uganda, Poland, Qatar, Slovakia, Czech Rep., Romania, Rwanda, Senegal, Sudan, South Sudan, South Africa, Swaziland, Tanzania, Chad, Togo, Yemen, Zambia, Zimbabwe and French overseas departments and communities of Region 1, the band 790-862 MHz and in Georgia, the band 806-862 MHz are also allocated to the mobile, except aeronautical mobile, service on a primary basis subject to the agreement by the administrations concerned obtained under No. 9.21 and under the GE06 Agreement, as appropriate, including those administrations mentioned in No. 5.312 where appropriate. See Resolutions 224 (Rev.WRC-12) and 749 (Rev.WRC-12). This allocation is effective until 16 June 2015. (WRC-12)

5.316B In Region 1, the allocation to the mobile, except aeronautical mobile, service on a primary basis in the frequency band 790-862 MHz shall come into effect from 17 June 2015 and shall be subject to agreement obtained under No. 9.21 with respect to the aeronautical radionavigation service in countries mentioned in No. 5.312. For countries party to the GE06 Agreement, the use of stations of the mobile service is also subject to the successful application of the procedures of that Agreement. Resolutions 224 (Rev.WRC-12) and 749 (Rev.WRC-12) shall apply, as appropriate. (WRC-12)

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5.317A Those parts of the band 698-960 MHz in Region 2 and the band 790-960 MHz in Regions 1 and 3 which are allocated to the mobile service on a primary basis are identified for use by administrations wishing to implement International Mobile Telecommunications (IMT) – see Resolutions 224 (Rev.WRC-12) and 749 (Rev.WRC-12), as appropriate. This identification does not preclude the use of these bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. (WRC-12)

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5.322 In Region 1, in the band 862-960 MHz, stations of the broadcasting service shall be operated only in the African Broadcasting Area (see Nos. 5.10 to 5.13) excluding Algeria, Burundi, Egypt, Spain, Lesotho, Libya, Morocco, Malawi, Namibia, Nigeria, South Africa, Tanzania, Zimbabwe and Zambia, subject to agreement obtained under No. 9.21. (WRC-12)

5.323 Additional allocation: in Armenia, Azerbaijan, Belarus, the Russian Federation, Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, Turkmenistan and Ukraine, the band 862-960 MHz, in Bulgaria the bands 862-890.2 MHz and 900-935.2 MHz, in Poland the band 862-876 MHz until 31 December 2017, and in Romania the bands 862-880 MHz and 915-925 MHz, are also allocated to the aeronautical radionavigation service on a primary basis. Such use is subject to agreement obtained under No. 9.21 with administrations concerned and limited to ground-based radiobeacons in operation on 27 October 1997 until the end of their lifetime. (WRC-12)

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5.327A The use of the frequency band 960-1164 MHz by the aeronautical mobile (R) service is limited to systems that operate in accordance with recognized international aeronautical standards. Such use shall be in accordance with Resolution 417 (Rev.WRC-12). (WRC-12)

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5.330 Additional allocation: in Angola, Saudi Arabia, Bahrain, Bangladesh, Cameroon, China, Djibouti, Egypt, the United Arab Emirates, Eritrea, Ethiopia, Guyana, India, Indonesia, Iran (Islamic Republic of), Iraq, Israel, Japan, Jordan, Kuwait, Nepal, Oman, Pakistan, the Philippines, Qatar, the Syrian Arab Republic, Somalia, Sudan, South Sudan, Chad, Togo and Yemen, the band 1215-1300 MHz is also allocated to the fixed and mobile services on a primary basis. (WRC-12)

5.331 Additional allocation: in Algeria, Germany, Saudi Arabia, Australia, Austria, Bahrain, Belarus, Belgium, Benin, Bosnia and Herzegovina, Brazil, Burkina Faso, Burundi, Cameroon, China, Korea (Rep. of), Croatia, Denmark, Egypt, the United Arab Emirates, Estonia, the Russian Federation, Finland, France, Ghana, Greece, Guinea, Equatorial Guinea, Hungary, India, Indonesia, Iran (Islamic Republic of), Iraq, Ireland, Israel, Jordan, Kenya, Kuwait, The Former Yugoslav Republic of Macedonia, Lesotho, Latvia, Lebanon, Liechtenstein, Lithuania, Luxembourg, Madagascar, Mali, Mauritania, Montenegro, Nigeria, Norway, Oman, Pakistan, the Netherlands, Poland, Portugal, Qatar, the Syrian Arab Republic, Dem. People's Rep. of Korea, Slovakia, the United Kingdom, Serbia, Slovenia, Somalia, Sudan, South Sudan, Sri Lanka, South Africa, Sweden, Switzerland, Thailand, Togo, Turkey, Venezuela and Viet Nam, the band 1215-1300 MHz is also allocated to the radionavigation service on a primary basis. In Canada and the United States, the band 1240-1300 MHz is also allocated to the radionavigation service, and use of the radionavigation service shall be limited to the aeronautical radionavigation service. (WRC-12)

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5.335 In Canada and the United States in the band 1240-1300 MHz, active spaceborne sensors in the Earth exploration-satellite and space research services shall not cause interference to, claim protection from, or otherwise impose constraints on operation or development of the aeronautical radionavigation service.

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5.338 In Kyrgyzstan, Slovakia and Turkmenistan, existing installations of the radionavigation service may continue to operate in the band 1350-1400 MHz. (WRC-12)

5.338A In the bands 1350-1400 MHz, 1427-1452 MHz, 22.55-23.55 GHz, 30-31.3 GHz, 49.7-50.2 GHz, 50.4-50.9 GHz, 51.4-52.6 GHz, 81-86 GHz and 92-94 GHz, Resolution 750 (Rev.WRC-12) applies. (WRC-12)

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5.342 Additional allocation: in Armenia, Azerbaijan, Belarus, the Russian Federation, Uzbekistan, Kyrgyzstan and Ukraine, the band 1429-1535 MHz, and in Bulgaria the band 1525-1535 MHz, are also allocated to the aeronautical mobile service on a primary basis exclusively for the purposes of aeronautical telemetry within the national territory. As of 1 April 2007, the use of the band 1452-1492 MHz is subject to agreement between the administrations concerned. (WRC-12)

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5.351A For the use of the bands 1518-1544 MHz, 1545-1559 MHz, 1610-1645.5 MHz, 1646.5-1660.5 MHz, 1668-1675 MHz, 1980-2010 MHz, 2170-2200 MHz, 2483.5-2520 MHz and 2670-2690 MHz by the mobile-satellite service, see Resolutions 212 (Rev.WRC-07) and 225 (Rev.WRC-12). (FCC)

5.352A In the band 1525-1530 MHz, stations in the mobile-satellite service, except stations in the maritime mobile-satellite service, shall not cause harmful interference to, or claim protection from, stations of the fixed service in Algeria, Saudi Arabia, Egypt, France and French overseas communities of Region 3, Guinea, India, Israel, Italy, Jordan, Kuwait, Mali, Morocco, Mauritania, Nigeria, Oman, Pakistan, the Philippines, Qatar, Syrian Arab Republic, Tanzania, Viet Nam and Yemen notified prior to 1 April 1998. (WRC-12)

5.353A In applying the procedures of Section II of Article 9 to the mobile-satellite service in the

bands 1530-1544 MHz and 1626.5-1645.5 MHz, priority shall be given to accommodating the spectrum requirements for distress, urgency and safety communications of the Global Maritime Distress and Safety System (GMDSS). Maritime mobile-satellite distress, urgency and safety communications shall have priority access and immediate availability over all other mobile satellite communications operating within a network. Mobile-satellite systems shall not cause unacceptable interference to, or claim protection from, distress, urgency and safety communications of the GMDSS. Account shall be taken of the priority of safety-related communications in the other mobile-satellite services. (The provisions of Resolution 222 (Rev.WRC-12) shall apply.) (FCC)

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5.355 Additional allocation: in Bahrain, Bangladesh, Congo (Rep. of the), Djibouti, Egypt, Eritrea, Iraq, Israel, Kuwait, Qatar, Syrian Arab Republic, Somalia, Sudan, South Sudan, Chad, Togo and Yemen, the bands 1540-1559 MHz, 1610-1645.5 MHz and 1646.5-1660 MHz are also allocated to the fixed service on a secondary basis. (WRC-12)

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5.357A In applying the procedures of Section II of Article 9 to the mobile-satellite service in the frequency bands 1545-1555 MHz and 1646.5-1656.5 MHz, priority shall be given to accommodating the spectrum requirements of the aeronautical mobile-satellite (R) service providing transmission of messages with priority 1 to 6 in Article 44. Aeronautical mobile-satellite (R) service communications with priority 1 to 6 in Article 44 shall have priority access and immediate availability, by pre-emption if necessary, over all other mobile-satellite communications operating within a network. Mobile-satellite systems shall not cause unacceptable interference to, or claim protection from, aeronautical mobile-satellite (R) service communications with priority 1 to 6 in Article 44. Account shall be taken of the priority of safety-related communications in the other mobile-satellite services. (The provisions of Resolution 222 (Rev.WRC-12) shall apply.) (WRC-12)

5.359 Additional allocation: in Germany, Saudi Arabia, Armenia, Austria, Azerbaijan, Belarus, Benin, Cameroon, the Russian Federation, France, Georgia, Greece, Guinea, Guinea-Bissau, Jordan, Kazakhstan, Kuwait, Lithuania, Mauritania, Uganda, Uzbekistan, Pakistan, Poland, the Syrian Arab Republic, Kyrgyzstan, the Dem. People's Rep. of Korea, Romania, Tajikistan, Tanzania, Tunisia, Turkmenistan and Ukraine, the bands 1550-1559 MHz, 1610-1645.5 MHz and 1646.5-1660 MHz are also allocated to the fixed service on a primary basis. Administrations are urged to make all practicable efforts to avoid the implementation of new fixed-service stations in these bands. (WRC-12)

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5.362B Additional allocation: The band 1559-1610 MHz is also allocated to the fixed service on a secondary basis in Algeria, Saudi Arabia, Armenia, Azerbaijan, Belarus, Benin, Cameroon, Russian Federation, Gabon, Georgia, Guinea, Guinea-Bissau, Jordan, Kazakhstan, Libya, Lithuania, Mali, Mauritania, Nigeria, Uzbekistan, Pakistan, Poland, the Syrian Arab Republic, Kyrgyzstan, Dem. People's Rep. of Korea, Romania, Senegal, Tajikistan, Tanzania, Tunisia, Turkmenistan and Ukraine until 1 January 2015, at which time this allocation shall no longer be valid. Administrations are urged to take all practicable steps to protect the radionavigation-satellite service and the aeronautical radionavigation service and not authorize new frequency assignments to fixed-service systems in this band. (WRC-12)

5.362C Additional allocation: in Congo (Rep. of the), Eritrea, Iraq, Israel, Jordan, Qatar, the Syrian Arab Republic, Somalia, Sudan, South Sudan, Chad, Togo and Yemen, the band 1559-1610 MHz is also allocated to the fixed service on a secondary basis until 1 January 2015, at which time this allocation shall no longer be valid. Administrations are urged to take all practicable steps to protect the radionavigation-satellite service and not authorize new frequency assignments to fixed-service systems in this band. (WRC-12)

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5.367 Additional allocation: The frequency band 1610-1626.5 MHz is also allocated to the aeronautical mobile-satellite (R) service on a primary basis, subject to agreement obtained under No. 9.21. (WRC-12)

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5.369 Different category of service: in Angola, Australia, China, Eritrea, Ethiopia, India, Iran (Islamic Republic of), Israel, Lebanon, Liberia, Madagascar, Mali, Pakistan, Papua New Guinea, Syrian Arab Republic, the Dem. Rep. of the Congo, Sudan, South Sudan, Togo and Zambia, the allocation of the band 1610-1626.5 MHz to the radiodetermination-satellite service (Earth-to-space) is on a primary basis (see No. 5.33), subject to agreement obtained under No. 9.21 from countries not listed in this provision. (WRC-12)

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5.371 Additional allocation: in Region 1, the band 1610-1626.5 MHz (Earth-to-space) is also allocated to the radiodetermination-satellite service on a secondary basis, subject to agreement obtained under No. 9.21. (WRC-12)

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5.381 Additional allocation: in Afghanistan, Cuba, India, Iran (Islamic Republic of) and Pakistan, the band 1690-1700 MHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. (WRC-12)

5.382 Different category of service: in Saudi Arabia, Armenia, Azerbaijan, Bahrain, Belarus, Congo (Rep. of the), Egypt, the United Arab Emirates, Eritrea, Ethiopia, the Russian Federation, Guinea, Iraq, Israel, Jordan, Kazakhstan, Kuwait, the Former Yugoslav Republic of Macedonia, Lebanon, Mauritania, Moldova, Mongolia, Oman, Uzbekistan, Poland, Qatar, the Syrian Arab Republic, Kyrgyzstan, Somalia, Tajikistan, Tanzania, Turkmenistan, Ukraine and Yemen, the allocation of the band 1690-1700 MHz to the fixed and mobile, except aeronautical mobile, services is on a primary basis (see No. 5.33), and in the Dem. People's Rep. of Korea, the allocation of the band 1690-1700 MHz to the fixed service is on a primary basis (see No. 5.33) and to the mobile, except aeronautical mobile, service on a secondary basis. (WRC-12)

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5.384A The bands, or portions of the bands, 1710-1885 MHz, 2300-2400 MHz and 2500-2690 MHz, are identified for use by administrations wishing to implement International Mobile Telecommunications (IMT) in accordance with Resolution 223 (Rev.WRC-12). This identification does not preclude the use of these bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. (FCC)

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5.387 Additional allocation: in Belarus, Georgia, Kazakhstan, Kyrgyzstan, Romania, Tajikistan and Turkmenistan, the band 1770-1790 MHz is also allocated to the meteorological-satellite service on a primary basis, subject to agreement obtained under No. 9.21. (WRC-12)

5.388 The bands 1885-2025 MHz and 2110-2200 MHz are intended for use, on a worldwide basis, by administrations wishing to implement International Mobile Telecommunications (IMT). Such use does not preclude the use of these bands by other services to which they are allocated. The bands should be made available for IMT in accordance with Resolution 212 (Rev.WRC-07). (See also Resolution 223 (Rev.WRC-12).) (WRC-12) (FCC)

5.388A In Regions 1 and 3, the bands 1885-1980 MHz, 2010-2025 MHz and 2110-2170 MHz and, in Region 2, the bands 1885-1980 MHz and 2110-2160 MHz may be used by high altitude platform stations as base stations to provide International Mobile Telecommunications (IMT), in accordance with Resolution 221 (Rev.WRC-07). Their use by IMT applications using high altitude platform stations as base stations does not preclude the use of these bands by any station in the services to which they are

allocated and does not establish priority in the Radio Regulations. (WRC-12)

5.388B In Algeria, Saudi Arabia, Bahrain, Benin, Burkina Faso, Cameroon, Comoros, Côte d'Ivoire, China, Cuba, Djibouti, Egypt, United Arab Emirates, Eritrea, Ethiopia, Gabon, Ghana, India, Iran (Islamic Republic of), Israel, Jordan, Kenya, Kuwait, Libya, Mali, Morocco, Mauritania, Nigeria, Oman, Uganda, Pakistan, Qatar, the Syrian Arab Republic, Senegal, Singapore, Sudan, South Sudan, Tanzania, Chad, Togo, Tunisia, Yemen, Zambia and Zimbabwe, for the purpose of protecting fixed and mobile services, including IMT mobile stations, in their territories from co-channel interference, a high altitude platform station (HAPS) operating as an IMT base station in neighbouring countries, in the bands referred to in No. 5.388A, shall not exceed a co-channel power flux-density of  $-127$  dB(W/(m<sup>2</sup> · MHz)) at the Earth's surface outside a country's borders unless explicit agreement of the affected administration is provided at the time of the notification of HAPS. (WRC-12)

5.389A The use of the bands 1980-2010 MHz and 2170-2200 MHz by the mobile-satellite service is subject to coordination under No. 9.11A and to the provisions of Resolution 716 (Rev.WRC-12). (FCC)

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5.389C The use of the bands 2010-2025 MHz and 2160-2170 MHz in Region 2 by the mobile-satellite service is subject to coordination under No. 9.11A and to the provisions of Resolution 716 (Rev.WRC-12). (FCC)

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5.398A Different category of service: In Armenia, Azerbaijan, Belarus, the Russian Federation, Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan and Ukraine, the band 2483.5-2500 MHz is allocated on a primary basis to the radiolocation service. The radiolocation stations in these countries shall not cause harmful interference to, or claim protection from, stations of the fixed, mobile and mobile-satellite services operating in accordance with the Radio Regulations in the frequency band 2483.5-2500 MHz. (WRC-12)

5.399 Except for cases referred to in No. 5.401, stations of the radiodetermination-satellite service operating in the frequency band 2483.5-2500 MHz for which notification information is received by the Bureau after 17 February 2012, and the service area of which includes Armenia, Azerbaijan, Belarus, the Russian Federation, Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan and Ukraine, shall not cause harmful interference to, and shall not claim protection from stations of the radiolocation service operating in these countries in accordance with No. 5.398A. (WRC-12)

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5.401 In Angola, Australia, Bangladesh, Burundi, China, Eritrea, Ethiopia, India, Iran (Islamic Republic of), Lebanon, Liberia, Libya, Madagascar, Mali, Pakistan, Papua New Guinea, Syrian Arab Republic, Dem. Rep. of the Congo, Sudan, Swaziland, Togo and Zambia, the band 2483.5-2500 MHz was already allocated on a primary basis to the radiodetermination-satellite service before WRC-12, subject to agreement obtained under No. 9.21 from countries not listed in this provision. Systems in the radiodetermination-satellite service for which complete coordination information has been received by the Radiocommunication Bureau before 18 February 2012 will retain their regulatory status, as of the date of receipt of the coordination request information. (WRC-12)

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5.410 The band 2500-2690 MHz may be used for tropospheric scatter systems in Region 1, subject to agreement obtained under No. 9.21. No. 9.21 does not apply to tropospheric scatter links situated entirely outside Region 1. Administrations shall make all practicable efforts to avoid developing new tropospheric scatter systems in this band. When planning new tropospheric scatter radio-relay links in this band, all possible measures shall be taken to avoid directing the antennas of these links towards the geostationary-satellite orbit. (WRC-12)

5.412 Alternative allocation: in Kyrgyzstan and Turkmenistan, the band 2500-2690 MHz is allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. (WRC-12)

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5.418 Additional allocation: in Korea (Rep. of), India, Japan and Thailand, the band 2535-2655 MHz is also allocated to the broadcasting-satellite service (sound) and complementary terrestrial broadcasting service on a primary basis. Such use is limited to digital audio broadcasting and is subject to the provisions of Resolution 528 (Rev.WRC-03). The provisions of No. 5.416 and Table 21-4 of Article 21, do not apply to this additional allocation. Use of non-geostationary-satellite systems in the broadcasting-satellite service (sound) is subject to Resolution 539 (Rev.WRC-03). Geostationary broadcasting-satellite service (sound) systems for which complete Appendix 4 coordination information has been received after 1 June 2005 are limited to systems intended for national coverage. The power flux-density at the Earth's surface produced by emissions from a geostationary broadcasting-satellite service (sound) space station operating in the band 2630-2655 MHz, and for which complete Appendix 4 coordination information has been received after 1 June 2005, shall not exceed the following limits, for all conditions and for all methods of modulation:

–130 dB(W/(m<sup>2</sup> · MHz)) for 0° ≤ θ ≤ 5°

–130 + 0.4 (θ - 5) dB(W/(m<sup>2</sup> · MHz))

for 5° < θ ≤ 25°

–122 dB(W/(m<sup>2</sup> · MHz)) for 25° < θ ≤ 90°

where θ is the angle of arrival of the incident wave above the horizontal plane, in degrees. These limits may be exceeded on the territory of any country whose administration has so agreed. As an exception to the limits above, the pfd value of –122 dB(W/(m<sup>2</sup> · MHz)) shall be used as a threshold for coordination under No. 9.11 in an area of 1500 km around the territory of the administration notifying the broadcasting-satellite service (sound) system.

In addition, an administration listed in this provision shall not have simultaneously two overlapping frequency assignments, one under this provision and the other under No. 5.416 for systems for which complete Appendix 4 coordination information has been received after 1 June 2005. (WRC-12)

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5.422 Additional allocation: in Saudi Arabia, Armenia, Azerbaijan, Bahrain, Belarus, Brunei Darussalam, Congo (Rep. of the), Côte d'Ivoire, Cuba, Djibouti, Egypt, the United Arab Emirates, Eritrea, Ethiopia, Gabon, Georgia, Guinea, Guinea-Bissau, Iran (Islamic Republic of), Iraq, Israel, Jordan, Kuwait, Lebanon, Mauritania, Mongolia, Montenegro, Nigeria, Oman, Pakistan, the Philippines, Qatar, Syrian Arab Republic, Kyrgyzstan, the Dem. Rep. of the Congo, Romania, Somalia, Tajikistan, Tunisia, Turkmenistan, Ukraine and Yemen, the band 2690-2700 MHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. Such use is limited to equipment in operation by 1 January 1985. (WRC-12)

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5.428 Additional allocation: in Azerbaijan, Mongolia, Kyrgyzstan and Turkmenistan, the band 3100-3300 MHz is also allocated to the radionavigation service on a primary basis. (WRC-12)

5.429 Additional allocation: in Saudi Arabia, Bahrain, Bangladesh, Brunei Darussalam, Cameroon, China, Congo (Rep. of the), Korea (Rep. of), Côte d'Ivoire, Egypt, the United Arab Emirates, India, Indonesia, Iran (Islamic Republic of), Iraq, Israel, Japan, Jordan, Kenya, Kuwait, Lebanon, Libya, Malaysia, Oman, Uganda, Pakistan, Qatar, the Syrian Arab Republic, the Dem. Rep. of the Congo, the Dem. People's Rep. of Korea and Yemen, the band 3300-3400 MHz is also allocated to the fixed and mobile services on a primary basis. The countries bordering the Mediterranean shall not claim protection for their fixed and mobile services from the radiolocation service. (WRC-12)

5.430 Additional allocation: in Azerbaijan, Mongolia, Kyrgyzstan and Turkmenistan, the band 3300-3400 MHz is also allocated to the radionavigation service on a primary basis. (WRC-12)

5.430A Different category of service: in Albania, Algeria, Germany, Andorra, Saudi Arabia, Austria, Azerbaijan, Bahrain, Belgium, Benin, Bosnia and Herzegovina, Botswana, Bulgaria, Burkina Faso, Cameroon, Cyprus, Vatican, Congo (Rep. of the), Côte d'Ivoire, Croatia, Denmark, Egypt, Spain, Estonia, Finland, France and French overseas departments and communities in Region 1, Gabon, Georgia, Greece, Guinea, Hungary, Ireland, Iceland, Israel, Italy, Jordan, Kuwait, Lesotho, Latvia, The Former Yugoslav Republic of Macedonia, Liechtenstein, Lithuania, Malawi, Mali, Malta, Morocco, Mauritania, Moldova, Monaco, Mongolia, Montenegro, Mozambique, Namibia, Niger, Norway, Oman, Netherlands, Poland, Portugal, Qatar, the Syrian Arab Republic, the Dem. Rep. of the Congo, Slovakia, Czech Rep., Romania, United Kingdom, San Marino, Senegal, Serbia, Sierra Leone, Slovenia, South Africa, Sweden, Switzerland, Swaziland, Chad, Togo, Tunisia, Turkey, Ukraine, Zambia and Zimbabwe, the band 3400-3600 MHz is allocated to the mobile, except aeronautical mobile, service on a primary basis subject to agreement obtained under No. 9.21 with other administrations and is identified for International Mobile Telecommunications (IMT). This identification does not preclude the use of this band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. At the stage of coordination the provisions of Nos. 9.17 and 9.18 also apply. Before an administration brings into use a (base or mobile) station of the mobile service in this band, it shall ensure that the power flux-density (pfd) produced at 3 m above ground does not exceed  $-154.5 \text{ dB(W/(m}^2 \cdot 4 \text{ kHz))}$  for more than 20% of time at the border of the territory of any other administration. This limit may be exceeded on the territory of any country whose administration has so agreed. In order to ensure that the pfd limit at the border of the territory of any other administration is met, the calculations and verification shall be made, taking into account all relevant information, with the mutual agreement of both administrations (the administration responsible for the terrestrial station and the administration responsible for the earth station), with the assistance of the Bureau if so requested. In case of disagreement, the calculation and verification of the pfd shall be made by the Bureau, taking into account the information referred to above. Stations of the mobile service in the band 3400-3600 MHz shall not claim more protection from space stations than that provided in Table 21-4 of the Radio Regulations (Edition of 2004). This allocation is effective from 17 November 2010. (WRC-12)

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5.431A Different category of service: in Argentina, Brazil, Chile, Costa Rica, Cuba, French overseas departments and communities in Region 2, Dominican Republic, El Salvador, Guatemala, Mexico, Paraguay, Suriname, Uruguay and Venezuela, the band 3400-3500 MHz is allocated to the mobile, except aeronautical mobile, service on a primary basis, subject to agreement obtained under No. 9.21. Stations of the mobile service in the band 3400-3500 MHz shall not claim more protection from space stations than that provided in Table 21-4 of the Radio Regulations (Edition of 2004). (WRC-12)

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5.432B Different category of service: in Bangladesh, China, French overseas communities of Region 3, India, Iran (Islamic Republic of), New Zealand and Singapore, the band 3400-3500 MHz is allocated to the mobile, except aeronautical mobile, service on a primary basis, subject to agreement obtained under No. 9.21 with other administrations and is identified for International Mobile Telecommunications (IMT). This identification does not preclude the use of this band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. At the stage of coordination the provisions of Nos. 9.17 and 9.18 also apply. Before an administration brings into use a (base or mobile) station of the mobile service in this band it shall ensure that the power flux-density (pfd) produced at 3 m above ground does not exceed  $-154.5 \text{ dB(W/(m}^2 \cdot 4 \text{ kHz))}$  for more than 20% of time at the border of the territory of any other administration. This limit may be exceeded on the territory of any country whose administration has so agreed. In order to ensure that the pfd limit at the border of the territory of any other administration is met, the calculations and verification shall be made, taking into account all relevant information, with the mutual agreement of both administrations (the administration responsible for the terrestrial station and the administration responsible for the earth station) with the assistance of the Bureau if so requested. In case of disagreement, the calculation and

verification of the pfd shall be made by the Bureau, taking into account the information referred to above. Stations of the mobile service in the band 3400-3500 MHz shall not claim more protection from space stations than that provided in Table 21-4 of the Radio Regulations (Edition of 2004). This allocation is effective from 17 November 2010. (WRC-12)

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5.433A In Bangladesh, China, French overseas communities of Region 3, Korea (Rep. of), India, Iran (Islamic Republic of), Japan, New Zealand and Pakistan, the band 3500-3600 MHz is identified for International Mobile Telecommunications (IMT). This identification does not preclude the use of this band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. At the stage of coordination the provisions of Nos. 9.17 and 9.18 also apply. Before an administration brings into use a (base or mobile) station of the mobile service in this band it shall ensure that the power flux-density (pfd) produced at 3 m above ground does not exceed  $-154.5$  dB (W/(m<sup>2</sup> · 4 kHz)) for more than 20% of time at the border of the territory of any other administration. This limit may be exceeded on the territory of any country whose administration has so agreed. In order to ensure that the pfd limit at the border of the territory of any other administration is met, the calculations and verification shall be made, taking into account all relevant information, with the mutual agreement of both administrations (the administration responsible for the terrestrial station and the administration responsible for the earth station), with the assistance of the Bureau if so requested. In case of disagreement, the calculation and verification of the pfd shall be made by the Bureau, taking into account the information referred to above. Stations of the mobile service in the band 3500-3600 MHz shall not claim more protection from space stations than that provided in Table 21-4 of the Radio Regulations (Edition of 2004). (WRC-12)

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5.439 Additional allocation: in Iran (Islamic Republic of), the band 4200-4400 MHz is also allocated to the fixed service on a secondary basis. (WRC-12)

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5.440A In Region 2 (except Brazil, Cuba, French overseas departments and communities, Guatemala, Paraguay, Uruguay and Venezuela), and in Australia, the band 4400-4940 MHz may be used for aeronautical mobile telemetry for flight testing by aircraft stations (see No. 1.83). Such use shall be in accordance with Resolution 416 (WRC-07) and shall not cause harmful interference to, nor claim protection from, the fixed-satellite and fixed services. Any such use does not preclude the use of this band by other mobile service applications or by other services to which this band is allocated on a co-primary basis and does not establish priority in the Radio Regulations. (WRC-07)

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5.443AA In the frequency bands 5000-5030 MHz and 5091-5150 MHz, the aeronautical mobile-satellite (R) service is subject to agreement obtained under No. 9.21. The use of these bands by the aeronautical mobile-satellite (R) service is limited to internationally standardized aeronautical systems. (WRC-12)

5.443B In order not to cause harmful interference to the microwave landing system operating above 5030 MHz, the aggregate power flux-density produced at the Earth's surface in the band 5030-5150 MHz by all the space stations within any radionavigation-satellite service system (space-to-Earth) operating in the band 5010-5030 MHz shall not exceed  $-124.5$  dB(W/m<sup>2</sup>) in a 150 kHz band. In order not to cause harmful interference to the radio astronomy service in the band 4990-5000 MHz, radionavigation-satellite service systems operating in the band 5010-5030 MHz shall comply with the limits in the band 4990-5000 MHz defined in Resolution 741 (Rev.WRC-12). (WRC-12)

5.443C The use of the frequency band 5030-5091 MHz by the aeronautical mobile (R) service is limited to internationally standardized aeronautical systems. Unwanted emissions from the aeronautical mobile (R) service in the frequency band 5030-5091 MHz shall be limited to protect RNSS system

downlinks in the adjacent 5010-5030 MHz band. Until such time that an appropriate value is established in a relevant ITU-R Recommendation, the e.i.r.p. density limit of -75 dBW/MHz in the frequency band 5010-5030 MHz for any AM(R)S station unwanted emission should be used. (WRC-12)

5.443D In the frequency band 5030-5091 MHz, the aeronautical mobile-satellite (R) service is subject to coordination under No. 9.11A. The use of this frequency band by the aeronautical mobile-satellite (R) service is limited to internationally standardized aeronautical systems. (WRC-12)

5.444 The frequency band 5030-5150 MHz is to be used for the operation of the international standard system (microwave landing system) for precision approach and landing. In the frequency band 5030-5091 MHz, the requirements of this system shall have priority over other uses of this band. For the use of the frequency band 5091-5150 MHz, No. 5.444A and Resolution 114 (Rev.WRC-12) apply. (WRC-12)

5.444A Additional allocation: the band 5091-5150 MHz is also allocated to the fixed-satellite service (Earth-to-space) on a primary basis. This allocation is limited to feeder links of non-geostationary satellite systems in the mobile-satellite service and is subject to coordination under No. 9.11A.

In the band 5091-5150 MHz, the following conditions also apply:

–prior to 1 January 2018, the use of the band 5091-5150 MHz by feeder links of non-geostationary-satellite systems in the mobile-satellite service shall be made in accordance with Resolution 114 (Rev.WRC-12);

–after 1 January 2016, no new assignments shall be made to earth stations providing feeder links of non-geostationary mobile-satellite systems;

–after 1 January 2018, the fixed-satellite service will become secondary to the aeronautical radionavigation service. (FCC)

5.444B The use of the frequency band 5091-5150 MHz by the aeronautical mobile service is limited to:

–systems operating in the aeronautical mobile (R) service and in accordance with international aeronautical standards, limited to surface applications at airports. Such use shall be in accordance with Resolution 748 (Rev.WRC-12);

–aeronautical telemetry transmissions from aircraft stations (see No. 1.83) in accordance with Resolution 418 (Rev.WRC-12). (WRC-12)

5.446 Additional allocation: in the countries listed in No. 5.369, the band 5150-5216 MHz is also allocated to the radiodetermination-satellite service (space-to-Earth) on a primary basis, subject to agreement obtained under No. 9.21. In Region 2, the band is also allocated to the radiodetermination-satellite service (space-to-Earth) on a primary basis. In Regions 1 and 3, except those countries listed in Nos. 5.369 and Bangladesh, the band is also allocated to the radiodetermination-satellite service (space-to-Earth) on a secondary basis. The use by the radiodetermination-satellite service is limited to feeder links in conjunction with the radiodetermination-satellite service operating in the bands 1610-1626.5 MHz and/or 2483.5-2500 MHz. The total power flux-density at the Earth's surface shall in no case exceed -159 dB (W/m<sup>2</sup>) in any 4 kHz band for all angles of arrival. (WRC-12)

5.446A The use of the bands 5150-5350 MHz and 5470-5725 MHz by the stations in the mobile, except aeronautical mobile, service shall be in accordance with Resolution 229 (Rev.WRC-12). (WRC-12)

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5.446C Additional allocation: in Region 1 (except in Algeria, Saudi Arabia, Bahrain, Egypt, United Arab Emirates, Jordan, Kuwait, Lebanon, Morocco, Oman, Qatar, Syrian Arab Republic, Sudan, South Sudan and Tunisia) and in Brazil, the band 5150-5250 MHz is also allocated to the aeronautical mobile service on a primary basis, limited to aeronautical telemetry transmissions from aircraft stations (see No. 1.83), in accordance with Resolution 418 (Rev.WRC-12). These stations shall not claim protection from other stations operating in accordance with Article 5. No. 5.43A does not apply. (WRC-12)

5.447 Additional allocation: in Côte d'Ivoire, Egypt, Israel, Lebanon, the Syrian Arab Republic and Tunisia, the band 5150-5250 MHz is also allocated to the mobile service, on a primary basis, subject to agreement obtained under No. 9.21. In this case, the provisions of Resolution 229 (Rev.WRC-12) do not apply. (WRC-12)

5.447A The allocation to the fixed-satellite service (Earth-to-space) in the band 5150-5250 MHz is limited to feeder links of non-geostationary-satellite systems in the mobile-satellite service and is subject to coordination under No. 9.11A.

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5.448 Additional allocation: in Azerbaijan, Kyrgyzstan, Romania and Turkmenistan, the band 5250-5350 MHz is also allocated to the radionavigation service on a primary basis. (WRC-12)

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5.450 Additional allocation: in Austria, Azerbaijan, Iran (Islamic Republic of), Kyrgyzstan, Romania, Turkmenistan and Ukraine, the band 5470-5650 MHz is also allocated to the aeronautical radionavigation service on a primary basis. (WRC-12)

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5.453 Additional allocation: in Saudi Arabia, Bahrain, Bangladesh, Brunei Darussalam, Cameroon, China, Congo (Rep. of the), Korea (Rep. of), Côte d'Ivoire, Djibouti, Egypt, the United Arab Emirates, Gabon, Guinea, Equatorial Guinea, India, Indonesia, Iran (Islamic Republic of), Iraq, Israel, Japan, Jordan, Kenya, Kuwait, Lebanon, Libya, Madagascar, Malaysia, Niger, Nigeria, Oman, Uganda, Pakistan, the Philippines, Qatar, the Syrian Arab Republic, the Dem. People's Rep. of Korea, Singapore, Sri Lanka, Swaziland, Tanzania, Chad, Thailand, Togo, Viet Nam and Yemen, the band 5650-5850 MHz is also allocated to the fixed and mobile services on a primary basis. In this case, the provisions of Resolution 229 (Rev.WRC-12) do not apply. (WRC-12)

5.454 Different category of service: in Azerbaijan, the Russian Federation, Georgia, Kyrgyzstan, Tajikistan and Turkmenistan, the allocation of the band 5670-5725 MHz to the space research service is on a primary basis (see No. 5.33). (WRC-12)

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5.457 In Australia, Burkina Faso, Cote d'Ivoire, Mali and Nigeria, the allocation to the fixed service in the bands 6440-6520 MHz (HAPS-to-ground direction) and 6560-6640 MHz (ground-to-HAPS direction) may also be used by gateway links for high-altitude platform stations (HAPS) within the territory of these countries. Such use is limited to operation in HAPS gateway links and shall not cause harmful interference to, and shall not claim protection from, existing services, and shall be in compliance with Resolution 150 (WRC-12). Existing services shall not be constrained in future development by HAPS gateway links. The use of HAPS gateway links in these bands requires explicit agreement with other administrations whose territories are located within 1000 kilometres from the border of an administration intending to use the HAPS gateway links. (WRC-12)

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5.457B In the bands 5925-6425 MHz and 14-14.5 GHz, earth stations located on board vessels may operate with the characteristics and under the conditions contained in Resolution 902 (WRC-03) in Algeria, Saudi Arabia, Bahrain, Comoros, Djibouti, Egypt, United Arab Emirates, Jordan, Kuwait, Libya, Morocco, Mauritania, Oman, Qatar, the Syrian Arab Republic, Sudan, South Sudan, Tunisia and Yemen, in the maritime mobile-satellite service on a secondary basis. Such use shall be in accordance with Resolution 902 (WRC-03). (WRC-12)

5.457C In Region 2 (except Brazil, Cuba, French overseas departments and communities, Guatemala, Paraguay, Uruguay and Venezuela), the band 5925-6700 MHz may be used for aeronautical mobile telemetry for flight testing by aircraft stations (see No. 1.83). Such use shall be in accordance

with Resolution 416 (WRC-07) and shall not cause harmful interference to, nor claim protection from, the fixed-satellite and fixed services. Any such use does not preclude the use of this band by other mobile service applications or by other services to which this band is allocated on a co-primary basis and does not establish priority in the Radio Regulations. (WRC-07)

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5.461B The use of the band 7750-7900 MHz by the meteorological-satellite service (space-to-Earth) is limited to non-geostationary satellite systems. (WRC-12)

5.462A In Regions 1 and 3 (except for Japan), in the band 8025-8400 MHz, the Earth exploration-satellite service using geostationary satellites shall not produce a power flux-density in excess of the following values for angles of arrival ( $\theta$ ), without the consent of the affected administration:

-135 dB(W/m<sup>2</sup>) in a 1 MHz band for  $0^\circ \leq \theta < 5^\circ$

-135 + 0.5 ( $\theta - 5$ ) dB(W/m<sup>2</sup>) in a 1 MHz band for  
 $5^\circ \leq \theta < 25^\circ$

-125 dB(W/m<sup>2</sup>) in a 1 MHz band for  $25^\circ \leq \theta \leq 90^\circ$  (WRC-12) (FCC)

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5.466 Different category of service: in Singapore and Sri Lanka, the allocation of the band 8400-8500 MHz to the space research service is on a secondary basis (see No. 5.32). (WRC-12)

5.468 Additional allocation: in Saudi Arabia, Bahrain, Bangladesh, Brunei Darussalam, Burundi, Cameroon, China, Congo (Rep. of the), Costa Rica, Djibouti, Egypt, the United Arab Emirates, Gabon, Guyana, Indonesia, Iran (Islamic Republic of), Iraq, Jamaica, Jordan, Kenya, Kuwait, Lebanon, Libya, Malaysia, Mali, Morocco, Mauritania, Nepal, Nigeria, Oman, Uganda, Pakistan, Qatar, Syrian Arab Republic, the Dem. People's Rep. of Korea, Senegal, Singapore, Somalia, Sudan, Swaziland, Tanzania, Chad, Togo, Tunisia and Yemen, the band 8500-8750 MHz is also allocated to the fixed and mobile services on a primary basis. (WRC-12)

5.469 Additional allocation: in Armenia, Azerbaijan, Belarus, the Russian Federation, Georgia, Hungary, Lithuania, Mongolia, Uzbekistan, Poland, Kyrgyzstan, the Czech Rep., Romania, Tajikistan, Turkmenistan and Ukraine, the band 8500-8750 MHz is also allocated to the land mobile and radionavigation services on a primary basis. (WRC-12)

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5.471 Additional allocation: in Algeria, Germany, Bahrain, Belgium, China, Egypt, the United Arab Emirates, France, Greece, Indonesia, Iran (Islamic Republic of), Libya, the Netherlands, Qatar, Sudan and South Sudan, the bands 8825-8850 MHz and 9000-9200 MHz are also allocated to the maritime radionavigation service, on a primary basis, for use by shore-based radars only. (WRC-12)

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5.477 Different category of service: in Algeria, Saudi Arabia, Bahrain, Bangladesh, Brunei Darussalam, Cameroon, Djibouti, Egypt, the United Arab Emirates, Eritrea, Ethiopia, Guyana, India, Indonesia, Iran (Islamic Republic of), Iraq, Jamaica, Japan, Jordan, Kuwait, Lebanon, Liberia, Malaysia, Nigeria, Oman, Pakistan, Qatar, Syrian Arab Republic, the Dem. People's Rep. of Korea, Singapore, Somalia, Sudan, South Sudan, Trinidad and Tobago, and Yemen, the allocation of the band 9800-10000 MHz to the fixed service is on a primary basis (see No. 5.33). (WRC-12)

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5.481 Additional allocation: in Germany, Angola, Brazil, China, Costa Rica, Côte d'Ivoire, El Salvador, Ecuador, Spain, Guatemala, Hungary, Japan, Kenya, Morocco, Nigeria, Oman, Uzbekistan, Pakistan, Paraguay, Peru, the Dem. People's Rep. of Korea, Romania, Tanzania, Thailand and Uruguay, the band 10.45-10.5 GHz is also allocated to the fixed and mobile services on a primary basis. (WRC-12)

5.482 In the band 10.6-10.68 GHz, the power delivered to the antenna of stations of the fixed and mobile, except aeronautical mobile, services shall not exceed –3 dBW. This limit may be exceeded, subject to agreement obtained under No. 9.21. However, in Algeria, Saudi Arabia, Armenia, Azerbaijan, Bahrain, Bangladesh, Belarus, Egypt, United Arab Emirates, Georgia, India, Indonesia, Iran (Islamic Republic of), Iraq, Jordan, Kazakhstan, Kuwait, Lebanon, Libya, Morocco, Mauritania, Moldova, Nigeria, Oman, Uzbekistan, Pakistan, Philippines, Qatar, Syrian Arab Republic, Kyrgyzstan, Singapore, Tajikistan, Tunisia, Turkmenistan and Viet Nam, this restriction on the fixed and mobile, except aeronautical mobile, services is not applicable. (WRC-07)

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5.483 Additional allocation: in Saudi Arabia, Armenia, Azerbaijan, Bahrain, Belarus, China, Colombia, Korea (Rep. of), Costa Rica, Egypt, the United Arab Emirates, Georgia, Iran (Islamic Republic of), Iraq, Israel, Jordan, Kazakhstan, Kuwait, Lebanon, Mongolia, Qatar, Kyrgyzstan, the Dem. People's Rep. of Korea, Tajikistan, Turkmenistan and Yemen, the band 10.68-10.7 GHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. Such use is limited to equipment in operation by 1 January 1985. (WRC-12)

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5.494 Additional allocation: in Algeria, Angola, Saudi Arabia, Bahrain, Cameroon, the Central African Rep., Congo (Rep. of the), Côte d'Ivoire, Djibouti, Egypt, the United Arab Emirates, Eritrea, Ethiopia, Gabon, Ghana, Guinea, Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Madagascar, Mali, Morocco, Mongolia, Nigeria, Oman, Qatar, the Syrian Arab Republic, the Dem. Rep. of the Congo, Somalia, Sudan, South Sudan, Chad, Togo and Yemen, the band 12.5-12.75 GHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a primary basis. (WRC-12)

5.495 Additional allocation: in France, Greece, Monaco, Montenegro, Uganda, Romania, Tanzania and Tunisia, the band 12.5-12.75 GHz is also allocated to the fixed and mobile, except aeronautical mobile, services on a secondary basis. (WRC-12)

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5.499 Additional allocation: in Bangladesh and India, the band 13.25-14 GHz is also allocated to the fixed service on a primary basis. In Pakistan, the band 13.25-13.75 GHz is allocated to the fixed service on a primary basis. (WRC-12)

5.500 Additional allocation: in Algeria, Angola, Saudi Arabia, Bahrain, Brunei Darussalam, Cameroon, Egypt, the United Arab Emirates, Gabon, Indonesia, Iran (Islamic Republic of), Iraq, Israel, Jordan, Kuwait, Lebanon, Madagascar, Malaysia, Mali, Morocco, Mauritania, Niger, Nigeria, Oman, Qatar, the Syrian Arab Republic, Singapore, Sudan, South Sudan, Chad and Tunisia, the band 13.4-14 GHz is also allocated to the fixed and mobile services on a primary basis. In Pakistan, the band 13.4-13.75 GHz is also allocated to the fixed and mobile services on a primary basis. (WRC-12)

5.501 Additional allocation: in Azerbaijan, Hungary, Japan, Kyrgyzstan, Romania and Turkmenistan, the band 13.4-14 GHz is also allocated to the radionavigation service on a primary basis. (WRC-12)

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5.504C In the band 14-14.25 GHz, the power flux-density produced on the territory of the countries of Saudi Arabia, Botswana, Côte d'Ivoire, Egypt, Guinea, India, Iran (Islamic Republic of), Kuwait, Nigeria, Oman, the Syrian Arab Republic and Tunisia by any aircraft earth station in the aeronautical mobile-satellite service shall not exceed the limits given in Annex 1, Part B of Recommendation ITU-R M.1643, unless otherwise specifically agreed by the affected administration(s). The provisions of this footnote in no way derogate the obligations of the aeronautical mobile-satellite service to operate as a secondary service in accordance with No. 5.29. (WRC-12)

5.505 Additional allocation: in Algeria, Angola, Saudi Arabia, Bahrain, Botswana, Brunei Darussalam, Cameroon, China, Congo (Rep. of the), Korea (Rep. of), Djibouti, Egypt, the United Arab Emirates, Gabon, Guinea, India, Indonesia, Iran (Islamic Republic of), Iraq, Israel, Japan, Jordan, Kuwait, Lebanon, Malaysia, Mali, Morocco, Mauritania, Oman, the Philippines, Qatar, the Syrian Arab Republic, the Dem. People's Rep. of Korea, Singapore, Somalia, Sudan, South Sudan, Swaziland, Tanzania, Chad, Viet Nam and Yemen, the band 14-14.3 GHz is also allocated to the fixed service on a primary basis. (WRC-12)

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5.508 Additional allocation: in Germany, France, Italy, Libya, The Former Yugoslav Rep. of Macedonia and the United Kingdom, the band 14.25-14.3 GHz is also allocated to the fixed service on a primary basis. (WRC-12)

5.508A In the band 14.25-14.3 GHz, the power flux-density produced on the territory of the countries of Saudi Arabia, Botswana, China, Côte d'Ivoire, Egypt, France, Guinea, India, Iran (Islamic Republic of), Italy, Kuwait, Nigeria, Oman, the Syrian Arab Republic, the United Kingdom and Tunisia by any aircraft earth station in the aeronautical mobile-satellite service shall not exceed the limits given in Annex 1, Part B of Recommendation ITU-R M.1643, unless otherwise specifically agreed by the affected administration(s). The provisions of this footnote in no way derogate the obligations of the aeronautical mobile-satellite service to operate as a secondary service in accordance with No. 5.29. (WRC-12)

5.509A In the band 14.3-14.5 GHz, the power flux-density produced on the territory of the countries of Saudi Arabia, Botswana, Cameroon, China, Côte d'Ivoire, Egypt, France, Gabon, Guinea, India, Iran (Islamic Republic of), Italy, Kuwait, Morocco, Nigeria, Oman, the Syrian Arab Republic, the United Kingdom, Sri Lanka, Tunisia and Viet Nam by any aircraft earth station in the aeronautical mobile-satellite service shall not exceed the limits given in Annex 1, Part B of Recommendation ITU-R M.1643, unless otherwise specifically agreed by the affected administration(s). The provisions of this footnote in no way derogate the obligations of the aeronautical mobile-satellite service to operate as a secondary service in accordance with No. 5.29. (WRC-12)

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5.511 Additional allocation: in Saudi Arabia, Bahrain, Cameroon, Egypt, the United Arab Emirates, Guinea, Iran (Islamic Republic of), Iraq, Israel, Kuwait, Lebanon, Oman, Pakistan, Qatar, the Syrian Arab Republic and Somalia, the band 15.35-15.4 GHz is also allocated to the fixed and mobile services on a secondary basis. (WRC-12)

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5.511E In the frequency band 15.4-15.7 GHz, stations operating in the radiolocation service shall not cause harmful interference to, or claim protection from, stations operating in the aeronautical radionavigation service. (WRC-12)

5.511F In order to protect the radio astronomy service in the frequency band 15.35-15.4 GHz, radiolocation stations operating in the frequency band 15.4-15.7 GHz shall not exceed the power flux-density level of  $-156$  dB(W/m<sup>2</sup>) in a 50 MHz bandwidth in the frequency band 15.35-15.4 GHz, at any radio astronomy observatory site for more than 2 per cent of the time. (WRC-12)

5.512 Additional allocation: in Algeria, Angola, Saudi Arabia, Austria, Bahrain, Bangladesh, Brunei Darussalam, Cameroon, Congo (Rep. of the), Costa Rica, Egypt, El Salvador, the United Arab Emirates, Eritrea, Finland, Guatemala, India, Indonesia, Iran (Islamic Republic of), Jordan, Kenya, Kuwait, Lebanon, Libya, Malaysia, Mali, Morocco, Mauritania, Montenegro, Nepal, Nicaragua, Niger, Oman, Pakistan, Qatar, Syrian Arab Republic, the Dem. Rep. of the Congo, Serbia, Singapore, Somalia, Sudan, South Sudan, Tanzania, Chad, Togo and Yemen, the band 15.7-17.3 GHz is also allocated to the fixed and mobile services on a primary basis. (WRC-12)

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5.514 Additional allocation: in Algeria, Angola, Saudi Arabia, Bahrain, Bangladesh, Cameroon, El Salvador, the United Arab Emirates, Guatemala, India, Iran (Islamic Republic of), Iraq, Israel, Italy, Japan, Jordan, Kuwait, Libya, Lithuania, Nepal, Nicaragua, Nigeria, Oman, Uzbekistan, Pakistan, Qatar, Kyrgyzstan, Sudan and South Sudan, the band 17.3-17.7 GHz is also allocated to the fixed and mobile services on a secondary basis. The power limits given in Nos. 21.3 and 21.5 shall apply. (WRC-12)

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5.522C In the band 18.6-18.8 GHz, in Algeria, Saudi Arabia, Bahrain, Egypt, the United Arab Emirates, Jordan, Lebanon, Libya, Morocco, Oman, Qatar, the Syrian Arab Republic, Tunisia and Yemen, fixed-service systems in operation at the date of entry into force of the Final Acts of WRC-2000 are not subject to the limits of No. 21.5A.

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5.524 Additional allocation: in Afghanistan, Algeria, Angola, Saudi Arabia, Bahrain, Brunei Darussalam, Cameroon, China, Congo (Rep. of the), Costa Rica, Egypt, the United Arab Emirates, Gabon, Guatemala, Guinea, India, Iran (Islamic Republic of), Iraq, Israel, Japan, Jordan, Kuwait, Lebanon, Malaysia, Mali, Morocco, Mauritania, Nepal, Nigeria, Oman, Pakistan, the Philippines, Qatar, the Syrian Arab Republic, the Dem. Rep. of the Congo, the Dem. People's Rep. of Korea, Singapore, Somalia, Sudan, South Sudan, Tanzania, Chad, Togo and Tunisia, the band 19.7-21.2 GHz is also allocated to the fixed and mobile services on a primary basis. This additional use shall not impose any limitation on the power flux-density of space stations in the fixed-satellite service in the band 19.7-21.2 GHz and of space stations in the mobile-satellite service in the band 19.7-20.2 GHz where the allocation to the mobile-satellite service is on a primary basis in the latter band. (WRC-12)

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5.530A Unless otherwise agreed between the administrations concerned, any station in the fixed or mobile services of an administration shall not produce a power flux-density in excess of  $-120.4 \text{ dB(W/(m}^2 \cdot \text{MHz))}$  at 3 m above the ground of any point of the territory of any other administration in Regions 1 and 3 for more than 20% of the time. In conducting the calculations, administrations should use the most recent version of Recommendation ITU-R P.452 (see Recommendation ITU-R BO.1898). (WRC-12)

5.530B In the band 21.4-22 GHz, in order to facilitate the development of the broadcasting-satellite service, administrations in Regions 1 and 3 are encouraged not to deploy stations in the mobile service and are encouraged to limit the deployment of stations in the fixed service to point-to-point links. (WRC-12)

5.530C The use of the band 21.4-22 GHz is subject to the provisions of Resolution 755 (WRC-12). (WRC-12)

5.530D See Resolution 555 (WRC-12). (WRC-12)

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5.532A The location of earth stations in the space research service shall maintain a separation distance of at least 54 km from the respective border(s) of neighbouring countries to protect the existing and future deployment of fixed and mobile services unless a shorter distance is otherwise agreed between the corresponding administrations. Nos. 9.17 and 9.18 do not apply. (WRC-12)

5.532B Use of the band 24.65-25.25 GHz in Region 1 and the band 24.65-24.75 GHz in Region 3 by the fixed-satellite service (Earth-to-space) is limited to earth stations using a minimum antenna diameter of 4.5 m. (WRC-12)

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5.536A Administrations operating earth stations in the Earth exploration-satellite service or the space research service shall not claim protection from stations in the fixed and mobile services operated by

other administrations. In addition, earth stations in the Earth exploration-satellite service or in the space research service should be operated taking into account the most recent version of Recommendation ITU-R SA.1862. (WRC-12)

5.536B In Saudi Arabia, Austria, Belgium, Brazil, Bulgaria, China, Korea (Rep. of), Denmark, Egypt, United Arab Emirates, Estonia, Finland, Hungary, India, Iran (Islamic Republic of), Ireland, Israel, Italy, Jordan, Kenya, Kuwait, Lebanon, Libya, Liechtenstein, Lithuania, Moldova, Norway, Oman, Uganda, Pakistan, the Philippines, Poland, Portugal, the Syrian Arab Republic, Dem. People's Rep. of Korea, Slovakia, the Czech Rep., Romania, the United Kingdom, Singapore, Sweden, Switzerland, Tanzania, Turkey, Viet Nam and Zimbabwe, earth stations operating in the Earth exploration-satellite service in the band 25.5-27 GHz shall not claim protection from, or constrain the use and deployment of, stations of the fixed and mobile services. (WRC-12)

5.536C In Algeria, Saudi Arabia, Bahrain, Botswana, Brazil, Cameroon, Comoros, Cuba, Djibouti, Egypt, United Arab Emirates, Estonia, Finland, Iran (Islamic Republic of), Israel, Jordan, Kenya, Kuwait, Lithuania, Malaysia, Morocco, Nigeria, Oman, Qatar, Syrian Arab Republic, Somalia, Sudan, South Sudan, Tanzania, Tunisia, Uruguay, Zambia and Zimbabwe, earth stations operating in the space research service in the band 25.5-27 GHz shall not claim protection from, or constrain the use and deployment of, stations of the fixed and mobile services. (WRC-12)

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5.537A In Bhutan, Cameroon, Korea (Rep. of), the Russian Federation, India, Indonesia, Iran (Islamic Republic of), Iraq, Japan, Kazakhstan, Malaysia, Maldives, Mongolia, Myanmar, Uzbekistan, Pakistan, the Philippines, Kyrgyzstan, the Dem. People's Rep. of Korea, Sudan, Sri Lanka, Thailand and Viet Nam, the allocation to the fixed service in the band 27.9-28.2 GHz may also be used by high altitude platform stations (HAPS) within the territory of these countries. Such use of 300 MHz of the fixed-service allocation by HAPS in the above countries is further limited to operation in the HAPS-to-ground direction and shall not cause harmful interference to, nor claim protection from, other types of fixed-service systems or other co-primary services. Furthermore, the development of these other services shall not be constrained by HAPS. See Resolution 145 (Rev.WRC-12). (WRC-12)

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5.542 Additional allocation: in Algeria, Saudi Arabia, Bahrain, Brunei Darussalam, Cameroon, China, Congo (Rep. of the), Egypt, the United Arab Emirates, Eritrea, Ethiopia, Guinea, India, Iran (Islamic Republic of), Iraq, Japan, Jordan, Kuwait, Lebanon, Malaysia, Mali, Morocco, Mauritania, Nepal, Oman, Pakistan, Philippines, Qatar, the Syrian Arab Republic, the Dem. People's Rep. of Korea, Somalia, Sudan, South Sudan, Sri Lanka and Chad, the band 29.5-31 GHz is also allocated to the fixed and mobile services on a secondary basis. The power limits specified in Nos. 21.3 and 21.5 shall apply. (WRC-12)

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5.543A In Bhutan, Cameroon, Korea (Rep. of), the Russian Federation, India, Indonesia, Iran (Islamic Republic of), Iraq, Japan, Kazakhstan, Malaysia, Maldives, Mongolia, Myanmar, Uzbekistan, Pakistan, the Philippines, Kyrgyzstan, the Dem. People's Rep. of Korea, Sudan, Sri Lanka, Thailand and Viet Nam, the allocation to the fixed service in the band 31-31.3 GHz may also be used by systems using high altitude platform stations (HAPS) in the ground-to-HAPS direction. The use of the band 31-31.3 GHz by systems using HAPS is limited to the territory of the countries listed above and shall not cause harmful interference to, nor claim protection from, other types of fixed-service systems, systems in the mobile service and systems operated under No. 5.545. Furthermore, the development of these services shall not be constrained by HAPS. Systems using HAPS in the band 31-31.3 GHz shall not cause harmful interference to the radio astronomy service having a primary allocation in the band 31.3-31.8 GHz, taking into account the protection criterion as given in Recommendation ITU-R RA.769. In order to ensure the protection of satellite passive services, the level of unwanted power density into a HAPS ground station antenna in the band 31.3-31.8 GHz shall be limited to -106 dB(W/MHz) under clear-sky conditions, and

may be increased up to  $-100$  dB(W/MHz) under rainy conditions to mitigate fading due to rain, provided the effective impact on the passive satellite does not exceed the impact under clear-sky conditions. See Resolution 145 (Rev.WRC-12). (WRC-12)

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5.545 Different category of service: in Armenia, Georgia, Kyrgyzstan, Tajikistan and Turkmenistan, the allocation of the band 31-31.3 GHz to the space research service is on a primary basis (see No. 5.33). (WRC-12)

5.546 Different category of service: in Saudi Arabia, Armenia, Azerbaijan, Belarus, Egypt, the United Arab Emirates, Spain, Estonia, the Russian Federation, Georgia, Hungary, Iran (Islamic Republic of), Israel, Jordan, Lebanon, Moldova, Mongolia, Oman, Uzbekistan, Poland, the Syrian Arab Republic, Kyrgyzstan, Romania, the United Kingdom, South Africa, Tajikistan, Turkmenistan and Turkey, the allocation of the band 31.5-31.8 GHz to the fixed and mobile, except aeronautical mobile, services is on a primary basis (see No. 5.33). (WRC-12)

5.547 The bands 31.8-33.4 GHz, 37-40 GHz, 40.5-43.5 GHz, 51.4-52.6 GHz, 55.78-59 GHz and 64-66 GHz are available for high-density applications in the fixed service (see Resolution 75 (WRC-12)). Administrations should take this into account when considering regulatory provisions in relation to these bands. Because of the potential deployment of high-density applications in the fixed-satellite service in the bands 39.5-40 GHz and 40.5-42 GHz (see No. 5.516B), administrations should further take into account potential constraints to high-density applications in the fixed service, as appropriate. (FCC)

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5.549 Additional allocation: in Saudi Arabia, Bahrain, Bangladesh, Egypt, the United Arab Emirates, Gabon, Indonesia, Iran (Islamic Republic of), Iraq, Israel, Jordan, Kuwait, Lebanon, Libya, Malaysia, Mali, Morocco, Mauritania, Nepal, Nigeria, Oman, Pakistan, the Philippines, Qatar, the Syrian Arab Republic, the Dem. Rep. of the Congo, Singapore, Somalia, Sudan, South Sudan, Sri Lanka, Togo, Tunisia and Yemen, the band 33.4-36 GHz is also allocated to the fixed and mobile services on a primary basis. (WRC-12)

\* \* \* \* \*

5.550 Different category of service: in Armenia, Azerbaijan, Belarus, the Russian Federation, Georgia, Kyrgyzstan, Tajikistan and Turkmenistan, the allocation of the band 34.7-35.2 GHz to the space research service is on a primary basis (see No. 5.33). (WRC-12)

\* \* \* \* \*

5.565 The following frequency bands in the range 275-1000 GHz are identified for use by administrations for passive service applications:

–radio astronomy service: 275-323 GHz, 327-371 GHz, 388-424 GHz, 426-442 GHz, 453-510 GHz, 623-711 GHz, 795-909 GHz and 926-945 GHz;

–Earth exploration-satellite service (passive) and space research service (passive): 275-286 GHz, 296-306 GHz, 313-356 GHz, 361-365 GHz, 369-392 GHz, 397-399 GHz, 409-411 GHz, 416-434 GHz, 439-467 GHz, 477-502 GHz, 523-527 GHz, 538-581 GHz, 611-630 GHz, 634-654 GHz, 657-692 GHz, 713-718 GHz, 729-733 GHz, 750-754 GHz, 771-776 GHz, 823-846 GHz, 850-854 GHz, 857-862 GHz, 866-882 GHz, 905-928 GHz, 951-956 GHz, 968-973 GHz and 985-990 GHz.

The use of the range 275-1000 GHz by the passive services does not preclude use of this range by active services. Administrations wishing to make frequencies in the 275-1000 GHz range available for active service applications are urged to take all practicable steps to protect these passive services from harmful interference until the date when the Table of Frequency Allocations is established in the above-mentioned 275-1000 GHz frequency range.

All frequencies in the range 1000-3000 GHz may be used by both active and passive services. (WRC-12)

## UNITED STATES (US) FOOTNOTES

\* \* \* \* \*

US52 In the VHF maritime mobile band (156-162 MHz), the following provisions shall apply:

(a) Except as provided for below, the use of the bands 161.9625-161.9875 MHz (AIS 1 with center frequency 161.975 MHz) and 162.0125-162.0375 MHz (AIS 2 with center frequency 162.025 MHz) by the maritime mobile and mobile-satellite (Earth-to-space) services is restricted to Automatic Identification Systems (AIS). The use of these bands by the aeronautical mobile (OR) service is restricted to AIS emissions from search and rescue aircraft operations. Frequencies in the AIS 1 band may continue to be used by non-Federal base, fixed, and land mobile stations until March 2, 2024.

(b) The frequency 156.3 MHz may also be used by aircraft stations for the purpose of search and rescue operations and other safety-related communications.

(c) Federal stations in the maritime mobile service may also be authorized as follows: (1) Vessel traffic services under the control of the U.S. Coast Guard on a simplex basis by coast and ship stations on the frequencies 156.25, 156.55, 156.6 and 156.7 MHz; (2) Inter-ship use of the frequency 156.3 MHz on a simplex basis; (3) Navigational bridge-to-bridge and navigational communications on a simplex basis by coast and ship stations on the frequencies 156.375 and 156.65 MHz; (4) Port operations use on a simplex basis by coast and ship stations on the frequencies 156.6 and 156.7 MHz; (5) Environmental communications on the frequency 156.75 MHz in accordance with the national plan; and (6) Duplex port operations use of the frequencies 157 MHz for ship stations and 161.6 MHz for coast stations.

\* \* \* \* \*

US74 In the bands 25.55-25.67, 73-74.6, 406.1-410, 608-614, 1400-1427, 1660.5-1670, 2690-2700, and 4990-5000 MHz, and in the bands 10.68-10.7, 15.35-15.4, 23.6-24.0, 31.3-31.5, 86-92, 100-102, 109.5-111.8, 114.25-116, 148.5-151.5, 164-167, 200-209, and 250-252 GHz, the radio astronomy service shall be protected from unwanted emissions only to the extent that such radiation exceeds the level which would be present if the offending station were operating in compliance with the technical standards or criteria applicable to the service in which it operates. Radio astronomy observations in these bands are performed at the locations listed in US385.

\* \* \* \* \*

US79 In the bands 1390-1400 MHz and 1427-1432 MHz, the following provisions shall apply:

(a) Airborne and space-to-Earth operations are prohibited.

(b) Federal operations (except for devices authorized by the FCC for the Wireless Medical Telemetry Service) are on a non-interference basis to non-Federal operations and shall not constrain implementation of non-Federal operations.

\* \* \* \* \*

US85 Differential-Global-Positioning-System (DGPS) Stations, limited to ground-based transmitters, may be authorized on a primary basis in the band 1559-1610 MHz for the specific purpose of transmitting DGPS information intended for aircraft navigation.

\* \* \* \* \*

US100 The following provisions shall apply to the bands 2310-2320 MHz and 2345-2360 MHz:

(a) The bands 2310-2320 and 2345-2360 MHz are available for Federal aeronautical telemetering and associated telecommand operations for flight testing of manned or unmanned aircraft, missiles, or major components thereof, on a secondary basis to the Wireless Communications Service (WCS). The frequencies 2312.5 MHz and 2352.5 MHz are shared on a co-equal basis by Federal stations for telemetering and associated telecommand operations of expendable and reusable launch vehicles, irrespective of whether such operations involve flight testing. Other Federal mobile telemetering uses may be provided in the bands 2310-2320 and 2345-2360 MHz on a non-interference basis to all other uses authorized pursuant to this footnote.

(b) The band 2345-2360 MHz is available for non-Federal aeronautical telemetering and associated telecommand operations for flight testing of manned or unmanned aircraft, missiles, or major components thereof, on a secondary basis to the WCS until January 1, 2020. The use of this allocation is restricted to non-Federal licensees in the Aeronautical and Fixed Radio Service holding a valid authorization on April 23, 2015.

\* \* \* \* \*

US111 In the band 5091-5150 MHz, aeronautical mobile telemetry operations for flight testing are conducted at the following locations. Flight testing at additional locations may be authorized on a case-by-case basis.

Location	Test Sites	Lat. (N)	Long. (W)
Gulf Area Ranges Complex (GARC)	Eglin AFB, Tyndall AFB, FL; Gulfport ANG Range, MS; Ft. Rucker, Redstone, NASA Marshall Space Flight Center, AL	30° 28'	86° 31'
Utah Ranges Complex (URC)	Dugway PG; Utah Test & Training Range (Hill AFB), UT	40° 57'	113° 05'
Western Ranges Complex (WRC)	Pacific Missile Range; Vandenberg AFB, China Lake NAWS, Pt. Mugu NAWS, Edwards AFB, Thermal, Nellis AFB, Ft. Irwin, NASA Dryden Flight Research Center, Victorville, CA	35° 29'	117° 16'
Southwest Ranges Complex (SRC)	Ft. Huachuca, Tucson, Phoenix, Mesa, Yuma, AZ	31° 33'	110° 18'
Mid-Atlantic Ranges Complex (MARC)	Patuxent River, Aberdeen PG, NASA Langley Research Center, NASA Wallops Flight Facility, MD	38° 17'	76° 24'
New Mexico Ranges Complex (NMRC)	White Sands Missile Range, Holloman AFB, Albuquerque, Roswell, NM; Amarillo, TX	32° 11'	106° 20'
Colorado Ranges Complex (CoRC)	Alamosa, Leadville, CO	37° 26'	105° 52'
Texas Ranges Complex (TRC)	Dallas/Ft. Worth, Greenville, Waco, Johnson Space Flight Center/Ellington Field, TX	32° 53'	97° 02'
Cape Ranges Complex (CRC)	Cape Canaveral, Palm Beach-Dade, FL	28° 33'	80° 34'
Northwest Range Complex (NWRC)	Seattle, Everett, Spokane, Moses Lake, WA; Klamath Falls, Eugene, OR	47° 32'	122° 18'
St. Louis	St Louis, MO	38° 45'	90° 22'
Wichita	Wichita, KS	37° 40'	97° 26'
Marietta	Marietta, GA	33° 54'	84° 31'
Glasgow	Glasgow, MT	48° 25'	106° 32'
Wilmington/Ridley	Wilmington, DE/Ridley, PA	39° 49'	75° 26'
San Francisco Bay Area (SFBA)	NASA Ames Research Center, CA	37° 25'	122° 03'
Charleston	Charleston, SC	32° 52'	80° 02'

\* \* \* \* \*

US113 Radio astronomy observations of the formaldehyde line frequencies 4825-4835 MHz and 14.47-14.5 GHz may be made at certain radio astronomy observatories as indicated below:

BANDS TO BE OBSERVED

4 GHz	14 GHz	Observatory
X	.....	National Astronomy and Ionosphere Center (NAIC), Arecibo, PR
X	X	National Radio Astronomy Observatory (NRAO), Green Bank, WV
X	X	NRAO, Socorro, NM
X	.....	Allen Telescope Array (ATA), Hat Creek, CA
X	X	Owens Valley Radio Observatory (OVRO), Big Pine, CA
X	X	NRAO's ten Very Long Baseline Array (VLBA) stations (see US131)
X	X	University of Michigan Radio Astronomy Observatory, Stinchfield Woods, MI
X	.....	Pisgah Astronomical Research Institute, Rosman, NC

Every practicable effort will be made to avoid the assignment of frequencies to stations in the fixed or mobile services in these bands. Should such assignments result in harmful interference to these observations, the situation will be remedied to the extent practicable.

\* \* \* \* \*

US139 Fixed stations authorized in the band 18.3-19.3 GHz under the provisions of 47 CFR 74.502(c), 74.602(g), 78.18(a)(4), and 101.147(r) may continue operations consistent with the provisions of those sections.

\* \* \* \* \*

US145 The following unwanted emissions power limits for non-geostationary satellites operating in the inter-satellite service that transmit in the band 22.55-23.55 GHz shall apply in any 200 MHz of the passive band 23.6-24 GHz, based on the date that complete advance publication information is received by the ITU's Radiocommunication Bureau:

(a) For information received before January 1, 2020: -36 dBW/200 MHz.

(b) For information received on or after January 1, 2020: -46 dBW/200 MHz.

US156 In the bands 49.7-50.2 GHz and 50.4-50.9 GHz, for earth stations in the fixed-satellite service (Earth-to-space), the unwanted emissions power in the band 50.2-50.4 GHz shall not exceed -20 dBW/200 MHz (measured at the input of the antenna), except that the maximum unwanted emissions power may be increased to -10 dBW/200 MHz for earth stations having an antenna gain greater than or equal to 57 dBi. These limits apply under clear-sky conditions. During fading conditions, the limits may be exceeded by earth stations when using uplink power control.

US157 In the band 51.4-52.6 GHz, for stations in the fixed service, the unwanted emissions power in the band 52.6-54.25 GHz shall not exceed -33 dBW/100 MHz (measured at the input of antenna).

US161 In the bands 81-86 GHz, 92-94 GHz, and 94.1-95 GHz and within the coordination distances indicated below, assignments to allocated services shall be coordinated with the following radio astronomy observatories. New observatories shall not receive protection from fixed stations that are licensed to operate in the one hundred most populous urbanized areas as defined by the U.S. Census Bureau for the year 2000.

(a) Within 25 km of the National Radio Astronomy Observatory's (NRAO's) Very Long Baseline Array (VLBA) Stations:

State	VLBA Station	Lat. (N)	Long. (W)
AZ	Kitt Peak	31° 57' 23"	111° 36' 45"
CA	Owens Valley	37° 13' 54"	118° 16' 37"
HI	Mauna Kea	19° 48' 05"	155° 27' 20"
IA	North Liberty	41° 46' 17"	091° 34' 27"
NH	Hancock	42° 56' 01"	071° 59' 12"
NM	Los Alamos	35° 46' 30"	106° 14' 44"
NM	Pie Town	34° 18' 04"	108° 07' 09"
TX	Fort Davis	30° 38' 06"	103° 56' 41"
VI	Saint Croix	17° 45' 24"	064° 35' 01"
WA	Brewster	48° 07' 52"	119° 41' 00"

(b) Within 150 km of the following observatories:

State	Telescope and site	Lat. (N)	Long. (W)
AZ	Heinrich Hertz Submillimeter Observatory, Mt. Graham	32° 42' 06"	109° 53' 28"
AZ	University of Arizona 12-m Telescope, Kitt Peak	31° 57' 12"	111° 36' 53"
CA	Caltech Telescope, Owens Valley	37° 13' 54"	118° 17' 36"
CA	Combined Array for Research in Millimeter-wave Astronomy (CARMA)	37° 16' 43"	118° 08' 32"
HI	James Clerk Maxwell Telescope, Mauna Kea	19° 49' 33"	155° 28' 47"
MA	Haystack Observatory, Westford	42° 37' 24"	071° 29' 18"
NM	NRAO's Very Large Array, Socorro	34° 04' 44"	107° 37' 06"
WV	NRAO's Robert C. Byrd Telescope, Green Bank	38° 25' 59"	079° 50' 23"

NOTE: Satisfactory completion of the coordination procedure utilizing the automated mechanism, see 47 CFR 101.1523, will be deemed to establish sufficient separation from radio astronomy observatories, regardless of whether the distances set forth above are met.

\* \* \* \* \*

US227 The bands 156.4875-156.5125 MHz and 156.5375-156.5625 MHz are also allocated to the fixed and land mobile services on a primary basis for non-Federal use in VHF Public Coast Station Areas 10-42. The use of these bands by the fixed and land mobile services shall not cause harmful interference to, nor claim protection from, the maritime mobile VHF radiocommunication service.

\* \* \* \* \*

US334 In the bands between 17.7 GHz and 20.2 GHz, the following provisions shall apply:

(a) In the bands between 17.8 GHz and 20.2 GHz, Federal space stations in both geostationary (GSO) and non-geostationary satellite orbits (NGSO) and associated earth stations in the fixed-satellite service (FSS) (space-to-Earth) may be authorized on a primary basis. For a Federal GSO FSS network to operate on a primary basis, the space station shall be located outside the arc, measured from east to west, 70-120° West longitude. Coordination between Federal FSS systems and non-Federal space and terrestrial systems operating in accordance with the United States Table of Frequency Allocations is required.

(b) In the bands between 17.8 GHz and 20.2 GHz, Federal earth stations operating with Federal space stations shall be authorized on a primary basis only in the following areas: Denver, Colorado; Washington, DC; San Miguel, California; and Guam. Prior to the commencement of non-Federal terrestrial operations in these areas, the FCC shall coordinate with NTIA all applications for new stations and modifications to existing stations as specified in 47 CFR 1.924(f), 74.32, and 78.19(f). In the band 17.7-17.8 GHz, the FCC shall also coordinate with NTIA all applications for new stations and modifications to existing stations that support the operations of Multichannel Video Programming Distributors (MVPD) in these areas, as specified in the aforementioned regulations.

(c) In the bands between 17.8 GHz and 19.7 GHz, the power flux-density (pfd) at the surface of the Earth produced by emissions from a Federal GSO space station or from a Federal space station in a

NGSO constellation of 50 or fewer satellites, for all conditions and for all methods of modulation, shall not exceed the following values in any 1 MHz band:

- (1) -115 dB(W/m<sup>2</sup>) for angles of arrival above the horizontal plane ( $\delta$ ) between 0° and 5°,
- (2) -115 + 0.5( $\delta$  - 5) dB(W/m<sup>2</sup>) for  $\delta$  between 5° and 25°, and
- (3) -105 dB(W/m<sup>2</sup>) for  $\delta$  between 25° and 90°.

(d) In the bands between 17.8 GHz and 19.3 GHz, the pfd at the surface of the Earth produced by emissions from a Federal space station in an NGSO constellation of 51 or more satellites, for all conditions and for all methods of modulation, shall not exceed the following values in any 1 MHz band:

- (1) -115 - X dB(W/m<sup>2</sup>) for  $\delta$  between 0° and 5°,
- (2) -115 - X + ((10 + X)/20)( $\delta$  - 5) dB(W/m<sup>2</sup>) for  $\delta$  between 5° and 25°, and
- (3) -105 dB(W/m<sup>2</sup>) for  $\delta$  between 25° and 90°; where X is defined as a function of the number of satellites, n, in an NGSO constellation as follows:

For  $n \leq 288$ ,  $X = (5/119)(n - 50)$  dB; and

For  $n > 288$ ,  $X = (1/69)(n + 402)$  dB.

\* \* \* \* \*

US338A In the band 1435-1452 MHz, operators of aeronautical telemetry stations are encouraged to take all reasonable steps to ensure that the unwanted emissions power does not exceed -28 dBW/27 MHz in the band 1400-1427 MHz. Operators of aeronautical telemetry stations that do not meet this limit shall first attempt to operate in the band 1452-1525 MHz prior to operating in the band 1435-1452 MHz.

\* \* \* \* \*

US343 In the mobile service, the frequencies between 1435 and 1525 MHz will be assigned for aeronautical telemetry and associated telecommand operations for flight testing of manned or unmanned aircraft and missiles, or their major components. Permissible usage includes telemetry associated with launching and reentry into the Earth's atmosphere as well as any incidental orbiting prior to reentry of manned objects undergoing flight tests. The following frequencies are shared on a co-equal basis with flight telemetering mobile stations: 1444.5, 1453.5, 1501.5, 1515.5, and 1524.5 MHz.

\* \* \* \* \*

US367 The band 5000-5150 MHz is also allocated to the aeronautical mobile-satellite (R) service on a primary basis, subject to agreement obtained under No. 9.21 of the ITU Radio Regulations.

\* \* \* \* \*

US444 The frequency band 5030-5150 MHz is to be used for the operation of the international standard system (microwave landing system) for precision approach and landing. In the frequency band 5030-5091 MHz, the requirements of this system shall have priority over other uses of this band. For the use of the frequency band 5091-5150 MHz, US444A and Resolution 114 (Rev.WRC-12) of the ITU Radio Regulations apply.

US444A The band 5091-5150 MHz is also allocated to the fixed-satellite service (Earth-to-space) on a primary basis for non-Federal use. This allocation is limited to feeder links of non-geostationary satellite systems in the mobile-satellite service and is subject to coordination under No. 9.11A of the ITU Radio Regulations. In the band 5091-5150 MHz, the following conditions also apply:

(a) Prior to January 1, 2018, the use of the band 5091-5150 MHz by feeder links of non-geostationary-satellite systems in the mobile-satellite service shall be made in accordance with Resolution 114 (Rev.WRC-12);

(b) After January 1, 2016, no new assignments shall be made to earth stations providing feeder links of non-geostationary mobile-satellite systems; and

(c) After January 1, 2018, the fixed-satellite service will become secondary to the aeronautical radionavigation service.

US444B In the band 5091-5150 MHz, the following provisions shall apply to the aeronautical mobile service:

(a) Use is restricted to: (1) Systems operating in the aeronautical mobile (R) service (AM(R)S) in accordance with international aeronautical standards, limited to surface applications at airports, and in accordance with Resolution 748 (Rev.WRC-12) (*i.e.*, AeroMACS); and (2) Aeronautical telemetry transmissions from aircraft stations (AMT) in accordance with Resolution 418 (Rev.WRC-12).

(b) Consistent with Radio Regulation No. 4.10, airport surface wireless systems operating in the AM(R)S have priority over AMT systems in the band.

(c) Operators of AM(R)S and AMT systems at the following airports are urged to cooperate with each other in the exchange of information about planned deployments of their respective systems so that the prospects for compatible sharing of the band are enhanced: 1) Boeing Field/King County Intl Airport, Seattle, WA; 2) Lambert-St. Louis Intl Airport, St. Louis, MO; 3) Charleston AFB/Intl Airport, Charleston, SC; 4) Wichita Dwight D. Eisenhower National Airport, Wichita, KS; 5) Roswell Intl Air Center Airport, Roswell, NM; and 6) William P. Gwinn Airport, Jupiter, FL. Other airports may be addressed on a case-by-case basis.

(d) Aeronautical fixed communications that are an integral part of the AeroMACS system authorized in paragraph (a)(1) are also authorized on a primary basis.

\* \* \* \* \*

US475 The use of the band 9300-9500 MHz by the aeronautical radionavigation service is limited to airborne radars and associated airborne beacons. In addition, ground-based radar beacons in the aeronautical radionavigation service are permitted in the band 9300-9320 MHz on the condition that harmful interference is not caused to the maritime radionavigation service.

US476A In the band 9300-9500 MHz, Federal stations in the Earth exploration-satellite service (active) and space research service (active) shall not cause harmful interference to, nor claim protection from, stations of the radionavigation and Federal radiolocation services.

US482 In the band 10.6-10.68 GHz, the following provisions and urgings apply:

(a) Non-Federal use of the fixed service shall be restricted to point-to-point stations, with each station supplying not more than -3 dBW of transmitter power to the antenna, producing not more than 40 dBW of EIRP, and radiating at an antenna main beam elevation angle of 20° or less. Licensees holding a valid authorization on **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]** to operate in this band may continue to operate as authorized, subject to proper license renewal.

(b) In order to minimize interference to the Earth exploration-satellite service (passive) receiving in this band, licensees of stations in the fixed service are urged to: (1) limit the maximum transmitter power supplied to the antenna to -15 dBW; and (2) employ automatic transmitter power control (ATPC). The maximum transmitter power supplied to the antenna of stations using ATPC may be increased by a value corresponding to the ATPC range, up to a maximum of -3 dBW.

US519 The band 18-18.3 GHz is also allocated to the meteorological-satellite service (space-to-Earth) on a primary basis. Its use is limited to geostationary satellites and shall be in accordance with the provisions of Article 21, Table 21-4 of the ITU *Radio Regulations*.

US532 In the bands 21.2-21.4 GHz, 22.21-22.5 GHz, and 56.26-58.2 GHz, the space research and Earth exploration-satellite services shall not receive protection from the fixed and mobile services operating in accordance with the Table of Frequency Allocations.

US550A In the band 36-37 GHz, the following provisions shall apply:

(a) For stations in the mobile service, the transmitter power supplied to the antenna shall not exceed -10 dBW, except that the maximum transmitter power may be increased to -3 dBW for stations used for public safety and disaster management.

(b) For stations in the fixed service, the elevation angle of the antenna main beam shall not exceed 20° and the transmitter power supplied to the antenna shall not exceed:

- (1) -5 dBW for hub stations of point-to-multipoint systems; or
- (2) -10 dBW for all other stations, except that the maximum transmitter power of stations using automatic transmitter power control (ATPC) may be increased by a value corresponding to the ATPC range, up to a maximum of -7 dBW.

US565 The frequency band 275-1000 GHz may be used by administrations for experimentation with, and development of, various active and passive services. In this band a need has been identified for the following spectral line measurements for passive services:

- radio astronomy service: 275-323 GHz, 327-371 GHz, 388-424 GHz, 426-442 GHz, 453-510 GHz, 623-711 GHz, 795-909 GHz and 926-945 GHz;
- Earth exploration-satellite service (passive) and space research service (passive): 275-277 GHz, 294-306 GHz, 316-334 GHz, 342-349 GHz, 363-365 GHz, 371-389 GHz, 416-434 GHz, 442-444 GHz, 496-506 GHz, 546-568 GHz, 624-629 GHz, 634-654 GHz, 659-661 GHz, 684-692 GHz, 730-732 GHz, 851-853 GHz and 951-956 GHz.

Future research in this largely unexplored spectral region may yield additional spectral lines and continuum bands of interest to the passive services. Administrations are urged to take all practicable steps to protect these passive services from harmful interference until the date when the allocation Table is established in the above-mentioned frequency band.

#### NON-FEDERAL GOVERNMENT (NG) FOOTNOTES

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NG22 The frequencies 156.050 and 156.175 MHz may be assigned to stations in the maritime mobile service for commercial and port operations in the New Orleans Vessel Traffic Service (VTS) area and the frequency 156.250 MHz may be assigned to stations in the maritime mobile service for port operations in the New Orleans and Houston VTS areas.

\* \* \* \* \*

NG34 The bands 758-775 MHz and 788-805 MHz are available for assignment to the public safety services, as described in 47 CFR part 90.

NG35 Frequencies in the bands 928-929 MHz, 932-932.5 MHz, 941-941.5 MHz, and 952-960 MHz may be assigned for multiple address systems and associated mobile operations on a primary basis.

\* \* \* \* \*

NG60 In the band 31-31.3 GHz, for stations in the fixed service authorized after **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER, PLUS 36 MONTHS]**, the unwanted emissions power in any 100 MHz of the 31.3-31.5 GHz Earth exploration-satellite service (passive) band shall be limited to -38 dBW (-38 dBW/100 MHz), as measured at the input to the antenna.

\* \* \* \* \*

NG92 The band 1900-2000 kHz is also allocated to the radiolocation service on a primary basis in Region 2 and on a secondary basis in Region 3. This use is restricted to radio buoy operations on the open sea.

\* \* \* \* \*

NG338A In the bands 1390-1395 MHz and 1427-1435 MHz, licensees are encouraged to take all reasonable steps to ensure that unwanted emissions power does not exceed the following levels in the band 1400-1427 MHz:

- (a) For stations of point-to-point systems in the fixed service: -45 dBW/27 MHz.
- (b) For stations in the mobile service (except for devices authorized by the FCC for the Wireless Medical Telemetry Service): -60 dBW/27 MHz.

NG535 The following provisions shall apply to the use of the 24.75-25.25 GHz range by the fixed-satellite service (Earth-to-space):

(a) In the band 24.75-25.05 GHz, feeder links to stations of the broadcasting-satellite service have priority over other uses. Such other uses must protect and may not claim protection from existing and future operating feeder-link networks to such broadcasting satellite stations.

(b) The use of the band 25.05-25.25 GHz is restricted to feeder links for the broadcasting-satellite service.

## PART 25—SATELLITE COMMUNICATIONS

8. The authority citation for part 25 continues to read as follows:

AUTHORITY: Interprets or applies sections 4, 301, 302, 303, 307, 309, 319, 332, 705, and 721 of the Communications Act, as amended, 47 U.S.C. 154, 301, 302, 303, 307, 309, 319, 332, 605, and 721, unless otherwise noted.

9. Section 25.202 is amended by revising paragraph (f) and adding paragraphs (i) and (j) to read as follows:

### **§ 25.202 Frequencies, frequency tolerance and emission limitations.**

\* \* \* \* \*

(f) Emission limitations. Except for SDARS terrestrial repeaters and as provided for in paragraph (i), the mean power of emissions shall be attenuated below the mean output power of the transmitter in accordance with the schedule set forth in paragraphs (f)(1) through (f)(4) of this section. The out-of-band emissions of SDARS terrestrial repeaters shall be attenuated in accordance with the schedule set forth in paragraph (h) of this section.

\* \* \* \* \*

(i) The following unwanted emissions power limits for non-geostationary satellites operating in the inter-satellite service that transmit in the 22.55-23.55 GHz band shall apply in any 200 MHz of the 23.6-24 GHz passive band, based on the date that complete advance publication information is received by the ITU's Radiocommunication Bureau:

(1) For information received before January 1, 2020: -36 dBW.

(2) For information received on or after January 1, 2020: -46 dBW.

(j) For earth stations in the Fixed-Satellite Service (Earth-to-space) that transmit in the 49.7-50.2 GHz and 50.4-50.9 GHz bands, the unwanted emission power in the 50.2-50.4 GHz band shall not exceed -20 dBW/200 MHz (measured at the input of the antenna), except that the maximum unwanted emission power may be increased to -10 dBW/200 MHz for earth stations having an antenna gain greater than or equal to 57 dBi. These limits apply under clear-sky conditions. During fading conditions, the limits may be exceeded by earth stations when using uplink power control.

## PART 27—MISCELLANEOUS WIRELESS COMMUNICATIONS SERVICES

10. The authority citation for part 27 continues to read as follows:

AUTHORITY: 47 U.S.C. 154, 301, 302a, 303, 307, 309, 332, 336, 337, 1403, 1404, 1451, and 1452, unless otherwise noted.

11. Section 27.53 is amended by revising paragraph (j) to read as follows:

### **§ 27.53 Emission limits.**

\* \* \* \* \*

(j)(1) For operations in the unpaired 1390-1392 MHz band and the paired 1392-1395 MHz and 1432-1435 MHz bands, the power of any emission outside the licensee's frequency band(s) of operation shall be attenuated below the transmitter power (P) by at least  $43 + 10 \log (P)$  dB. Compliance with these provisions is based on the procedures described in paragraph (a)(4) of this section.

(2) In the 1390-1395 MHz and 1432-1435 MHz bands, licensees are encouraged to take all reasonable steps to ensure that unwanted emission power does not exceed the following levels in the band 1400-1427 MHz:

(i) For stations of point-to-point systems in the fixed service: -45 dBW/27 MHz.

(ii) For stations in the mobile service: -60 dBW/27 MHz.

\* \* \* \* \*

12. Section 27.803 is amended by revising paragraph (b)(4) to read as follows:

**§27.803 Coordination requirements.**

\* \* \* \* \*

(b) \* \* \*

\* \* \* \* \*

(4) That requires approval of the Frequency Advisory Subcommittee (FAS) of the Interdepartment Radio Advisory Committee (IRAC). Licensees in the 1432-1435 MHz band must receive FAS approval, prior to operation of fixed sites or mobile units within the NTIA recommended protection radii of the Government sites listed in footnote US83 of § 2.106 of this chapter.

\* \* \* \* \*

**PART 74 – EXPERIMENTAL RADIO, AUXILIARY, SPECIAL BROADCAST AND OTHER PROGRAM DISTRIBUTIONAL SERVICES**

13. The authority citation for part 74 continues to read as follows:

AUTHORITY: 47 U.S.C. 154, 302a, 303, 307, 309, 336 and 554.

14. Section 74.32 is amended to read as follows:

**§ 74.32 Operation in the 17.7-17.8 GHz and 17.8-19.7 GHz bands.**

The following exclusion areas and coordination areas are established to minimize or avoid harmful interference to Federal Government earth stations receiving in the 17.7-19.7 GHz band:

(a) No application seeking authority for fixed stations supporting the operations of Multichannel Video Programming Distributors (MVPD) in the 17.7-17.8 GHz band or to operate in the 17.8-19.7 GHz band for any service will be accepted for filing if the proposed station is located within 20 km of Denver, CO (39° 43' N, 104° 46' W) or Washington, DC (38° 48' N, 76° 52' W).

(b) Any application for a new station license to provide MVPD operations in the 17.7-17.8 GHz band or to operate in the 17.8-19.7 GHz band for any service, or for modification of an existing station license in these bands which would change the frequency, power, emission, modulation, polarization, antenna height or directivity, or location of such a station, must be coordinated with the Federal Government by the Commission before an authorization will be issued, if the station or proposed station is located in whole or in part within any of the following areas:

(1) Denver, CO area:

(i) Between latitudes 41° 30' N and 38° 30' N and between longitudes 103° 10' W and 106° 30' W.

(ii) Between latitudes 38° 30' N and 37° 30' N and between longitudes 105° 00' W and 105° 50' W.

(iii) Between latitudes 40° 08' N and 39° 56' N and between longitudes 107° 00' W and 107° 15' W.

(2) Washington, DC area:

(i) Between latitudes 38° 40' N and 38° 10' N and between longitudes 78° 50' W and 79° 20' W.

(ii) Within 178 km of 38° 48' N, 76° 52' W.

(3) San Miguel, CA area:

(i) Between latitudes 34° 39' N and 34° 00' N and between longitudes 118° 52' W and 119° 24' W.

(ii) Within 200 km of 35° 44' N, 120° 45' W.

(4) Guam area: Within 100 km of 13° 35' N, 144° 51' E.

NOTE TO § 74.32: The coordinates cited in this section are specified in terms of the “North American Datum of 1983 (NAD 83).”

## PART 78 – CABLE TELEVISION RELAY SERVICE

15. The authority citation for part 78 continues to read as follows:

AUTHORITY: Secs. 2, 3, 4, 301, 303, 307, 308, 309, 48 Stat., as amended, 1064, 1065, 1066, 1081, 1082, 1083, 1084, 1085; 47 U.S.C. 152, 153, 154, 301, 303, 307, 308, 309.

16. Section 78.19 is amended by revising paragraph (f) to read as follows:

### **§ 78.19 Interference.**

\* \* \* \* \*

(f) 17.7-19.7 GHz band. The following exclusion areas and coordination areas are established to minimize or avoid harmful interference to Federal Government earth stations receiving in the 17.7-19.7 GHz band:

(1) No application seeking authority to operate in the 17.7-19.7 GHz band will be accepted for filing if the proposed station is located within 50 km of Denver, CO (39° 43' N, 104° 46' W) or Washington, DC (38° 48' N, 76° 52' W).

(2) Any application seeking authority for a new fixed station license supporting the operations of Multichannel Video Programming Distributors (MVPD) in the 17.7-17.8 GHz band or to operate in the 17.8-19.7 GHz band for any service, or for modification of an existing station license in these bands which would change the frequency, power, emission, modulation, polarization, antenna height or directivity, or location of such a station, must be coordinated with the Federal Government by the Commission before an authorization will be issued, if the station or proposed station is located in whole or in part within any of the following areas:

(i) Denver, CO area:

(A) Between latitudes 41° 30' N and 38° 30' N and between longitudes 103° 10' W and 106° 30' W.

(B) Between latitudes 38° 30' N and 37° 30' N and between longitudes 105° 00' W and 105° 50' W.

(C) Between latitudes 40° 08' N and 39° 56' N and between longitudes 107° 00' W and 107° 15' W.

(ii) Washington, DC area:

(A) Between latitudes 38° 40' N and 38° 10' N and between longitudes 78° 50' W and 79° 20' W.

(B) Within 178 km of 38° 48' N, 76° 52' W.

(iii) San Miguel, CA area:

(A) Between latitudes 34° 39' N and 34° 00' N and between longitudes 118° 52' W and 119° 24' W.

(B) Within 200 km of 35° 44' N, 120° 45' W.

(iv) Guam area: Within 100 km of 13° 35' N, 144° 51' E.

NOTE TO § 78.19(F): The coordinates cited in this section are specified in terms of the “North American Datum of 1983 (NAD 83).”

\* \* \* \* \*

**PART 80 – STATIONS IN THE MARITIME SERVICES**

17. The authority citation for Part 80 continues to read as follows:

AUTHORITY: Secs. 4, 303, 307(e), 309, and 332, 48 Stat. 1066, 1082, as amended; 47 U.S.C. 154, 303, 307(e), 309, and 332, unless otherwise noted. Interpret or apply 48 Stat. 1064-1068, 1081-1105, as amended; 47 U.S.C. 151-155, 301-609; 3 UST 3450, 3 UST 4726, 12 UST 2377.

18. Section 80.371 is amended by revising note 3 in paragraph (c) to read as follows:

**§ 80.371 Public correspondence frequencies.**

\* \* \* \* \*

(c) \* \* \*

\* \* \* \* \*

<sup>3</sup>The frequency 161.975 MHz is available only for Automatic Identification System communications. In VPCAs 10-42, site-based stations licensed to operate on frequency 161.975 MHz prior to March 2, 2009 may continue to operate on a co-primary basis on that frequency until March 2, 2024.

\* \* \* \* \*

**PART 87 – AVIATION SERVICES**

19. The authority citation for Part 87 continues to read as follows:

AUTHORITY: 47 U.S.C. 154, 303 and 307(e), unless otherwise noted.

20. Section 87.5 is amended by adding the following term and definition:

**§ 87.5 Definitions.**

\* \* \* \* \*

Flight telemetering mobile station. A telemetering mobile station used for transmitting data from an airborne vehicle, excluding data related to airborne testing of the vehicle itself (or major components thereof).

\* \* \* \* \*

21. Section 87.133 is amended by revising paragraph (f) to read as follows:

**§ 87.133 Frequency stability.**

\* \* \* \* \*

(f) The carrier frequency tolerance of all transmitters that operate in the 1435-1525 MHz or 2345-2395 MHz band is 0.002 percent. The carrier frequency tolerance of all transmitters that operate in the 5091-5150 MHz band is 0.005 percent.

\* \* \* \* \*

22. Section 87.137 is amended by revising note 8 to the table of assignable emissions in paragraph (a) to read as follows:

**§ 87.137 Types of emission.**

(a) \* \* \*

Notes:

\* \* \* \* \*

<sup>8</sup>The authorized bandwidth is equal to the necessary bandwidth for frequency or digitally modulated transmitters used in aeronautical telemetering and associated aeronautical telemetry or telecommand stations that operate in the 1435-1525 MHz, 2345-2395 MHz, or 5091-5150 MHz band. The necessary bandwidth must be computed in accordance with part 2 of this chapter.

\* \* \* \* \*

23. Section 87.139 is amended by revising the introductory text in paragraphs (a), (d), (e), and (f) and by adding paragraph (m) to read as follows:

**§ 87.139 Emission limitations.**

(a) Except for ELTs and when using single sideband (R3E, H3E, J3E), or frequency modulation (F9) or digital modulation (F9Y) for telemetry or telecommand in the 1435-1525 MHz, 2345-2395 MHz, or 5091-5150 MHz band or digital modulation (G7D) for differential GPS, the mean power of any emissions must be attenuated below the mean power of the transmitter (pY) as follows:

\* \* \* \* \*

(d) Except for telemetry in the 1435-1525 MHz band, when the frequency is removed from the assigned frequency by more than 250 percent of the authorized bandwidth for aircraft stations above 30 MHz and all ground stations the attenuation must be at least  $43+10 \log_{10} pY$  dB.

(e) When using frequency modulation or digital modulation for telemetry or telecommand in the 1435-1525 MHz, 2345-2395 MHz, or 5091-5150 MHz band with an authorized bandwidth equal to or less than 1 MHz the emissions must be attenuated as follows:

\* \* \* \* \*

(f) When using frequency modulation or digital modulation for telemetry or telecommand in the 1435-1525 MHz, 2345-2395 MHz, or 5091-5150 MHz band with an authorized bandwidth greater than 1 MHz, the emissions must be attenuated as follows:

\* \* \* \* \*

(m) In the 1435-1452 MHz band, operators of aeronautical telemetry stations are encouraged to take all reasonable steps to ensure that unwanted emissions power does not exceed -28 dBW/27 MHz in the 1400-1427 MHz band. Operators of aeronautical telemetry stations that do not meet this limit shall first attempt to operate in the 1452-1525 MHz band prior to operating in the 1435-1452 MHz band.

\* \* \* \* \*

24. Section 87.173 is amended by revising the frequency table in paragraph (b) as follows:

- a. The entries for the 2310-2320 MHz band and the 24750-25050 MHz band are removed.
- b. The entry for the 5000-5250 MHz band is replaced with an entry for the 5030-5150 MHz band.
- c. Entries for the 5091-5150 MHz and 24450-24650 MHz bands are added.

The additions and revisions read as follows:

**§ 87.173 Frequencies.**

\* \* \* \* \*

(b) Frequency table:

Frequency or frequency band	Subpart	Class of station	Remarks
* *	* *	* *	*
5030-5150 MHz.....	Q	MA, RLW	Microwave landing systems.
5031.000 MHz.....	Q	RLT	
5091-5150 MHz.....	J	MA, FAT	Aeronautical telemetry.
* *	* *	* *	*
24450-24650 MHz.....	F, Q	MA, RL	Aeronautical radionavigation.
32300-33400 MHz.....	F, Q	MA, RL	Aeronautical radionavigation.

\* \* \* \* \*

25. Section 87.187 is amended by revising paragraphs (p) and (x) to read as follows:

**§ 87.187 Frequencies.**

\* \* \* \* \*

(p) The 1435-1525 MHz and 2360-2395 MHz bands are available on a primary basis, and the 2345-2360 MHz band is available on a secondary basis (the latter band only until January 1, 2020), for telemetry and telecommand associated with the flight testing of aircraft, missiles, or related major components. This includes launching into space, reentry into the Earth's atmosphere and incidental orbiting prior to reentry. In the 1435-1525 MHz band, the following frequencies are shared on a co-equal basis with flight telemetering mobile stations: 1444.5, 1453.5, 1501.5, 1515.5, and 1524.5 MHz. In the 2360-2395 MHz band, the following frequencies may be assigned for telemetry and associated telecommand operations of expendable and re-usable launch vehicles, whether or not such operations involve flight testing: 2364.5, 2370.5 and 2382.5 MHz. See §87.303(d).

Note to paragraph (p): Aeronautical telemetry operations must protect Miscellaneous Wireless Communications Services operating in the 2345-2360 MHz band.

\* \* \* \* \*

(x) The frequency bands 24450-24650 MHz and 32300-33400 MHz are available for airborne radionavigation devices.

\* \* \* \* \*

26. Section 87.303 is amended by revising paragraph (d) to read as follows:

**§ 87.303 Frequencies.**

\* \* \* \* \*

(d) Aeronautical mobile telemetry (AMT) operations are conducted in the 1435-1525 MHz, 2345-2395 MHz, and 5091-5150 MHz bands on a co-equal basis with U.S. Government stations.

(1) Frequencies in the 1435-1525 MHz and 2360-2395 MHz bands are assigned in the mobile service primarily for aeronautical telemetry and associated telecommand operations for flight testing of aircraft and missiles, or their major components. Until January 1, 2020, the 2345-2360 MHz band is also available to licensees holding a valid authorization on April 23, 2015 for these purposes on a secondary basis. Permissible uses of these bands include telemetry and associated telecommand operations associated with the launching and reentry into the Earth's atmosphere, as well as any incidental orbiting prior to reentry, of objects undergoing flight tests. In the 1435-1525 MHz band, the following

frequencies are shared on a co-equal basis with flight telemetering mobile stations: 1444.5, 1453.5, 1501.5, 1515.5, and 1524.5 MHz. In the 2360-2395 MHz band, the following frequencies may be assigned for telemetry and associated telecommand operations of expendable and re-usable launch vehicles, whether or not such operations involve flight testing: 2364.5, 2370.5 and 2382.5 MHz. All other mobile telemetry uses of the 2360-2395 MHz band shall be on a non-interfering and unprotected basis to the above uses.

(2) Frequencies in the 5091-5150 MHz band are assigned in the aeronautical mobile service on a primary basis for flight testing of aircraft. AMT use of these frequencies is restricted to aircraft stations transmitting to aeronautical stations (AMT ground stations) in the flight test areas listed in 47 CFR 2.106, footnote US111.

(3) The authorized bandwidths for stations that operate in the 1435-1525 MHz, 2345-2395 MHz, or 5091-5150 MHz bands are normally 1, 3 or 5 MHz. Applications for greater bandwidths will be considered in accordance with the provisions of § 87.135. Each assignment will be centered on a frequency between 1435.5 MHz and 1524.5 MHz, between 2345.5 MHz and 2394.5 MHz, or between 5091.5 MHz and 5149.5 MHz, with 1 MHz channel spacing.

\* \* \* \* \*

27. Section 87.305 is amended by revising paragraph (a)(1) to read as follows:

**§ 87.305 Frequency coordination.**

(a)(1) Each application for a new station license, renewal or modification of an existing license concerning flight test frequencies, except as provided in paragraph (b) of this section, must be accompanied by a statement from a frequency advisory committee. The committee must comment on the frequencies requested or the proposed changes in the authorized station and the probable interference to existing stations. The committee must consider all stations operating on the frequencies requested or assigned within 320 km (200 mi) of the proposed area of operation and all prior coordinations and assignments on the proposed frequency(ies). The committee must also recommend frequencies resulting in the minimum interference. The committee must coordinate in writing all requests for frequencies or proposed operating changes in the 1435-1525 MHz, 2345-2360 MHz (only until January 1, 2020), 2360-2395 MHz, and 5091-5150 MHz bands with the responsible Government Area Frequency Coordinators listed in the NTIA “Manual of Regulations and Procedures for Federal Radio Frequency Management.” In addition, committee recommendations may include comments on other technical factors and may contain recommended restrictions which it believes should appear on the license.

\* \* \* \* \*

28. Section 87.475 is amended by adding paragraphs (b)(11) and (b)(14) to read as follows:

**§ 87.475 Frequencies.**

\* \* \* \* \*

(b) \* \* \*

\* \* \* \* \*

(11) 5030-5150 MHz: This band is to be used for the operation of the international standard system (microwave landing system).

\* \* \* \* \*

(14) 24,450-24,650 MHz and 32,300-33,400 MHz: In these bands, land-based radionavigation aids are permitted where they operate with airborne radionavigation devices.

\* \* \* \* \*

**PART 90 – PRIVATE LAND MOBILE RADIO SERVICES**

29. The authority citation for Part 90 continues to read as follows:

AUTHORITY: Sections 4(i), 11, 303(g), 303(r), and 332(c)(7) of the Communications Act of 1934, as amended, 47 U.S.C. 154(i), 161, 303(g), 303(r), and 332(c)(7), and Title VI of the Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. 112-96, 126 Stat. 156.

30. Section 90.210 is amended by adding paragraph (c)(4) to read as follows:

**§ 90.210 Emission masks.**

\* \* \* \* \*

(c) \* \* \*

\* \* \* \* \*

(4) In the 1427-1432 MHz band, licensees are encouraged to take all reasonable steps to ensure that unwanted emissions power does not exceed the following levels in the 1400-1427 MHz band:

(i) For stations of point-to-point systems in the fixed service: -45 dBW/27 MHz.

(ii) For stations in the mobile service: -60 dBW/27 MHz.

\* \* \* \* \*

31. Section 90.103 is amended by removing and reserving paragraphs (c)(25), (c)(26), (c)(27), and (c)(28) and by revising the Kilohertz portion of the Radiolocation Service Frequency Table in paragraph (b) to read as follows:

**§ 90.103 Radiolocation Service.**

\* \* \* \* \*

(b) \* \* \*

RADIOLOCATION SERVICE FREQUENCY TABLE

Frequency or band	Class of station(s)	Limitation
<b>Kilohertz</b>		
70 to 90.....	Radiolocation land or mobile	1
90 to 110.....	Radiolocation land	2
110 to 130.....	Radiolocation land or mobile	1
1705 to 1715.....	.....do	4, 5, 6
1715 to 1750.....	.....do	5, 6
1750 to 1800.....	.....do	5, 6
3230 to 3400.....	.....do	6, 8
<b>Megahertz</b>		
* * *	* *	* *

(c) \* \* \*

\* \* \* \* \*

(25) [Reserved]

(26) [Reserved]

(27) [Reserved]

(28) [Reserved]

\* \* \* \* \*

**PART 97 – AMATEUR RADIO SERVICE**

32. The authority citation for part 97 continues to read as follows:

AUTHORITY: 48 Stat. 1066, 1082, as amended; 47 U.S.C. 154, 303. Interpret or apply 48 Stat. 1064-1068, 1081-1105, as amended; 47 U.S.C. 151-155, 301-609, unless otherwise noted.

33. Section 97.301 is amended by revising the kHz portion of the tables in paragraphs (b), (c), and (d) to read as follows:

**§ 97.301 Authorized frequency bands.**

\* \* \* \* \*

(b) \* \* \*

Wavelength band	ITU Region 1	ITU Region 2	ITU Region 3	Sharing requirements see § 97.303 (Paragraph)
MF	kHz	kHz	kHz	
160 m.....	1810-1850.....	1800-2000.....	1800-2000.....	(a)
**	**	*	*	*

(c) \* \* \*

Wavelength band	ITU Region 1	ITU Region 2	ITU Region 3	Sharing requirements see § 97.303 (Paragraph)
MF	kHz	kHz	kHz	
160 m.....	1810-1850.....	1800-2000.....	1800-2000.....	(a)
**	**	*	*	*

(d) \* \* \*

Wavelength band	ITU Region 1	ITU Region 2	ITU Region 3	Sharing requirements see § 97.303 (Paragraph)
MF	kHz	kHz	kHz	
160 m.....	1810-1850.....	1800-2000.....	1800-2000.....	(a)
**	**	*	*	*

\* \* \* \* \*

34. Section 97.303 is amended by revising paragraph (c) and removing and reserving paragraph (g) to read as follows:

**§ 97.303 Frequency sharing requirements.**

\* \* \* \* \*

(c) Amateur stations transmitting in the 76-77.5 GHz segment, the 78-81 GHz segment, the 136-141 GHz segment, or the 241-248 GHz segment must not cause harmful interference to, and must accept interference from, stations authorized by the United States Government, the FCC, or other nations in the radiolocation service.

\* \* \* \* \*

(g) [Reserved]

\* \* \* \* \*

**PART 101—FIXED MICROWAVE SERVICES**

35. The authority citation for part 101 continues to read as follows:

AUTHORITY: 47 U.S.C. 154, 303.

36. Section 101.31 is amended by revising paragraph (b)(1) to read as follows:

**§ 101.31 Temporary and conditional authorizations.**

\* \* \* \* \*

(b) Conditional authorization. (1) An applicant for a new point-to-point microwave radio station(s) or a modification of an existing station(s) in the 952.95-956.15 and 956.55-959.75 MHz band segments; the 3700-4200, 5925-6425, 6525-6875, and 6875-7125 MHz bands; the 10.550-10.680, 10.700-11.700, 12.700-13.150, 13.200-13.250, 17.700-18.300, and 19.300-19.700 GHz bands; and the 21.800-22.000 and 23.000-23.200 GHz band segments (see §101.147(s)(8) for specific service usage) may operate the proposed station(s) during the pendency of its applications(s) upon the filing of a properly completed formal application(s) that complies with subpart B of part 101, if the applicant certifies that the following conditions are satisfied:

\* \* \* \* \*

37. Section 101.111 is amended by adding paragraph (d) to read as follows:

**§ 101.111 Emission limitations.**

\* \* \* \* \*

(d) Interference to passive sensors. These limitations are necessary to minimize the probability of harmful interference to reception in the 10.6-10.68 GHz and 31-31.3 GHz bands onboard space stations in the Earth exploration-satellite service (passive).

(1) 10.6-10.68 GHz. Fixed stations are restricted to point-to-point operations, with each station supplying not more than -3 dBW of transmitter power to the antenna, producing not more than 40 dBW of EIRP, and radiating at an antenna main beam elevation angle of 20° or less. Licensees holding a valid authorization on **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]** to operate in this band may continue to operate as authorized, subject to proper license renewal. Licensees are urged to: (i) limit the maximum transmitter power supplied to the antenna to -15 dBW; and (ii) employ automatic transmitter power control (ATPC). The maximum transmitter power supplied to the antenna of stations using ATPC may be increased by a value corresponding to the ATPC range, up to a maximum of -3 dBW.

(2) 31-31.3 GHz. For fixed stations authorized after **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER, PLUS 36 MONTHS]**, the unwanted emissions power in any 100 MHz of the 31.3-31.5 GHz band shall be limited to -38 dBW (-38 dBW/100 MHz), as measured at the input to the antenna.

## APPENDIX E

## Final Regulatory Flexibility Analysis

1. As required by the Regulatory Flexibility Act of 1980, as amended (RFA),<sup>1</sup> an Initial Regulatory Flexibility Analysis (IRFA) was incorporated in the *Notice of Proposed Rulemaking* in ET Docket No. 12-338 (*WRC-07 NPRM*).<sup>2</sup> The Commission sought written public comment on the proposals in the *WRC-07 NPRM*, including comment on the IRFA. This present Final Regulatory Flexibility Analysis (FRFA) conforms to the RFA.<sup>3</sup>

**A. Need for, and Objectives of the Report and Order**

2. In this Report and Order, the Commission amends Parts 1, 2, 25, 27, 74, 78, 80, 87, 90, 97, and 101 of its rules to complete implementation of various allocation decisions from the Final Acts of the World Radiocommunications Conference (Geneva, 2007) (WRC-07) in the Commission's Table of Frequency Allocations, to revise certain other allocations in the Table, and to update certain related service rules. The decisions adopted in this Report and Order conform the Commission's rules, to the extent practical, to the decisions that the international community made at WRC-07 and will collectively promote the advancement of new and expanded services and provide significant benefits to the American public.

**B. Summary of Significant Issues Raised by Public Comments in Response to the IRFA**

3. No comments were filed in direct response to the IRFA.

**C. Response to Comments by the Chief Counsel for Advocacy of the Small Business Administration**

4. Pursuant to the Small Business Jobs Act of 2010, the Commission is required to respond to any comments filed by the Chief Counsel for Advocacy of the Small Business Administration (SBA), and to provide a detailed statement of any change made to the proposed rules as a result of those comments. The Chief Counsel did not file any comments in response to the proposed rules in this proceeding.

**D. Description and Estimate of the Number of Small Entities to Which the Adopted Rules Will Apply**

5. The RFA directs agencies to provide a description of and, where feasible, an estimate of the number of small entities that may be affected by the proposed rules, if adopted.<sup>4</sup> The RFA generally defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction." In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act.<sup>5</sup> A small business

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<sup>1</sup> See 5 U.S.C. § 603. The RFA, *see* 5 U.S.C. § 601 – 612, has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), Pub. L. No. 104-121, Title II, 110 Stat. 857 (1996), and the Small Business Jobs Act of 2010, Public Law No. 111-240, 124 Stat. 2504 (2010).

<sup>2</sup> See Amendment of Parts 1, 2, 15, 74, 78, 87, 90, and 97 of the Commission's Rules Regarding Implementation of the Final Acts of the World Radiocommunication Conference (Geneva, 2007) (WRC-07), Other Allocation Issues, and Related Rule Updates, ET Docket No. 12-338, *Notice of Proposed Rulemaking and Order*, 27 FCC Rcd 14598 (2012) (*WRC-07 NPRM*).

<sup>3</sup> See 5 U.S.C. § 604.

<sup>4</sup> *Id.* at § 603(b)(3).

concern is one which: 1) is independently owned and operated; 2) is not dominant in its field of operation; and 3) satisfies any additional criteria established by the SBA.<sup>6</sup>

**Small Businesses, Small Organizations, and Small Governmental Jurisdictions.** Our action may, over time, affect small entities that are not easily categorized at present. We therefore describe here, at the outset, three comprehensive, statutory small entity size standards.<sup>7</sup> First, nationwide, there are a total of 28.2 million small businesses, according to the SBA.<sup>8</sup> In addition, a “small organization” is generally “any not-for-profit enterprise which is independently owned and operated and is not dominant in its field.”<sup>9</sup> Nationwide, as of 2012, there were approximately 2,300,000 small organizations.<sup>10</sup> Finally, the term “small governmental jurisdiction” is defined generally as “governments of cities, towns, townships, villages, school districts, or special districts, with a population of less than fifty thousand.”<sup>11</sup> Census Bureau data for 2012 indicate that there were 90,056 local governments in the United States.<sup>12</sup> Thus, we estimate that most governmental jurisdictions are small.

**Amateur Radio Service.** Because “small entities,” as defined in the RFA, are not persons eligible for licensing in the amateur service, this rule does not apply to “small entities.” Rather, it applies exclusively to individuals who are the control operators of amateur radio stations.

**Satellite Telecommunications and All Other Telecommunications.** Two economic census categories address the satellite industry. Both these categories have a small business size standard of \$32.5 million or less in annual receipts under SBA rules.<sup>13</sup>

The category of Satellite Telecommunications “comprises establishments primarily engaged in providing telecommunications services to other establishments in the telecommunications and broadcasting industries by forwarding and receiving communications signals via a system of satellites or reselling satellite telecommunications.”<sup>14</sup> Census Bureau data for 2007 show that 512 Satellite Telecommunications firms operated for that entire year.<sup>15</sup> Of this total, 464 firms had annual receipts of under \$10 million, and 18 firms had receipts of \$10 million to \$24,999,999.<sup>16</sup> Consequently, the Commission estimates that the majority of Satellite Telecommunications firms are small entities that

(Continued from previous page) \_\_\_\_\_

<sup>5</sup> 5 U.S.C. § 601(3) (incorporating by reference the definition of “small business concern” in 15 U.S.C. § 632).

Pursuant to the RFA, the statutory definition of a small business applies “unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register.” 5 U.S.C. § 601(3).

<sup>6</sup> Small Business Act, 15 U.S.C. § 632 (1996).

<sup>7</sup> See 5 U.S.C. §§ 601(3)–(6).

<sup>8</sup> See SBA, Office of Advocacy, “Frequently Asked Questions,”

[http://www.sba.gov/sites/default/files/FAQ\\_March\\_2014\\_0.pdf](http://www.sba.gov/sites/default/files/FAQ_March_2014_0.pdf) (last visited May 2, 2014; figures are from 2011).

<sup>9</sup> 5 U.S.C. § 601(4).

<sup>10</sup> NATIONAL CENTER FOR CHARITABLE STATISTICS, THE NONPROFIT ALMANAC (2012).

<sup>11</sup> 5 U.S.C. § 601(5).

<sup>12</sup> U.S. CENSUS BUREAU, GOVERNMENT ORGANIZATION SUMMARY REPORT: 2012 (rel. Sep. 26, 2013),

[http://www2.census.gov/govs/cog/g12\\_org.pdf](http://www2.census.gov/govs/cog/g12_org.pdf) (last visited May 2, 2014).

<sup>13</sup> 13 C.F.R. § 121.201, North American Industry Classification System (“NAICS”) codes 517410 and 517919.

<sup>14</sup> U.S. Census Bureau, 2007 NAICS Definitions, “517410 Satellite Telecommunications.”

<sup>15</sup> See [http://factfinder.census.gov/servlet/IBQTable?\\_bm=y&-geo\\_id=&-skip=900&-ds\\_name=EC0751SSSZ4&-lang=en](http://factfinder.census.gov/servlet/IBQTable?_bm=y&-geo_id=&-skip=900&-ds_name=EC0751SSSZ4&-lang=en).

<sup>16</sup> See [http://factfinder.census.gov/servlet/IBQTable?\\_bm=y&-geo\\_id=&-skip=900&-ds\\_name=EC0751SSSZ4&-lang=en](http://factfinder.census.gov/servlet/IBQTable?_bm=y&-geo_id=&-skip=900&-ds_name=EC0751SSSZ4&-lang=en).

might be affected by our action.

The second category, *i.e.* “All Other Telecommunications” comprises “establishments primarily engaged in providing specialized telecommunications services, such as satellite tracking, communications telemetry, and radar station operation. This industry also includes establishments primarily engaged in providing satellite terminal stations and associated facilities connected with one or more terrestrial systems and capable of transmitting telecommunications to, and receiving telecommunications from, satellite systems. Establishments providing Internet services or voice over Internet protocol (VoIP) services via client-supplied telecommunications connections are also included in this industry.”<sup>17</sup> For this category, Census Bureau data for 2007 show that there were a total of 2,383 firms that operated for the entire year.<sup>18</sup> Of this total, 2,347 firms had annual receipts of under \$25 million and 12 firms had annual receipts of \$25 million to \$49,999,999.<sup>19</sup> Consequently, the Commission estimates that the majority of All Other Telecommunications firms are small entities.

**Fixed Microwave Services.** Fixed microwave services include common carrier,<sup>20</sup> private operational-fixed,<sup>21</sup> and broadcast auxiliary radio services.<sup>22</sup> At present, there are approximately 22,015 common carrier fixed licensees and 61,670 private operational-fixed licensees and broadcast auxiliary radio licensees in the microwave services. The Commission has not created a size standard for a small business specifically with respect to fixed microwave services. For purposes of this analysis, the Commission uses the SBA small business size standard for the category Wireless Telecommunications Carriers (except Satellite), which is 1,500 or fewer employees.<sup>23</sup> The Commission does not have data specifying the number of these licensees that have no more than 1,500 employees, and thus we are unable at this time to estimate with greater precision the number of fixed microwave service licensees that would qualify as small business concerns under the SBA’s small business size standard. Consequently, the Commission estimates that there are 22,015 or fewer common carrier fixed licensees and 61,670 or fewer private operational-fixed licensees and broadcast auxiliary radio licensees in the microwave services that may be small and may be affected by the rules and policies proposed herein. We note, however, that the common carrier microwave fixed licensee category includes some large entities.

**Wireless Telecommunications Carriers (except satellite).** This industry comprises establishments engaged in operating and maintaining switching and transmission facilities to provide communications via the airwaves. Establishments in this industry have spectrum licenses and provide services using that spectrum, such as cellular phone services, paging services, wireless Internet access, and wireless video

<sup>17</sup> <http://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=517919&search=2007%20NAICS%20Search>.

<sup>18</sup> [http://factfinder.census.gov/servlet/IBQTable?\\_bm=y&-geo\\_id=&-skip=900&-ds\\_name=EC0751SSSZ4&-lang=en](http://factfinder.census.gov/servlet/IBQTable?_bm=y&-geo_id=&-skip=900&-ds_name=EC0751SSSZ4&-lang=en).

<sup>19</sup> [http://factfinder.census.gov/servlet/IBQTable?\\_bm=y&-geo\\_id=&-skip=900&-ds\\_name=EC0751SSSZ4&-lang=en](http://factfinder.census.gov/servlet/IBQTable?_bm=y&-geo_id=&-skip=900&-ds_name=EC0751SSSZ4&-lang=en).

<sup>20</sup> See 47 C.F.R. §§ 101 *et seq.* for common carrier fixed microwave services (except Multipoint Distribution Service).

<sup>21</sup> Persons eligible under Parts 80 and 90 of the Commission’s Rules can use Private Operational-Fixed Microwave services. See 47 C.F.R. Parts 80 and 90. Stations in this service are called operational-fixed to distinguish them from common carrier and public fixed stations. Only the licensee may use the operational-fixed station and only for communications related to the licensee’s commercial, industrial, or safety operations.

<sup>22</sup> Auxiliary Microwave Service is governed by Part 74 of Title 47 of the Commission’s Rules. See 47 C.F.R. Part 74. This service is available to licensees of broadcast stations and to broadcast and cable network entities. Broadcast auxiliary microwave stations are used for relaying broadcast television signals from the studio to the transmitter, or between two points such as a main studio and an auxiliary studio. The service also includes mobile television pickups, which relay signals from a remote location back to the studio.

<sup>23</sup> 13 C.F.R. § 121.201, NAICS code 517210.

services.<sup>24</sup> The appropriate size standard under SBA rules is for the category Wireless Telecommunications Carriers. The size standard for that category is that a business is small if it has 1,500 or fewer employees.<sup>25</sup> Under the present and prior categories, the SBA has deemed a wireless business to be small if it has 1,500 or fewer employees.<sup>26</sup> For this category, census data for 2007 show that there were 11,163 firms that operated for the entire year.<sup>27</sup> Of this total, 10,791 firms had employment of 999 or fewer employees and 372 had employment of 1,000 employees or more.<sup>28</sup> Thus under this category and the associated small business size standard, the Commission estimates that the majority of wireless telecommunications carriers (except satellite) are small entities that may be affected by our proposed action.<sup>29</sup>

**Wireless Equipment Manufacturers.** This industry is comprised of businesses primarily engaged in manufacturing radio, television broadcast, and wireless communications equipment. Examples of products made by these establishments are: transmitting and receiving antennas, cable television equipment, cordless phones, global positioning system (GPS) equipment, pagers, cellular phones, mobile communications equipment, and radio and television studio and broadcasting equipment.<sup>30</sup> In this category, the SBA has deemed a business manufacturing radio and television broadcasting equipment, wireless telecommunications equipment, or both, to be small if it has fewer than 750 employees.<sup>31</sup> For this category of manufacturing, Census data for 2007 show that there were 919 firms that operated that year. Of those establishments, 531 had between 1 and 19 employees; 240 had between 20 and 99 employees; and 148 had more than 100 employees.<sup>32</sup> Since 771 establishments had fewer than 100 employees, and since only 148 had more than 100 employees, the vast majority of manufacturers in this category would be considered small under applicable standards.

**Frequency Coordinators.** Neither the Commission nor the SBA has developed a small business size standard specifically applicable to spectrum frequency coordinators. Since 2007, the Census Bureau has placed wireless firms within the broad, economic census category of Wireless Telecommunications Carriers (except Satellite).<sup>33</sup> Under this category, the SBA has deemed a wireless business to be small if it has 1,500 or fewer employees.<sup>34</sup> Census data for 2007 show that there were 1,383 firms that operated

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<sup>24</sup> See <http://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=517210&search=2007%20NAICS%20Search>.

<sup>25</sup> 13 C.F.R. § 121.201, NAICS code 517210.

<sup>26</sup> 13 C.F.R. § 121.201, NAICS code 517210. The now-superseded, pre-2007 C.F.R. citations were 13 C.F.R. § 121.201, NAICS codes 517211 and 517212 (referring to the 2002 NAICS).

<sup>27</sup> U.S. Census Bureau, Subject Series: Information, Table 5, “Establishment and Firm Size: Employment Size of Firms for the United States: 2007 NAICS Code 517210” (issued Nov. 2010).

<sup>28</sup> *Id.* Available census data do not provide a more precise estimate of the number of firms that have employment of 1,500 or fewer employees; the largest category provided is for firms with “100 employees or more.”

<sup>29</sup> See [http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN\\_2007\\_US\\_51SSSZ2&prodType=table](http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2007_US_51SSSZ2&prodType=table).

<sup>30</sup> <http://www.census.gov/econ/industry/def/d334220.htm>.

<sup>31</sup> See 13 C.F.R. § 121.201, NAICS code 334220.

<sup>32</sup> [http://factfinder.census.gov/servlet/IBQTable?\\_bm=y&-geo\\_id=&-\\_skip=300&-ds\\_name+EC073111&-\\_lang=en](http://factfinder.census.gov/servlet/IBQTable?_bm=y&-geo_id=&-_skip=300&-ds_name+EC073111&-_lang=en).

<sup>33</sup> U.S. Census Bureau, 2007 NAICS Definitions, “517210 Wireless Telecommunications Categories (Except Satellite)”; <http://www.census.gov/naics/2007/def/ND517210.HTM#N517210>.

<sup>34</sup> 13 C.F.R. § 121.201, NAICS code 517210 (2007 NAICS).

that year. Of those, 1,368 had fewer than 100 employees, and 15 firms had more than 100 employees.<sup>35</sup> Thus, under this category and the associated small business standard, the majority of firms can be considered small.

**E. Description of Projected Reporting, Recordkeeping and Other Compliance Requirements for Small Entities**

6. The WRC-07 R&O did not establish any new reporting or recordkeeping requirements for small entities. The WRC-07 R&O established “other” compliance requirements for manufacturers of equipment, applicants/licensees, and frequency coordinators. Licensees are required to use equipment and operate licensed stations in a manner that complies with the Commission’s existing and newly adopted rules. The compliance requirements established in the WRC-07 R&O are the same for small and large entities.

7. Manufacturers of aircraft stations transmitting telemetry in the 1435-1525 MHz, 2345-2395 MHz, or 5091-5150 MHz band must meet the following emissions limitations and frequency stability requirements:

- Except for emergency locator transmitters (ELTs) and when using single sideband (R3E, H3E, J3E), or frequency modulation (F9) or digital modulation (F9Y) for telemetry or telecommand in the 1435-1525 MHz, 2345-2395 MHz, or 5091-5150 MHz band or digital modulation (G7D) for differential GPS, the mean power of any emission must be attenuated below the mean power of the transmitter (pY) as follows: 1) When the frequency is removed from the assigned frequency by more than 50 percent up to and including 100 percent of the authorized bandwidth the attenuation must be at least 25 dB; 2) When the frequency is removed from the assigned frequency by more than 100 percent up to and including 250 percent of the authorized bandwidth the attenuation must be at least 35 dB; 3) When the frequency is removed from the assigned frequency by more than 250 percent of the authorized bandwidth the attenuation for aircraft station transmitters’ emissions must be at least 40 dB; and the attenuation for aeronautical station transmitters’ emissions must be at least  $43 + 10 \log_{10} pY$  dB.
- When using frequency modulation or digital modulation for telemetry or telecommand in the 1435-1525 MHz, 2345-2395 MHz, or 5091-5150 MHz band with an authorized bandwidth equal to or less than 1 megahertz the emissions must be attenuated as follows: (1) On any frequency removed from the assigned frequency by more than 100 percent of the authorized bandwidth up to and including 100 percent plus 0.5 megahertz, the attenuation must be at least 60 dB, when measured in a 3.0 kilohertz bandwidth. This signal need not be attenuated more than 25 dB below 1 milliwatt. (2) On any frequency removed from the assigned frequency by more than 100 percent of the authorized bandwidth plus 0.5 megahertz, the attenuation must be at least  $55 + 10 \log_{10} pY$  dB when measured in a 3.0 kilohertz bandwidth.
- When using frequency modulation or digital modulation for telemetry or telecommand in the 1435-1525 MHz, 2345-2395 MHz, or 5091-5150 MHz band with an authorized bandwidth greater than 1 megahertz, the emissions must be attenuated as follows: 1) On any frequency removed from the assigned frequency by more than 50 percent of the authorized bandwidth plus 0.5 megahertz up to and including 50 percent of the authorized bandwidth plus 1.0 megahertz, the attenuation must be 60 dB, when measured in a 3.0 kilohertz bandwidth. The signal need not be attenuated more than 25 dB below 1 milliwatt. 2) On any frequency removed from the assigned frequency by more than 50 percent of the authorized bandwidth plus 1.0 megahertz, the attenuation must be at least  $55 + 10 \log_{10} pY$  dB, when measured in a 3.0 kilohertz bandwidth.

<sup>35</sup>U.S. Census Bureau, 2007 Economic Census, Sector 51, 2007 NAICS cod 517210 (rel. Oct. 20, 2009), [http://factfinder.census.gov/servlet/IBQTable?\\_bm=y&-geo\\_id=&-fds\\_name=EC0700A1&-\\_skip=700&-ds\\_name=EC0751SSSZ5&-\\_lang=en](http://factfinder.census.gov/servlet/IBQTable?_bm=y&-geo_id=&-fds_name=EC0700A1&-_skip=700&-ds_name=EC0751SSSZ5&-_lang=en).

- The carrier frequency tolerance of all transmitters that operate in the 1435-1525 MHz or 2345-2395 MHz band is 0.002 percent. The carrier frequency tolerance of all transmitters that operate in the 5091-5150 MHz band is 0.005 percent.

8. In addition, manufacturers of equipment must meet the following requirements:

- The following unwanted emission power limits for non-geostationary satellites operating in the inter-satellite service that transmit in the 22.55-23.55 GHz band shall apply in any 200 megahertz of the 23.6-24 GHz passive band, based on the date that complete advance publication information is received by the ITU's Radiocommunication Bureau: For information received before January 1, 2020: -36 dBW/200 MHz. For information received on or after January 1, 2020: -46 dBW/200 MHz.
- For new fixed stations in the 31-31.3 GHz band authorized three years after the effective date of the WRC-07 R&O, the unwanted emission power in any 100 megahertz of the 31.3-31.5 GHz band shall be limited to -38 dBW (-38 dBW/100 MHz), as measured at the input to the antenna.
- For earth stations in the Fixed-Satellite Service (Earth-to-space) that transmit in the 49.7-50.2 GHz and 50.4-50.9 GHz bands, the unwanted emission power in the 50.2-50.4 GHz band shall not exceed -20 dBW/200 MHz (measured at the input of the antenna), except that the maximum unwanted emission power may be increased to -10 dBW/200 MHz for earth stations having an antenna gain greater than or equal to 57 dBi. These limits apply under clear-sky conditions. During fading conditions, the limits may be exceeded by earth stations when using uplink power control.

9. The following requirements apply to applicants/licensees or frequency coordinators:

- In the 1435-1452 MHz band, operators of aeronautical telemetry stations are encouraged to take all reasonable steps to ensure that unwanted emissions power level does not exceed -28 dBW/27 MHz in the 1400-1427 MHz band. Operators of aeronautical telemetry stations that do not meet this limit shall first attempt to operate in the 1452-1525 MHz band prior to operating in the 1435-1452 MHz band.
- In the 1435-1525 MHz, 2345-2360 MHz (only until January 1, 2020), 2360-2395 MHz, and 5091-5150 MHz bands, each application for a new station license, renewal or modification of an existing license concerning flight test frequencies, except as provided in paragraph (b) of Section 87.305, must be accompanied by a statement from a frequency advisory committee. The committee must comment on the frequencies requested or the proposed changes in the authorized station and the probable interference to existing stations. The committee must consider all stations operating on the frequencies requested or assigned within 320 km (200 mi) of the proposed area of operation and all prior coordinations and assignments on the proposed frequency(ies). The committee must also recommend frequencies resulting in the minimum interference. The committee must coordinate in writing all requests for frequencies or proposed operating changes in the 1435-1525 MHz, 2345-2360 MHz (only until January 1, 2020), 2360-2395 MHz, and 5091-5150 MHz bands with the responsible Government Area Frequency Coordinators listed in the NTIA "Manual of Regulations and Procedures for Federal Radio Frequency Management." In addition, committee recommendations may include comments on other technical factors and may contain recommended restrictions which it believes should appear on the license.
- New fixed stations in the 10.6-10.68 GHz band are restricted to point-to-point operations, with each station supplying not more than -3 dBW of transmitter power to the antenna, producing not more than 40 dBW of EIRP, and radiating at an antenna main beam elevation angle of 20° or less.
- Any application for a new station license to provide Multichannel Video Programming Distributors operations in the 17.7-17.8 GHz band or to operate in the 17.8-19.7 GHz band for any service, or for modification of an existing station license in these bands which would change the frequency, power, emission, modulation, polarization, antenna height or directivity, or location of such a station, be coordinated with the Federal Government by the Commission before an authorization will be issued, if the station or proposed station is located in whole or in part within any of the following areas:

(1) San Miguel, CA area: Between latitudes 34° 39' N and 34° 00' N and between longitudes 118° 52' W and 119° 24' W or within 200 km of 35° 44' N, 120° 45' W; and (2) Guam area: Within 100 km of 13° 35' N, 144° 51' E.

**F. Steps Taken to Minimize Significant Economic Impact on Small Entities and Significant Alternatives Considered**

10. The RFA requires an agency to describe any significant alternatives that it has considered in reaching its proposed approach, which may include the following four alternatives (among others): 1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; 2) the clarification, consolidation, or simplification of compliance or reporting requirements under the rule for small entities; 3) the use of performance, rather than design, standards; and 4) an exemption from coverage of the rule, or any part thereof, for small entities.<sup>36</sup>

11. In the *WRC-07 NPRM*, the Commission proposed to delete the non-Federal radiolocation service (RLS) allocation from the 1900-2000 kHz band, stating that a review of its licensing database found that no one is licensed to use this allocation. In its reply comments to the *WRC-07 NPRM*, ITM Marine stated that the U.S.-based high seas migratory species fishing fleets operate radio buoys in the 1900-2000 kHz band. In order to remove the otherwise unused RLS allocation from the Allocation Table without affecting existing radio buoy use by U.S. commercial fishing vessels, the WRC-07 R&O added a new footnote to the Allocation Table (footnote NG92) that authorizes U.S. commercial fishing vessels to continue to use radio buoys on the open sea under a ship station license. This action is expected to have a positive non-burdensome impact on commercial fishing vessels, many of which are owned by small businesses, by authorizing these entities to operate radio buoys under a ship station license instead of obtaining separate licenses for the radio buoys.

12. The WRC-07 R&O delays the implementation of the unwanted emissions power limit for new fixed stations in the 31-31.3 GHz band. Because the Commission has delayed the implementation of this new requirement for 3 years, it appears that the economic impact of this requirement has been minimized to the extent practicable for all licensees, including small entities.

**Report to Congress:** The Commission will send a copy of the Report and Order, including this FRFA, in a report to Congress pursuant to the Congressional Review Act.<sup>37</sup> In addition, the Commission will send a copy of the Report and Order, including this FRFA, to the Chief Counsel for Advocacy of the SBA. A copy of the Report and Order and FRFA (or summaries thereof) will also be published in the Federal Register.

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<sup>36</sup> 5 U.S.C. § 603(c).

<sup>37</sup> See 5 U.S.C. § 801(a)(1)(A).

**APPENDIX F****Proposed Rules**

For the reasons discussed in the preamble, the Federal Communications Commission proposes to amend 47 C.F.R. Parts 2, 15, 80, 90, 97, and 101 as follows:

**PART 2 – FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS;  
GENERAL RULES AND REGULATIONS**

1. The authority citation for part 2 continues to read as follows:

AUTHORITY: 47 U.S.C. 154, 302a, 303, and 336, unless otherwise noted.

2. Section 2.100 is amended to read as follows:

**§ 2.100 International regulations in force.**

The ITU Radio Regulations, Edition of 2012, have been incorporated to the extent practicable in this part.

3. Section 2.106, the Table of Frequency Allocations, is amended as follows:

- a. Pages 1-2, 4-5, 7-8, 11-13, 15-16, 18-20, 23, 42, 45, 51, 53-54, 57, 62-63, and 67-68 are revised.

- b. In the list of United States (US) Footnotes, footnotes US52 and US565 are revised; footnotes US115, US132A, US162, and US511E are added; and footnote US367 is removed.

- c. In the list of non-Federal Government (NG) Footnotes, footnote NG16 is added, footnote NG49 is removed, and footnote NG92 is revised.

**§ 2.106 Table of Frequency Allocations.**

The revisions and additions read as follows:

\* \* \* \* \*

International Table			United States Table		FCC Rule Part(s)
Region 1 Table	Region 2 Table	Region 3 Table	Federal Table	Non-Federal Table	
Below 8.3 (Not Allocated)			Below 8.3 (Not Allocated)		
5.53 5.54			5.53 5.54		
8.3-9 METEOROLOGICAL AIDS 5.54A 5.54B 5.54C			8.3-9 METEOROLOGICAL AIDS 5.54A		
9-11.3 METEOROLOGICAL AIDS 5.54A RADIONAVIGATION			9-11.3 METEOROLOGICAL AIDS 5.54A RADIONAVIGATION US18 US2		
11.3-14 RADIONAVIGATION			11.3-14 RADIONAVIGATION US18 US2		
14-19.95 FIXED MARITIME MOBILE 5.57 5.55 5.56			14-19.95 FIXED MARITIME MOBILE 5.57 US2	14-19.95 Fixed US2	
19.95-20.05 STANDARD FREQUENCY AND TIME SIGNAL (20 kHz)			19.95-20.05 STANDARD FREQUENCY AND TIME SIGNAL (20 kHz) US2		
20.05-70 FIXED MARITIME MOBILE 5.57			20.05-59 FIXED MARITIME MOBILE 5.57 US2	20.05-59 FIXED US2	
			59-61 STANDARD FREQUENCY AND TIME SIGNAL (60 kHz) US2		
			61-70 FIXED MARITIME MOBILE 5.57 US2	61-70 FIXED US2	
5.56 5.58					
70-72 RADIONAVIGATION 5.60	70-90 FIXED MARITIME MOBILE 5.57 MARITIME RADIONAVIGATION 5.60 Radiolocation	70-72 RADIONAVIGATION 5.60 Fixed Maritime mobile 5.57 5.59	70-90 FIXED MARITIME MOBILE 5.57 Radiolocation	70-90 FIXED Radiolocation	Private Land Mobile (90)
72-84 FIXED MARITIME MOBILE 5.57 RADIONAVIGATION 5.60		72-84 FIXED MARITIME MOBILE 5.57 RADIONAVIGATION 5.60			
5.56					
84-86 RADIONAVIGATION 5.60		84-86 RADIONAVIGATION 5.60 Fixed Maritime mobile 5.57 5.59			

86-90 FIXED MARITIME MOBILE 5.57 RADIONAVIGATION 5.56	5.61	86-90 FIXED MARITIME MOBILE 5.57 RADIONAVIGATION 5.60	US2	US2	
90-110 RADIONAVIGATION 5.62 Fixed 5.64			90-110 RADIONAVIGATION 5.62 US18 US2 US104		Aviation (87) Private Land Mobile (90)
110-112 FIXED MARITIME MOBILE RADIONAVIGATION 5.64 112-115 RADIONAVIGATION 5.60 115-117.6 RADIONAVIGATION 5.60 Fixed Maritime mobile 5.64 5.66 117.6-126 FIXED MARITIME MOBILE RADIONAVIGATION 5.60 5.64 126-129 RADIONAVIGATION 5.60 129-130 FIXED MARITIME MOBILE RADIONAVIGATION 5.60 5.64	110-130 FIXED MARITIME MOBILE MARITIME RADIONAVIGATION 5.60 Radiolocation	110-112 FIXED MARITIME MOBILE RADIONAVIGATION 5.60 5.64 112-117.6 RADIONAVIGATION 5.60 Fixed Maritime mobile 5.64 5.65 117.6-126 FIXED MARITIME MOBILE RADIONAVIGATION 5.60 5.64 126-129 RADIONAVIGATION 5.60 Fixed Maritime mobile 5.64 5.65 129-130 FIXED MARITIME MOBILE RADIONAVIGATION 5.60 5.64	110-130 FIXED MARITIME MOBILE Radiolocation		Private Land Mobile (90)
5.64 130-135.7 FIXED MARITIME MOBILE 5.64 5.67 135.7-137.8 FIXED MARITIME MOBILE Amateur 5.67A 5.64 5.67 5.67B	5.61 5.64 130-135.7 FIXED MARITIME MOBILE 5.64 135.7-137.8 FIXED MARITIME MOBILE Amateur 5.67A 5.64	5.64 130-135.7 FIXED MARITIME MOBILE RADIONAVIGATION 5.64 135.7-137.8 FIXED MARITIME MOBILE RADIONAVIGATION Amateur 5.67A 5.64 5.67B	5.64 US2 130-135.7 FIXED MARITIME MOBILE 5.64 US2 135.7-137.8 FIXED MARITIME MOBILE 5.64 US2	135.7-137.8 FIXED MARITIME MOBILE Amateur 5.67A 5.64 US2	Maritime (80) Maritime (80) Amateur Radio (97)

435-472 MARITIME MOBILE 5.79 Aeronautical radionavigation 5.77			435-495 MARITIME MOBILE 5.79 5.79A Aeronautical radionavigation	435-472 MARITIME MOBILE 5.79 5.79A	
5.82	5.78 5.82			5.82 US2 US231	
472-479 MARITIME MOBILE 5.79 Amateur 5.80A Aeronautical radionavigation 5.77 5.80				472-479 MARITIME MOBILE 5.79 5.79A Amateur 5.80A	Maritime (80) Amateur Radio (97)
5.80B 5.82				5.82 US2 US231	
479-495 MARITIME MOBILE 5.79 5.79A Aeronautical radionavigation 5.77	479-495 MARITIME MOBILE 5.79 5.79A Aeronautical radionavigation 5.77 5.80			479-495 MARITIME MOBILE 5.79 5.79A	Maritime (80)
5.82	5.82		5.82 US2 US231	5.82 US2 US231	
495-505 MARITIME MOBILE			495-505 MARITIME MOBILE		Maritime (80) Aviation (87)
505-526.5 MARITIME MOBILE 5.79 5.79A 5.84 AERONAUTICAL RADIONAVIGATION	505-510 MARITIME MOBILE 5.79	505-526.5 MARITIME MOBILE 5.79 5.79A 5.84 AERONAUTICAL RADIONAVIGATION	505-510 MARITIME MOBILE 5.79		Maritime (80)
	510-525 MARITIME MOBILE 5.79A 5.84 AERONAUTICAL RADIONAVIGATION	AERONAUTICAL RADIONAVIGATION Aeronautical mobile Land mobile	510-525 MARITIME MOBILE (ships only) 5.79A 5.84 AERONAUTICAL RADIONAVIGATION (radiobeacons) US18 US14 US225		Maritime (80) Aviation (87)
	525-535 BROADCASTING 5.86 AERONAUTICAL RADIONAVIGATION	526.5-535 BROADCASTING Mobile 5.88	525-535 MOBILE US221 AERONAUTICAL RADIONAVIGATION (radiobeacons) US18 US239		Aviation (87) Private Land Mobile (90)
526.5-1606.5 BROADCASTING	535-1605 BROADCASTING	535-1606.5 BROADCASTING	535-1605	535-1605 BROADCASTING NG1 NG5	Radio Broadcast (AM)(73) Private Land Mobile (90)
5.87 5.87A 1606.5-1625 FIXED MARITIME MOBILE 5.90 LAND MOBILE	1605-1625 BROADCASTING 5.89	1606.5-1800 FIXED MOBILE RADIOLOCATION RADIONAVIGATION	1605-1615 MOBILE US221 G127 1615-1705	1605-1705 BROADCASTING 5.89	Radio Broadcast (AM)(73) Alaska Fixed (80) Private Land Mobile (90)
5.92 1625-1635 RADIOLOCATION	5.90 1625-1705 FIXED MOBILE BROADCASTING 5.89 Radiolocation 5.90		US299	US299 NG1 NG5	
5.93 1635-1800 FIXED MARITIME MOBILE 5.90 LAND MOBILE	1705-1800 FIXED MOBILE RADIOLOCATION AERONAUTICAL RADIONAVIGATION		1705-1800 FIXED MOBILE RADIOLOCATION		Alaska Fixed (80) Private Land Mobile (90)
5.92 5.96		5.91	US240		

International Table			United States Table		FCC Rule Part(s)
Region 1 Table	Region 2 Table	Region 3 Table	Federal Table	Non-Federal Table	
1800-1810 RADIOLOCATION	1800-1850 AMATEUR	1800-2000 AMATEUR FIXED MOBILE except aeronautical mobile RADIONAVIGATION Radiolocation	1800-2000	1800-2000 AMATEUR	Maritime (80) Amateur Radio (97)
5.93 1810-1850 AMATEUR					
5.98 5.99 5.100 1850-2000 FIXED MOBILE except aeronautical mobile	1850-2000 AMATEUR FIXED MOBILE except aeronautical mobile RADIOLOCATION RADIONAVIGATION				
5.92 5.96 5.103 2000-2025 FIXED MOBILE except aeronautical mobile (R)	2000-2065 FIXED MOBILE	5.97	2000-2065 FIXED MOBILE	2000-2065 MARITIME MOBILE	Private Land Mobile (90)
5.92 5.103 2025-2045 FIXED MOBILE except aeronautical mobile (R) Meteorological aids 5.104					
5.92 5.103 2045-2160 FIXED MARITIME MOBILE LAND MOBILE	2065-2107 MARITIME MOBILE 5.105		US340 2065-2107 MARITIME MOBILE 5.105	US340 NG7	
5.92 2160-2170 RADIOLOCATION	5.106 2107-2170 FIXED MOBILE		US296 US340 2107-2170 FIXED MOBILE	2107-2170 FIXED MOBILE except aeronautical mobile	Maritime (80) Private Land Mobile (90)
5.93 5.107 2170-2173.5 MARITIME MOBILE			US340 2170-2173.5 MARITIME MOBILE (telephony)	US340 NG7 2170-2173.5 MARITIME MOBILE	Maritime (80)
2173.5-2190.5 MOBILE (distress and calling)			2173.5-2190.5 MOBILE (distress and calling)		Maritime (80) Aviation (87)
5.108 5.109 5.110 5.111 2190.5-2194 MARITIME MOBILE			5.108 5.109 5.110 5.111 US279 US340 2190.5-2194 MARITIME MOBILE (telephony)	US340 2190.5-2194 MARITIME MOBILE	Maritime (80)
			US340	US340	

International Table			United States Table		FCC Rule Part(s)
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3.23-3.4 FIXED MOBILE except aeronautical mobile BROADCASTING 5.113  5.116 5.118			3.23-3.4 FIXED MOBILE except aeronautical mobile Radiolocation  US340		Maritime (80) Aviation (87) Private Land Mobile (90)
3.4-3.5 AERONAUTICAL MOBILE (R)			3.4-3.5 AERONAUTICAL MOBILE (R)  US283 US340		Aviation (87)
3.5-3.8 AMATEUR FIXED MOBILE except aeronautical mobile  5.92	3.5-3.75 AMATEUR  5.119 3.75-4 AMATEUR FIXED MOBILE except aeronautical mobile (R)	3.5-3.9 AMATEUR FIXED MOBILE   3.9-3.95 AERONAUTICAL MOBILE BROADCASTING  3.95-4 FIXED BROADCASTING  5.126	3.5-4          US340	3.5-4 AMATEUR          US340	Amateur Radio (97)
4-4.063 FIXED MARITIME MOBILE 5.127  5.126			4-4.063 FIXED MARITIME MOBILE  US340		Maritime (80)
4.063-4.438 MARITIME MOBILE 5.79A 5.109 5.110 5.130 5.131 5.132  5.128			4.063-4.438 MARITIME MOBILE 5.79A 5.109 5.110 5.130 5.131 5.132 US82  US296 US340		Maritime (80) Aviation (87)
4.438-4.488 FIXED MOBILE except aeronautical mobile (R) Radiolocation 5.132A  5.132B	4.438-4.488 FIXED MOBILE except aeronautical mobile (R) RADIOLOCATION 5.132A	4.438-4.488 FIXED MOBILE except aeronautical mobile Radiolocation 5.132A	4.438-4.488 FIXED MOBILE except aeronautical mobile (R) RADIOLOCATION 5.132A  US340		Maritime (80) Private Land Mobile (90)
4.488-4.65 FIXED MOBILE except aeronautical mobile (R)			4.488-4.65 FIXED MOBILE except aeronautical mobile	4.488-4.65 FIXED MOBILE except aeronautical mobile (R)  US22 US340	Maritime (80) Aviation (87) Private Land Mobile (90)
4.65-4.7 AERONAUTICAL MOBILE (R)			4.65-4.7 AERONAUTICAL MOBILE (R)  US282 US283 US340		Aviation (87)

4.7-4.75 AERONAUTICAL MOBILE (OR)			4.7-4.75 AERONAUTICAL MOBILE (OR) US340		
4.75-4.85 FIXED AERONAUTICAL MOBILE (OR) LAND MOBILE BROADCASTING 5.113	4.75-4.85 FIXED MOBILE except aeronautical mobile (R) BROADCASTING 5.113	4.75-4.85 FIXED BROADCASTING 5.113 Land mobile	4.75-4.85 FIXED MOBILE except aeronautical mobile (R) US340	Maritime (80) Private Land Mobile (90)	
4.85-4.995 FIXED LAND MOBILE BROADCASTING 5.113			4.85-4.995 FIXED MOBILE US340	4.85-4.995 FIXED US340	Aviation (87) Private Land Mobile (90)
4.995-5.003 STANDARD FREQUENCY AND TIME SIGNAL (5 MHz)			4.995-5.005 STANDARD FREQUENCY AND TIME SIGNAL (5 MHz)		
5.003-5.005 STANDARD FREQUENCY AND TIME SIGNAL Space research			US1 US340		
5.005-5.06 FIXED BROADCASTING 5.113			5.005-5.06 FIXED US22 US340	Aviation (87) Private Land Mobile (90)	
5.06-5.25 FIXED Mobile except aeronautical mobile 5.133			5.06-5.25 FIXED US22 Mobile except aeronautical mobile US212 US340	Maritime (80) Aviation (87) Private Land Mobile (90)	
5.25-5.275 FIXED MOBILE except aeronautical mobile Radiolocation 5.132A 5.133A	5.25-5.275 FIXED MOBILE except aeronautical mobile RADIOLOCATION 5.132A	5.25-5.275 FIXED MOBILE except aeronautical mobile Radiolocation 5.132A	5.25-5.275 FIXED MOBILE except aeronautical mobile RADIOLOCATION 5.132A US340	Maritime (80) Private Land Mobile (90)	
5.275-5.45 FIXED MOBILE except aeronautical mobile			5.275-5.45 FIXED US22 Mobile except aeronautical mobile US23 US340	Maritime (80) Aviation (87) Private Land Mobile (90) Amateur Radio (97)	
5.45-5.48 FIXED AERONAUTICAL MOBILE (OR) LAND MOBILE	5.45-5.48 AERONAUTICAL MOBILE (R)	5.45-5.48 FIXED AERONAUTICAL MOBILE (OR) LAND MOBILE	5.45-5.68 AERONAUTICAL MOBILE (R)	Aviation (87)	
5.48-5.68 AERONAUTICAL MOBILE (R) 5.111 5.115			5.111 5.115 US283 US340		
5.68-5.73 AERONAUTICAL MOBILE (OR) 5.111 5.115			5.68-5.73 AERONAUTICAL MOBILE (OR) 5.111 5.115 US340		
5.73-5.9 FIXED LAND MOBILE	5.73-5.9 FIXED MOBILE except aeronautical mobile (R)	5.73-5.9 FIXED MOBILE except aeronautical mobile (R)	5.73-5.9 FIXED MOBILE except aeronautical mobile (R) US340	Maritime (80) Aviation (87) Private Land Mobile (90)	

International Table			United States Table		FCC Rule Part(s)
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11.175-11.275 AERONAUTICAL MOBILE (OR)			11.175-11.275 AERONAUTICAL MOBILE (OR)  US340		
11.275-11.4 AERONAUTICAL MOBILE (R)			11.275-11.4 AERONAUTICAL MOBILE (R)  US283 US340		Aviation (87)
11.4-11.6 FIXED			11.4-11.6 FIXED  US340		Private Land Mobile (90)
11.6-11.65 BROADCASTING 5.134			11.6-12.1 BROADCASTING 5.134    US136 US340		International Broadcast Stations (73F)
5.146					
11.65-12.05 BROADCASTING					
5.147					
12.05-12.1 BROADCASTING 5.134					
5.146					
12.1-12.23 FIXED			12.1-12.23 FIXED  US340		Private Land Mobile (90)
12.23-13.2 MARITIME MOBILE 5.109 5.110 5.132 5.145			12.23-13.2 MARITIME MOBILE 5.109 5.110 5.132 5.145 US82  US296 US340		Maritime (80)
13.2-13.26 AERONAUTICAL MOBILE (OR)			13.2-13.26 AERONAUTICAL MOBILE (OR)  US340		
13.26-13.36 AERONAUTICAL MOBILE (R)			13.26-13.36 AERONAUTICAL MOBILE (R)  US283 US340		Aviation (87)
13.36-13.41 FIXED RADIO ASTRONOMY			13.36-13.41 RADIO ASTRONOMY	13.36-13.41 RADIO ASTRONOMY	
5.149			US342 G115	US342	
13.41-13.45 FIXED Mobile except aeronautical mobile (R)			13.41-13.45 FIXED Mobile except aeronautical mobile (R)  US340	13.41-13.45 FIXED  US340	Private Land Mobile (90)

13.45-13.55 FIXED Mobile except aeronautical mobile (R) Radiolocation 5.132A 5.149A	13.45-13.55 FIXED Mobile except aeronautical mobile (R) Radiolocation 5.132A	13.45-13.55 FIXED Mobile except aeronautical mobile (R) Radiolocation 5.132A US340	13.45-13.55 FIXED Radiolocation 5.132A US340	
13.55-13.57 FIXED Mobile except aeronautical mobile (R) 5.150	13.55-13.57 FIXED Mobile except aeronautical mobile (R) 5.150	13.55-13.57 FIXED Mobile except aeronautical mobile (R) 5.150 US340	13.55-13.57 FIXED 5.150 US340	ISM Equipment (18) Private Land Mobile (90)
13.57-13.6 BROADCASTING 5.134 5.151 13.6-13.8 BROADCASTING 13.8-13.87 BROADCASTING 5.134 5.151 13.87-14 FIXED Mobile except aeronautical mobile (R)	13.57-13.87 BROADCASTING 5.134 US136 US340	13.57-13.87 BROADCASTING 5.134 US136 US340		International Broadcast Stations (73F)
14-14.25 AMATEUR AMATEUR-SATELLITE 14.25-14.35 AMATEUR 5.152	14-14.35 US340	13.87-14 FIXED Mobile except aeronautical mobile (R) US340	13.87-14 FIXED US340	Private Land Mobile (90)
14.35-14.99 FIXED Mobile except aeronautical mobile (R)	14-14.35 US340	14-14.35 US340	14-14.25 AMATEUR AMATEUR-SATELLITE US340 14.25-14.35 AMATEUR US340	Amateur Radio (97)
14.99-15.005 STANDARD FREQUENCY AND TIME SIGNAL (15 MHz) 5.111 15.005-15.01 STANDARD FREQUENCY AND TIME SIGNAL Space research 15.01-15.1 AERONAUTICAL MOBILE (OR)	14.99-15.01 STANDARD FREQUENCY AND TIME SIGNAL (15 MHz) 5.111 US1 US340 15.01-15.1 AERONAUTICAL MOBILE (OR) US340	14.35-14.99 FIXED Mobile except aeronautical mobile (R) US340	14.35-14.99 FIXED US340	Private Land Mobile (90)

International Table			United States Table		FCC Rule Part(s)
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15.1-15.6 BROADCASTING			15.1-15.8 BROADCASTING 5.134		International Broadcast Stations (73F)
15.6-15.8 BROADCASTING 5.134			US136 US340		
5.146			15.8-16.1 FIXED		Private Land Mobile (90)
15.8-16.1 FIXED			US340		
5.153			16.1-16.2 FIXED		
16.1-16.2 FIXED Radiolocation 5.145A	16.1-16.2 FIXED RADIOLOCATION 5.145A	16.1-16.2 FIXED Radiolocation 5.145A	16.1-16.2 FIXED RADIOLOCATION 5.145A	US340	
5.145B			16.2-16.36 FIXED		Maritime (80)
16.2-16.36 FIXED			US340		
16.36-17.41 MARITIME MOBILE 5.109 5.110 5.132 5.145			16.36-17.41 MARITIME MOBILE 5.109 5.110 5.132 5.145 US82		
			US296 US340		
17.41-17.48 FIXED			17.41-17.48 FIXED		Private Land Mobile (90)
			US340		
17.48-17.55 BROADCASTING 5.134			17.48-17.9 BROADCASTING 5.134		International Broadcast Stations (73F)
5.146			US136 US340		
17.55-17.9 BROADCASTING			17.9-17.97 AERONAUTICAL MOBILE (R)		Aviation (87)
17.9-17.97 AERONAUTICAL MOBILE (R)			US283 US340		
17.97-18.03 AERONAUTICAL MOBILE (OR)			17.97-18.03 AERONAUTICAL MOBILE (OR)		
			US340		
18.030-18.052 FIXED			18.03-18.068 FIXED		Maritime (80) Private Land Mobile (90)
18.052-18.068 FIXED			US340		
Space research			18.068-18.168	18.068-18.168 AMATEUR AMATEUR-SATELLITE	Amateur Radio (97)
18.068-18.168 AMATEUR AMATEUR-SATELLITE			US340	US340	
5.154			18.168-18.78 FIXED		Maritime (80) Private Land Mobile (90)
18.168-18.78 FIXED Mobile except aeronautical mobile			US340		

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Region 1 Table	Region 2 Table	Region 3 Table	Federal Table	Non-Federal Table	
22.855-23 FIXED 5.156			22.855-23 FIXED US340		Private Land Mobile (90)
23-23.2 FIXED Mobile except aeronautical mobile (R) 5.156			23-23.2 FIXED Mobile except aeronautical mobile (R) US340	23-23.2 FIXED US340	
23.2-23.35 FIXED 5.156A AERONAUTICAL MOBILE (OR)			23.2-23.35 AERONAUTICAL MOBILE (OR) US340		
23.35-24 FIXED MOBILE except aeronautical mobile 5.157			23.35-24.45 FIXED MOBILE except aeronautical mobile US340	23.35-24.45 FIXED US340	Private Land Mobile (90)
24-24.45 FIXED LAND MOBILE					
24.45-24.6 FIXED LAND MOBILE Radiolocation 5.132A 5.158	24.45-24.65 FIXED LAND MOBILE RADIOLOCATION 5.132A	24.45-24.6 FIXED LAND MOBILE Radiolocation 5.132A	24.45-24.65 FIXED MOBILE except aeronautical mobile RADIOLOCATION 5.132A US340	24.45-24.65 FIXED RADIOLOCATION 5.132A US340	
24.6-24.89 FIXED LAND MOBILE	24.65-24.89 FIXED LAND MOBILE	24.6-24.89 FIXED LAND MOBILE	24.65-24.89 FIXED MOBILE except aeronautical mobile US340	24.65-24.89 FIXED US340	
24.89-24.99 AMATEUR AMATEUR-SATELLITE			24.89-24.99 US340	24.89-24.99 AMATEUR AMATEUR-SATELLITE US340	Amateur Radio (97)
24.99-25.005 STANDARD FREQUENCY AND TIME SIGNAL (25 MHz)			24.99-25.01 STANDARD FREQUENCY AND TIME SIGNAL (25 MHz)		
25.005-25.01 STANDARD FREQUENCY AND TIME SIGNAL Space research			US1 US340		
25.01-25.07 FIXED MOBILE except aeronautical mobile			25.01-25.07 US340	25.01-25.07 LAND MOBILE US340 NG112	Private Land Mobile (90)
25.07-25.21 MARITIME MOBILE			25.07-25.21 MARITIME MOBILE US82 US281 US296 US340	25.07-25.21 MARITIME MOBILE US82 US281 US296 US340 NG112	Maritime (80) Private Land Mobile (90)

25.21-25.55 FIXED MOBILE except aeronautical mobile			25.21-25.33  US340	25.21-25.33 LAND MOBILE  US340	Private Land Mobile (90)
			25.33-25.55 FIXED MOBILE except aeronautical mobile  US340	25.33-25.55  US340	
25.55-25.67 RADIO ASTRONOMY  5.149			25.55-25.67 RADIO ASTRONOMY US74  US342		
25.67-26.1 BROADCASTING			25.67-26.1 BROADCASTING  US25 US340		International Broadcast Stations (73F) Remote Pickup (74D)
26.1-26.175 MARITIME MOBILE 5.132			26.1-26.175 MARITIME MOBILE 5.132  US25 US340		Remote Pickup (74D) Low Power Auxiliary (74H) Maritime (80)
26.175-26.2 FIXED MOBILE except aeronautical mobile			26.175-26.2  US340	26.175-26.2 LAND MOBILE  US340	Remote Pickup (74D) Low Power Auxiliary (74H)
26.2-26.35 FIXED MOBILE except aeronautical mobile Radiolocation 5.132A 5.133A	26.2-26.42 FIXED MOBILE except aeronautical mobile RADIOLOCATION 5.132A	26.2-26.35 FIXED MOBILE except aeronautical mobile Radiolocation 5.132A	26.2-26.42 RADIOLOCATION US132A  US340	26.2-26.42 LAND MOBILE RADIOLOCATION US132A  US340	
26.35-27.5 FIXED MOBILE except aeronautical Mobile	26.42-27.5 FIXED MOBILE except aeronautical mobile	26.35-27.5 FIXED MOBILE except aeronautical mobile	26.42-26.48  US340	26.42-26.48 LAND MOBILE  US340	
			26.48-26.95 FIXED MOBILE except aeronautical mobile  US340	26.48-26.95  US340	
			26.95-27.41  5.150 US340	26.95-26.96 FIXED 5.150 US340	ISM Equipment (18)
				26.96-27.23 MOBILE except aeronautical mobile 5.150 US340	ISM Equipment (18) Personal Radio (95)
				27.23-27.41 FIXED MOBILE except aeronautical mobile  5.150 US340	ISM Equipment (18) Private Land Mobile (90) Personal Radio (95)
5.150	5.150	5.150			

			34-35 FIXED MOBILE	34-35	
			35-36	35-36 FIXED LAND MOBILE	Public Mobile (22) Private Land Mobile (90)
			36-37 FIXED MOBILE	36-37	
			US220	US220	
			37-37.5	37-37.5 LAND MOBILE  NG124	Private Land Mobile (90)
37.5-38.25 FIXED MOBILE Radio astronomy			37.5-38 Radio astronomy	37.5-38 LAND MOBILE Radio astronomy	
			US342	US342 NG59 NG124	
			38-38.25 FIXED MOBILE RADIO ASTRONOMY	38-38.25 RADIO ASTRONOMY	
5.149			US81 US342	US81 US342	
38.25-39 FIXED MOBILE	38.25-39.986 FIXED MOBILE	38.25-39.5 FIXED MOBILE	38.25-39 FIXED MOBILE	38.25-39	
39-39.5 FIXED MOBILE Radiolocation 5.132A			39-40	39-40 LAND MOBILE	Private Land Mobile (90)
5.159					
39.5-39.986 FIXED MOBILE		39.5-39.986 FIXED MOBILE RADIOLOCATION 5.132A			
39.986-40.02 FIXED MOBILE Space research		39.986-40 FIXED MOBILE RADIOLOCATION 5.132A Space research		NG124	
		40-40.02 FIXED MOBILE Space research	40-41.015 FIXED MOBILE	40-41.015	ISM Equipment (18) Private Land Mobile (90)
40.02-40.98 FIXED MOBILE					
5.150			5.150 US210 US220	5.150 US210 US220	

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Region 1 Table	Region 2 Table	Region 3 Table	Federal Table	Non-Federal Table	
40.98-41.015 FIXED MOBILE Space research 5.160 5.161			(See previous page)		
41.015-42 FIXED MOBILE			41.015-41.665 FIXED MOBILE RADIOLOCATION US132A US220	41.015-41.665 RADIOLOCATION US132A  US220	Private Land Mobile (90)
5.160 5.161 5.161A			41.665-42 FIXED MOBILE US220	41.665-42  US220	
42-42.5 FIXED MOBILE Radiolocation 5.132A	42-42.5 FIXED MOBILE		42-43.35	42-43.35 FIXED LAND MOBILE	Public Mobile (22) Private Land Mobile (90)
5.160 5.161B	5.161			NG124 NG141	
42.5-44 FIXED MOBILE			43.35-44 RADIOLOCATION US132A	43.35-43.69 FIXED LAND MOBILE RADIOLOCATION US132A NG124 43.69-44 LAND MOBILE RADIOLOCATION US132A NG124	Private Land Mobile (90)
5.160 5.161 5.161A					
44-47 FIXED MOBILE			44-46.6	44-46.6 LAND MOBILE NG124 NG141	
5.162 5.162A			46.6-47 FIXED MOBILE	46.6-47	
47-68 BROADCASTING	47-50 FIXED MOBILE	47-50 FIXED MOBILE BROADCASTING  5.162A	47-49.6	47-49.6 LAND MOBILE  NG124	Private Land Mobile (90)
5.162A 5.163 5.164 5.165 5.169 5.171			49.6-50 FIXED MOBILE	49.6-50	
5.162A 5.166 5.167 5.167A 5.168 5.170			50-73	50-54 AMATEUR	Amateur Radio (97)

	54-68 BROADCASTING Fixed Mobile 5.172	54-68 FIXED MOBILE BROADCASTING 5.162A		54-72 BROADCASTING	Broadcast Radio (TV)(73) LPTV, TV Translator/ Booster (74G) Low Power Auxiliary (74H)
68-74.8 FIXED MOBILE except aeronautical mobile	68-72 BROADCASTING Fixed Mobile 5.173	68-74.8 FIXED MOBILE		NG5 NG14 NG115 NG149	
	72-73 FIXED MOBILE			72-73 FIXED MOBILE NG3 NG16 NG56	Public Mobile (22) Maritime (80) Aviation (87) Private Land Mobile (90) Personal Radio (95)
	73-74.6 RADIO ASTRONOMY 5.178		73-74.6 RADIO ASTRONOMY US74 US246		
	74.6-74.8 FIXED MOBILE		74.6-74.8 FIXED MOBILE US273		Private Land Mobile (90)
5.149 5.175 5.177 5.179		5.149 5.176 5.179			
74.8-75.2 AERONAUTICAL RADIONAVIGATION			74.8-75.2 AERONAUTICAL RADIONAVIGATION		Aviation (87)
5.180 5.181			5.180		
75.2-87.5 FIXED MOBILE except aeronautical mobile	75.2-75.4 FIXED MOBILE 5.179		75.2-75.4 FIXED MOBILE US273		Private Land Mobile (90)
	75.4-76 FIXED MOBILE	75.4-87 FIXED MOBILE	75.4-88	75.4-76 FIXED MOBILE NG3 NG16 NG56	Public Mobile (22) Maritime (80) Aviation (87) Private Land Mobile (90) Personal Radio (95)
	76-88 BROADCASTING Fixed Mobile	5.182 5.183 5.188		76-88 BROADCASTING NG5 NG14 NG115 NG149	Broadcast Radio (TV)(73) LPTV, TV Translator/ Booster (74G) Low Power Auxiliary (74H)
5.175 5.179 5.187	5.185	87-100 FIXED MOBILE BROADCASTING			
87.5-100 BROADCASTING	88-100 BROADCASTING		88-108	88-108 BROADCASTING NG2	Broadcast Radio (FM)(73) FM Translator/Booster (74L)
5.190					
100-108 BROADCASTING			US93	US93 NG5	
5.192 5.194					
108-117.975 AERONAUTICAL RADIONAVIGATION			108-117.975 AERONAUTICAL RADIONAVIGATION		Aviation (87)
5.197 5.197A			5.197A US93		

International Table			United States Table		FCC Rule Part(s)
Region 1 Table	Region 2 Table	Region 3 Table	Federal Table	Non-Federal Table	
(See previous page)	(See previous page)		150.8-152.855	150.8-152.855 FIXED LAND MOBILE NG4 NG51 NG112	Public Mobile (22) Private Land Mobile (90) Personal Radio (95)
153-154 FIXED MOBILE except aeronautical mobile (R) Meteorological aids			US73	US73 NG124	
			152.855-156.2475	152.855-154 LAND MOBILE NG4	Remote Pickup (74D) Private Land Mobile (90)
				NG124	
154-156.4875 FIXED MOBILE except aeronautical mobile (R)	154-156.4875 FIXED MOBILE	154-156.4875 FIXED MOBILE		154-156.2475 FIXED LAND MOBILE NG112 5.226 NG22 NG124 NG148	Maritime (80) Private Land Mobile (90) Personal Radio (95)
5.225A 5.226 156.4875-156.5625 MARITIME MOBILE (distress and calling via DSC)	5.226	5.225A 5.226	156.2475-156.5125	156.2475-156.5125 MARITIME MOBILE NG22	Maritime (80) Aviation (87)
			5.226 US52 US227 US266	5.226 US52 US227 US266 NG124	
			156.5125-156.5375 MARITIME MOBILE (distress, urgency, safety and calling via DSC)		
			5.111 5.226 US266		
5.111 5.226 5.227 156.5625-156.7625 FIXED MOBILE except aeronautical mobile (R)	156.5625-156.7625 FIXED MOBILE		156.5375-156.7625	156.5375-156.7625 MARITIME MOBILE	
5.226	5.226		5.226 US52 US227 US266	5.226 US52 US227 US266	
156.7625-156.7875 MARITIME MOBILE Mobile-satellite (Earth-to-space)	156.7625-156.7875 MARITIME MOBILE MOBILE-SATELLITE (Earth-to-space)	156.7625-156.7875 MARITIME MOBILE Mobile-satellite (Earth-to-space)	156.7625-156.7875	MOBILE-SATELLITE (Earth-to-space) (AIS 3)	
5.111 5.226 5.228	5.111 5.226 5.228	5.111 5.226 5.228	5.226 US52 US266		
156.7875-156.8125 MARITIME MOBILE (distress and calling)			156.7875-156.8125	MARITIME MOBILE (distress, urgency, safety and calling)	
5.111 5.226			5.111 5.226 US266		
156.8125-156.8375 MARITIME MOBILE Mobile-satellite (Earth-to-space)	156.8125-156.8375 MARITIME MOBILE MOBILE-SATELLITE (Earth-to-space)	156.8125-156.8375 MARITIME MOBILE Mobile-satellite (Earth-to-space)	156.8125-156.8375	MOBILE-SATELLITE (Earth-to-space) (AIS 4)	
5.111 5.226 5.228	5.111 5.226 5.228	5.111 5.226 5.228	5.226 US52 US266		
156.8375-161.9625 FIXED MOBILE except aeronautical mobile	156.8375-161.9625 FIXED MOBILE		156.8375-157.0375	156.8375-157.0375 MARITIME MOBILE	
			5.226 US52 US266	5.226 US52 US266	
			157.0375-157.1875 MARITIME MOBILE US214	157.0375-157.1875	Maritime (80)
			5.226 US266 G109	5.226 US214 US266	

5000-5010 AERONAUTICAL MOBILE-SATELLITE (R) 5.443AA AERONAUTICAL RADIONAVIGATION RADIONAVIGATION-SATELLITE (Earth-to-space)	5000-5010 AERONAUTICAL MOBILE (R) US115 AERONAUTICAL MOBILE-SATELLITE (R) 5.443AA AERONAUTICAL RADIONAVIGATION US260 RADIONAVIGATION-SATELLITE (Earth-to-space) US211	Aviation (87)
5010-5030 AERONAUTICAL MOBILE-SATELLITE (R) 5.443AA AERONAUTICAL RADIONAVIGATION RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) 5.328B 5.443B	5010-5030 AERONAUTICAL MOBILE-SATELLITE (R) 5.443AA AERONAUTICAL RADIONAVIGATION US260 RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) 5.443B US115 US211	
5030-5091 AERONAUTICAL MOBILE (R) 5.443C AERONAUTICAL MOBILE-SATELLITE (R) 5.443D AERONAUTICAL RADIONAVIGATION	5030-5091 AERONAUTICAL MOBILE (R) 5.443C AERONAUTICAL MOBILE-SATELLITE (R) 5.443D AERONAUTICAL RADIONAVIGATION US260	
5.444 5091-5150 AERONAUTICAL MOBILE 5.444B AERONAUTICAL MOBILE-SATELLITE (R) 5.443AA AERONAUTICAL RADIONAVIGATION	US211 US444 5091-5150 AERONAUTICAL MOBILE US111 US444B AERONAUTICAL MOBILE-SATELLITE (R) 5.443AA AERONAUTICAL RADIONAVIGATION US260	Satellite Communications (25) Aviation (87)
5.444 5.444A 5150-5250 FIXED-SATELLITE (Earth-to-space) 5.447A MOBILE except aeronautical mobile 5.446A 5.446B AERONAUTICAL RADIONAVIGATION	US211 US344 US444 US444A 5150-5250 AERONAUTICAL RADIONAVIGATION US260	5150-5250 FIXED-SATELLITE (Earth-to-space) 5.447A US344 AERONAUTICAL RADIONAVIGATION US260
5.446 5.446C 5.447 5.447B 5.447C 5250-5255 EARTH EXPLORATION-SATELLITE (active) MOBILE except aeronautical mobile 5.446A 5.447F RADIOLOCATION SPACE RESEARCH 5.447D	US211 US307 US344 5.447C US211 US307	RF Devices (15) Satellite Communications (25) Aviation (87)
5.447E 5.448 5.448A 5255-5350 EARTH EXPLORATION-SATELLITE (active) MOBILE except aeronautical mobile 5.446A 5.447F RADIOLOCATION SPACE RESEARCH (active)	5.448A 5255-5350 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION G59 SPACE RESEARCH (active) 5.447D	5250-5255 Earth exploration-satellite (active) Radiolocation Space research
5.447E 5.448 5.448A 5350-5460 EARTH EXPLORATION-SATELLITE (active) 5.448B AERONAUTICAL RADIONAVIGATION 5.449 RADIOLOCATION 5.448D SPACE RESEARCH (active) 5.448C	5.448A 5350-5460 EARTH EXPLORATION-SATELLITE (active) 5.448B SPACE RESEARCH (active) AERONAUTICAL RADIONAVIGATION 5.449 RADIOLOCATION G56	5255-5350 Earth exploration-satellite (active) Radiolocation Space research (active)
	US390 G130	5350-5460 AERONAUTICAL RADIONAVIGATION 5.449 Earth exploration-satellite (active) 5.448B Space research (active) Radiolocation
		US390

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7145-7235 FIXED MOBILE SPACE RESEARCH (Earth-to-space) 5.460			7145-7190 FIXED SPACE RESEARCH (deep space) (Earth-to-space) US262 5.458 G116	7145-7235	RF Devices (15)
			7190-7235 FIXED SPACE RESEARCH (Earth-to-space) G133		
5.458 5.459			5.458 G134	5.458 US262	
7235-7250 FIXED MOBILE			7235-7250 FIXED	7235-7250	
5.458			5.458	5.458	
7250-7300 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE			7250-7300 FIXED-SATELLITE (space-to-Earth) MOBILE-SATELLITE (space-to-Earth) Fixed	7250-8025	
5.461			G117		
7300-7450 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile			7300-7450 FIXED FIXED-SATELLITE (space-to-Earth) Mobile-satellite (space-to-Earth)		
5.461			G117		
7450-7550 FIXED FIXED-SATELLITE (space-to-Earth) METEOROLOGICAL-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile			7450-7550 FIXED FIXED-SATELLITE (space-to-Earth) METEOROLOGICAL-SATELLITE (space-to-Earth) Mobile-satellite (space-to-Earth)		
5.461A			G104 G117		
7550-7750 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile			7550-7750 FIXED FIXED-SATELLITE (space-to-Earth) Mobile-satellite (space-to-Earth)		
			G117		
7750-7900 FIXED METEOROLOGICAL-SATELLITE (space-to-Earth) 5.461B MOBILE except aeronautical mobile			7750-7900 FIXED METEOROLOGICAL-SATELLITE (space-to-Earth) 5.461B		

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5.511D 15.43-15.63 FIXED-SATELLITE (Earth-to-space) 5.511A RADIOLOCATION 5.511E 5.511F AERONAUTICAL RADIONAVIGATION			US211 15.43-15.63 RADIOLOCATION 5.511E 5.511F US511E AERONAUTICAL RADIONAVIGATION US260	US211 US511E 15.43-15.63 FIXED-SATELLITE (Earth-to-space) AERONAUTICAL RADIONAVIGATION US260	Satellite Communications (25) Aviation (87)
5.511C 15.63-15.7 RADIOLOCATION 5.511E 5.511F AERONAUTICAL RADIONAVIGATION			5.511C US211 US359 15.63-15.7 RADIOLOCATION 5.511E 5.511F US511E AERONAUTICAL RADIONAVIGATION US260	5.511C US211 US359 US511E 15.63-15.7 AERONAUTICAL RADIONAVIGATION US260	Aviation (87)
5.511D 15.7-16.6 RADIOLOCATION			US211 15.7-16.6 RADIOLOCATION G59	US211 US511E 15.7-17.2 Radiolocation	Private Land Mobile (90)
5.512 5.513 16.6-17.1 RADIOLOCATION Space research (deep space) (Earth-to-space)			5.512 5.513 16.6-17.1 RADIOLOCATION G59 Space research (deep space) (Earth-to-space)		
5.512 5.513 17.1-17.2 RADIOLOCATION			5.512 5.513 17.1-17.2 RADIOLOCATION G59		
5.512 5.513 17.2-17.3 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION SPACE RESEARCH (active)			5.512 5.513 5.513A 17.2-17.3 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION G59 SPACE RESEARCH (active)	17.2-17.3 Earth exploration-satellite (active) Radiolocation Space research (active)	
5.512 5.513 5.513A 17.3-17.7 FIXED-SATELLITE (Earth-to-space) 5.516 (space-to-Earth) 5.516A 5.516B Radiolocation	17.3-17.7 FIXED-SATELLITE (Earth-to-space) 5.516 BROADCASTING-SATELLITE Radiolocation	17.3-17.7 FIXED-SATELLITE (Earth-to-space) 5.516 Radiolocation	17.3-17.7 Radiolocation US259 G59	17.3-17.7 FIXED-SATELLITE (Earth-to-space) US271 BROADCASTING-SATELLITE US402 NG163	Satellite Communications (25)
5.514 17.7-18.1 FIXED FIXED-SATELLITE (space-to-Earth) 5.484A (Earth-to-space) 5.516 MOBILE	5.514 5.515 17.7-18.1 FIXED FIXED-SATELLITE (space-to-Earth) 5.517 (Earth-to-space) 5.516 BROADCASTING-SATELLITE Mobile 5.515	5.514 17.7-18.1 FIXED FIXED-SATELLITE (space-to-Earth) 5.484A (Earth-to-space) 5.516 MOBILE	US402 G117 17.7-17.8	US259 17.7-17.8 FIXED FIXED-SATELLITE (Earth-to-space) US271	Satellite Communications (25) TV Broadcast Auxiliary (74F) Cable TV Relay (78) Fixed Microwave (101)
			US334 G117	US334	

International Table			United States Table		FCC Rule Part(s)
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21.4-22 FIXED MOBILE BROADCASTING-SATELLITE 5.208B	21.4-22 FIXED MOBILE	21.4-22 FIXED MOBILE BROADCASTING-SATELLITE 5.208B 5.530A 5.530B 5.530C 5.530D 5.531	21.4-22 FIXED MOBILE		
5.530A 5.530B 5.530C 5.530D 5.530A 5.530C					
22-22.21 FIXED MOBILE except aeronautical mobile 5.149			22-22.21 FIXED MOBILE except aeronautical mobile US342		
22.21-22.5 EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE except aeronautical mobile RADIO ASTRONOMY SPACE RESEARCH (passive) 5.149 5.532			22.21-22.5 EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE except aeronautical mobile RADIO ASTRONOMY SPACE RESEARCH (passive) US342 US532		Satellite Communications (25) Fixed Microwave (101)
22.5-22.55 FIXED MOBILE			22.5-22.55 FIXED MOBILE US211		
22.55-23.15 FIXED INTER-SATELLITE 5.338A MOBILE SPACE RESEARCH (Earth-to-space) 5.532A 5.149			22.55-23.15 FIXED INTER-SATELLITE US145 US278 MOBILE SPACE RESEARCH (Earth-to-space) 5.532A US342		
23.15-23.55 FIXED INTER-SATELLITE 5.338A MOBILE			23.15-23.55 FIXED INTER-SATELLITE US145 US278 MOBILE		Fixed Microwave (101)
23.55-23.6 FIXED MOBILE			23.55-23.6 FIXED MOBILE		
23.6-24 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 5.340			23.6-24 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY US74 SPACE RESEARCH (passive) US246		

24-24.05 AMATEUR AMATEUR-SATELLITE 5.150			24-24.05	24-24.05 AMATEUR AMATEUR-SATELLITE 5.150 US211	ISM Equipment (18) Amateur Radio (97)
24.05-24.25 RADIOLOCATION Amateur Earth exploration-satellite (active) 5.150			24.05-24.25 RADIOLOCATION G59 Earth exploration-satellite (active) 5.150	24.05-24.25 Amateur Earth exploration-satellite (active) Radiolocation 5.150	RF Devices (15) ISM Equipment (18) Private Land Mobile (90) Amateur Radio (97)
24.25-24.45 FIXED	24.25-24.45 RADIONAVIGATION	24.25-24.45 FIXED MOBILE RADIONAVIGATION	24.25-24.45	24.25-24.45 FIXED	RF Devices (15) Fixed Microwave (101)
24.45-24.65 FIXED INTER-SATELLITE	24.45-24.65 INTER-SATELLITE RADIONAVIGATION 5.533	24.45-24.65 FIXED INTER-SATELLITE MOBILE RADIONAVIGATION 5.533	24.45-24.65 INTER-SATELLITE RADIONAVIGATION 5.533		RF Devices (15) Satellite Communications (25)
24.65-24.75 FIXED FIXED-SATELLITE (Earth-to-space) 5.532B INTER-SATELLITE	24.65-24.75 INTER-SATELLITE RADIOLOCATION-SATELLITE (Earth-to-space)	24.65-24.75 FIXED FIXED-SATELLITE (Earth-to-space) 5.532B INTER-SATELLITE MOBILE 5.533	24.65-24.75 INTER-SATELLITE RADIOLOCATION-SATELLITE (Earth-to-space)		
24.75-25.25 FIXED FIXED-SATELLITE (Earth-to-space) 5.532B	24.75-25.25 FIXED-SATELLITE (Earth-to-space) 5.535	24.75-25.25 FIXED FIXED-SATELLITE (Earth-to-space) 5.535 MOBILE	24.75-25.25	24.75-25.05 FIXED-SATELLITE (Earth-to-space) NG535 25.05-25.25 FIXED FIXED-SATELLITE (Earth-to-space) NG535	RF Devices (15) Satellite Communications (25) Fixed Microwave (101)
25.25-25.5 FIXED INTER-SATELLITE 5.536 MOBILE Standard frequency and time signal-satellite (Earth-to-space)			25.25-25.5 FIXED INTER-SATELLITE 5.536 MOBILE Standard frequency and time signal-satellite (Earth-to-space)	25.25-25.5 Inter-satellite 5.536 Standard frequency and time signal-satellite (Earth-to-space)	RF Devices (15)
25.5-27 EARTH EXPLORATION-SATELLITE (space-to-Earth) 5.536B FIXED INTER-SATELLITE 5.536 MOBILE SPACE RESEARCH (space-to-Earth) 5.536C Standard frequency and time signal-satellite (Earth-to-space)			25.5-27 EARTH EXPLORATION- SATELLITE (space-to-Earth) FIXED INTER-SATELLITE 5.536 MOBILE SPACE RESEARCH (space-to-Earth) Standard frequency and time signal-satellite (Earth-to-space)	25.5-27 SPACE RESEARCH (space-to-Earth) Inter-satellite 5.536 Standard frequency and time signal-satellite (Earth-to-space)	
5.536A			5.536A US258	5.536A US258	

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35.2-35.5 METEOROLOGICAL AIDS RADIOLOCATION 5.549			US360 G117	US360	
35.5-36 METEOROLOGICAL AIDS EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION SPACE RESEARCH (active) 5.549 5.549A			35.5-36 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION SPACE RESEARCH (active) US360 G117	35.5-36 Earth exploration-satellite (active) Radiolocation Space research (active) US360	
36-37 EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE SPACE RESEARCH (passive) 5.149 5.550A			36-37 EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE SPACE RESEARCH (passive) US342 US550A		
37-37.5 FIXED MOBILE except aeronautical mobile SPACE RESEARCH (space-to-Earth) 5.547			37-38 FIXED MOBILE except aeronautical mobile SPACE RESEARCH (space-to-Earth)	37-37.5 FIXED MOBILE except aeronautical mobile	
37.5-38 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile SPACE RESEARCH (space-to-Earth) Earth exploration-satellite (space-to-Earth) 5.547				37.5-38 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile	Satellite Communications (25)
38-39.5 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE Earth exploration-satellite (space-to-Earth) 5.547			38-38.6 FIXED MOBILE 38.6-39.5	38.6-39.5 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE NG175	Satellite Communications (25) Fixed Microwave (101)
39.5-40 FIXED FIXED-SATELLITE (space-to-Earth) 5.516B MOBILE MOBILE-SATELLITE (space-to-Earth) Earth exploration-satellite (space-to-Earth) 5.547			39.5-40 FIXED-SATELLITE (space-to-Earth) MOBILE-SATELLITE (space-to-Earth) US382 G117	39.5-40 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE NG175 US382	

76-77.5 RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite Space research (space-to-Earth)	76-77.5 RADIO ASTRONOMY RADIOLOCATION Space research (space-to-Earth)	76-77 RADIO ASTRONOMY RADIOLOCATION Amateur Space research (space-to-Earth) US342	RF Devices (15)
5.149	US342	77-77.5 RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite Space research (space-to-Earth) US342	RF Devices (15) Amateur Radio (97)
77.5-78 AMATEUR AMATEUR-SATELLITE Radio astronomy Space research (space-to-Earth)	77.5-78 Radio astronomy Space research (space-to-Earth)	77.5-78 AMATEUR AMATEUR-SATELLITE Radio astronomy Space research (space-to-Earth)	
5.149	US342	US342	
78-79 RADIOLOCATION Amateur Amateur-satellite Radio astronomy Space research (space-to-Earth)	78-79 RADIO ASTRONOMY RADIOLOCATION Space research (space-to-Earth)	78-79 RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite Space research (space-to-Earth)	
5.149 5.560	5.560 US342	5.560 US342	
79-81 RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite Space research (space-to-Earth)	79-81 RADIO ASTRONOMY RADIOLOCATION Space research (space-to-Earth)	79-81 RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite Space research (space-to-Earth)	
5.149	US342	US342	
81-84 FIXED 5.338A FIXED-SATELLITE (Earth-to-space) MOBILE MOBILE-SATELLITE (Earth-to-space) RADIO ASTRONOMY Space research (space-to-Earth)	81-84 FIXED US162 FIXED-SATELLITE (Earth-to-space) US297 MOBILE MOBILE-SATELLITE (Earth-to-space) RADIO ASTRONOMY Space research (space-to-Earth)		RF Devices (15) Fixed Microwave (101)
5.149 5.561A	US161 US342 US389		
84-86 FIXED 5.338A FIXED-SATELLITE (Earth-to-space) 5.561B MOBILE RADIO ASTRONOMY	84-86 FIXED US162 FIXED-SATELLITE (Earth-to-space) MOBILE RADIO ASTRONOMY		
5.149	US161 US342 US389		

International Table			United States Table		FCC Rule Part(s)
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5.340 92-94 FIXED 5.338A MOBILE RADIO ASTRONOMY RADIOLOCATION			US246 92-94 FIXED US162 MOBILE RADIO ASTRONOMY RADIOLOCATION		RF Devices (15) Fixed Microwave (101)
5.149 94-94.1 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION SPACE RESEARCH (active) Radio astronomy			US161 US342 94-94.1 EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION SPACE RESEARCH (active) Radio astronomy	94-94.1 RADIOLOCATION Radio astronomy	RF Devices (15)
5.562 5.562A 94.1-95 FIXED MOBILE RADIO ASTRONOMY RADIOLOCATION			5.562 5.562A 94.1-95 FIXED MOBILE RADIO ASTRONOMY RADIOLOCATION	5.562A	RF Devices (15) Fixed Microwave (101)
5.149 95-100 FIXED MOBILE RADIO ASTRONOMY RADIOLOCATION RADIONAVIGATION RADIONAVIGATION-SATELLITE			US161 US342 95-100 FIXED MOBILE RADIO ASTRONOMY RADIOLOCATION RADIONAVIGATION RADIONAVIGATION-SATELLITE		
5.149 5.554 100-102 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive)			5.554 US342 100-102 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY US74 SPACE RESEARCH (passive)		
5.340 5.341 102-105 FIXED MOBILE RADIO ASTRONOMY			5.341 US246 102-105 FIXED MOBILE RADIO ASTRONOMY		
5.149 5.341			5.341 US342		

International Table			United States Table		FCC Rule Part(s)
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200-209 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 5.340 5.341 5.563A			200-209 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY US74 SPACE RESEARCH (passive) 5.341 5.563A US246		
209-217 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE RADIO ASTRONOMY 5.149 5.341			209-217 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE RADIO ASTRONOMY 5.341 US342		
217-226 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE RADIO ASTRONOMY SPACE RESEARCH (passive) 5.562B 5.149 5.341			217-226 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE RADIO ASTRONOMY SPACE RESEARCH (passive) 5.562B 5.341 US342		
226-231.5 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) 5.340			226-231.5 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive) US246		
231.5-232 FIXED MOBILE Radiolocation			231.5-232 FIXED MOBILE Radiolocation		
232-235 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE Radiolocation			232-235 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE Radiolocation		
235-238 EARTH EXPLORATION-SATELLITE (passive) FIXED-SATELLITE (space-to-Earth) SPACE RESEARCH (passive) 5.563A 5.563B			235-238 EARTH EXPLORATION-SATELLITE (passive) FIXED-SATELLITE (space-to-Earth) SPACE RESEARCH (passive) 5.563A 5.563B		
238-240 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE RADIOLOCATION RADIONAVIGATION RADIONAVIGATION-SATELLITE			238-240 FIXED FIXED-SATELLITE (space-to-Earth) MOBILE RADIOLOCATION RADIONAVIGATION RADIONAVIGATION-SATELLITE		

240-241 FIXED MOBILE RADIOLOCATION	240-241 FIXED MOBILE RADIOLOCATION		
241-248 RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite	241-248 RADIO ASTRONOMY RADIOLOCATION	241-248 RADIO ASTRONOMY RADIOLOCATION Amateur Amateur-satellite	ISM Equipment (18) Amateur Radio (97)
5.138 5.149 248-250 AMATEUR AMATEUR-SATELLITE Radio astronomy	5.138 US342 248-250 Radio astronomy	5.138 US342 248-250 AMATEUR AMATEUR-SATELLITE Radio astronomy	Amateur Radio (97)
5.149 250-252 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY SPACE RESEARCH (passive)	US342	US342	
5.340 5.563A	250-252 EARTH EXPLORATION-SATELLITE (passive) RADIO ASTRONOMY US74 SPACE RESEARCH (passive)		
252-265 FIXED MOBILE MOBILE-SATELLITE (Earth-to-space) RADIO ASTRONOMY RADIONAVIGATION RADIONAVIGATION-SATELLITE	5.563A US246		
5.149 5.554	252-265 FIXED MOBILE MOBILE-SATELLITE (Earth-to-space) RADIO ASTRONOMY RADIONAVIGATION RADIONAVIGATION-SATELLITE		
265-275 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE RADIO ASTRONOMY	5.554 US211 US342		
5.149 5.563A	265-275 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE RADIO ASTRONOMY		
275-3000 (Not allocated)	5.563A US342		
5.565	275-3000 (Not allocated)		Amateur Radio (97)
	5.565 US565		

## UNITED STATES (US) FOOTNOTES

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US52 In the VHF maritime mobile band (156-162 MHz), the following provisions shall apply:

(a) Except as provided for below, the use of the bands 161.9625-161.9875 MHz (AIS 1 with center frequency 161.975 MHz) and 162.0125-162.0375 MHz (AIS 2 with center frequency 162.025 MHz) by the maritime mobile and mobile-satellite (Earth-to-space) services is restricted to Automatic Identification Systems (AIS). The use of these bands by the aeronautical mobile (OR) service is restricted to AIS emissions from search and rescue aircraft operations. Frequencies in the AIS 1 band may continue to be used by non-Federal base, fixed, and land mobile stations until March 2, 2024.

(b) Except as provided for below, the use of the bands 156.7625-156.7875 MHz (AIS 3 with center frequency 156.775 MHz) and 156.8125-156.8375 MHz (AIS 4 with center frequency 156.825 MHz) by the mobile-satellite service (Earth-to-space) is restricted to the reception of long-range AIS broadcast messages from ships (Message 27; see most recent version of Recommendation ITU-R M.1371). The frequencies 156.775 MHz and 156.825 MHz may continue to be used by non-Federal ship and coast stations for navigation-related port operations or ship movement until August 26, 2019.

(c) The frequency 156.3 MHz may also be used by aircraft stations for the purpose of search and rescue operations and other safety-related communication.

(d) Federal stations in the maritime mobile service may also be authorized as follows: (1) Vessel traffic services under the control of the U.S. Coast Guard on a simplex basis by coast and ship stations on the frequencies 156.25, 156.55, 156.6 and 156.7 MHz; (2) Inter-ship use of the frequency 156.3 MHz on a simplex basis; (3) Navigational bridge-to-bridge and navigational communications on a simplex basis by coast and ship stations on the frequencies 156.375 and 156.65 MHz; (4) Port operations use on a simplex basis by coast and ship stations on the frequencies 156.6 and 156.7 MHz; (5) Environmental communications on the frequency 156.75 MHz in accordance with the national plan; and (6) Duplex port operations use of the frequencies 157 MHz for ship stations and 161.6 MHz for coast stations.

\*\*\*\*\*

US115 In the bands 5000-5010 MHz and 5010-5030 MHz, the following provisions shall apply:

(a) In the band 5000-5010 MHz, systems in the aeronautical mobile (R) service (AM(R)S) shall be operated in accordance with international aeronautical standards and are limited to surface applications at airports (i.e., AeroMACS).

(b) The band 5010-5030 MHz is also allocated on a primary basis to the AM(R)S, limited to surface applications at airports that operate in accordance with international civil aviation standards. In making assignments for this band, attempts shall first be made to satisfy the AM(R)S requirements in the bands 5000-5010 MHz and 5091-5150 MHz. AM(R)S systems used in the band 5010-5030 MHz shall be designed and implemented to be capable of operational modification if receiving harmful interference from the radionavigation-satellite service. Finally, notwithstanding Radio Regulation No. 4.10, stations in the AM(R)S operating in this band shall be designed and implemented to be capable of operational modification to reduce throughput and/or preclude the use of specific frequencies in order to ensure protection of radionavigation-satellite service systems operating in this band.

(c) Aeronautical fixed communications that are an integral part of the AeroMACS system in the bands 5000-5010 MHz and 5010-5030 MHz are also authorized on a primary basis.

\*\*\*\*\*

US132A In the bands 26.2-26.42 MHz, 41.015-41.665 MHz, and 43.35-44 MHz, applications of radiolocation service are limited to oceanographic radars operating in accordance with ITU Resolution 612 (Rev. WRC-12). Oceanographic radars shall not cause harmful interference to, or claim protection from, non-Federal stations in the land mobile service in the bands 26.2-26.42 MHz and 43.69-44 MHz, Federal stations in the fixed or mobile services in the band 41.015-41.665 MHz, and non-Federal stations in the fixed or land mobile services in the band 43.35-43.69 MHz.

\*\*\*\*\*

US162 In the bands 81-86 GHz and 92-94 GHz, operators of stations in the fixed service are encouraged to take all reasonable steps to ensure that unwanted emission power in any 100 MHz bandwidth in the band 86-92 GHz, measured at the antenna port, does not exceed the following levels:

Band	Maximum levels (where f in GHz is the center frequency of any 100 MHz)
81-86 GHz	-41 - 14(f - 86) dBW for $86.05 \leq f \leq 87$ GHz and -55 dBW for $87 \leq f \leq 91.95$ GHz
92-94 GHz	-41 - 14(92 - f) dBW for $91 \leq f \leq 91.95$ GHz and -55 dBW for $86.05 \leq f \leq 91$ GHz

\* \* \* \* \*

US511E The use of the band 15.4-15.7 GHz by the radiolocation service is limited to Federal systems requiring a necessary bandwidth greater than 1600 MHz that cannot be accommodated within the band 15.7-17.3 GHz except as described below. In the band 15.4-15.7 GHz, stations operating in the radiolocation service shall not cause harmful interference to, nor claim protection from, radars operating in the aeronautical radionavigation service. Radar systems operating in the radiolocation service shall not be developed solely for operation in the band 15.4-15.7 GHz. Radar systems requiring use of the band 15.4-15.7 GHz for testing, training, and exercises may be accommodated on a case-by-case basis.

\* \* \* \* \*

US565 International footnote 5.565 does not establish priority of use in the United States Table of Frequency Allocations, and does not preclude or constrain the allocation of frequency bands in the range 275-3000 GHz to active services at a future date.

\* \* \* \* \*

#### NON-FEDERAL GOVERNMENT (NG) FOOTNOTES

\* \* \* \* \*

NG16 In the bands 72-73 MHz and 75.4-76 MHz, frequencies may be authorized for mobile operations in the Industrial/Business Radio Pool, subject to the condition that no interference is caused to the reception of television stations operating on channels 4 and 5.

\* \* \* \* \*

NG92 The band 1900-2000 kHz is also allocated on a primary basis to the maritime mobile service in Regions 2 and 3 and to the radiolocation service in Region 2, and on a secondary basis to the radiolocation service in Region 3. The use of these allocations is restricted to radio buoy operations on the open sea. Stations in the amateur, maritime mobile, and radiolocation services located in Region 2 shall be protected from harmful interference only to the extent that such radiation exceeds the level which would be present if the offending station were operating in compliance with the technical rules applicable to the service in which it operates.

\* \* \* \* \*

#### PART 15 – RADIO FREQUENCY DEVICES

4. The authority citation for Part 15 is amended to read as follows:

AUTHORITY: 47 U.S.C. 154, 302a, 303, 304, 307, 336, 544a, and 549.

5. Section 15.113 is amended by revising paragraph (a) to read as follows:

§ 15.113 Power Line Carrier Systems

\* \* \* \* \*

(a) A power utility operating a power line carrier system shall submit the details of proposed new systems or changes to existing systems to an industry-operated entity as set forth in § 90.35(g) of this chapter. No notification to the FCC is required.

\* \* \* \* \*

**PART 80 – STATIONS IN THE MARITIME SERVICES**

6. The authority citation for Part 80 continues to read as follows:

AUTHORITY: Secs. 4, 303, 307(e), 309, and 332, 48 Stat. 1066, 1082, as amended; 47 U.S.C. 154, 303, 307(e), 309, and 332, unless otherwise noted. Interpret or apply 48 Stat. 1064-1068, 1081-1105, as amended; 47 U.S.C. 151-155, 301-609; 3 UST 3450, 3 UST 4726, 12 UST 2377.

7. Section 80.215 is amended by removing note 13 from paragraph (e)(1) and by removing and reserving paragraph (g)(3).

**§ 80.215 Transmitter power.**

\* \* \* \* \*

(e) \* \* \*

(1) Ship stations 156-162 MHz—25 W<sup>6</sup>

\* \* \* \* \*

(g) \* \* \*

\* \* \* \* \*

(3) [Reserved]

\* \* \* \* \*

8. Section 80.373 is amended by revising the portion of the table in paragraph (f) that is titled “Port Operations” by removing the entries for channel designator 75 (156.775 MHz) and channel designator 76 (156.825 MHz) and by removing note 18.

**§ 80.373 Private communications frequencies.**

\* \* \* \* \*

(f) \* \* \*

FREQUENCIES IN THE 156-162 MHZ BAND

Channel designator	Carrier frequency (MHz) ship transmit	Carrier frequency (MHz) coast transmit	Points of communication (intership and between coast and ship unless otherwise indicated)
<b>Port Operations</b>			
01A <sup>1</sup>	156.050	156.050	
63A <sup>1</sup>	156.175	156.175	
05A <sup>2</sup>	156.250	156.250	
65A	156.275	156.275	
66A	156.325	156.325	
12 <sup>3</sup>	156.600	156.600	
73	156.675	156.675	
14 <sup>3</sup>	156.700	156.700	
74	156.725	156.725	
77 <sup>4</sup>	156.875		Intership only.
20A <sup>12</sup>	157.000		Intership only.
<b>Navigational (Bridge-to-Bridge)<sup>5</sup></b>			
**	**	**	*

9. Section 80.375 is amended by adding paragraph (f) to read as follows:

**§ 80.375 Radiodetermination frequencies.**

\* \* \* \* \*

(f) Radiodetermination frequencies for commercial fishing vessels. Frequencies in the 1900-2000 kHz band are authorized for radio buoy operations under a ship station license provided:

(1) The use of these frequencies is related to commercial fishing operations on the open sea. This use is not permitted within the exclusive economic area or territorial waters of a foreign country (unless provided for by an international agreement); and

(2) The output power does not exceed 10 watts and the station antenna height does not exceed 4.6 meters (15 feet) above sea level in a buoy station or 6 meters (20 feet) above the mast of the ship on which it is installed.

NOTE: Frequencies in the 1900-2000 kHz band may also be used to transmit data related to commercial fishing and by radio buoy systems that do not use radio direction-finding to locate the radio buoys.

10. Section 80.871 is amended by revising the table in paragraph (d) to remove the entries for channel designator 75 (156.775 MHz) and channel designator 76 (156.825 MHz).

**§ 80.871 VHF radiotelephone station.**

\* \* \* \* \*

(d) \* \* \*

Channel designators	Transmitting frequencies (MHz)	
	Ship station	Coast station
** *	**	**
15	156.750	156.750
16	156.800	156.800
17	156.850	156.850
** *	**	**

**PART 90 – PRIVATE LAND MOBILE RADIO SERVICES**

11. The authority citation for Part 90 continues to read as follows:

AUTHORITY: Sections 4(i), 11, 303(g), 303(r), and 332(c)(7) of the Communications Act of 1934, as amended, 47 U.S.C. 154(i), 161, 303(g), 303(r), and 332(c)(7), and Title VI of the Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. 112-96, 126 Stat. 156.

12. Section 90.7 is amended by adding the following term and definition in alphabetical order to read as follows:

§ 90.7 Definitions.

\* \* \* \* \*

Equivalent Isotropically Radiated Power (EIRP). The product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna (absolute or isotropic gain).

\* \* \* \* \*

13. Section 90.103 is amended by adding or revising the following entries to the table in paragraph (b) and by adding paragraph (c)(3) to read as follows:

**§ 90.103 Radiolocation Service.**

\* \* \* \* \*

(b) \* \* \*

RADIOLOCATION SERVICE FREQUENCY TABLE

Frequency or band	Class of station(s)	Limitation
Kilohertz		
* * *	* *	* *
4438 to 4488 .....	Radiolocation land	3
5250 to 5275 .....	.....do	3
Megahertz		
13.45 to 13.55 .....	.....do	3
16.10 to 16.20 .....	.....do	3
24.45 to 24.65 .....	.....do	3
26.20 to 26.42 .....	.....do	3
41.015 to 41.665 .....	.....do	3
43.35 to 44.00 .....	.....do	3
420 to 450 .....	Radiolocation land or mobile	21
2450 to 2500 .....	.....do	9, 22, 23
* * *	* *	* *

(c) \* \* \*

\* \* \* \* \*

(3) Operations in this band are limited to oceanographic radars using transmitters with a peak equivalent isotropically radiated power (EIRP) not to exceed 25 dBW. Oceanographic radars must not cause harmful interference to, nor claim protection from interference caused by, stations in the fixed or mobile services as specified in § 2.106, footnotes 5.132A, 5.145A, and US132A. See Resolution 612 of the ITU Radio Regulations for international coordination requirements. Operators of oceanographic radars are urged to use directional antennas and techniques that allow multiples of such radars to operate

on the same frequency.

\* \* \* \* \*

## PART 97 – AMATEUR RADIO SERVICE

14. The authority citation for part 97 continues to read as follows:

AUTHORITY: 48 Stat. 1066, 1082, as amended; 47 U.S.C. 154, 303. Interpret or apply 48 Stat. 1064-1068, 1081-1105, as amended; 47 U.S.C. 151-155, 301-609, unless otherwise noted.

15. Section 97.3(b) is amended by revising the definitions to read as follows:

### **§ 97.3 Definitions.**

\* \* \* \* \*

(b) \* \* \*

(1) EHF (extremely high frequency). The frequency range 30-300 GHz.

(2) EIRP (equivalent isotropically radiated power). The product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna (absolute or isotropic gain).

NOTE: Divide EIRP by 1.64 to convert to effective radiated power.

(3) ERP (effective radiated power) (in a given direction). The product of the power supplied to the antenna and its gain relative to a half-wave dipole in a given direction.

NOTE: Multiply ERP by 1.64 to convert to equivalent isotropically radiated power.

(4) HF (high frequency). The frequency range 3-30 MHz.

(5) Hz. Hertz.

(6) LF (low frequency). The frequency range 30-300 kHz.

(7) m. Meters.

(8) MF (medium frequency). The frequency range 300-3000 kHz.

(9) PEP (peak envelope power). The average power supplied to the antenna transmission line by a transmitter during one RF cycle at the crest of the modulation envelope taken under normal operating conditions.

(10) RF. Radio frequency.

(11) SHF (super high frequency). The frequency range 3-30 GHz.

(12) UHF (ultra high frequency). The frequency range 300-3000 MHz.

(13) VHF (very high frequency). The frequency range 30-300 MHz.

(14) W. Watts.

\* \* \* \* \*

16. Section 97.15 is amended by adding paragraph (c) to read as follows:

### **§ 97.15 Station antenna structures.**

\* \* \* \* \*

(c) Antennas used to transmit in the 2200 m and 630 m bands must not exceed 60.96 meters (200 feet) in height above ground level.

17. Section 97.301 is amended by revising the kHz portion of the tables in paragraphs (b), (c), and (d) to read as follows:

### **§ 97.301 Authorized frequency bands.**

\* \* \* \* \*

(b) \* \* \*

Wavelength band	ITU Region 1	ITU Region 2	ITU Region 3	Sharing requirements see § 97.303 (Paragraph)
LF	kHz	kHz	kHz	
2200 m.....	135.7-137.8.....	135.7-137.8.....	135.7-137.8.....	(a), (g)
MF	kHz	kHz	kHz	
630 m.....	472-479.....	472-479.....	472-479.....	(g)
160 m.....	1810-1850.....	1800-2000.....	1800-2000.....	(a)
* *	* *	*	*	*

(c) \* \* \*

Wavelength band	ITU Region 1	ITU Region 2	ITU Region 3	Sharing requirements see § 97.303 (Paragraph)
LF	kHz	kHz	kHz	
2200 m.....	135.7-137.8.....	135.7-137.8.....	135.7-137.8.....	(a), (g)
MF	kHz	kHz	kHz	
630 m.....	472-479.....	472-479.....	472-479.....	(g)
160 m.....	1810-1850.....	1800-2000.....	1800-2000.....	(a)
* *	* *	*	*	*

(d) \* \* \*

Wavelength band	ITU Region 1	ITU Region 2	ITU Region 3	Sharing requirements see § 97.303 (Paragraph)
LF	kHz	kHz	kHz	
2200 m.....	135.7-137.8.....	135.7-137.8.....	135.7-137.8.....	(a), (g)
MF	kHz	kHz	kHz	
630 m.....	472-479.....	472-479.....	472-479.....	(g)
160 m.....	1810-1850.....	1800-2000.....	1800-2000.....	(a)
* *	* *	*	*	*

\* \* \* \* \*

18. Section 97.303 is amended by adding paragraph (g) to read as follows:

**§ 97.303 Frequency sharing requirements.**

\* \* \* \* \*

(g) In the 2200 m and 630 m bands:

(1) Power line carrier (PLC) systems are authorized in accordance with 47 CFR 15.113 to operate in the 9-490 kHz range on transmission lines that deliver electric power from generation plants to distribution substations. Amateur stations are restricted to use at permanent fixed locations. The transmitting antenna of amateur fixed stations must be located at a horizontal distance of least [separation distance] km ([separation distance] mile) from any electric power transmission line. Electric power transmission lines do not include those electric lines which connect the distribution substation to the customer or house wiring.

(2) Amateur stations transmitting in the 2200 m band must not cause harmful interference to, and must accept interference from, stations authorized by the United States (NTIA and FCC) and other nations in the fixed and maritime mobile services, and for amateur stations located in ITU Region 3, this

requirement also includes stations authorized by other nations in the radionavigation service. Amateur stations transmitting in the 2200 m band must make all necessary adjustments – including temporary or permanent termination of transmission – if harmful interference is caused.

(3) Amateur stations transmitting in the 630 m band must not cause harmful interference to, and must accept interference from, stations authorized by the FCC in the maritime mobile service and stations authorized by the United States Government and other nations in the maritime mobile and aeronautical radionavigation services. In particular, amateur stations must ensure that no harmful interference is caused to the frequency 490 kHz. Amateur stations transmitting in the 630 m band must make all necessary adjustments – including temporary or permanent termination of transmission – if harmful interference is caused.

\* \* \* \* \*

19. Section 97.313 is amended by adding paragraphs (k) and (l) to read as follows.

**§ 97.313 Transmitter power standards.**

\* \* \* \* \*

(k) No station may transmit in the 2200 m band with an equivalent isotropically radiated power (EIRP) exceeding 1 W (0.61 W ERP).

(l) No station may transmit in the 630 m band with an equivalent isotropically radiated power (EIRP) exceeding 5 W (3.049 W ERP). In Alaska, stations in the 630 m band located within 800 kilometers (497 miles) of the Russian Federation may not transmit with an EIRP exceeding 1 W (0.61 W ERP).

\* \* \* \* \*

**PART 101—FIXED MICROWAVE SERVICES**

20. The authority citation for part 101 continues to read as follows:

AUTHORITY: 47 U.S.C. 154, 303.

21. Section 101.111 is amended by revising paragraph (d) and adding paragraph (d)(5) to read as follows:

**§ 101.111 Emission limitations.**

\* \* \* \* \*

(d) Interference to passive sensors. These limitations are necessary to minimize the probability of harmful interference to reception in the 10.6-10.68 GHz, 31-31.3 GHz, and 86-92 GHz bands onboard space stations in the Earth exploration-satellite service (passive).

\* \* \* \* \*

(5) In the 81-86 GHz and 92-94 GHz bands, licensees of stations in the fixed service are encouraged to take all reasonable steps to ensure that unwanted emission power in any 100 MHz bandwidth in the band 86-92 GHz, measured at the antenna port, does not exceed the following levels:

Band	Maximum levels (where f in GHz is the center frequency of any 100 MHz)
81-86 GHz	-41 - 14(f - 86) dBW for 86.05 ≤ f ≤ 87 GHz and -55 dBW for 87 ≤ f ≤ 91.95 GHz
92-94 GHz	-41 - 14(92 - f) dBW for 91 ≤ f ≤ 91.95 GHz and -55 dBW for 86.05 ≤ f ≤ 91 GHz

## APPENDIX G

## Initial Regulatory Flexibility Analysis

1. As required by the Regulatory Flexibility Act (RFA),<sup>1</sup> the Commission has prepared this present Initial Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact on small entities by the policies and rules proposed in this WRC-12 Notice of Proposed Rule Making (WRC-12 Notice). Written public comments are requested on this IRFA. Comments must be identified as responses to the IRFA and must be filed by the deadlines for comments provided on the first page of this WRC-12 Notice. The Commission will send a copy of this WRC-12 Notice, including this IRFA, to the Chief Counsel for Advocacy of the Small Business Administration (SBA).<sup>2</sup> In addition, the WRC-12 Notice and IRFA (or summaries thereof) will be published in the Federal Register.<sup>3</sup>

**A. Need for, and Objectives of, the Proposed Rules**

2. In the WRC-12 Notice, the Commission proposes to amend parts 2, 15, 80, 90, 97, and 101 of its rules to implement certain of the allocation decisions from the World Radiocommunication Conference (Geneva, 2012) (WRC-12) in the Commission's Table of Frequency Allocations, and to make certain updates to its service rules. If adopted, these proposals would conform the Commission's rules, to the extent practical, to the decisions that the international community made at WRC-12 and would promote the advancement of new and expanded services and provide significant benefits to the American public.

**B. Legal Basis**

3. The proposed action is authorized under Sections 4(i), 301, 303(c), 303(f), and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. §§ 154(i), 301, 303(c), 303(f), and 303(r).

**C. Description and Estimate of the Number of Small Entities To Which the Proposed Rules Will Apply**

4. The RFA directs agencies to provide a description of and, where feasible, an estimate of the number of small entities that may be affected by the proposed rules, if adopted.<sup>4</sup> The RFA generally defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction."<sup>5</sup> In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act.<sup>6</sup> A small business concern is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the SBA.<sup>7</sup>

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<sup>1</sup> See 5 U.S.C. § 603. The RFA, *see* 5 U.S.C. § 601 – 612, has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), Pub. L. No. 104-121, Title II, 110 Stat. 857 (1996).

<sup>2</sup> See 5 U.S.C. § 603(a).

<sup>3</sup> See *id.*

<sup>4</sup> 5 U.S.C. § 603(b)(3).

<sup>5</sup> 5 U.S.C. § 601(6).

<sup>6</sup> 5 U.S.C. § 601(3) (incorporating by reference the definition of "small business concern" in 15 U.S.C. § 632). Pursuant to the RFA, the statutory definition of a small business applies "unless an agency, after consultation with the Office of Advocacy of the Small Business Administration and after opportunity for public comment, establishes one or more definitions of such term which are appropriate to the activities of the agency and publishes such definition(s) in the Federal Register." 5 U.S.C. § 601(3).

<sup>7</sup> Small Business Act, 15 U.S.C. § 632 (1996).

**Small Businesses, Small Organizations, and Small Governmental Jurisdictions.** Our action may, over time, affect small entities that are not easily categorized at present. We therefore describe here, at the outset, three comprehensive, statutory small entity size standards.<sup>8</sup> First, nationwide, there are a total of 28.2 million small businesses, according to the SBA.<sup>9</sup> In addition, a “small organization” is generally “any not-for-profit enterprise which is independently owned and operated and is not dominant in its field.”<sup>10</sup> Nationwide, as of 2012, there were approximately 2,300,000 small organizations.<sup>11</sup> Finally, the term “small governmental jurisdiction” is defined generally as “governments of cities, towns, townships, villages, school districts, or special districts, with a population of less than fifty thousand.”<sup>12</sup> Census Bureau data for 2012 indicate that there were 90,056 local governments in the United States.<sup>13</sup> Thus, we estimate that most governmental jurisdictions are small.

**Amateur Radio Service.** Because “small entities,” as defined in the RFA, are not persons eligible for licensing in the amateur service, this proposed rule does not apply to “small entities.” Rather, it applies exclusively to individuals who are the control operators of amateur radio stations.

**Wireless Telecommunications Carriers (except satellite).** This industry comprises establishments engaged in operating and maintaining switching and transmission facilities to provide communications via the airwaves. Establishments in this industry have spectrum licenses and provide services using that spectrum, such as cellular phone services, paging services, wireless Internet access, and wireless video services.<sup>14</sup> The appropriate size standard under SBA rules is for the category Wireless Telecommunications Carriers. The size standard for that category is that a business is small if it has 1,500 or fewer employees.<sup>15</sup> Under the present and prior categories, the SBA has deemed a wireless business to be small if it has 1,500 or fewer employees.<sup>16</sup> For this category, census data for 2007 show that there were 11,163 firms that operated for the entire year.<sup>17</sup> Of this total, 10,791 firms had employment of 999 or fewer employees and 372 had employment of 1,000 employees or more.<sup>18</sup> Thus under this category and the associated small business size standard, the Commission estimates that the majority of wireless telecommunications carriers (except satellite) are small entities that may be affected by our proposed action.<sup>19</sup>

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<sup>8</sup> See 5 U.S.C. §§ 601(3)–(6).

<sup>9</sup> See SBA, Office of Advocacy, “Frequently Asked Questions,” [http://www.sba.gov/sites/default/files/FAQ\\_March\\_2014\\_0.pdf](http://www.sba.gov/sites/default/files/FAQ_March_2014_0.pdf) (last visited May 2, 2014; figures are from 2011).

<sup>10</sup> 5 U.S.C. § 601(4).

<sup>11</sup> NATIONAL CENTER FOR CHARITABLE STATISTICS, THE NONPROFIT ALMANAC (2012).

<sup>12</sup> 5 U.S.C. § 601(5).

<sup>13</sup> U.S. CENSUS BUREAU, GOVERNMENT ORGANIZATION SUMMARY REPORT: 2012 (rel. Sep. 26, 2013), [http://www2.census.gov/govs/cog/g12\\_org.pdf](http://www2.census.gov/govs/cog/g12_org.pdf) (last visited May 2, 2014).

<sup>14</sup> See <http://www.census.gov/cgi-bin/sssd/naics/naicsrch?code=517210&search=2007%20NAICS%20Search>.

<sup>15</sup> 13 C.F.R. § 121.201, NAICS code 517210.

<sup>16</sup> 13 C.F.R. § 121.201, NAICS code 517210. The now-superseded, pre-2007 C.F.R. citations were 13 C.F.R. § 121.201, NAICS codes 517211 and 517212 (referring to the 2002 NAICS).

<sup>17</sup> U.S. Census Bureau, Subject Series: Information, Table 5, “Establishment and Firm Size: Employment Size of Firms for the United States: 2007 NAICS Code 517210” (issued Nov. 2010).

<sup>18</sup> *Id.* Available census data do not provide a more precise estimate of the number of firms that have employment of 1,500 or fewer employees; the largest category provided is for firms with “100 employees or more.”

<sup>19</sup> See [http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN\\_2007\\_US\\_51SSSZ2&prodType=table](http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2007_US_51SSSZ2&prodType=table).

**D. Description of Projected Reporting, Recordkeeping, and Other Compliance Requirements for Small Entities**

5. The WRC-12 Notice does not propose to establish any new reporting or recordkeeping requirements for small entities. The WRC-12 Notice proposes to establish “other” compliance requirement for applicants/licensees. The compliance requirements proposed in the WRC-12 Notice are the same for small and large entities.

6. The WRC-12 Notice proposes that frequencies in the 1900-2000 kHz band be authorized for radio buoy operations under a ship station license provided: 1) The use of these frequencies is related to commercial fishing operations on the open sea. This use is not permitted within the exclusive economic area or territorial waters of a foreign country (unless provided for by an international agreement); and 2) The output power does not exceed 10 watts and the station antenna height does not exceed 4.6 meters (15 feet) above sea level in a buoy station or 6 meters (20 feet) above the mast of the ship on which it is installed.

7. The WRC-12 Notice proposes to limit radiolocations service operations in the 4438-4488 kHz, 5250-5275 kHz, 13.45-13.55 GHz, 16.10-16.20 MHz, 24.45-24.65 MHz, 26.20-26.42 MHz, 41.015-41.665 MHz, 43.35-44 MHz to oceanographic radars using transmitters with a peak equivalent isotropically radiated power that do not exceed 25 dBW. The WRC-12 Notice also proposes that oceanographic radars must not cause harmful interference to, nor claim protection from interference caused by, stations in the incumbent fixed or mobile services. In addition, the proposed rules provide a cross reference to Resolution 612 of the ITU Radio Regulations for the international coordination requirements. These requirements state that each oceanographic radar station shall transmit a station identification (call sign) on the assigned frequency, in international Morse code at manual speed, at the end of each data acquisition cycle, but at an interval of no more than 20 minutes; and that the separation distances between an oceanographic radar and the border of other countries shall be between 80 and 920 kilometers. Finally, the WRC-12 Notice proposes to require that licensees of oceanographic radars that currently operate under Part 5 of the rules transition their operations to frequencies within an allocated band within 5 years of the adoption of final rules in this proceeding.

**E. Steps Taken to Minimize Significant Economic Impact on Small Entities, and Significant Alternatives Considered**

8. The RFA requires an agency to describe any significant alternatives that it has considered in reaching its proposed approach, which may include the following four alternatives (among others): (1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance or reporting requirements under the rule for small entities; (3) the use of performance, rather than design, standards; and (4) an exemption from coverage of the rule, or any part thereof, for small entities.<sup>20</sup>

9. The WRC-12 Notice proposes to authorize commercial fishing vessels to operate radio buoys in the 1900-2000 kHz band under a ship station license. This action is expected to have a positive non-burdensome impact on commercial fishing vessels, many of which are owned by small businesses, by authorizing these entities to operate radio buoys under a ship station license instead of obtaining separate licenses for the radio buoys.

10. The WRC-12 Notice proposes that the 156.7625-156.7875 MHz and 156.8125-156.8375 MHz bands may continue to be used by non-Federal ship and coast stations for navigation-related port operations or ship movement until August 26, 2019. Because of the proposed delayed transition date, we believe that we have minimized the impact on a small business that operates coast stations in these bands to extent practicable.

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<sup>20</sup> See 5 U.S.C. § 603(c).

**F. Federal Rules that May Duplicate, Overlap, or Conflict With the Proposed Rule**

11. None.