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

In the Matter of	)	
	)	
Amendment of Parts 2, 25 and 97 of the	)	
Commission's Rules with Regard to the	)	ET Docket No. 98-142
Mobile-Satellite Service Above 1 GHz	)	

NOTICE OF PROPOSED RULE MAKING

Adopted: July 28, 1998 **Released: August 4, 1998**

Comment Date: [30 days from publication in the Federal Register]
Reply Comment Date: [45 days from publication in the Federal Register]

By the Commission:

I. INTRODUCTION

1. By this action, we propose to amend Part 2 of the Commission's Rules by allocating the 5091-5250 MHz and 15.43-15.63 GHz bands to the fixed-satellite service ("FSS")[1] on a co-primary basis for Earth-to-space ("uplink") transmissions and by allocating the 6700-7075 MHz and 15.43-15.63 GHz bands on a co-primary basis for space-to-Earth ("downlink") transmissions. We also propose to amend Part 25 in order to add these frequency bands to the list of frequencies available for use by the Satellite Communications Service. We further propose to limit the use of these new FSS allocations to feeder links[2] that would be used in conjunction with the service links[3] of non-geostationary satellite orbit mobile-satellite service ("NGSO MSS") systems.[4] The

[1] The fixed-satellite service is a radiocommunication service between earth stations at given points, when one or more satellites are used; the given position may be a specified point or any 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. *See* 47 C.F.R. § 2.1.

[2] A feeder link is a radio link from an earth station at a given location to a space station, or *vice versa*, conveying information for a space radiocommunication service other than for the fixed-satellite service. The given location may be at a specified point, or at any fixed point within specified areas. *See* 47 C.F.R. § 2.1.

[3] A service link is the transmission path between a space station of an MSS network and a user mobile earth station.

adoption of these proposals would provide spectrum for feeder links to support the current and immediate requirements of NGSO MSS systems. In order to implement these feeder-link allocations, we propose, consistent with the international allocations and footnotes, to maintain the international standard system's right of precedence over all other uses in the 5000-5150 MHz band and to remove that right in the 5150-5250 MHz band, to delete the aeronautical mobile-satellite (R) service allocations in the 5150-5250 MHz and 15.4-15.7 GHz bands, and to delete the FSS and inter-satellite feederlink allocations for the aeronautical radionavigation and/or aeronautical mobile (R) services in the 5000-5250 MHz and 15.4-15.7 GHz bands.[5]

2. In addition, we propose to implement the clarification concerning the maximum power flux density ("PFD")[6] for Big LEO service uplinks at 1610-1626.5 MHz that was adopted at the 1995 World Radiocommunication Conference ("WRC-95")[7] and the more lenient coordination threshold standard for Big LEO service downlinks at 2483.5-2500 MHz that was adopted at the 1997 World Radiocommunication Conference ("WRC-97").[8] The proposals we make in this instant proceeding are consistent with international allocations for these frequency bands and will provide incumbent operations in these bands with adequate protection from harmful interference.

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[4] The mobile-satellite service 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. Note: This service may also include feeder links necessary for its operation. *See* 47 C.F.R. § 2.1.

[5] The 5000-5250 MHz and 15.4-15.7 GHz bands are currently allocated to the FSS and the inter-satellite services, for connection between one or more earth stations at specified fixed points on the Earth and space stations, when these services are used in conjunction with the aeronautical radionavigation and/or aeronautical mobile (R) service.

[6] PFD (or simply "power density") is defined as the power per unit area normal to the direction of propagation, usually expressed in units of watts per square meter (W/m^2).

[7] WRC-95 changes to the Radio Regulations have been codified in the International Telecommunication Union's *Radio Regulations*, Volume 4, Geneva, 1996, ISBN 92-61-05171-5.

[8] *See Final Acts of the World Radiocommunication Conference (WRC-97) Geneva, 1997.* We observe that the majority of the provisions revised by WRC-97 will apply provisionally as from January 1, 1999; the remaining provisions will apply as from the special dates of application indicated in Article S59.

II. BACKGROUND

3. At the 1992 World Administrative Radio Conference ("WARC-92"), the 1610-1626.5 MHz band was allocated to the mobile-satellite (Earth-to-space) service and the 2483.5-2500 MHz band was allocated to the mobile-satellite (space-to-Earth) service. On December 13, 1993, we allocated these bands domestically[9] and these service link allocations subsequently became known as the "Mobile-Satellite Service Above 1 GHz," more commonly known as the "Big LEO" service.

4. On October 13, 1994, we adopted the rules and policies to govern the Big LEO service.[10] We observed that in addition to the service links connecting mobile subscriber units with the satellites, one or more "gateway" or central earth stations are needed to complete the transmission paths, process the information being transmitted, and interconnect the system with other communications networks or with other user transceivers. Because feeder links operate with gateway stations at fixed points, they are assigned frequencies allocated to the FSS.[11] At the time that the Big LEO *Report and Order* was adopted, however, we were unable to satisfy the feeder link requirements of some of the Big LEO applicants. Therefore, until the feeder link requirements of all qualified applicants could be met, we declined to assign spectrum unconditionally.[12] Instead, we stated that we envisioned granting unconditional licenses, including specific feeder link frequencies, at the earlier of two events: (1) domestic allocations sufficient to support all Big LEO systems become available, regardless of frequency band, or (2) the completion of WRC-95, assuming sufficient spectrum is made available to satisfy these feeder link requirements. We also said that in the interim we would permit qualified applicants to construct satellites capable of operating with particular feeder-link frequencies at the applicants' own risk. We noted that, in addition to the U.S. MSS systems, MSS systems of other administrations will require access to feeder link spectrum.

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[9] *See Amendment of Section 2.106 of the Commission's Rules to Allocate the 1610-1626.5 MHz band and the 2483.5-2500 MHz Bands for Use by the Mobile-Satellite Service, Including Non-geostationary Satellites*, ET Docket No. 92-28, *Report and Order*, 9 FCC Rcd 536 (1993) ("*Big LEO Allocation Report and Order*").

[10] *See Amendment of the Commission's Rules to Establish Rules and Policies Pertaining to a Mobile Satellite Service in the 1610-1626.5/2483.5-2500 MHz Frequency Bands*, CC Docket No. 92-166, *Report and Order*, 9 FCC Rcd 5936 (1994). In that action, we adopted a band-sharing plan for the Big LEO service: spectrum between 1610 MHz and 1621.35 MHz would be assignable for shared use by as many as four Big LEO licensees using CDMA architecture; the 1621.35-1626.50 MHz band would be reserved for assignment to a single Big LEO licensee using TDMA/FDMA architecture, for service links in both directions (Earth-to-space and space-to-Earth); and the 2483.5-2500 MHz band would be reserved for service links in the space-to-Earth direction for CDMA systems.

[11] *Id.* at ¶ 163.

[12] *Id.* at ¶ 166.

5. On January 31, 1995, we granted the applications of Motorola Satellite Communications, Inc.,[13] TRW Inc.,[14] and L/Q Licensee, Inc. ("L/Q")[15] for a license to construct, launch, and operate a Big LEO system. At that time, L/Q was authorized to construct, at its own risk, a mobile satellite system capable of operating with feeder links in the 5025-5225 MHz (Earth-to-space) and 6875-7075 MHz (space-to-Earth) bands.

6. WRC-95 was convened by the International Telecommunication Union ("ITU") from October 23 to November 17, 1995 in Geneva, Switzerland. The primary proposals of the United States for WRC-95 sought the designation of spectrum for MSS feeder links, additional global spectrum allocations for MSS service links,[16] and a reduction in the technical and operational constraints on current global MSS allocations. The United States was very successful in this endeavor.

7. WRC-97 was convened by the ITU from October 27 to November 21, 1997 in Geneva. With regard to the Big LEO feeder links, the only major change adopted at WRC-97 is the deletion of the fixed-satellite service allocations in the 15.40-15.43 GHz and 15.63-15.70 GHz band segments. The primary purpose of this instant proceeding is to determine how to implement in the United States those decisions reflected in the *WRC-95 and WRC-97 Final Acts* regarding the Big LEO service that we have not previously considered. We believe that the need for these additional domestic allocations has already been established by the applications of L/Q,[17] Mobile Communications Holdings, Inc. ("MCHI"),[18] and Constellation Communications,

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[13] *See Order and Authorization*, DA 95-131, 10 FCC Rcd 2268 (1995). Motorola Satellite Communications was authorized, *inter alia*, to construct, at its own risk, a mobile satellite system capable of operating with feeder links in the 19.4-19.6 GHz (space-to-Earth) band and 29.1-29.3 GHz (Earth-to-space) band.

[14] *See Order and Authorization*, DA 95-130, 10 FCC Rcd 2263 (1995). TRW Inc. was authorized, *inter alia*, to construct, at its own risk, a mobile satellite system capable of operating with feeder links in the 29.7-30.0/19.8-20.1 GHz bands. Subsequently, TRW Inc.'s space segment license was modified: feeder uplink reception is now authorized in the 29.1-29.4 GHz band, and feeder downlink transmission is authorized in the 19.3-19.6 GHz band. (TRW's gateway earth stations have not yet been authorized to transmit in the 29.1-29.4 GHz band.)

[15] *See Order and Authorization*, DA 95-128, 10 FCC Rcd 2333 (1995). At that time, L/Q Licensee, Inc. was known as Loral/Qualcomm Partnership, L.P.

[16] After considering the *WARC-92 Final Acts* and the *WRC-95 Final Acts*, we recently allocated 70 megahertz of spectrum at 1990-2025 MHz (uplink) and 2165-2200 MHz (downlink) for MSS service links, effective January 1, 2000. *See Amendment of Section 2.106 of the Commission's Rules to Allocate Spectrum at 2 GHz for Use by the Mobile-Satellite Service*, ET Docket No. 95-18, *First Report and Order and Further Notice of Proposed Rule Making*, FCC 97-93, released March 14, 1997. We stated that this 2 GHz band MSS allocation will allow the United States to participate in global MSS systems and realize the benefits to consumers of such systems. *Id.* at ¶ 14. No additional allocations for NGSO MSS feederlinks were made at WRC-97.

[17] On November 18, 1996, we granted L/Q's request for a waiver of the Table of Allocations. *See L/Q LICENSEE, INC. Application for modification to construct, launch, and operate low-Earth-orbit satellites and request for waiver of Table of Allocations*, File Nos. 88-SAT-WAIV-96 and 90-SAT-ML-96, *Order and Authorization*, DA 96-1924. Specifically, L/Q is permitted to launch and operate space stations transmitting at frequencies in the 6875-

Inc. ("Constellation")[19] that our International Bureau and Office of Engineering and Technology have previously granted acting jointly under delegated authority. Each of these actions was conditioned on the outcome of this instant proceeding.

III. DISCUSSION

A. NGSO MSS Feeder Links

8. 5000-5250 MHz Band. Prior to WRC-95, the 5000-5250 MHz band was allocated to the aeronautical radionavigation service ("ARNS") on a primary basis worldwide.[20] This band was designated for the international standard system for the aeronautical radionavigation service (*e.g.*, the microwave landing system) to provide aircraft with precision approach and landing information, and the requirements of this system took precedence over all other uses of the 5000-5250 MHz band.[21] The 5000-5250 MHz band was also allocated to the aeronautical mobile-

7055 MHz range for feeder links and telemetry from its Globalstar satellites to fixed earth stations and also configured for reception of feeder-link transmissions from fixed earth stations to Globalstar satellites in the 5091-5250 MHz range.

[18] On June 30, 1997, we granted MCHI's application for a license to construct, launch, and operate a Big LEO system. We waived the rule that normally requires operating frequencies to be assigned consistently with the U.S. Table of Frequency Allocations, and authorized MCHI to construct a mobile satellite system capable of operating with feeder links in the 6875-7075 MHz (space-to-Earth) and 15.45-15.65 GHz (Earth-to-space) bands. We noted that WRC-97 will likely shift the NGSO MSS feeder uplink band at 15.45-15.65 MHz down by 20 megahertz to 15.43-15.63 MHz. Accordingly, we granted MCHI's license with a proviso that the authorization will be subject to any pertinent frequency shift of the feeder uplink band that is adopted at WRC-97. *See Application of MOBILE COMMUNICATIONS HOLDINGS, INC. for authority to construct, launch, and operate an elliptical low earth orbit Mobile Satellite System*, File Nos. 11-DSS-P-91(6), 18-DSS-P-91(18), 11-SAT-LA-95, 12-SAT-AMEND-95, 158-SAT-AMEND-96, *Order and Authorization*, DA 97-1367, ¶¶ 32-34.

[19] On June 30, 1997, we granted Constellation's application for a license to construct, launch, and operate a Big LEO system. We waived the rule that normally requires operating frequencies to be assigned consistently with the U.S. Table of Frequency Allocations, and authorized Constellation to construct a mobile satellite system capable of operating with feeder links in the 6875-7025 MHz (space-to-Earth) and 5091-5250 MHz (Earth-to-space) bands. *See Application of CONSTELLATION COMMUNICATIONS, INC. For authority to construct, launch, and operate a low earth orbit Mobile Satellite System*, File Nos. 17-DSS-P-91(48), CSS-91-013, 9-SAT-LA-95, 10-SAT-AMEND-95, 159-SAT-AMEND-96, *Order and Authorization*, DA 97-1366, ¶¶ 19-21.

[20] The aeronautical radionavigation service is a radionavigation service intended for the benefit and for the safe operation of aircraft. *See* 47 C.F.R. § 87.5.

[21] See 47 C.F.R. § 2.106, footnote 796. The ICAO Standard Microwave Landing System ("MLS") is an all-weather precision approach and landing system that will eventually replace the Instrument Landing System ("ILS") as the international standard. MLS operates on 200 channels in the 5030-5091 MHz band (300 kHz centers from 5030 MHz to 5090.7 MHz). A MLS station supports navigation and guidance for suitably-equipped aircraft out to a range of 43 kilometers (23 nautical miles) and an altitude of 6096 meters (20,000 feet).

satellite (route) service on a primary basis worldwide, and such use was subject to agreement obtained under the procedure set forth in Article 14 of the Radio Regulations.[22] In addition, the 5000-5250 MHz band was allocated to the fixed-satellite and inter-satellite services on a primary basis worldwide, for use in conjunction with the aeronautical radionavigation service and/or aeronautical mobile (R) service.[23] The 5150-5216 MHz band was also allocated to the radiodetermination-satellite (space-to-Earth) service in Region 2 and in certain other countries on a primary basis and in all other countries on a secondary basis, but such use was limited to feeder links in conjunction with the radiodetermination-satellite service operating in the 1610-1626.5 MHz and/or 2483.5-2500 MHz bands, and the total PFD at the Earth's surface was limited to -159 dBW/m^2 for all angles of arrival.[24]

9. In the United States, the 5000-5250 MHz band is Government/non-Government shared spectrum and the allocations and international footnotes discussed or referenced above have been adopted domestically.[25] Additionally, in the United States, aeronautical mobile communications which are an integral part of aeronautical radionavigation systems may be satisfied in the 5000-5250 MHz band as per footnote US260. The 5000-5250 MHz band is listed in the rules for Aviation Services as available for air carrier and private aircraft as part of the microwave landing system.[26] The radiodetermination-satellite service at 5150-5216 MHz is listed in the rules for the Satellite Communications Service.[27]

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[22] *See* 47 C.F.R. § 2.106, footnote 733 (also pertains to the 1610-1626.5 MHz and the 15.4-15.7 GHz bands). The aeronautical mobile-satellite (route) service is an aeronautical mobile-satellite service reserved for communications relating to safety and regularity of flights, primarily along national or international civil air routes. The aeronautical mobile-satellite service is a mobile-satellite service in which mobile earth stations are located on board aircraft; survival craft stations and emergency position-indicating radiobeacons may also participate in this service. *See* 47 C.F.R. § 2.1.

[23] *See* 47 C.F.R. § 2.106, footnote 797. The aeronautical mobile route (R) service is an aeronautical mobile service reserved for communications relating to safety and regularity of flight, primarily along national or international civil air routes. *See* 47 C.F.R. § 2.1.

[24] *See* 47 C.F.R. § 2.106, footnote 797A. The radiodetermination-satellite service is a radiocommunication service for the purpose of radiodetermination involving the use of one or more space stations. This service may also include feeder links necessary for its own operation. Radiodetermination is 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. *See* 47 C.F.R. § 2.1.

[25] The information in footnote 797A that pertains to the United States is also listed in footnote US307. Therefore, we are deleting reference to footnote 797A in the United States table.

[26] *See* 47 C.F.R. § 87.173.

[27] *See* 47 C.F.R. § 25.202(a)(2).

10. In addition, we recently made the 5150-5250 MHz band available for use by Unlicensed National Information Infrastructure ("U-NII") devices and limited such use to wide bandwidth, high data rate digital operations.[28] In order to facilitate sharing of the 5150-5250 MHz band with future NGSO MSS feeder uplinks, we restricted U-NII use of this band to indoor operations with a maximum peak transmitter output power of 50 milliwatts and an antenna gain of up to 6 dBi.[29] This power limit is expected to allow U-NII devices transmitting in the 5150-5250 MHz band to provide a variety of short-range communications, such as those between computing devices (such as computers, servers, printers, *etc.*) within a very local area, such as in a room or in adjoining rooms.[30]

11. WRC-95 significantly revised the international allocations in the 5000-5250 MHz band. First, the 5091-5250 MHz band is now allocated to the fixed-satellite (Earth-to-space) service on a co-primary basis worldwide, and this FSS uplink allocation is limited to NGSO MSS feeder links and is subject to coordination under No. S9.11A (revised Resolution 46). This overall FSS uplink allocation is accomplished in two parts: a new footnote allocation -- S5.444A -- for the 5091-5150 MHz band and a table entry allocation for the 5150-5250 MHz band that is constrained by new footnote S5.447A.[31] In addition to the use and coordination requirements that apply throughout 5091-5250 MHz band, footnote S5.444A subjects the 5091-5150 MHz portion of this overall FSS uplink band to the following conditions: after January 1, 2008, no new assignments will be made to stations providing NGSO MSS feeder links; prior to January 1, 2010, the requirements of existing and planned international standard systems for the aeronautical radionavigation service which cannot be met in the 5000-5091 MHz band take precedence over other uses of the 5091-5150 MHz band and the use of the 5091-5150 MHz band by NGSO MSS feeder links will be made in accordance with Resolution 114, which was adopted at WRC-95;[32] and after January 1, 2010, the fixed-satellite service will become secondary to the

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[28] *See Amendment of the Commission's Rules to Provide for Operation of Unlicensed NII Devices in the 5 GHz Frequency Range*, ET Docket No. 96-102, *Report and Order*, 12 FCC Rcd 1576 (1997) ("*U-NII Report and Order*"), *recon. pending*. The 5250-5350 MHz and 5725-5825 MHz bands were also made available for use by U-NII devices.

[29] This equates to a maximum equivalent isotropically radiated power ("EIRP") of one watt. EIRP is the product of the power supplied to the antenna and the antenna gain in a given direction relative to an isotropic antenna. *See* 47 C.F.R. § 2.1. We also permitted manufacturers the option of using higher gain antennas, provided there is a corresponding reduction in transmitter output power of one dB for every dB that the antenna gain exceeds 6 dBi.

[30] *U-NII Report and Order* at ¶¶ 42-44. In addition, the peak power spectral density from an U-NII transmission must not exceed 2.5 milliwatts in any one megahertz of the 5150-5250 MHz band. If the directional gain of the transmitting antenna is greater than 6 dBi, the peak power spectral density, as well as the peak transmit power, must be reduced by the amount in dB that the directional gain exceeds 6 dBi. *Id.* at Appendix A, Section 15.407(a).

[31] Footnote S5.447A reads as follows: The allocation to the fixed-satellite service (Earth-to-space) is limited to feeder links of non-geostationary-satellite systems in the mobile-satellite service and is subject to coordination under Resolution 46 (Rev.WRC-95)/No. S9.11A.

[32] *See WRC-95 Final Acts*, Resolution 114: "Use of the Band 5091-5150 MHz by the Fixed-Satellite Service (Earth-to-Space) (Limited to feeder links of the non-geostationary Mobile-Satellite Service)," pp. 671-673.

aeronautical radionavigation service. Resolution 114 states, *inter alia*, that WRC-95 urges administrations (1) when authorizing stations in the aeronautical radionavigation service, to assign frequencies giving priority to the 5000-5091 MHz band; and (2) when assigning frequencies in the 5091-5250 MHz band before January 1, 2010 to stations of the aeronautical radionavigation service or to stations providing NGSO MSS feeder links, to take all practicable steps to avoid mutual interference between them.

12. Second, through new footnote S5.447B, WRC-95 additionally allocated the 5150-5216 MHz band to the fixed-satellite (space-to-Earth) service on a primary basis worldwide. This FSS downlink allocation is also limited to NGSO MSS feeder links and is subject to provisions of No. S9.11A. In addition, the power flux-density at the Earth's surface produced by FSS space stations transmitting in the 5150-5216 MHz band must not exceed -164 dB(W/m^2) in any 4 kHz band for all angles of arrival.

13. Third, through new footnote S5.447C, WRC-95 required that NGSO MSS feeder links in the 5150-5250 MHz band be coordinated on an equal basis with non-geostationary radiodetermination satellite networks operating in the 5150-5216 MHz band that were brought into use prior to November 17, 1995. Radiodetermination satellite networks brought into use after November 17, 1995, can not claim protection from, and may not cause harmful interference to, NGSO MSS feeder links.

14. In order to implement the above FSS allocations, WRC-95 reduced the amount of spectrum for which the international standard systems have precedence over all other uses from the 5000-5250 MHz band to the 5000-5150 MHz band,[33] reduced the primary aeronautical mobile-satellite (R) service allocation at 5000-5250 MHz to the 5000-5150 MHz band,[34] and suppressed footnote 797.

15. ITU-R Study Group 4 has recently received from its Working Group 4A a new draft Recommendation for coordinating NGSO MSS feeder uplinks with the microwave landing system ("MLS").[35] Specifically, Annex 1 of the draft recommendation states that coordination will not be required between MSS Gateway earth stations and MLS transmitter sites at approximately equal altitudes separated by more than 400 kilometers (216 nautical miles). For separation

[33] *See* Appendix A, footnote S5.444 (previously 796). While the aeronautical radionavigation service would not have precedence in the 5150-5250 MHz band, the aeronautical radionavigation allocation would be co-primary with the FSS allocation.

[34] *See* Appendix A, footnote S5.367 (previously 733).

[35] *See* Draft New Recommendation ITU-R [4A/XM]: "Method for Determining Coordination Distances, in the 5 GHz Band, between the International Standard Microwave Landing System (MLS) Stations Operating in the Aeronautical Radionavigation Service (ARNS) and NGSO Mobile Satellite Service (MSS) Stations Providing Feeder Uplink Services," Document 4/66-E, January 23, 1997.

distances less than 400 kilometers, or in cases where station altitudes are substantially different, it describes the various factors that would trigger the need for coordination.

16. *Proposal.* We propose to allocate the 5150-5250 MHz band to the non-Government fixed-satellite (Earth-to-space) service on a primary basis; to adopt international footnotes S5.367 (previously 733), S5.444 (796), S5.444A, S5.447A, and S5.447C domestically; to delete reference to footnote 797 from the United States table; and to add the 5091-5250 MHz band to the list of frequency bands available in the Satellite Communications Service. The adoption of this proposal would provide Big LEO and other commercial systems with 159 megahertz of contiguous NGSO MSS feeder uplink spectrum from 5091 MHz to 5250 MHz. However, we caution Globalstar and any other prospective user of the 5091-5250 MHz band that Working Group 4A is still developing the sharing criteria between ARNS and FSS uplinks for this band; that prior to January 1, 2010, the requirements of existing and planned international standard systems (*e.g.*, microwave landing systems) which cannot be met in the 5000-5091 MHz band will take precedence over other uses of the 5091-5150 MHz band; and, that after January 1, 2010, FSS uplinks will operate on a secondary basis to the aeronautical radionavigation service in the 5091-5150 MHz band.[36] In addition, we seek comment on footnote S5.447B, which provides for "reverse band working" in the 5150-5216 MHz band.

17. Finally, we observe that the National Telecommunications and Information Administration ("NTIA") has previously adopted footnote G126, which states that Differential-Global-Positioning-System ("DGPS") stations may be authorized on a primary basis in the 5000-5150 MHz bands for the specific purpose of transmitting DGPS information intended for aircraft navigation.[37] We propose to add footnote G126 to the Government column of the 5000-5150 MHz band.

18. FSS Downlinks at 6700-7075 MHz. Prior to WRC-95, the 5925-7075 MHz band was allocated to the fixed, fixed-satellite (Earth-to-space), and mobile services on a co-primary basis worldwide.[38] FSS use of the 6725-7025 MHz uplink band segment had to be in accordance with the provisions of Appendix 30B of the Radio Regulations as per footnote 792A.[39] In addition, footnote 809 states that passive microwave sensor measurements are carried out over the oceans in the 6425-7075 MHz band and that administrations should bear in mind the needs of the earth

[36] We note that studies have shown that co-frequency sharing between MLS and gateway earth stations may be technically feasible. *See WRC-95 Preparation Report*, Section C, p.2.

[37] This function can also be performed in the 108-117.975 MHz and 1559-1610 MHz bands.

[38] The fixed service is a radiocommunication service between fixed points. The mobile service is a radiocommunication service between mobile and land stations, or between mobile stations. *See* 47 C.F.R. § 2.1.

[39] *See ITU Radio Regulations*, Edition of 1990, Revised in 1994, Appendix 30B: "Provisions and Associated Plan for the Fixed-Satellite Service in the Frequency Bands 4500-4800 MHz, 6725-7025 MHz, 10.70-10.95 GHz, 11.20-11.45 GHz and 12.75-13.25 GHz."

exploration-satellite (passive) and space research (passive) services in their future planning of the band.[40]

19. In the United States, the 6525-7075 MHz band is essentially non-Government exclusive spectrum[41] and is allocated to the fixed and fixed-satellite (Earth-to-space) services on a co-primary basis,[42] with FSS use of the 6725-7025 MHz band segment constrained by footnote 792A. In addition, the 6875-7075 MHz band is allocated on a primary basis to the mobile service. The 6525-6875 MHz portion of the fixed service allocation is available for licensing under the rules of the Fixed Microwave Service, as both a common carrier radio service and a private radio service.[43] The Television Broadcast Auxiliary Stations ("BAS") Service and the Cable Television Relay Service ("CARS") use the fixed and mobile service allocations at 6875-7075 MHz for electronic news gathering, remote event coverage, intercity relay, studio-to-transmitter links, *etc.*[44] The 6525.0-6541.5 MHz band segment is listed as available for uplinks

[40] The earth exploration-satellite service 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 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. The earth exploration-satellite service may also include feeder links necessary for its operation. The space research service is a radiocommunication service in which spacecraft or other objects in space are used for scientific or technological research purposes. A passive sensor is a measuring instrument in the earth exploration-satellite service or in the space research service by means of which information is obtained by reception of radio waves of natural origin. *See* 47 C.F.R. § 2.1.

[41] We have also adopted international footnote 809 domestically, and thus both Government agencies and non-Government licensees may use the 6700-7075 MHz band to carry out passive microwave sensor measurements over the oceans.

[42] We recently authorized American Mobile Radio Corporation ("AMRC") to launch and operate two geostationary satellites (located at 85^0 W.L. and 115^0 W.L.) for the purpose of providing a satellite digital audio radio service ("SDARS"). AMRC's satellites will use the 7025-7075 MHz band to receive programming information and the 2332.5-2345.0 MHz band to transmit this information to subscribers. The earth station(s) will be authorized in a separate Order. *See American Mobile Radio Corporation Application for Authority to Construct, Launch, and Operate Two Satellites in the Satellite Digital Audio Radio Service*, File Nos. 72-SAT-AMEND-97, 10/11-DSS-P-9312/15/92, 26/27-DSS-LA-931/15/93, 83/84-SAT-AMEND-953/10/95, 72-SAT-AMEND-97, *Order and Authorization*, DA 97-2210, released October 16, 1997.

[43] *See* 47 C.F.R. §§ 101.101, 101.147(l). The maximum allowable EIRP from fixed stations in the 6700-6875 MHz band is 55 dBW. *See* 47 C.F.R. § 101.113.

[44] *See* 47 C.F.R. Part 74, Subpart F and 47 C.F.R. § 78.18(a)(8). (In the CARS service, the 6875-7075 MHz band is available for mobile use only.) In the 6875-7075 MHz band, BAS fixed stations are limited to 55 dBW EIRP, and BAS and CARS mobile stations are limited to 35 dBW EIRP. *See* 47 C.F.R. §§ 74.636, 78.101. Television translator relay stations may also be authorized to use frequencies in the 6875-7075 MHz sub-band on a secondary basis. *See* 47 C.F.R. § 2.106, footnote NG118.

from control centers to radiodetermination satellites in the rules for the Satellite Communications Service.[45]

20. WRC-95 allocated the 6700-7075 MHz band to the fixed-satellite (space-to-Earth) service on a co-primary basis with the existing services, subject to two constraining footnotes. First, as required by footnote S5.458B, use of this FSS downlink allocation is limited to NGSO MSS feeder links,[46] is subject to coordination under No. S9.11A, and is not subject to S22.2.[47] In particular, No. S9.11A states that feeder-link emissions from a non-geostationary space station may not exceed the following limits at the Earth's surface:[48]

Frequency Band	Limit in dB(W/m^2) for Angles of Arrival (δ) Above the Horizontal Plane			Reference Bandwidth
	0^0 - 5^0	5^0 - 25^0	25^0 - 90^0	
6700-6825 MHz	-137	-137 + 0.5(δ-5)	-127	1 MHz
6825-7075 MHz	-154 and -134	-154 + 0.5(δ-5) and -134 + 0.5(δ-5)	-144 and -124	4 kHz 1 MHz

Second, footnote S5.458A states that, in making assignments to FSS space stations in the 6700-7075 MHz band, administrations are urged to take all practicable steps to protect spectral line observations of the radio astronomy service in the 6650-6675.2 MHz band from harmful interference.[49]

21. WRC-95 also revised footnotes 792A and 809. Specifically, at WRC-95, an allocation for reverse transmission NGSO MSS feeder links was added to bands currently used by GSO FSS networks. Therefore a conforming amendment was made to footnote 792A (re-

[45] *See* 47 C.F.R. § 25.202(a)(2).

[46] WRC-95 adopted this limitation because of the difficulty of co-directional sharing of frequencies between NGSO MSS feeder links and GSO FSS networks.

[47] S22.2 (previously RR No. 2613) states that "Non-geostationary space stations shall cease or reduce to a negligible level their emissions, and their associated earth stations shall not transmit to them, whenever there is unacceptable interference to geostationary-satellite space systems in the fixed-satellite service operating in accordance with these Regulations."

[48] *See WRC-97 Final Acts*, Resolution 46 (now re-numbered as No. S9.11A), Annex 2 to Resolution 46 (Rev.WRC-97), A2.2.1, entitled "Sharing between feeder links of the non-geostationary mobile-satellite service (space-to-Earth) and terrestrial services in the same frequency bands."

[49] The radio astronomy service is a service involving radio astronomy. Radio astronomy is astronomy based on the reception of radio waves of cosmic origin. *See* 47 C.F.R. § 2.1.

numbered as S5.441) to specify the direction of transmission for those FSS allocations whose use must be in accordance with Appendix S30B (previously Appendix 30B).[50] Footnote 809 (re-numbered as S5.458) was modified to state that administrations should bear in mind the needs of the Earth exploration-satellite (passive) and space research (passive) services in their future planning of the 7075-7250 MHz band, as well as the 6425-7025 MHz band.

22. *Proposal.* We observe that the 1995 Conference Preparatory Meeting ("CPM-95") Report indicated that studies have shown that bi-directional spectrum sharing between geostationary fixed-satellite service and non-geostationary mobile-satellite service feeder link networks is technically feasible given careful site selection and antenna sizing, and depending on the number of gateway earth stations.[51] At WRC-95, we proposed the 6700-7025 MHz band as a "reverse band" candidate. We made this proposal because the numerous restrictions on the GSO FSS uplink allotment plan for the 6725-7025 MHz band have resulted in only light use of this band throughout the world, including the United States.[52] Therefore, we believe that the 6700-7075 MHz band could be used for feeder downlinks by up to four NGSO MSS systems using currently available technology, with two of the systems "cross polarized" from the other two.[53] Accordingly, we propose to allocate the 6700-7075 MHz band to the non-Government

[50] WRC-97 further revised footnote S5.441 in order to specify that use of the 10.70-10.95 GHz (space-to-Earth), 11.20-11.45 GHz (space-to-Earth), and 12.75-13.25 GHz (Earth-to-space) bands by NGSO satellite systems in the fixed-satellite service would be governed by Resolution COM5-18. (GSO use of these bands will continue to be governed by Appendix S30B.)

[51] *See Preparation for International Telecommunication Union World Radio Communication Conferences*, IC Docket No. 94-31, *Report*, 10 FCC Rcd 12783 (1995) ("*WRC-95 Preparation Report*"), at Section C, p. 6.

[52] Appendix 30B was adopted at the *World Administrative Conference on the Use of the Geostationary-Satellite Orbit and the Planning of Space Services Utilizing It*, First Session, Geneva, 1985; Second Session, Geneva, 1988. Specific to this proceeding, the United States has access to the 6725-7025 MHz band (uplink) and the 4500-4800 MHz band (downlink) at a nominal orbital position of 101 degrees West Longitude. It was intended that these bands would be implemented as part of a multi-beam network, operating from a single orbital location. *See ITU Radio Regulations*, Appendix 30B, Article 10.

[53] For instance, two of the feeder links could be left hand circularly polarized and two could be right hand circularly polarized. With GSO FSS uplinks and NGSO MSS feeder downlinks sharing the same spectrum, coordination is between GSO FSS earth stations (transmit) and NGSO MSS gateway earth stations (receive) and between GSO FSS space stations (receive) and NGSO MSS space stations (transmit). We observe that Constellation (6875-7025 MHz), Globalstar (6875-7075 MHz), and MCHI (6875-7075 MHz) are all currently licensed in the upper portion of the 6700-7075 MHz band. It is unclear whether more than two MSS systems could use the same frequencies for co-directional feeder-link transmissions without causing mutual interference. Computer simulation studies conducted in preparation for WRC-95 indicated that two NGSO MSS systems could feasibly share spectrum for co-directional feeder-link transmission, but insufficient data was available to support sharing between three or more systems. We therefore conditioned Constellation's and MCHI's licenses: before commencing operation Constellation and MCHI must each demonstrate that it can feasibly share this spectrum with all other persons or organizations with full or conditional authority to use any part of it for feeder-link transmission in the United States.

fixed-satellite (space-to-Earth) service on a co-primary basis;[54] to adopt international footnotes S5.440 (previously 791), S5.441 (792A), S5.458 (809), S5.458A, and S5.458B domestically; to add a cross reference to the rules for the Satellite Communications Service with respect to the 6875-7075 MHz band; and to add the 6700-7075 MHz band (space-to-Earth) to the list of FSS frequency bands available in the Satellite Communications Service.[55] In addition, we propose to adopt footnote S5.149 which states, *inter alia*, that in making assignments to stations of other services, administrations are urged to take all practicable steps to protect radio astronomy use of the 6650-6675.2 MHz band from harmful interference.[56] Finally, we propose to replace the Domestic Public Fixed Service (Part 21) and Private Operational-Fixed Microwave Service (Part 94) cross references with one for the Fixed Microwave Services (Part 101); to delete the erroneous cross reference to the Domestic Public Fixed Service (Part 21) for the 6875-7075 MHz band in the Table of Frequency Allocations; and to add an existing Part 2 requirement to the rules for the Amateur Radio Service.[56] We request comment on all of the above proposals. In particular, comment is sought on the PFD limits in No. S9.11A (previously known as Resolution 46). It is our belief that the proposed PFD limits will afford terrestrial fixed and broadcast auxiliary users of the band with adequate protection. We assume that each satellite system will require only a few gateways, approximately six in number. We solicit comment on this assumption, on how many gateways overall are likely to use this band, whether technological advances are likely to significantly increase the number of gateways,[57] and where these gateways are likely to be geographically located, especially whether they will likely be located in rural areas, or in urban areas. In general, we request comment on the likely impact of sharing the spectrum with Big LEO feeder links upon the terrestrial users.

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[54] As previously noted, our license grants for L/Q, MCHI, and Constellation are subject to the outcome of this allocation proceeding.

[55] The administrative aspects of the coordination process can be found in 47 C.F.R. §§ 25.203, 25.251. The technical aspects of the coordination process are set forth in 47 C.F.R. §§ 25.252-256.

[56] *See* Appendix A, Section 2.106, note S5.149.

[56] Specifically, we propose to add the following sentence to the frequency sharing requirements listed in paragraph 97.303(m)(4): In the 5.650-5.925 GHz segment, no amateur station shall cause harmful interference to, nor is protected from interference due to the operation of, Government stations authorized in the radiolocation service.

[57] Currently, gateways tend to cost in excess of one million dollars each.

22. 15.4-15.7 GHz Band. Prior to WRC-95, the 15.4-15.7 GHz band was allocated to the aeronautical radionavigation service on a primary basis worldwide.[58] This band was also allocated to the aeronautical mobile-satellite (R) service on a primary basis worldwide.[59] In addition, this band was allocated to the fixed-satellite and inter-satellite services, for connection between one or more earth stations at specified fixed points on the Earth and space stations, when these services are used in conjunction with the aeronautical radionavigation and/or aeronautical mobile (R) service.[60]

23. In the United States, the 15.4-15.7 GHz band is Government/non-Government shared spectrum, and the aeronautical radionavigation allocation and international footnotes discussed or referenced above have been adopted by both NTIA and the Commission. In addition, aeronautical mobile communications, which are an integral part of aeronautical radionavigation systems, may also be satisfied in the 15.4-15.7 GHz band.[61] According to footnote US211, applicants for airborne or space station assignments are urged to take all practicable steps to protect radio astronomy observations in the adjacent bands from harmful interference.[62] The 15.4-15.7 GHz band is listed among the frequencies available in the Aviation Services.[63]

24. There is fairly extensive use of the 15.4-15.7 GHz band by the aeronautical radionavigation service for airborne, land and ocean based stations. Specifically, aircraft landing systems ("ALS"), aircraft multipurpose radars ("MPR"), and the radar sensing and measurement

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[58] We note that S4.10 (previously No. 953) applies. It states: "Members recognize that the safety aspects of radionavigation and other safety programs 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." *See ITU Radio Regulations*, Article 9, p. RR9-1.

[59] *See* 47 C.F.R. § 2.106, footnote 733 (making the allocation, but subjecting this use to the procedures set forth in Article 14 of the Radio Regulations). *See also ITU Radio Regulations*, Article 14: "Supplementary Procedure to Be Applied in Cases Where a Footnote in the Table of Frequency Allocations Requires an Agreement with an Administration."

[60] *See* 47 C.F.R. § 2.106, footnote 797 (making the allocation, but subjecting this use to the procedures set forth in Article 14).

[61] *See* 47 C.F.R. § 2.106, footnote US260.

[62] In addition, footnote US211 states that footnote US74 applies. In turn, footnote US74 states that the radio astronomy service in 15.35-15.40 GHz band will be protected from extraband radiation 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.

[63] *See* 47 C.F.R. § 87.173(b). The class of station for this band is RL, which is radionavigation land (unspecified). *See* 47 C.F.R. § 87.171.

system ("RSMS")[64] operate throughout the 15.4-15.7 GHz band. In addition, surface based radars ("SBR")[65] operate in the 15.6375-16.7125 GHz band.

25. WRC-95 allocated the 15.4-15.7 GHz band to the fixed-satellite (space-to-Earth) service on a primary basis worldwide and this allocation is constrained by footnote S5.511A.[66] Specifically, footnote S5.511A states that this FSS downlink allocation is limited to NGSO MSS feeder links and is subject to coordination under No. S9.11A. Further, emissions from a non-geostationary space station are limited to a power flux-density limit at the Earth's surface of −146 dBW/m^2/MHz ("−146 dB") in the 15.40-15.45 GHz and 15.65-15.70 GHz band segments for all angles of arrival[67] and these emissions must not interfere with radio astronomy reception in the 15.35-15.40 GHz band segment.[68] In addition, footnote S5.511A permits emissions from a non-geostationary space station to produce a power flux-density of −111 dB at the Earth's

[64] RSMS technology at 15 GHz is particularly suited to smaller aircraft, including helicopters. RSMS offers the benefits of compact, light, equipment with good antenna directivity and more than adequate performance for many operational radionavigation applications which are not practicable at lower frequencies due to propagation or other reasons. RSMS is essentially used in low level operations up to a nominal height of around 1500 meters.

[65] Land- and ship-based SBRs are used for the detection, location and movement of aircraft and other vehicles on the surface of airports and other aircraft landing areas. The lowest center frequency used by SBRs is 15.65 GHz and this equipment transmits a 25 megahertz 3.5 dB bandwidth pulse, which means that the lowest SBR frequency is 15.6375 GHz. Thus SBR operations -- which can only tolerate a very low PFD value from FSS transmissions -- would in certain instances overlap the NGSO MSS feeder uplink allocation at 15.45-15.65 GHz. By shifting this feeder uplink band to 15.43-15.63 GHz (discussed in ¶¶ 31-32 of the text), there is at least a 75 megahertz guard band between the two systems. As a side effect of this shift, RSMS operations would also receive additional protection.

[66] The power flux-density limits and coordination threshold in footnote S5.511A will apply, subject to review by ITU-R and based on the studies referred to in Resolution 116, until changed by a future competent world radiocommunication conference.

[67] These limits relate to the power flux-density which would be obtained under assumed free-space propagation conditions. We note that calculations based on the characteristics of ARNS systems operating in the 15.4-15.7 GHz band with an interference threshold of 10% of ARNS system noise have confirmed that the maximum PFD value in S5.511A of -146 dB (W/m^2/MHz) at the Earth's surface is necessary for the protection of SBR systems at angles of arrival below 5 degrees while the maximum value in S5.511A of -111 dB(W/m^2/MHz) is necessary for the protection of ALS systems at all angles of arrival.

[68] The threshold levels of interference and associated power flux-density limits which are detrimental to the radio astronomy service are given in Recommendation ITU-R RA.769.

surface in the 15.45-15.65 GHz band segment for all angles of arrival,[69] but requires that any planned PFD that exceeds −146 dB be coordinated with the affected administrations.

26. Footnote S5.511C states that the band 15.45-15.65 GHz is additionally allocated to the fixed-satellite service (Earth-to-space) on a primary basis and that such use is limited to NGSO MSS feeder links and is subject to coordination under No. S9.11A. Until such time as the studies called for in Resolution 117 are completed: 1) administrations operating stations in the aeronautical radionavigation service are urged to limit the average EIRP to 42 dBW; 2) stations in the fixed-satellite service shall not cause harmful interference to stations in the aeronautical radionavigation service (No. 953/S4.10 applies).

27. In order to implement the above FSS allocations, WRC-95 deleted reference to the 15.4-15.7 GHz band from footnote 733, suppressed footnote 797,[70] and added footnote S5.511B, which states that aircraft stations are not permitted to transmit in the 15.45-15.65 GHz band.

28. In addition, WRC-95 adopted Resolutions 116 and 117, which called for studies by the ITU-R of the sharing situation between NGSO MSS feeder downlinks and ARNS in the 15.4-15.7 GHz band and between NGSO MSS feeder uplinks and ARNS in the 15.45-15.65 GHz band, respectively. These studies have been completed, and in response to these studies, at WRC-97 the United States proposed significant changes for the 15.4-15.7 GHz band.[71] Specifically, the United States proposed to delete the FSS downlink allocations in the 15.40-15.43 GHz and 15.63-15.70 GHz segments and to revise the PFD limits in the remaining segment (15.43-15.63 GHz) from −111 dB to −127 dB depending on the angle of arrival.[72] The United States made this proposal in order to protect surface based radars from harmful interference.[73]

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[69] These limits relate to the power flux-density which would be obtained under assumed free-space propagation conditions. We note that calculations with an interference threshold of 10% of ARNS system noise have confirmed that the maximum PFD value in S5.511A of -146 dB (W/m^2/MHz) at the Earth's surface is necessary for the protection of SBR systems at angles of arrival below 5 degrees while the maximum value in S5.511A of -111 dB(W/m^2/MHz) is necessary for the protection of ALS systems at all angles of arrival.

[70] Footnote 797 reads as follows: The bands 5000-5250 MHz and 15.4-15.7 GHz are also allocated to the fixed-satellite service and the inter-satellite service, for connection between one or more earth stations at specified fixed points on the Earth and space stations, when these services are used in conjunction with the aeronautical radionavigation and/or aeronautical mobile (R) service. Such use shall be subject to agreement obtained under the procedure set forth in Article 14.

[71] *See* note 52, *supra*, "Issues Concerning Existing and Possible Additional Frequency Allocations For Feeder Links in the 15.4-15.7 GHz Band And Regulatory Aspects As Related To The Mobile-Satellite Services (JPDP 38)," at pp. 89-93.

[72] As previously noted, WRC-95 had adopted two PFD limits for the NGSO MSS downlink band at 15.4-15.7 GHz: a more stringent −146 dB limit in the 15.40-15.45 GHz and 15.65-15.70 GHz segments and a more lenient −111 dB limit in the 15.45-15.65 GHz segment. *See* ¶ 25, *supra*.

[73] These radars operate at 15.65 GHz ± 10 MHz.

These radars can tolerate only a low PFD of −146 dBW emitted from the proposed NGSO MSS feeder downlinks.[74] The United States proposed to delete the NGSO MSS feeder downlink allocations in the 15.40-15.43 GHz and 15.63-15.70 GHz band segments because we believed that the requisite PFD limit of −146 dB would effectively preclude NGSO MSS feeder downlink reception in these segments. In addition, the deletion of the NGSO MSS feeder downlink allocation at 15.40-15.43 GHz would create a thirty megahertz guardband that would protect radio astronomy and passive sensor use of the 15.35-15.40 GHz band from downlink out-of-band emissions. Finally, the United States proposed to suppress footnote S5.511B because its provisions unnecessarily inhibit the use of some existing aeronautical radionavigation systems in the 15.45-15.65 GHz segment and seriously constrain the design and operation of other practical aeronautical radionavigation systems.

29. WRC-97 adopted the United States proposals for the 15.4-15.7 GHz band with minor changes. Specifically, WRC-97 reduced the NGSO MSS feeder downlink allocation to 200 megahertz of spectrum at 15.43-15.63 GHz, shifted the corresponding uplink allocation into the same 15.43-15.63 GHz band, and revised footnote S5.511A to read as follows:

> Use of the band 15.43-15.63 GHz by the fixed-satellite service (space-to-Earth) (see Resolution COM5-8 (WRC-97)) and (Earth-to-space) is limited to feeder links of non-geostationary systems in the mobile-satellite service, subject to coordination under Resolution 46 (Rev. WRC-97)/No. S9.11A. In the space-to-Earth direction, the minimum earth station antenna elevation angle above and gain toward the local horizontal plane and the minimum coordination distances to protect an earth station from harmful interference shall be in accordance with Recommendation ITU-R S.1341. Also in the space-to-Earth direction, harmful interference shall not be caused to stations of the radio astronomy service using the band 15.35-15.4 GHz. The threshold levels of interference and associated power flux-density limits which are detrimental to the radio astronomy service are given in Recommendation ITU-R RA.769-1. Special measures will need to be employed to protect the radio astronomy service in the band 15.35-15.4 GHz.[75]

[74] This proposal would provide a 10 megahertz guard band between highest frequency in the feeder uplink band (15.63 GHz) and the lowest surface based radar frequency (15.64 GHz).

[75] *See* Appendix A. We note that "above about 40 MHz sharing may be practicable with services in which the transmitters are not in direct line-of-sight of the observatories, but coordination may be necessary, particularly if the transmitters are of high power." *See* Recommendation ITU-R RA.769-1: "Protection Criteria Used for Radioastronomical Measurements," recommends 4. Table 1 of this document specifies the threshold levels of interference detrimental to radioastronomy continuum observations: for the center frequency 15.375 ± 25 MHz, the PFD limit for geostationary satellites is -156 dB(W/m^2); no value is listed for NGSO MSS feeder uplinks. In addition, Table 4 specifies that the threshold interference levels for Very Long Baseline Interferometry ("VLBI") observations using center frequency 15.375 GHz is -187 dB(W/m^2 · Hz).

In addition, WRC-97 limited the permissible PFD at the Earth's surface produced by space stations transmitting in the 15.43-15.63 GHz band, for all conditions and for all methods of modulation, to the following values:[76]

Limit in dB(W/m^2) for Angle of Arrival (δ) Above the Horizontal Plane[77]	
Angle	PFD Limit
0-20°	−127
20-25°	$-127 + 0.56\ (\delta - 20)^2$
25-29°	−113
29-31°	$-136.9 + 25 \log (\delta - 20)$
31-90°	−111

WRC-97 also suppressed footnote S5.511B and to revised footnote S5.511C to read as follows:

> Stations operating in the aeronautical radionavigation service shall limit the effective e.i.r.p. in accordance with Recommendation ITU-R S.1340. The minimum coordination distances required to protect aeronautical radionavigation stations (No. S4.10 applies) from harmful interference from feeder-link earth stations and the maximum e.i.r.p. transmitted toward the local horizontal plane by a feeder-link earth station shall be in accordance with Recommendation ITU-R S.1340.

[76] *See WRC-97 Final Acts*, Annex 2 to Resolution 46 (Rev.WRC-97), A2.2.1. We note that the adoption of the maximum PFD values listed in A2.2.1 makes coordination of satellite emissions with receiving ARNS stations unnecessary. In addition, Recommendation ITU-R S.1341 recommends that surface based radars be precluded from operating in the 15.43-15.63 GHz band segment; that the coordination threshold distances required to protect ARNS stations from feeder downlink emissions be established as 150 kilometers from the ground segment for aircraft landing systems and as 600 kilometers for aircraft using general purpose radars; that feeder downlink earth stations limit their operations to angles of at least 5 degrees above the local horizontal plane; and that, for all conditions and all methods of modulation, feeder downlink emissions take into account the threshold levels for the radio astronomy service set forth in ITU-R RA.769-1 for the 15.35-15.40 GHz band. *See* Recommendation ITU-R S.1341.

[77] The limit relates to the PFD which would be obtained under assumed free-space propagation conditions and with a one megahertz reference bandwidth.

Recommendation ITU-R S.1340 recommends that the effective EIRP of ARNS stations be limited to elevation-specific values;[78] that NGSO MSS feeder uplinks be designed to operate in the interference environment produced by such ARNS stations; that coordination of ARNS emissions with satellite receiving stations not be required; that the EIRP transmitted toward the local horizontal plane by a feeder-uplink earth station be required to not exceed 54 dB(W/MHz); that SBR stations be precluded from operating in the 15.43-15.63 GHz band segment; and that the coordination threshold distances required to protect ARNS stations from feeder uplink emissions be established as 270 kilometers from an aircraft landing surface for radar sensing and

[78] Specifically, Recommendation ITU-R S.1340 recommends that ARNS emissions expressed as effective EIRP should not exceed the following:

For Aircraft Landing Systems and for Feeder-Link Bandwidths Greater Than Three Megahertz	
Effective EIRP (E_{eff})	Angles of Departure Above the Local Horizontal Plane (x)
53 dBW	$0^\circ \leq x < 8^\circ$
53 - 0.833 (x-8) dBW	$8^\circ \leq x < 14^\circ$
48 dBW	$14^\circ \leq x < 32^\circ$
48 - 9 (x - 32) dBW	$32^\circ \leq x < 34^\circ$
30 dBW	$34^\circ \leq x < 40^\circ$
30 - 0.2 (x - 20) dBW	$40^\circ \leq x < 90^\circ$

For General Purpose Aircraft Radars and for Feeder-Link Bandwidths Greater Than One Megahertz	
Effective EIRP	Angles of Departure Above the Local Horizontal Plane
62 dBW	$0^\circ \leq x < 20^\circ$
62 - 0.56 $(x - 20)^2$ dBW	$20^\circ \leq x < 25^\circ$
48 dBW	$25^\circ \leq x < 29^\circ$
71.86 - 25 log (x - 20) dBW	$29^\circ \leq x < 68^\circ$
29.8 dBW	$68^\circ \leq x < 90^\circ$

E_{eff} is an EIRP which causes the same level of interference to a phase modulated signal as a continuous noise like interferer: $E_{eff} = E_p + 15 \log [1 + 5 \div PW]$ dBW.
Where: E_p = the peak pulse EIRP in dBW of the ARNS station.
PW = the pulse duration in microseconds of the ARNS station.

measurement systems, as 515 kilometers from an aircraft landing surface for aircraft landing systems, and as 600 kilometers for aircraft using general purpose radars.

30. Finally, WRC-97 adopted footnote S5.511D, which, *inter alia*, permits FSS systems that were advanced published as of November 21, 1997, to operate in the 15.40-15.43 GHz and 15.65-15.70 GHz downlink bands with a maximum PFD of −146 dB. This footnote represents the only significant change to the 15.4-15.7 GHz band that was adopted at WRC-97 but not proposed by the United States, and it reads as follows:

> Fixed-satellite service systems for which complete information for advance publication has been received by the Bureau by 21 November 1997[79] may operate in the bands 15.4-15.43 GHz and 15.63-15.7 GHz in the space-to-Earth direction and 15.63-15.65 GHz in the Earth-to-space direction. In the bands 15.4-15.43 GHz and 15.65-15.7 GHz, emissions from a non-geostationary space station shall not exceed the power flux-density limits at the Earth's surface of −146 dB(W/m^2/MHz) for all angles of arrival. In the band 15.63-15.65 GHz, where an administration plans emissions from a non-geostationary space station that exceed −146 dB(W/m^2/MHz) for any angle of arrival, it shall coordinate under Resolution 46 (Rev. WRC-97)/No. S9.11A with the affected administrations. Stations in the fixed-satellite service operating in the band 15.63-15.65 GHz in the Earth-to-space direction shall not cause harmful interference to stations in the aeronautical radionavigation service (No. S4.10 applies).

31. *Proposal.* In preparation for WRC-97, the Commission, the WRC-97 Advisory Committee, and NTIA assisted the ITU in the development of the necessary technical constraints that would allow FSS uplinks and downlinks to co-exist with incumbent services in the 15.4-15.7 GHz band. WRC-97 adopted the United States proposals for the 15.4-15.7 GHz band. We now propose to implement these WRC-97 changes domestically. Specifically, we propose to allocate the 15.43-15.63 GHz band to the fixed-satellite service for both uplink and downlink transmissions and to adopt international footnotes S5.511A and S5.511C domestically. We also propose to delete reference to footnotes 733 and 797 from the 15.4-15.7 GHz band entry in the Table of Frequency Allocations, to add a cross reference to the rules for the Satellite Communications Service into the 15.43-15.63 GHz band entry, and to add both the FSS uplink and downlink allocations to the list of frequency bands available in the Satellite Communications Service.[80] We request comment on these proposals.

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[79] Commission staff is unaware of any advanced published system that met this deadline. However, the staff cautions that there currently is approximately a year-and-a-half processing backlog at the ITU.

[80] As noted in footnote 19, we recently granted MCHI a space segment license to employ the 15.45-15.65 GHz band for feeder uplink reception as part if its ELLIPSO Big LEO system. (MCHI's gateway earth stations have not yet been authorized to transmit in the 15.45-15.65 GHz band.) We granted MCHI's license with a proviso that the authorization will be subject to any pertinent frequency shift of this feeder uplink band that is adopted at WRC-97.

B. Big LEO Service Link Coordination

32. During our preparation for WRC-95, we stated that technical constraints that could hinder implementation of the Big LEO service had been identified in that proceeding and in the ITU-R process.[81] Accordingly, we proposed that WRC-95 remove several of these constraints from the Big LEO service link spectrum. WRC-95 generally adopted our proposals, and we are now proposing to implement domestically these WRC-95 changes.

33. Uplinks. Big LEO systems are authorized to use the 1610-1626.5 MHz band for their service uplinks.[82] In our WRC-95 preparation, we proposed to modify footnote 731E by specifying a "peak" power density limit in those parts of the 1610-1626.5 MHz band which are used by systems operating in accordance with footnote 732,[83] and by specifying a "mean" power density in the part of the band where no such systems are operating.[84] We also stated that interference protection under RR No. 953[85] should be sufficient and accordingly proposed to delete the language specifying additional protection of non-MSS services in the 1610-1626.5 MHz band.

34. WRC-95 adopted our proposal for RR 731E (re-numbered as S5.364), except that the additional protection of non-MSS services was not deleted.[86] In addition, international footnotes 722, 731F, 732, 733, 733A, 733E, and 734, which have previously been adopted domestically, were re-numbered as S5.341, S5.365, S5.366, S5.367, S5.368, S5.372, and S5.149,[87] respectively. Accordingly, we propose to update the United States table by adopting these international footnotes domestically. We request comment on this proposal. Finally, we observe that a recent

[81] *See WRC-95 Preparation Report* at ¶¶ 27-68.

[82] The 1610-1626.5 MHz band is allocated to the ARNS (and to aeronautical mobile communications that are an integral part of ARNS), the aeronautical mobile-satellite (R) service (by footnote 733), the radiodetermination-satellite (Earth-to-space) service, and the mobile-satellite (Earth-to-space) service on a co-primary basis. The 1610.6-1613.8 MHz band is additionally allocated to the radio astronomy service on a primary basis.

[83] Footnote 732 states that: "The band 1610-1626.5 MHz is reserved on a worldwide basis for the use and development of airborne electronic aids to air navigation and any directly associated ground-based or satellite-borne facilities. Such satellite use is subject to agreement obtained under the procedure set forth in Article 14."

[84] Peak power density is the maximum instantaneous power density occurring when power is transmitted. Mean power density is the instantaneous power density integrated over a source repetition period.

[85] *See* note 58, *supra.*

[86] WRC-95 adopted peak and mean EIRP densities. This merely clarifies that the peak and mean power density that we proposed at WRC-95 are referenced to an isotropic antenna.

[87] International footnote S5.149 was formed by merging various footnotes, including 734.

revision to footnote US319 was inadvertently not published in the Code of Federal Regulations[88] and that footnote S5.368 (previously 733A) was inadvertently not added to the 1613.8-1626.5 MHz band.[89] We therefore take this opportunity to correct these oversights.

35. Downlinks. Big LEO systems are authorized to use the 2483.5-2500 MHz band for their service downlinks.[90] In our preparation for WRC-95, we expressed concern that footnote 753F references PFD limits in RR No. 2566 that may be too stringent and could result in unnecessary coordination. We also proposed to add cautionary language in footnote 753F to protect radio astronomy in the 4990-5000 MHz band and declined to propose to suppress footnote 733E.

36. Footnote 753F states that coordination, in this band, of space stations of the mobile-satellite and radiodetermination-satellite services with terrestrial services is required only if the PFD produced by a space station at the Earth's surface exceeds the limits in Radio Regulation No. 2566.[91] WRC-95 re-numbered footnote 753F as S5.402 and modified it to provide a more lenient coordination threshold standard than the current requirement and this new coordination threshold standard is incorporated in Resolution 46/No. S9.11A.[92] WRC-97 further revised the

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[88] *See* Appendix A, footnote US319. In the *Big LEO Allocation Report and Order*, Government MSS stations in the 1610-1626.5 MHz and 2483.5-2500 MHz bands were limited to earth stations operating with non-Government space stations. See note 9, *supra*, p. 552.

[89] Footnote 733A was added to the 1610-1613.8 MHz band in the *Big LEO Allocation Report and Order*. *See* note 9, *supra*, at ¶ 26 and Appendix B. The effect of this footnote is that radiodetermination-satellite and mobile-satellite systems in the 1610-1626.5 MHz band are not required to be designed to take "special measures" to ensure that aeronautical radionavigation and other safety services operating in the 1610-1626.5 MHz band are free from harmful interference. In the *WRC-95 Final Acts*, footnote 733A was re-numbered as S5.368 and the phrase "with the exception of the aeronautical radionavigation-satellite service" was added.

[90] The 2483.5-2500 MHz band is allocated to the radiodetermination-satellite (space-to-Earth) service and to the mobile-satellite (space-to-Earth) service on a co-primary basis and to the radiolocation service on a secondary basis. The frequency 2450 MHz is allocated for use by Industrial, Scientific, and Medical ("ISM") equipment with a tolerance of $\pm$ 50 MHz. *See* 47 C.F.R. § 2.106, footnote 752 (re-numbered as S5.150), and § 18.301. In addition, grandfathered broadcast auxiliary and private radio stations operate in the 2483.5-2500 MHz band on a primary basis. *See* 47 C.F.R. § 2.106, footnote NG147.

[91] *See* 47 C.F.R. § 2.106, footnote 753F.

[92] *See Interim Procedures for the Coordination and Notification of Frequency Assignments of Satellite Networks in Certain Space Services and Other Services to Which certain Bands are Allocated*, Resolution 46 (Rev.WRC-95), *WRC-95 Final Acts*, pp. 620-667. *See also* Annex 2 to Resolution 46 at A2.1.2.3.1. The threshold values are obtained under assumed free-space propagation conditions.

interim procedures in Resolution 46.[93] The table below contrasts the new and old coordination standards:

PFD Limit in any 4 kHz (dBW/m^2)			Angles of Arrival (δ)
New Coordination Standard		Old Coordination Standard[94]	
Geostationary space stations	Non-geostationary space stations		
-146	-144	-152	$0° \leq \delta \leq 5°$
-128 in 1 MHz	-126 in 1 MHz		
-146 + 0.5(δ-5)	-144 + 0.65(δ-5)	-152 + 0.5(δ-5)	$5° \leq \delta \leq 25°$
-128 + 0.5(δ-5) in 1 MHz	-126 + 0.65(δ-5) in 1 MHz		
-136	-131	-142	$25° \leq \delta \leq 90°$
-118 in 1 MHz	-113 in 1 MHz		

We also note that the procedures for the coordination and notification of frequency assignments of satellite networks established under No. S9.11A are only interim in nature. In particular, we observe that the coordination threshold factors applicable to terrestrial services other than fixed services may be reviewed at a future conference.[95] Nonetheless, we believe that the new coordination threshold will adequately protect incumbent terrestrial services, while significantly increasing the usefulness of the 2483.5-2500 MHz band for Big LEO service downlinks. In addition, international footnotes 752 and 753A, which have previously been adopted domestically, were re-numbered as S5.150 and S5.398, respectively. Accordingly, we propose to update the United States table by adopting these international footnotes domestically. We invite comments

[93] *See WRC-97 Final Acts,* Resolution 46 (Rev.WRC-97), Annex 2 to Resolution 46 (Rev.WRC-97), A2.1.2.3.1, entitled "Method for the determination of the need for coordination between mobile-satellite service space stations (space-to-Earth) and other terrestrial services sharing the same frequency band in the 1 to 3 GHz range."

[94] *See* ITU Radio Regulations, Edition of 1990, Revised in 1994, at 2566.

[95] *See* Resolution 46, A2.1.2.3.1, note 4.

inadvertently not published in the Code of Federal Regulations,[97] and we therefore take this opportunity to correct this oversight.

IV. PROCEDURAL INFORMATION

37. Initial Regulatory Flexibility Certification. The Regulatory Flexibility Act requires that a regulatory flexibility analysis be prepared for notice and comment rulemaking proceedings, unless the agency certifies that "the rule will not, if promulgated, have a significant economic impact on a substantial number of small entities." We have determined that the rules proposed in this *Notice of Proposed Rule Making* will not, if promulgated, have a significant economic impact on a substantial number of small entities. See the Initial Regulatory Flexibility Certification ("IRFC") set forth in Appendix B. Written public comments are requested on the IRFC. These comments must be filed in accordance with the same filing deadlines as comments on the rest of this *Notice of Proposed Rule Making*, but they must have a separate and distinct heading designating them as responses to the IRFC. The Commission's Office of Public Affairs, Reference Operations Division, shall send a copy of this *Notice of Proposed Rule Making*, including the IRFC, to the Chief Counsel for Advocacy of the Small Business Administration.

38. Ex Parte Rules -- Permit-But-Disclose Proceedings. This is a permit-but-disclose notice and comment rule making proceeding. *Ex parte* presentations are permitted, except during any Sunshine Agenda period, provided they are disclosed as provided in the Commission's rules. *See generally* 47 C.F.R. Sections 1.1202(a), 1.1203, and 1.1206.

39. Authority. This action is taken pursuant to Sections 4(i), 7(a), 303(c), 303(f), 303(g), and 303(r) of the Communications Act of 1934, as amended, 47 U.S.C. Sections 154(i), 157(a), 303(c), 303(f), 303(g), and 303(r).

40. Comment. Pursuant to Sections 1.415 and 1.419 of the Commission's rules, 47 C.F.R. §§ 1.415, 1.419, interested parties may file comments by **[30 days from publication in the Federal Register]**, and reply comments by **[45 days from publication in the Federal Register]**. Comments may be filed using the Commission's Electronic Comment Filing System ("ECFS") or by filing paper copies. *See Electronic Filing of Documents in Rulemaking Proceedings*, 63 Fed. Reg. 24,121 (1998).

41. Comments filed through the ECFS can be sent as an electronic file via the Internet to <http://www.fcc.gov/e-file/ecfs.html>. Generally, only one copy of an electronic submission must be filed. If multiple docket or rulemaking numbers appear in the caption of this proceeding, however, commenters must transmit one electronic copy of the comments to each docket or

[97] *See* Appendix A, footnote NG147. In the *Big LEO Allocation Report and Order*, grandfathered broadcast auxiliary and private radio stations were permitted to continue to operate in the 2483.5-2500 MHz band on a primary basis with the mobile-satellite service, in addition to the radiodetermination-satellite service. See note 9, *supra*, p. 552.

rulemaking number referenced in the caption. In completing the transmittal screen, commenters should include their full name, Postal Service mailing address, and the applicable docket or rulemaking number. Parties may also submit an electronic comment by Internet e-mail. To get filing instructions for e-mail comments, commenters should send an e-mail to ecfs@fcc.gov, and should include the following words in the body of the message, "get form <your e-mail address>." A sample form and directions will be sent in reply.

42. Parties who choose to file by paper must file an original and four copies of all comments, reply comments and supporting comments. If participants want each Commissioner to receive a personal copy of their comments, an original plus nine comments must be filed. If more than one docket or rulemaking number appear in the caption of this proceeding, commenters must submit two additional copies for each additional docket or rulemaking number. All filings must be sent to the Commission's Secretary, Magalie Roman Salas, Office of the Secretary, Federal Communications Commission, 1919 M St. N.W., Room 222, Washington, D.C. 20554.

43. All relevant and timely comments will be considered by the Commission before final action is taken in this proceeding. Comments and reply comments will be available for public inspection during regular business hours in the FCC Reference Center (Room 239) of the Federal Communications Commission, 1919 M Street, N.W., Washington, DC 20554.

44. Additional Information. For further information concerning this rule making proceeding contact Tom Mooring at (202) 418-2450, internet: tmooring@fcc.gov, Office of Engineering and Technology, Federal Communications Commission, Washington, DC 20554.

FEDERAL COMMUNICATIONS COMMISSION

Magalie Roman Salas

Magalie Roman Salas
Secretary