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

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In the Matter of	)	
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Amendment of Part 2 of the Commission's Rules to Allocate Additional Spectrum to the Inter-Satellite, Fixed, and Mobile Services and to Permit Unlicensed Devices to Use Certain Segments in the 50.2-50.4 GHz and 51.4-71.0 GHz Bands	)	ET Docket No. 99-261

REPORT AND ORDER

Adopted: December 19, 2000 **Released:** December 22, 2000

By the Commission:

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I. INTRODUCTION

1. By this action, we realign allocations in the 50.2-50.4 GHz and 51.4-71 GHz frequency bands. This action continues our efforts to facilitate the commercialization of the "millimeter wave" spectrum. Until recently, commercial use of this spectrum was not economically viable. However, recent technological advances make this spectrum increasingly usable for commercial services and products. Therefore, we have reexamined potential uses of this spectrum and how best it can be allocated to further the public interest. The realignment of allocations that we adopt today will meet current demands for spectrum in this frequency range and is consistent with the international allocation changes the United States sought and obtained at the 1997 World Radiocommunication Conference ("WRC-97").

II. EXECUTIVE SUMMARY

2. We are providing a net increase of 2.27 gigahertz of spectrum allocated on a primary basis to the fixed and mobile services.[1] This spectrum will be shared by Federal agencies and non-Federal Government licensees. Specifically, we allocate the 51.4-52.6 GHz and 58.2-59 GHz bands to the Federal and non-Federal Government fixed and mobile services, allocate the 64-66 GHz band to the Federal and non-Federal Government fixed and mobile except aeronautical mobile services, and delete the Federal and non-Federal Government fixed and mobile services from the 50.2-50.4 GHz and 54.25-55.78 GHz bands. We anticipate that much of this spectrum will be used by mobile service licensees to connect their base stations together and to connect their systems to other systems ("backbone infrastructure for mobile services"). We are also making the 57-59 GHz band available for use by Part 15 unlicensed devices.[2] This 2 gigahertz of spectrum and the existing Part 15 unlicensed band at 59-64 GHz will operate under the same technical rules. We anticipate that this additional unlicensed spectrum (used either separately or in conjunction with the 59-64 GHz band) will be useful for very high speed and/or high bandwidth communications over short distances and for networking backbone purposes in congested areas.

3. We are also providing separate inter-satellite service ("ISS")[3] allocations for Federal agencies and for non-Federal Government ("commercial") licensees. Specifically, we allocate the 65-71 GHz band to the non-Federal Government ISS and delete the non-Federal Government ISS allocation from the 56.9-57 GHz and 59-64 GHz bands. We also allocate the 64-65 GHz band to the Federal Government ISS. The net result of the ISS allocations and deletions is an increase of 0.9 GHz for commercial ISS and 1 GHz for Federal ISS. The remaining ISS allocations in this frequency range (54.25-56.9 GHz and 57-58.2 GHz) will be available for both Federal and commercial use. These ISS allocations will provide satellite licensees with the spectrum they need to interconnect satellites within their respective networks. The use of inter-satellite links are expected to make satellite networks more efficient, resulting in the provision of more enhanced services like video telephony, medical and technical tele-imaging, high speed data networks and "bandwidth on demand" to consumers. In addition, the use of inter-satellite links will enable satellite licensees to provide more efficient interconnections between their service areas.[4]

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[1] The fixed service is a radiocommunication service between specified fixed points. The mobile service is a radiocommunication service between mobile and land stations, or between mobile stations. 47 C.F.R. § 2.1(c). More specifically, 2 of the 2.27 gigahertz is not allocated to the aeronautical mobile service, *i.e.*, the 64-66 GHz band is allocated to the mobile except aeronautical mobile service in order to protect inter-satellite links.

[2] 47 C.F.R. Part 15 - Radio Frequency Devices.

[3] ISS is a radiocommunication service providing links between satellites. 47 C.F.R. § 2.1(c).

[4] *See* joint Comments of Loral Space and Communications Ltd. and Globalstar, L.P. at 3.

4. To provide spectrum for the above services, we are reducing the net amount of spectrum allocated to the Earth exploration-satellite (passive) and space research (passive) services by 1.9 gigahertz and are reducing the amount of spectrum allocated to the radio astronomy service by 4.65 gigahertz. According to NTIA, the deleted space research (passive) and radio astronomy allocations are unused and unneeded and the deleted Earth exploration-satellite (passive) allocations are unneeded. In sum, the realignment provides a significant increase in spectrum for fixed, mobile, and inter-satellite services and unlicensed devices, while improving the operation of passive sensors in the Earth exploration-satellite service ("EESS").[5] The Table, below, summarizes the existing allocations versus the allocations as realigned in this Order.[6]

[5] Passive sensor operations in the 54.25-59.3 GHz band are protected by generally limiting the use of the ISS allocations in this band to transmissions between satellites in geostationary orbit and by limiting the energy that can reach the passive sensor satellites, which operate much closer to the Earth's surface.

[6] *See* 47 C.F.R. § 2.106 - Table of Frequency Allocations for the complete listing of existing allocations and footnotes to the Table.

Existing vs Realigned Allocations (Federal and non-Federal Government allocations are identical, unless otherwise specified)			
Band (GHz)	Existing Allocations	Realigned Allocations	Summary of Major Changes
50.2-50.4	EESS (passive) SPACE RESEARCH (passive) FIXED MOBILE (Passive sensors do not receive protection from fixed & mobile.)	EESS (passive) SPACE RESEARCH (passive) (No stations will be authorized to transmit in this band.)	Reduction of 0.2 GHz for fixed and mobile services.
51.4-54.25	EESS (passive) SPACE RESEARCH (passive) RADIO ASTRONOMY (No stations will be authorized to transmit in this band.)	51.4-52.6 FIXED MOBILE	Additional 1.2 GHz for fixed and mobile services. Reductions of 1.2 GHz for EESS and space research and of 2.85 GHz for radio astronomy.
		52.6-54.25 EESS (passive) SPACE RESEARCH (passive) (No stations will be authorized to transmit in this band.)	
54.25-58.2	ISS EESS (passive) SPACE RESEARCH (passive) FIXED MOBILE (aeronautical mobile prohibited from causing interference to ISS) (Passive sensors do not receive protection from fixed & mobile.)	54.25-55.78 ISS EESS (passive) SPACE RESEARCH (passive)	ISS use limited to transmissions between GSO satellites. Reduction of 1.53 GHz for fixed and mobile.
		55.78-58.2 ISS (55.78-56.9 GHz and 57-58.2 GHz allocated for Federal and non-Federal Government use; 56.9-57 GHz allocated only for Federal Government use) EESS (passive) SPACE RESEARCH (passive) FIXED MOBILE (aeronautical mobile prohibited from causing interference to ISS) Radio astronomy observations may be made on an unprotected basis at 56.24-56.29 GHz (57-58.2 GHz is available for Part 15 unlicensed devices.)	ISS use limited to transmission between GSO satellites, except that additional flexibility is authorized per footnote G128. Additional 1.2 GHz for Part 15 devices. Reduction of 0.1 GHz for commercial ISS.
58.2-59	EESS (passive) SPACE RESEARCH (passive) RADIO ASTRONOMY (No stations will be authorized to transmit in this band.)	EESS (passive) SPACE RESEARCH (passive) FIXED MOBILE (airborne stations prohibited in 58.422-58.472 GHz) Radio astronomy observations may be made on an unprotected basis at 58.422-58.472 GHz (Available for Part 15 unlicensed devices.)	Additional 0.8 GHz for fixed and mobile services and for Part 15 devices. Reduction of 1 GHz for radio astronomy.

Continuation of Existing vs Realigned Allocations			
Band (GHz)	Existing Allocations	Realigned Allocations	Summary of Major Changes
59-64	ISS FIXED MOBILE (aeronautical mobile prohibited from causing interference to ISS) RADIOLOCATION (airborne radars prohibited from causing interference to ISS) 61-61.5 GHz is designated for ISM applications. (Available for Part 15 unlicensed devices.)	Federal Government ISS FIXED MOBILE (aeronautical mobile prohibited from causing interference to ISS) RADIOLOCATION (airborne radars prohibited from causing interference to ISS) EESS (passive; limited to the 59-59.3 GHz band) SPACE RESEARCH (passive; limited to the 59-59.3 GHz band) 61-61.5 GHz is designated for ISM applications. Radio astronomy observations may be made on an unprotected basis at 59.139-59.189 GHz, 59.566-59.616 GHz, 60.281-60.331 GHz, 60.41-60.46 GHz, and 62.461-62.511 GHz. (Available for Part 15 unlicensed devices.)	Additional 0.3 GHz for EESS and space research. Federal Government ISS use limited to transmissions between GSO satellites in the 59-59.3 GHz band. Reduction of 5 GHz for commercial ISS.
64-65	EESS (passive) SPACE RESEARCH (passive) RADIO ASTRONOMY (No stations will be authorized to transmit in this band.)	Federal Government ISS FIXED MOBILE except aeronautical mobile	Additional 1 GHz for fixed and mobile except aeronautical mobile services and for Federal Government ISS. Reduction of 1 GHz for EESS, space research, and radio astronomy.
65-66	EESS SPACE RESEARCH Fixed Mobile	non-Federal Government ISS EESS SPACE RESEARCH FIXED MOBILE except aeronautical mobile	Additional 1 GHz for commercial ISS (available to both GSO and NGSO systems). Elevation of 1 GHz for fixed and mobile except aeronautical mobile services from secondary to primary status.
66-71	MSS RADIONAVIGATION-SAT. RADIONAVIGATION MOBILE (land mobile shall not cause interference to in-band space services)	non-Federal Government ISS MSS RADIONAVIGATION-SAT. RADIONAVIGATION MOBILE (land mobile shall not cause interference to in-band space services and aeronautical mobile shall not cause interference to ISS)	Additional 5 GHz for commercial ISS (available to both GSO and NGSO systems).

III. BACKGROUND

5. The 50.2-50.4 GHz and 51.4-71 GHz bands are part of the millimeter wave spectrum.[7] In the United States, these bands are classified as Federal/non-Federal Government shared spectrum. Currently, the Federal and non-Federal Government allocations for these bands are identical.[8] At this time, only Federal Government inter-satellite and Earth exploration-satellite (passive)[9] services make use of portions of this spectrum. However, we note that Part 15 unlicensed devices that will operate in the 59-64 GHz band and Industrial, Scientific, and Medical ("ISM") equipment[10] that will operate at 61.25 GHz are under active development.

6. In May 1995, the National Telecommunications and Information Administration ("NTIA") of the U.S. Department of Commerce[11] suggested modifications to current spectrum allocations. NTIA's suggestions were designed to better accommodate existing Federal Government and proposed commercial satellite systems.[12] NTIA noted that Federal agencies operate satellites in the 60 GHz region of the spectrum in the Earth exploration-satellite (passive) and inter-satellite services. NTIA was aware that a non-Federal Government satellite applicant had requested the use of spectrum in this frequency range for inter-satellite links. To ensure acceptable operations between Federal Government users and proposed non-Federal Government users, NTIA urged the Commission to initiate a rulemaking to allocate the 65-71 GHz band to the Federal and non-Federal Government inter-satellite service. In addition, NTIA stated that, while the 54.25-58.2 GHz band was allocated to both the ISS and space-based passive services, co-channel sharing between these services would be difficult, particularly in cases involving inter-satellite links between low-Earth orbiting ("LEO") satellites. Subsequently, NTIA recommended that separate ISS spectrum be provided for Federal and commercial satellite networks.

7. In July 1996, the Commission adopted a band plan that enabled GSO and NGSO FSS systems, feeder links for NGSO mobile satellite service systems, and Local Multipoint Distribution Service ("LMDS") systems to operate in the Ka-band.[13] The Commission subsequently licensed an

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[7] The term "millimeter wave" is taken from the fact that the wavelength of radio signals for frequencies between 30 GHz and 300 GHz ranges from 10 millimeters down to 1 millimeter. The propagation of millimeter wave radio signals is more limited than that of radio signals at lower frequencies.

[8] *See* 47 C.F.R. § 2.106 (1999).

[9] Federal agencies make use of the allocation to the Earth exploration-satellite service (passive) in the 50.2-50.4 GHz and 51.4-59 GHz bands to perform satellite passive remote sensing. More specifically, this remote sensing measures atmospheric temperature profiles via oxygen absorption.

[10] *See* 47 C.F.R. Part 18. In this frequency range, the ISM frequency of interest is 61.25 GHz, with its specified tolerance of ± 250 MHz. *See* 47 C.F.R. § 18.301. "ISM equipment operating on a frequency specified in § 18.301 is permitted unlimited radiated energy in the band specified for that frequency." *See* 47 C.F.R. § 18.305(a).

[11] NTIA, *inter alia*, establishes policies concerning spectrum assignments and use by radio stations belonging to and operated by the United States Government, and develops, in cooperation with the Commission, a comprehensive long-range plan for improved management of all electromagnetic spectrum resources in the United States. *See* 47 U.S.C. § 902(b)(2)(K)-(L).

[12] *See* Letter to Chief, Office of Engineering and Technology ("OET"), from the Associate Administrator, Office of Spectrum Management, NTIA, dated May 4, 1995 (First NTIA Letter).

[13] *See Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission's Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for* (continued....)

NGSO FSS Ka-band system[14] and thirteen GSO FSS Ka-band systems.[15] Nine of these licensees have requested ISS spectrum.

8. In 1997, the United States made proposals at WRC-97, including those for the 50.2-50.4 GHz and 51.4-71 GHz bands.[16] The goal of the U.S. 50.2-50.4 GHz and 51.4-71 GHz band proposals was to provide additional spectrum for both ISS and fixed and mobile services, while fully protecting existing and future spaceborne passive sensor operations in these bands. In November 1997, WRC-97 adopted these proposals with minor adjustments as explained below.[17] In May 1998, NTIA requested

(Continued from previous page)
Local Multipoint Distribution Service and for Fixed Satellite Services, First Report and Order and Fourth Notice of Proposed Rulemaking, 11 FCC Rcd 19005 (1996); Order on Reconsideration, 12 FCC Rcd 6424 (1997); Second Report and Order, Order on Reconsideration, and Fifth Notice of Proposed Rulemaking, 12 FCC Rcd 12545 (1997); Second Order on Reconsideration, 12 FCC Rcd 15082 (1997); Third Report and Order, 12 FCC Rcd 22310 (1997) (*"28 GHz Third Report and Order"*); Third Order on Reconsideration, 13 FCC Rcd 4856 (1998); Fourth Report and Order, 13 FCC Rcd 11655 (1998). The Ka-band includes the 17.7-20.2 GHz (downlink) and 27.5-30 GHz (uplink) bands.

[14] In March 1997, the Commission authorized Teledesic L.L.C. to construct, launch, and operate an NGSO satellite system to provide domestic and international fixed-satellite services. *See* Ka-band authorization of Teledesic (File Nos. 22-DSS-P/LS-94, 43-SAT-AMEND-95, 127-SAT-AMEND-95). This Authorization Order did not include operating authority for any inter-satellite links.

[15] In May 1997, the Commission granted licenses to 13 companies for 73 satellites to provide broadband GSO FSS services in the Ka-band. *See* Authorizations of: Comm, Inc. (DA 97-968); GE American Communications, Inc. (DA 97-970); EchoStar Satellite Corporation (DA 97-969); Hughes Communications Galaxy, Inc. (DA 97-971); KaStar Satellite Communications Corp. (DA 97-972); Lockheed Martin Corporation (DA 97-973); Loral Space & Communications Ltd. (DA 97-974); Morning Star Satellite Company, L.L.C. (DA 97-975); NetSat 28 Company, L.L.C. (DA 97-976); Orion Atlantic, L.P. (DA 97-979); Orion Network Systems, Inc. (DA 97-977); PanAmSat Licensee Corp. (DA 97-978); and VisionStar, Inc. (DA 97-980) (International Bureau, May 9, 1997). The Commission also assigned the thirteen GSO/FSS licensees orbital locations. *See Assignment of Orbital Locations to Space Station in the Ka-band, Order*, 12 FCC Rcd 13737 (1997).

[16] *See United States Proposals for the Work of the [WRC-97] Conference*, Document USWRC-97.10-E, dated July 24, 1997, Proposals for Agenda Item 1.9.4.3, entitled "The Existing Frequency Allocations Near 60 GHz and, if Necessary, Their Respective Allocation, with a View to Protecting the Earth Exploration-Satellite (passive) Service Systems Operating in the Unique Oxygen Absorption Frequency Band from About 50 GHz to About 70 GHz. (A Consequential Allocation to the Inter-Satellite Service in the 65-71 GHz Bands) (JPDP 12)."

[17] *See International Telecommunication Union Final Acts of the World Radiocommunication Conference 1997*, Geneva, 1997 ("*WRC-97 Final Acts*"). The ITU, headquartered in Geneva, Switzerland, is the United Nations' organization within which Member States coordinate global telecommunication networks and services. The sharing of frequencies at the international level by Member States is accomplished by means of the [International] Table of Frequency Allocations, assignment and allotment plans, and coordination procedures as prescribed in the *Radio Regulations*. The *Radio Regulations*, including the [International] Table of Frequency Allocations, can be amended only by a WRC, to which all Member States are invited. The *WRC-97 Final Acts* have been incorporated into the *Radio Regulations*. *See Radio Regulations*, Edition of 1998.

WRC-97 adopted the U.S. proposals with the following exceptions. The 59-59.3 GHz band is additionally allocated to the Earth exploration-satellite and space research services on a primary basis; the proposed mobile service allocation in the 64-65 GHz band is instead a mobile except aeronautical mobile service allocation; the fixed and mobile service allocations in the 65-66 GHz band are primary allocations instead of secondary allocations; and footnotes S5.555A, S5.547, S5.556A (vice S5.562; WRC-97 also added the 59-59.3 GHz band to the footnote), S5.556B (vice S5.557) are adopted.

that the Commission initiate a rulemaking to implement the *WRC-97 Final Acts* with respect to the 50.2-71 GHz bands.[18] In this Order, we adopt the majority of the WRC-97 allocation decisions domestically.[19]

9. In June 1998, the Commission's International Bureau directed the Ka-band licensees to specify the frequency bands they proposed to use in light of the international allocations adopted at WRC-97. The licensees were also asked to coordinate the specific frequency bands with other Ka-band licensees to ensure they would not interfere with each other's systems before notifying the Commission of their requests.[20] The nine Ka-band licensees updated their requests for ISS spectrum on October 9, 1998.[21] Subsequently, the Bureau determined that additional information was needed from the licensees in light of other applications also requesting ISS spectrum.[22] In December of 1999, the International Bureau sent out a request asking the licensees both to specify and justify their ISS spectrum requirements at each of their assigned orbital locations. The licensees responded in January of this year.

10. On April 30, 1999, NTIA revised its request with respect to footnote US263.[23] NTIA stated that there have been studies within ITU Working Party 7C regarding compatibility between high density applications in the fixed service ("HDFS") and passive sensors. NTIA stated that these studies have identified potential sharing problems in the 55.78-56.26 GHz band that may necessitate limiting the power and antenna pattern of HDFS systems in order to adequately protect critical passive sensor operations in this band. Therefore, NTIA requested that footnote US263 be modified by deleting the 55.78-56.26 GHz sub-band from the list of bands wherein the space research and Earth exploration-satellite services do not receive protection from fixed and mobile operations.

11. In July of 1999, we released a *Notice of Proposed Rule Making* ("*Notice*") responding to NTIA's request, including its proposed modification to footnote US263.[24] On August 27, 1999, the

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[18] *See* Letter to Chief, OET, from the Acting Associate Administrator, Office of Spectrum Management, NTIA, dated May 18, 1998 (Second NTIA Letter). In this letter, NTIA observed that WRC-97 modified the International Table of Frequency Allocations in the frequency range 50.2-71 GHz consistent with U.S. proposals to the conference.

[19] We are adopting the WRC-97 realignment except for footnotes S5.556 and S5.547.

[20] *See* individual Letters from Thomas S. Tycz, Chief, Satellite and Radiocommunication Division, International Bureau, to David G. O'Neil, Counsel for Ka-Star Satellite Communications Corp., Raymond G. Bender, Counsel for Lockheed Martin, Mark A. Grannis, Counsel for Teledesic Corporation, Pantelis Michalopoulos, Counsel for Comm, Inc., David Moskowitz, Echostar Satellite Corporation, Philip Verveer, Counsel for CyberStar Licensee LLC, John P. Janka, Counsel for Hughes, Joseph A. Godles, Counsel for PanAmSat, Karis A. Hastings, Counsel for GE Americom, dated June 10, 1998.

[21] *See Amendment of Part 2 of the Commission's Rules to Allocate Additional Spectrum to the Inter-Satellite, Fixed, and Mobile Service and to Permit Unlicensed Devices to Use Certain Segments in the 50.2-50.4 GHz and 51.4-71.0 GHz Bands*, Notice of Proposed Rulemaking, 14 FCC Rcd 12473, App. B (1999) ("*Notice*"). *See also* First Round GSO Ka-Band Licensees' Report to the FCC entitled "*Sharing of Various Frequency Bands Allocated to the Inter-Satellite Service*," filed October 9, 1998.

[22] *Id.* These parties include four from the second Ka-band processing round, one from the 2 GHz band, and five from the 40 GHz processing round. The 2 GHz service links are at 1990-2025 MHz and 2165-2200 MHz. The 40 GHz service links are in segments contained in the 36-51.4 GHz band.

[23] *See* Letter to Chief, OET, from the Acting Associate Administrator, Office of Spectrum Management, NTIA, dated April 30, 1999 (Third NTIA Letter).

[24] *See Notice*, 14 FCC Rcd 12473.

Commission's Office of Engineering and Technology ("OET") extended the comment and reply comment deadlines to September 21, 1999, and October 6, 1999, respectively.[25] We received nine comments and seven reply comments in response to the *Notice*.[26]

12. Recently, the World Radiocommunication Conference (Istanbul, 2000) ("WRC-2000") concluded.[27] The only substantive change in the frequency range under consideration in this instant proceeding deals with protecting EESS from HDFS in the 55.78-56.26 sub-band.[28] WRC-2000 did not adopt the United States' proposal for protecting EESS operations. On September 27, 2000, NTIA requested that we adopt the U.S. proposal in this Report and Order.[29]

IV. DISCUSSION

A. Realignment of the Fixed, Mobile, and Passive Services

13. In the *Notice*, we proposed to realign the existing frequency allocations in the 50.2-50.4 GHz and 51.4-71 GHz bands. Specifically, we proposed to allocate the 51.4-52.6 GHz and 58.2-59 GHz bands to the fixed and mobile services on a primary basis and to delete unused fixed and mobile allocations from the 50.2-50.4 GHz and 54.25-55.78 GHz bands. We also proposed to allocate the 64-66 GHz band to the fixed and mobile except aeronautical mobile services on a primary basis.[30] In addition, we proposed to allocate the 59-59.3 GHz band to the Earth exploration-satellite (passive) and space research (passive) services on a primary basis and to delete the passive sensor allocations from the 51.4-52.6 GHz and 64-65 GHz bands.

14. These proposals were based on ITU-R studies and an NTIA finding. The ITU-R studies concluded that high atmospheric attenuation rates make it possible for passive sensors[31] to share spectrum with terrestrial fixed and mobile services at frequencies above 55.78 GHz.[32] As a result of the

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[25] *Amendment of Part 2 of the Commission's Rules to Allocate Additional Spectrum to the Inter-Satellite, Fixed, and Mobile Service and to Permit Unlicensed Devices to Use Certain Segments in the 50.2-50.4 GHz and 51.4-71.0 GHz Bands*, Order Granting Motion to Extend Comment Dates (rel. 1999).

[26] For a list of parties filing comments and reply comments, please refer to Appendix B. NTIA's Reply Comment is late-filed. On our own motion, we accept NTIA's Reply Comment in order to have a complete record.

[27] *See Provisional Final Acts of the World Radiocommunication Conference (Istanbul, 2000) - (WRC-2000)*.

[28] See para. 28, *infra*.

[29] *See* Letter to Chief, OET, from the Associate Administrator, Office of Spectrum Management, NTIA, dated September 27, 2000.

[30] *Notice*, 14 FCC Rcd at 12484, para. 12. Currently, the 65-66 GHz band is allocated to the fixed and mobile services on a secondary basis. We proposed to allocate the 64-66 GHz band to the mobile except aeronautical mobile service in order to protect in-band ISS operations. See para. 47, *supra*.

[31] Satellite-borne passive microwave sensors are used to obtain atmospheric temperature profiles important for weather forecasting and climate studies. These sensor measurements can only be obtained in the vicinity of unique molecular oxygen resonance frequencies located between 50 GHz and 70 GHz.

[32] *United States Proposals for the Work of the [WRC-97] Conference*, Document USWRC-97.10-E, at 123, dated July 24, 1997, Proposals for Agenda Item 1.9.4.3, entitled "The Existing Frequency Allocations Near 60 GHz and, if Necessary, Their Respective Allocation, with a View to Protecting the Earth Exploration-Satellite (continued....)

ITU-R studies, we proposed to allocate the 58.2-59 GHz and 65-66 GHz bands to the fixed and mobile services on a co-primary basis with passive sensors, except that aeronautical mobile services would not be permitted in the 65-66 GHz band.[33]

15. Below 55.78 GHz, the ITU-R studies found that fixed and mobile operations could not share spectrum with passive sensors without causing harmful interference. This interference could affect weather forecasts and give false results on measurements of warming of the Earth.[34] Because of these concerns, in the *Notice* we proposed to delete the fixed and mobile allocations from the 50.2-50.4 GHz and 54.25-55.78 GHz bands. In addition, NTIA found that the 51.4-52.6 GHz and 64-65 GHz bands are no longer required for passive sensor operations.[35] As a result of this finding, we proposed to allocate the 51.4-52.6 GHz and 64-65 GHz bands to the fixed and mobile services on a primary basis and to delete the passive sensor allocations from these bands.

16. The only commenters that addressed the proposals to realign the fixed, mobile, and passive sensor allocations at 51.4-52.6 GHz and 64-65 GHz were the National Academies' Committee on Radio Frequencies ("CORF")[36] and the Fixed Wireless Communications Coalition ("FWCC"). CORF supports the realignment, stating that the Commission's proposals will likely lead to improvement of the operation of passive sensors in the Earth exploration-satellite service.[37] CORF states that the 51.4-52.6 GHz band is less important to EESS and can be relinquished in favor of fixed and mobile services, as part of a realignment of frequencies that protects EESS observations at other frequencies.

17. FWCC states that the fixed service requires "unconstrained" spectrum as proposed in the *Notice*. FWCC has no objection to the conclusions in the ITU-R studies that the fixed service and passive sensors can share spectrum above 55.78 GHz without constraints. Thus, FWCC supports the allocation of "unconstrained" spectrum for the fixed service in the 55.78-59 GHz and 64-66 GHz bands, and does not object to the deletion of the fixed allocation from the 50.2-50.4 GHz and 54.25-55.78 GHz bands.[38] FWCC also supports an exclusive allocation for the fixed service in the 51.4-52.6 GHz band.

(Continued from previous page)
(passive) Service Systems Operating in the Unique Oxygen Absorption Frequency Band from About 50 GHz to About 70 GHz. (A Consequential Allocation to the Inter-Satellite Service in the 65-71 GHz Bands) (JPDP 12);" *see* ITU-R Recommendation SA.1259, "Feasibility of Sharing Between Spaceborne Passive Sensors and the Fixed Service from 50 to 60 GHz." We also note that the European Radiocommunications Committee ("ERO") within the European Conference of Postal and Telecommunications Administrations ("CEPT") has concluded that in frequencies above 55.78 GHz "the Fixed Service can operate without any risk of causing interference to passive sensors." *See* ERC Report 45, entitled "Sharing Between the Fixed and Earth Exploration-Satellite (Passive) Services in the Band 50.2-66 GHz," Sesimbra, January 1997.

[33] The 54.25-58.2 GHz band was previously allocated to the fixed and mobile service on a primary basis. The 65-66 GHz band was previously allocated to the fixed and mobile services on a secondary basis. *See* 47 C.F.R. § 2.106 (1999).

[34] *See* CORF Comments at 3.

[35] *See supra* note 16; *see also Notice*, 14 FCC Rcd at 12485, para. 13.

[36] CORF represents the interests of the scientific users of the radio spectrum, including users of the radio astronomy and EESS bands.

[37] *See* CORF Comments at 1.

[38] FWCC Comments at 2.

FWCC requests that the 51.4-52.6 GHz, 55.78-59 GHz, and 64-66 GHz bands *not* be allocated to the mobile service because of technical difficulties in sharing with fixed services.[39]

18. We are adopting our realignment proposals with respect to the fixed, mobile, and passive service. These allocations and deletions conform U.S. spectrum allocations in these bands to those adopted at WRC-97. We concur with CORF's assessment that this realignment will improve the operations of passive sensors in this frequency range. This and previous Commission actions will together provide the fixed service with 10.94 gigahertz of "unconstrained" spectrum in the 51.4-52.6 GHz and 56.26-66 GHz bands.[40] We believe that providing mobile allocations in the 51.4-52.6 GHz, 55.78-59 GHz, and 64-66 GHz bands will provide future wide-area licensees with needed flexibility and thus, decline to limit terrestrial use of these bands to only the fixed service. In sum, the realignment produces a net gain of 2.27 gigahertz of spectrum allocated on a primary basis for the fixed and mobile services and also eliminates the need for constraints on fixed and mobile services because these services will not share spectrum with the passive services below 55.78 GHz.[41] The specific amendments to the Table of Frequency Allocations are described below.

19. First, we delete the unused fixed and mobile service allocations from the 50.2-50.4 GHz band. This action eliminates potential sources of interference by providing exclusive spectrum for passive sensor measurements. We note that NASA believes that the 50.2-50.4 GHz band is probably the single most important passive sensing band in the 50-60 GHz range since it is used as a reference for all measurements in all channels from 52.6-59.3 GHz.[42] It has the most stringent interference criteria as the interference threshold cannot be exceeded more than 0.01% of the time according to ITU Recommendation 1029-1.

20. Second, we allocate the 51.4-52.6 GHz and 58.2-59 GHz bands to the fixed and mobile services on a primary basis and allocate the 64-66 GHz band to the fixed and mobile except aeronautical mobile services on a primary basis. We delete the unneeded EESS allocations and the unused space research allocations from the 51.4-52.6 GHz and 64-65 GHz bands.

21. Third, we delete the fixed and mobile service allocations from the 54.25-55.78 GHz band. Consequently, the requirement in footnote 909 that aeronautical mobile station transmissions in this band not cause harmful interference to ISS operations is unneeded and is therefore deleted. We take these actions to protect ongoing in-band passive sensor measurements from sources of potential interference.[43] According to CORF, uncorrupted passive microwave observations in these bands improve weather prediction and climate monitoring.[44] Deleting the fixed and mobile allocations from the 54.25-55.78 GHz band will not have a detrimental impact to any operations because these bands are not being used for fixed and/or mobile services.

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[39] FWCC Comments at 2-3.

[40] By unconstrained, we mean that technical limitations on the fixed service will not be needed in order to protect passive sensors. *See* para. 17. In contrast, it now appears that the 55.78-56.26 GHz band will require technical limitations in order to protect sensors. *See* paras. 28-30.

[41] As a consequence of the realignment, we also modify footnote US246. *See* para.23.

[42] *See* e-mail from Remote Sensing Spectrum Manager, NASA Spectrum Management Office, dated August 2, 2000.

[43] *See supra* para. 15.

[44] CORF Comments at 3.

22. Fourth, we allocate the 59-59.3 GHz band to the Earth exploration-satellite (passive) and space research (passive) services on a primary basis. This 300 megahertz allocation implements the WRC-97 allocation domestically for these services.

23. As a result of the realignment, we must modify footnotes US246 and US263. Currently, the bands 51.4-54.25 GHz, 58.2-59 GHz, and 64-65 GHz are "passive" bands; that is, the Commission does not permit transmissions in these bands. This requirement is codified at footnote US246. We modify footnote US246 by shifting the prohibition against authorizing stations to transmit from the 51.4-54.25 GHz, 58.2-59 GHz, and 64-65 GHz bands to the 50.2-50.4 GHz and 52.6-54.25 GHz bands to be consistent with the Commission's decision to narrow the passive bands to 50.2-50.4 GHz and 52.6-54.25 GHz. Currently, passive sensors (in the space research and Earth exploration-satellite services) share the bands 50.2-50.4 GHz and 54.25-58.2 GHz with (active) fixed and mobile services. Footnote US263 states that these co-channel services equally share the spectrum. In this proceeding, we delete the fixed and mobile services from the bands 50.2-50.4 GHz and 54.25-55.78 GHz. We therefore modify footnote US263 by shifting the passive sensor bands that will not receive protection from properly operating fixed and mobile services from the 50.2-50.4 GHz and 54.25-58.2 GHz bands to the 56.26-58.2 GHz band.

B. High-Density Applications in the Fixed Service ("HDFS")

24. In the *Notice*, we acknowledged that WRC-97 adopted new footnote S5.547.[45] Footnote S5.547 makes the 31.8-33.4 GHz, 51.4-52.6 GHz, 55.78-59 GHz, and 64-66 GHz bands "available for high-density applications in the fixed service."[46] We requested comment on whether footnote S5.547 should be adopted domestically, what the ramifications of such an action would be, and whether, in order to assure spectrum availability for HDFS, the bands should *not* be allocated to the mobile service.[47] Moreover, if we adopted footnote S5.547, we stated that it might be necessary to place a limit on the radiated power of HDFS stations toward zenith in the 55.78-56.26 GHz sub-band in order to protect passive sensors.[48]

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[45] Footnote S5.547 originally read as follows: "The bands 31.8-33.4 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 726 (WRC-97))." Consideration of the adoption of footnote S5.547 for the 31.8-33.4 GHz band is outside the scope of this proceeding.

[46] High density systems and usages in the fixed service are generally characterized by applications requiring the ability to: (1) operate on a point-to-point or point-to-multipoint basis, or a combination of both; (2) flexibly achieve, over short periods of time, a concentration of links on the same channel(s) within an area; (3) increase frequency reuse; and (4) decrease terminal size and cost of equipment. The term "high density fixed service" does not refer to a particular application or band in the fixed service, but does describe the phenomena of maximized deployment densities, spectrum reuse and spectral efficiencies realized by concentrated deployments. Often these deployment density, spectrum reuse and spectral efficiency factors become more pronounced in the higher bands. Use of the term "high density" can be applied in the same fashion to any radio service that may be widely utilized for commercial or other purposes. Some fixed service high density systems and usages are deployed in license areas where the operator enjoys an exclusive license which allows flexible deployment within a defined geographic area. Known current high density systems and usages in the fixed service include narrowband wireless access, fixed wireless access, and wideband applications ranging in bands up to 66 GHz. It is likely that HDFS applications will also become operational above 66 GHz. *See Proposed Expanded Element of the CPM-99 Report*, Addendum 1 to ITU-R Document 9B/66-E, Document 7D-9D/32-E, dated October 5, 1998.

[47] *See Notice*, 14 FCC Rcd at 12486, para. 14.

[48] *Notice* at footnote 51.

25. All of the parties commenting on the issue support adoption of footnote S5.547. However, these parties disagree on whether this spectrum should be used for licensed fixed services or for unlicensed Part 15 devices.

26. FWCC, Nokia Telecommunications Inc. ("Nokia"), and Hewlett Packard Company ("HP") urge the adoption of footnote S5.547 in the context of *licensed* fixed services. FWCC believes that its adoption is necessary in order to provide spectrum availability for licensed HDFS in the 51.4-52.6 GHz, 55.78-59 GHz, and 64-66 GHz bands.[49] FWCC states that these specific bands have been identified in the ITU Radio Regulations for the HDFS to address specifically the needs of IMT-2000 systems.[50] As seen by the FWCC, it is important for the Commission to protect these bands for fixed use to meet the backbone infrastructure requirements of future mobile services. Additionally, FWCC states that, in the interests of global harmonization, it is important that the Commission adopt domestically spectrum allocations made internationally for the fixed service.

27. In contrast, Nokia and HP support making the 57-59 GHz and 64-66 GHz bands available for HDFS use on an *unlicensed* basis.[51] Specifically, HP supports the concept of an unlicensed high-density fixed service and therefore, the basic concept enshrined in footnote S5.547. However, HP believes we should refrain from adopting footnote S5.547 unless it can be concluded that this footnote does not contain any imbedded technical requirements or unnecessarily restrictive definition of what constitutes high-density fixed service. In its reply comments, NTIA expressed concern that sufficient information may not be available to support changes to the United States Table of Frequency Allocations regarding HDFS.[52]

28. At WRC-2000, footnote S5.547 was modified[53] and new footnote S5.557A was adopted. Footnote S5.557A reads as follows: "In the band 55.78-56.26 GHz, in order to protect stations in the Earth exploration-satellite service (passive), the maximum power density delivered by a transmitter to the antenna of a fixed service station is limited to -26 dB(W/MHz)."

29. We decline to adopt footnote S5.547 at this time. Adoption is unnecessary given that, as a result of this Order, the 51.4-52.6 GHz, 55.78-59 GHz, and 64-66 GHz bands are allocated to the fixed service on a primary basis and thus, are available for any fixed point-to-point or fixed point-to-multipoint use, including HDFS use. Further we decline to limit these bands to HDFS only, which would be counter to our policy of permitting the maximum flexibility where appropriate to licensees and equipment

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[49] FWCC Comments at 2-3. FWCC also recommends that we also designate the 31.8-33.4 GHz band for HDFS applications. Revision of the 31.8-33.4 GHz band is not under consideration in this proceeding.

[50] IMT-2000 stands for International Mobile Telecommunications 2000 and it is sometimes referred to as 3G, for third generation mobile systems.

[51] Nokia Comments at 2; HP Comments at 8-9

[52] *See* Letter to Chief, OET, from the Acting Associate Administrator, Office of Spectrum Management, NTIA, dated November 8, 1999 (Fourth NTIA Letter).

[53] Footnote S5.547 now reads as follows: "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 Resolutions 75 (WRC-2000) and 79 (WRC-2000)). 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, administrations should further take into account potential constraints to high-density applications in the fixed service, as appropriate (see Resolution 84 (WRC-2000))."

manufacturers in using spectrum to meet market demands.[54] If we designate the 51.4-52.6 GHz, 55.78-59 GHz, and 64-66 GHz bands for HDFS use only, then other fixed and mobile services, and their related technologies, may be precluded from using this spectrum even if a demand develops for these services.

30. Irrespective of whether footnote S5.447 is adopted, NTIA requests that passive sensors on board Earth exploration satellites be protected from unacceptable interference in the sub-band 55.78-56.26 GHz. In the *Notice*, we proposed to modify footnote US263 by deleting the sub-band 55.78-56.26 GHz in order to allow passive sensors to receive protection from fixed and mobile operations. We made this proposal because there have been studies within ITU Working Party 7C regarding compatibility between HDFS and EESS (passive). During the U.S. WRC-2000 preparatory process, this issue was discussed within the delegation, including Commission and private sector participants. In its proposals for WRC-2000, the United States stated that "based upon studies contained within Recommendation ITU-R SA.1279, sharing is feasible between the EESS passive and the HDFS provided that the parameters assumed in the Recommendation are not exceeded."[55] Therefore, the United States proposed that WRC-2000 adopt the following international footnote: "Within the band 55.78-56.26 GHz, the maximum power density delivered by a transmitter to the antenna of the FS [Fixed Service] is limited to -28.5 dB(W/MHz) in order to protect stations in the EESS passive service." WRC-2000 did not adopt the United States proposal. Instead, WRC-2000 adopted -26 dB(W/MHz) in new footnote S5.557A. NTIA finds the WRC-2000 limit unacceptable and requests that we adopt the U.S. proposal domestically. We believe that this issue requires additional public comment and thus, decline to adopt a limit at this time. Instead, we will consider NTIA's request in our upcoming WRC-2000 Implementation proceeding.

C. Unlicensed Devices

1. Additional Availability

31. In 1996, the Commission made the 59-64 GHz band available for unlicensed Part 15 devices because the propagation characteristics of this band limits its use to very short-range communications.[56] The Commission found that licensing the band was unnecessary because of the limited potential for interference due to oxygen absorption and the narrow beamwidth of point-to-point antennas likely to be used in this spectrum.[57]

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[54] *See, e.g., Principles for Reallocation of Spectrum to Encourage the Development of Telecommunications Technologies for the New Millennium, Policy Statement*, 14 FCC Rcd 19868 (1999).

[55] *See* United States of America PROPOSALS FOR THE WORK OF THE [WRC-2000] CONFERENCE, Document 12-E, dated 12 January 2000, Proposals for agenda item 1.4. The proposed footnote in Document 12-E was modified at WRC-2000 to read as quoted above.

[56] *See Amendment of Parts 2, 15, and 97 of the Commission's Rules to Permit Use of Radio Frequencies Above 40 GHz for New Radio Applications*, First Report and Second Notice of Proposed Rule Making, 11 FCC Rcd 4481, 4494-97, paras. 28-36 (1996)(making the 59-64 GHz band available for unlicensed use under the existing fixed and mobile service allocations and stating that it would not adopt service rules for licensed services in the 59-64 GHz band at that time) ("*Part 15 Above 40 GHz Order*"); *see also* 47 C.F.R. § 15.255.

[57] *Part 15 Above 40 GHz Order*, 11 FCC Rcd at 4496, para. 33. The propagation characteristics of millimeter wave radio signals are more limited than that of radio signals at lower frequencies. Signals in the millimeter wave bands are significantly affected by the presence of oxygen and water vapor within the atmosphere. Absorption and scattering caused by oxygen and water vapor limit the range of millimeter wave transmissions to a few kilometers almost regardless of the power used. The amount of signal attenuation due to absorption and scattering varies with frequency and other factors. Attenuation caused by oxygen is significant throughout the millimeter wave spectrum, but increases dramatically at frequencies around 60 GHz and 120 GHz. (continued....)

32. In the *Notice*, we proposed to make the 57-59 GHz and 64-66 GHz bands available for use by unlicensed devices under Part 15 of the Commission's Rules.[58] We tentatively found that licensing was not necessary for these bands because the oxygen absorption characteristics of these bands limited the potential for interference.[59] We also tentatively found that low-power unlicensed use of these bands was ideal because it further reduced the chance of harmful interference to in-band sensors.[60] We sought comment on whether the 55.78-57 GHz band also should be made available for use by unlicensed Part 15 devices.[61]

33. Harmonix Corporation ("Harmonix"), HP, the International Microwave Power Institute ("IMPI"), the License Exempt Spectrum Subcommittee ("LESS"), and Nokia support making the 57-59 GHz and 64-66 GHz bands available for use by unlicensed Part 15 devices.[62] HP, Nokia, and Harmonix believe that the addition of the 57-59 GHz and 64-66 GHz bands to the existing 59-64 GHz unlicensed band will increase the availability of flexible, low-cost, high-bandwidth communications.[63] Furthermore, making additional spectrum available for unlicensed Part 15 devices would make it possible for these devices to avoid ISM operations in the sub-band 61-61.5 GHz,[64] while still having sufficient contiguous bandwidth for high-capacity communications.[65] HP and Nokia state that the propagation characteristics of the 57-59 GHz and 59-64 GHz bands are essentially the same.[66] In particular, we note that Nokia states that it has developed technology that can use the 57-59 GHz band for the fixed links between base stations and that the use of this technology could ease congestion on the 2.1 GHz, 6 GHz, and 11 GHz bands. [67] Nokia further states that it has already begun deploying this type of equipment in the 57-59 GHz band in Europe. Nokia believes that by harmonizing U.S. and international applications, the Commission will foster economies of scale that will encourage the introduction of this spectrally efficient technology in the United States.

34. Harmonix states that making the 64-66 GHz band available for unlicensed use would double the data speed achievable over short distances and would make some bandwidth at the edges of the "oxygen absorption band" suitable for somewhat greater distances.[68] While HP also supports making

(Continued from previous page)
Id. at 4484, para. 5, n.6; *Amendment of Parts 2, 15, and 97 of the Commission's Rules to Permit Use of Radio Frequencies Above 40 GHz for New Radio Applications*, Notice of Proposed Rule Making, 9 FCC Rcd 7078, 7081, para. 8 (1994) (*Part 15 Above 40 GHz Notice*).

[58] *Notice*, 14 FCC Rcd at 12487, para. 17.

[59] *Id.* at 12488, para. 17.

[60] *Id.*

[61] *Id.*

[62] Harmonix Comments at 1; HP Comments at 2-5; IMPI Comments at 2; LESS Reply Comments at 1; Nokia Comments at 2.

[63] HP Comments at 4; Nokia Comments at 2; Harmonix Comments at 2-5.

[64] *See* 47 C.F.R. § 18.301.

[65] HP Comments at 4; IMPI Comments at 1-2; Nokia Reply Comments at 7.

[66] *See e.g.*, HP Comments at 6-7; Nokia Comments at 6.

[67] Nokia Comments at 5.

[68] Harmonix Comments at 3.

the 64-66 GHz band available for use by Part 15 devices, it acknowledges the different propagation characteristics that make this band more suitable for slightly longer distance communications. HP states that oxygen absorption has a minimum value of 2 dB/km in the 64-66 GHz band, which is significantly less attenuation than would occur in the existing unlicensed band.[69] In contrast, KaStar Satellite Communications Corp. ("KaStar") requests that we not make spectrum available for unlicensed devices in the 65-66 GHz band until technical rules are adopted that will protect GSO and NGSO FSS licensees and applicants.[70] LESS recommends that we address KaStar's request in a separate proceeding.

35. LESS supports making the 55.78-57 GHz (in addition to the 57-59 GHz and 64-66 GHz bands) available for unlicensed use. LESS states that point-to-point links between base stations use narrow-beam directional antennas placed typically at heights above 40 meters (about 131 feet) and thus, the probability of interference is low. LESS also states that unlicensed links in the 55.78-59 GHz band could be used for redundancy and low priority traffic or for a variety of other applications such as home networking.[71] In contrast, FWCC argues against making the 55.78-59 GHz band available for use by unlicensed Part 15 devices, claiming that additional spectrum is needed by the fixed service for "last mile" applications.[72] FWCC questions the desirability of operating base stations on an unlicensed basis and argues that it is highly unlikely that mobile base station interconnectivity can be achieved using "unregulated" spectrum.[73] Nokia states that FWCC is incorrect: it has designed and is currently marketing in Europe a micro-cellular base station that operates on an unlicensed basis in the 57-59 GHz band. Nokia further argues that its micro-cellular solution will allow carriers to respond rapidly to a lack of system capacity in hot spots precisely because it is unlicensed.

36. At 57-59 GHz, we believe that unlicensed equipment can generally operate without causing interference because the oxygen absorption characteristics of this spectrum limit the range of the signals. As indicated in the *Notice*, it is this limited range and the resulting limited potential for interference that makes this spectrum ideal for use by unlicensed Part 15 devices. Although the limited range of such transmissions might appear to be a major disadvantage for longer range applications, the ability to reuse frequencies within very short distances allows a higher concentration of transmitters to be located in a geographical area than is possible with transmitters that operate at lower frequencies. Also, the wide bandwidth available in the millimeter wave spectrum can support the operation of wireless communications links with capacity approaching that of coaxial cable and fiber optic systems.[74] Therefore, we find that licensing of point-to-point fixed links in the 57-59 GHz band is not necessary because the oxygen absorption rate and the narrow beamwidth of antennas likely to be operating in this frequency range limit the potential for interference. The propagation characteristics of this band limit its use to short links. As a result, its use has little chance of causing harmful interference to in-band passive sensors. Nonetheless, we are prohibiting the use of unlicensed equipment operating in the 57-59 GHz band on aircraft or satellites. Making this spectrum available for use by unlicensed Part 15 devices provides operators with greater flexibility in using this

[69] HP Comments at 7.

[70] KaStar Comments at 1.

[71] LESS Reply Comments at 1.

[72] FWCC Comments at 2.

[73] FWCC Comments at 3. FWCC argues in favor of allocating the 55.78-59 GHz and 64-66 GHz bands for fixed licensed services only. FWCC also opposes allocating these bands for mobile services because they claim that sharing between fixed and mobile services is "practically impossible." FWCC Comments at 2-3.

[74] *Part 15 Above 40 GHz Notice*, 9 FCC Rcd at 7081-82, para. 8.

spectrum. Unlicensed use provides a multitude of users with a high level of flexibility in how they use the spectrum. Making this spectrum available to unlicensed Part 15 devices harmonizes U.S. spectrum applications with international spectrum applications and allows the U.S. market to benefit from technology currently being used in Europe. This fulfills the goal of global harmonization of spectrum usage by enabling innovations that can be used both here and abroad, lessening the overall developmental costs of new and innovative technologies. Therefore, this band is ideally suited for terrestrial unlicensed use. Accordingly, we make the 57-59 GHz band available for use by unlicensed Part 15 devices.

37. We decline to make the 55.78-57 GHz and 64-66 GHz bands available to Part 15 devices at this time. We are especially cognizant of the fact that there are differences in propagation characteristics of the 64-66 GHz band versus the 57-64 GHz band. Thus, the greater distances mentioned by Harmonix means that there could also be an increased risk of interference between users of the 64-66 GHz band if appropriate technical limits are not adopted. Given the different propagation characteristics of the 64-66 GHz band and the 57-64 GHz band combined with our decision to make two more gigahertz of spectrum available for unlicensed use in the 57-59 GHz band, we decline to make the 64-66 GHz band available for use by unlicensed devices at this time.

2. Spectrum Etiquette for the 57-64 GHz Band

38. In the *Notice*, we did not propose technical rules for unlicensed use of the 57-59 GHz band.[75] We did however seek comment on the technical rules needed for spectrally efficient operation of unlicensed devices in this band. We also asked if we should employ the existing technical rules and etiquette from the 59-64 GHz band for this band.[76] The commenting parties generally support applying the spectrum etiquette for the 59-64 GHz band to the 57-59 GHz band.[77] For example, Harmonix, HP, and Nokia argue that we should extend the spectrum etiquette for the 59-64 GHz band to the 57-59 GHz band because the signal propagation/oxygen attenuation characteristics of this band are similar to the 59-64 GHz band.[78] We concur with the parties and extend the etiquette rules concerning the 59-64 GHz band to include the 57-59 GHz band. This action will provide users with access to seven gigahertz of contiguous spectrum and promote the rapid introduction of unlicensed devices in this band. We amend Section 15.255 of our rules to reflect this change.

39. Because we are expanding the current spectrum etiquette to the 57-59 GHz band, we believe it is appropriate to modify Section 15.255 of our rules. Specifically, Section 15.255(d) reserves the 59-59.05 GHz segment for specific purposes – spurious emissions and a publicly-accessible coordination channel.[79] To enable users unfettered access to contiguous spectrum between 57 GHz and 64 GHz, we move the coordination channel from 59-59.05 GHz to 57-57.05 GHz. This will preserve the goals of setting aside 50 megahertz of spectrum to allow techniques for mitigating or eliminating interference that may occur between different unlicensed transmitters operating in the same frequency

[75] *Notice*, 14 FCC Rcd at 12488, para. 18.

[76] *Id.*

[77] *See e.g.*, HP Comments at 5-7; Harmonix Comments at 3-4; Nokia Comments at 8-9; Nokia Reply Comments at 5-7.

[78] HP Comments at 6-7; Nokia Comments at 8-9; Nokia Reply Comments at 6-9. HP notes that the spectrum etiquette for the 59-64 GHz band is the result of a year long, industry intensive effort that was subject to public comment. HP Comments at 6.

[79] 47 C.F.R. §15.255(d).

band and will provide flexibility in channel widths for unlicensed devices. This change should not affect any existing operations because no unlicensed equipment has been authorized to operate in the 59-64 GHz band. Accordingly, we are revising Section 15.255(g) of our Rules to reflect this decision.

40. Finally, we note that Harmonix, while supporting extending the 59-64 GHz spectrum etiquette to the 57-59 GHz band, recommends that the transmitter identification requirement found in Section 15.255(i) of our Rules be modified.[80] Harmonix notes that the requirement was designed to make it possible for a user experiencing interference to identify the source of the interference and that it was drafted primarily to suit indoor wireless local area network systems using wide-angle antennas.[81] Harmonix claims that when applied to outdoor point-to-point systems, the requirement adds significant cost without concomitant benefit. It asserts that the propagation characteristics of this spectrum combined with the use of narrowly focused beam of a point-to-point system will result in an inherently low probability of creating interference.[82] Harmonix claims its experience in Japan confirms its claims that these radios are "very unlikely to cause detectable interference" to other systems, or to each other.[83] They also argue that the transmitter identification is not workable in the field because it requires the victim to know the manufacturer of the offending equipment. Section 15.255(i) of our rules requires each manufacturer to publish instructions on how to detect and decode its transmitter identification.[84] According to Harmonix however, the interference victim cannot obtain the instructions for decoding the transmitter identification information without first determining the identity of the manufacturer, something it cannot determine without detecting and decoding the transmitter identification.[85] Thus, the victim must have the instructions to identify the manufacturer but it must identify the manufacturer to identify the instructions.[86] As such, the transmitter requirement appears to be useless.

41. We decline to eliminate the transmitter identification requirement at this time. Instead, we modify the requirement to protect the systems for which it was designed, *i.e.*, transmissions that emanate from inside a building.[87] This minor alteration should protect indoor systems from interference, while not unnecessarily burdening outdoor systems that pose little interference threat to indoor systems or other outdoor systems. Indoor equipment will be required to have the ID because indoor equipment is under the control of the system operator. The system operator knows its equipment and thus can decode

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[80] *See* 47 C.F.R. § 15.255(i).

[81] Harmonix Comments at 4.

[82] Harmonix Comments at 4-5. More specifically Harmonix states: "At a distance where the beam is wide enough that it might present any realistic threat to other equipment, the power has dissipated to insignificant levels. Even without taking oxygen absorption or rain fade into account, a 60 GHz transmitter operating at the maximum allowable EIRP produces an energy density one kilometer away of only 80 pW/cm^2. In addition, an outdoor signal must pass through window glass or walls before it can interfere with an indoor system such as a wireless LAN. Typical office building window glass attenuates another 25-30 dB at these frequencies. Attenuation through walls is even higher." *Id.*

[83] Harmonix Comments at 5.

[84] Harmonix Comments at 5 (citing 47 C.F.R. § 15.255(i)).

[85] Harmonix Comments at 5.

[86] Harmonix Comments at 5.

[87] According to Harmonix, the transmitter identification requirement "appears to have been drafted primarily to suit indoor wireless LAN systems using wide-angle antennas." Harmonix Comments at 4.

the ID information and find out which transmitter is interfering with the rest of its system. In contrast, the victim of interference from outdoor equipment would not be able to determine the identity of the manufacturer and thus, the victim could not decode the ID. This spectrum is likely to be used for point-to-point operations and thus this is not likely to be a problem. Expanding the spectrum etiquette for the 59-64 GHz band to the 57-59 GHz and modifying it as discussed above makes the 57-59 GHz band available immediately without burdening it with potentially unnecessary regulatory requirements.

D. Inter-Satellite Service ("ISS")

1. Separate Federal and Commercial Allocations

42. In the *Notice*, we proposed to provide separate ISS spectrum for Federal and non-Federal Government satellite systems. Specifically, we proposed to allocate the 65-71 GHz band to the non-Federal Government ISS, to delete the non-Federal Government ISS allocation from the 56.9-57 GHz and 59-64 GHz bands, and to allocate the 64-65 GHz band to the Federal Government ISS. We made these proposals based on (1) a pressing demand for spectrum that could be used for commercial inter-satellite links,[88] (2) NTIA assertions that Federal Government operations in the 59-64 GHz band are not compatible with proposed commercial ISS uses of this band,[89] and (3) a tentative finding that allocating the 65-71 GHz band for exclusive commercial use is sufficient to accommodate all pending requests by NGSO licensees for ISS spectrum. We also proposed to adopt footnote S5.558 domestically, thereby requiring that aeronautical mobile operations in the 66-71 GHz bands not cause harmful interference to inter-satellite links.[90]

43. The commenters support the ISS proposals made in the *Notice*.[91] Lockheed Martin Corporation ("Lockheed Martin") and the Satellite Industry Association ("SIA") agree with our tentative conclusion that all pending ISS requests from *NGSO* licensees can be accommodated in the 65-71 GHz band.[92] Lockheed Martin, GE American Communications, Inc. ("GE Americom"), and SIA support the adoption of footnote S5.558.[93]

44. KaStar states that allocation of the 65-71 GHz band should be sufficient to permit existing *GSO* FSS Ka-band licensees to operate their inter-satellite links without causing harmful interference to each other.[94] However, KaStar also states that it is uncertain whether GSO FSS and

[88] *Notice*, 14 FCC Rcd at 12481, para. 9; *see id.* at Appendix B; *supra.* note 15 for Ka-band satellite applications.

[89] *Id.* at 12481, para. 9.

[90] WRC-97 re-numbered footnote 909 as S5.558, added the 66-71 GHz band to the footnote, and reduced the 54.25-58.20 GHz band to 58.78-58.20 GHz. Footnote S5.558 reads as follows: "In the bands 55.78-58.2 GHz, 59-64 GHz, 66-71 GHz, 116-134 GHz, 170-182 GHz and 185-190 GHz, stations in the aeronautical mobile service may be operated subject to not causing harmful interference to the inter-satellite service (see No. S5.43)."

[91] Lockheed Comments at 2; KaStar Comments at 1; Loral Comments at 3; GE American Reply Comments at 2; SIA Reply Comments at 1-2.

[92] Lockheed Martin Comments at 3; SIA Reply Comments at 4.

[93] Lockheed Martin Comments at 2-3; GE Americom Reply Comments at 2-3; SIA Reply Comments at 3.

[94] KaStar Comments at 3. KaStar also states that the additional spectrum from 54.25-56.9 GHz and 57-58.2 GHz provides ISS spectrum for future commercial GSO FSS systems.

NGSO FSS systems can share the 65-71 GHz band or whether a further partitioning of that band would be necessary. KaStar requests that second-round and future GSO and NGSO FSS applicants be prohibited from causing interference to "incumbent" GSO and NGSO FSS licensees.

45. We find that there is pressing demand for ISS spectrum and that Federal Government operations in 59-64 GHz band are not compatible with proposed commercial use. We also find that ITU-R technical studies have demonstrated that it is feasible for ISS and existing services to share the 65-71 GHz band[95] and that the 65-71 GHz band can accommodate all pending requests by NGSO commercial licensees for ISS spectrum.[96] Therefore, we are providing separate ISS spectrum for commercial entities and Federal agencies. Accordingly, we allocate the 65-71 GHz band to the non-Federal Government inter-satellite service on a primary basis. This six gigahertz allocation provides GSO and NGSO commercial satellite licensees with the ISS spectrum they need to interconnect satellites within their respective networks.[97] This action should enhance competition and facilitate the introduction of advanced satellite telecommunications services in the United States and around the world.[98]

46. To provide separate ISS spectrum for Federal agencies, we allocate the 64-65 GHz band on a primary basis to the Federal Government inter-satellite service and delete the non-Federal Government ISS allocation from the 56.9-57 GHz and 59-64 GHz bands. Currently, there is 8.95 gigahertz of spectrum allocated for Federal and non-Federal Government ISS use in this frequency range (54.25-58.2 GHz and 59-64 GHz). As a result of this Order, Federal agencies will have exclusive access to 6.1 gigahertz of ISS spectrum (56.9-57 GHz and 59-65 GHz) and commercial satellite companies will have exclusive access to 6 gigahertz (65-71 GHz), with 3.85 gigahertz that remains shared between Federal agencies and commercial licensees (54.25-56.9 GHz and 57-58.2 GHz). However, 400 megahertz of the Federal Government exclusive ISS spectrum is limited to GSOs (56.9-57 GHz and 59-59.3 GHz), none of the commercial exclusive spectrum is limited to GSOs, and all of the shared spectrum is limited to GSOs. To compensate Federal agencies for the WRC-97 imposed GSO limitation on the use of the band 59-59.3 GHz (300 megahertz), the Commission provides Federal agencies with 100 megahertz of "extra" spectrum.

47. We also take the following steps to protect the new ISS allocations in the 64-71 GHz band. As discussed below, we allocate the 64-66 GHz band to the fixed and mobile except aeronautical mobile services.[99] The restriction on aeronautical mobile services combined with the oxygen attenuation characteristics of this spectrum should prevent interference between terrestrial fixed and mobile services and ISS operations in the same band. Further, to protect ISS operations in the 66-71 GHz band, we adopt footnote S5.558, thereby requiring that aeronautical mobile operations not cause harmful interference to

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[95] These studies were carried out by ITU-R Working Party 4A in response to Resolution 643. These studies also conclude that a new ISS allocation in the 64-71 GHz band, combined with limiting ISS use of the 54.25-56.90 and 57-58.2 GHz bands to GSO satellites would fully satisfy the known requirements of the inter-satellite links in this frequency range. *See e.g.*, ITU-R Recommendation S.1339 on the "Feasibility of Sharing Between Spaceborne Sensors of the Earth Exploration-Satellite Service and Inter-Satellite Links of Geostationary-Satellite Networks in the Range 50 to 65 GHz;" ITU-R Recommendation S.1327, "Requirements and Suitable Bands for Operation of the Inter-Satellite Service within the Range 50.2-71 GHz" (Sept. 18, 1997).

[96] *See Notice*, 14 FCC Rcd at 12481 n.31, App. B.

[97] Loral/Globalstar Comments at 3; Lockheed Comments at 2; GE Americom Reply Comments at 1.

[98] Lockheed Comments at 2; *see* SIA Reply Comments at 2.

[99] *See infra* para. 13.

ISS operations in this band. This restriction, combined with the existing prohibition on land mobile services causing interference to space radiocommunication services in these bands,[100] should enable ISS operators to take full advantage of this new allocation without suffering interference from terrestrial uses of the band.

48. While we believe that sufficient ISS spectrum is available for current satellite systems, we are concerned about whether there will be enough spectrum for future systems. Therefore, we intend to explore whether the sub-bands 58.2-58.422 GHz and 58.472-59 GHz can be allocated to the inter-satellite service on a primary basis at a future competent international conference.[101]

2. International Footnote S5.556A

49. WRC-97 adopted footnote S5.556A in order to permit passive sensors and inter-satellite links to make use of the same spectrum. Specifically, footnote S5.556A limits ISS use of the 54.25-56.9 GHz, 57-58.2 GHz, and 59-59.3 GHz bands to transmissions between geostationary satellites that comply with a p.f.d. limit of -147 dBW per square meter per 100 megahertz for all angles of arrival at the passive sensor's orbital altitude, *i.e.*, altitudes of 1000 kilometers (approximately 621.4 miles) or less above the Earth's surface.[102] In the *Notice*, we proposed to adopt international footnote S5.556A domestically. We based this proposal on ITU-R technical studies that have shown that these restrictions are necessary to prevent ISS transmissions from causing harmful interference to passive sensor reception in the 54.25-58.2 GHz band.[103]

50. CORF, Lockheed Martin, and GE Americom support the adoption of footnote S5.556A.[104] For example, CORF states that studies have shown that operation of inter-satellite links in planned networks of NGSO fixed and mobile satellites can cause excessive interference to passive sensors in the 54.25-58.2 GHz band. These same studies show, however, that inter-satellite links between GSO satellites will not cause excessive interference provided that a p.f.d. limit is instituted to protect the sensors. Specifically, CORF states that sharing is feasible between passive sensors and GSO inter-satellite links provided the p.f.d. at altitudes of 1,000 km or less above the Earth's surface produced by

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[100] *See* 47 C.F.R. § 2.106, footnote S5.553.

[101] *See* paras. 52-55 concerning the deletion of the radio astronomy service from 750 megahertz of spectrum in the 58.2-59 GHz band.

[102] Footnote S5.556A reads: "Use of the bands 54.25-56.9 GHz, 57-58.2 GHz and 59-59.3 GHz by the inter-satellite service is limited to satellites in geostationary-satellite orbit. The single-entry power flux-density at all altitudes from 0 km to 1000 km above the Earth's surface produced by a station in the inter-satellite service, for all conditions and for all methods of modulation, shall not exceed -147 dB (W/m^2/100 MHz) for all angles of arrival." *See Amendment of Part 2 of the Commission's Rules to Make Non-Substantive Revisions to the Table of Frequency Allocations*, Memorandum Opinion and Order, 15 FCC Rcd 3459, App. B (1999) ("*Table Clean-up Order*"). We observe that the United States' WRC-97 proposals for footnote S5.556A did not include the 59-59.3 GHz band. However, NTIA has requested that the Commission adopt this requirement in the 59-59.3 GHz Government-only ISS band. *See* 1998 NTIA Letter.

[103] *See* ITU-R Draft New Recommendation SA[7/153] - "Spectrum Sharing between Spaceborne Passive Sensors and Inter-Satellite Links in the Range 50.2-61.3 GHz." This draft Recommendation has been superseded by ITU-R Recommendation SA.1279, "Spectrum Sharing between Spaceborne Passive Sensors and Inter-Satellite Links in the Range 50.2-59.3 GHz."

[104] CORF Comments at 3; Lockheed Comments at 4; GE Americom Reply Comments at 2-3.

emissions from a space station do not exceed -147 dBW/m²/(100 MHz) for all angles of arrival.[105] Given compliance with this emission limit, we find that it is feasible for passive sensors and GSO inter-satellite links to share the 54.25-59.3 GHz band. Accordingly, we adopt footnote S5.556A domestically. We note that, while footnote S5.556A explicitly precludes NGSO networks from accessing 4.15 gigahertz of spectrum (56.25-56.9 GHz, 57-58.2 GHz, and 59-59.3 GHz), there is sufficient spectrum in the 65-71 GHz band to accommodate all pending requests by NGSO commercial licensees for ISS spectrum.

3. The 56.9-57 GHz Band

51. In paragraph 46, above, we provide Federal agencies with exclusive use of the ISS allocation in the 56.9-57 GHz band. At WRC-97, ISS use of the 56.9-57 GHz band was limited to transmissions between GSO satellites and to transmissions from NGSO satellites in high-Earth orbit to those in low-Earth orbit.[106] In its 1998 letter, NTIA requested that we also permit transmissions between GSO satellites and satellites in high-Earth orbit and from GSO satellites to satellites in low-Earth orbits.[107] In the *Notice*,[108] we proposed to provide Federal agencies with the requested flexibility. No party commented on NTIA's request. Accordingly, we adopt the following footnote to our Table of Frequency Allocations:

> G128 Use of the band 56.9-57 GHz by inter-satellite systems is limited to transmissions between satellites in geostationary orbit, to transmissions between satellites in geostationary satellite orbit and those in high-Earth orbit, to transmissions from satellites in geostationary satellite orbit to those in low-Earth orbit, and to transmissions from non-geostationary satellites in high-Earth orbit to those in low-Earth orbit. For links between satellites in the geostationary satellite orbit, the single entry power flux-density at all altitudes from 0 km to 1000 km above the Earth's surface, for all conditions and for all methods of modulation, shall not exceed -147 dB (W/m²/100 MHz) for all angles of arrival.

E. Radio Astronomy and Radiolocation

52. In the *Notice*, we proposed to reflect the *WRC-97 Final Acts* in the United States Table by deleting the radio astronomy service's direct Table allocation from the 51.4-54.25 GHz and 64-65 GHz bands and by adopting footnote S5.556, which permits radio astronomy observations to be carried out under national arrangements.[109] These proposals were based on a tentative finding that radio

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[105] CORF Comments at 3.

[106] Specifically, WRC-97 adopted footnote S5.558A, which reads as follows: "Use of the band 56.9-57 GHz by inter-satellite systems is limited to links between satellites in geostationary-satellite orbit and to transmissions from non-geostationary satellites in high-Earth orbit to those in low-Earth orbit. For links between satellites in the geostationary-satellite orbit, the single entry power flux-density at all altitudes from 0 km to 1 000 km above the Earth's surface, for all conditions and for all methods of modulation, shall not exceed -147 dB(W/m²/100 MHz) for all angles of arrival."

[107] *See* 1998 NTIA Letter at note 20, *supra*. *See also Notice*, 14 FCC Rcd 12481 at para. 11.

[108] *Notice*, 14 FCC Rcd at 12483, para. 11.

[109] *Notice*, 14 FCC Rcd at 12491-92, para. 21. Footnote S5.556 reads as follows: "In the bands 51.4-54.25 GHz, 58.2-59 GHz, 64-65 GHz, 72.77-72.91 GHz and 93.07-93.27 GHz, radio astronomy observations may be carried out under national arrangements." *See Table Clean-up Order*, 15 FCC Rcd 3459, App. B. National arrangements are agreements between the FCC and NTIA. In some cases, Canada and Mexico may not concur (continued....)

astronomy use of the 51.4-54.25 GHz and 64-65 GHz bands is a domestic issue best authorized under national arrangements.[110] In the United States, these bands are allocated to the Federal and non-Federal Government radio astronomy ("RA") service on a primary basis.[111] Nevertheless, the coordinator for Task 2 of ITU-R Joint Rapporteurs Group 7D-9D found that there was no known usage of the 51.4-52.6 GHz, 55.78-59 GHz, and 64-66 GHz bands by the RA community. Further they found that "[e]ven if radio astronomical use were to develop, there should not be any problems with radio astronomy stations sharing [these] band[s with] . . . HDFS since RA use of these bands must already be coordinated with the fixed service within individual Administrations."[112] NTIA requested that the radio astronomy service allocation be deleted from the 51.4-54.25 GHz and 64-65 GHz bands because it is unused and to make way for the fixed, mobile, and ISS allocations discussed above. NTIA also requested that we implement international footnote S5.556 in these bands to allow RA operations on a national basis if the need for these frequencies develops within the RA community. NTIA did not propose any change to the radio astronomy service allocation in the 58.2-59 GHz band.[113]

53. In comments, CORF agrees that, "due to atmospheric absorption, terrestrial radio astronomy observations are not made in the 51.4-54.25 GHz, 58.2-59 GHz, and 64-65 GHz bands."[114] As a result, CORF does not oppose deletion of these allocations. Instead, CORF requests that we provide footnote protection to seven 50 megahertz sub-bands centered on 56.265 GHz, 62.486 GHz, 58.447 GHz, 59.591 GHz, 60.306 GHz, 60.435 GHz, and 59.164 GHz. CORF requests that the footnote limit assignment of these frequencies, and where necessary, to assign the frequencies starting with the latter frequencies.[115] CORF informs us that "space-based observations of the oxygen molecule in cosmic molecular clouds are an important and imminent goal of scientific research."[116] CORF is concerned that space-based observations at frequencies between 56 GHz and 62 GHz would be vulnerable to interference from ISS transmissions, such as those we allocated in this Order.[117] CORF notes that measurement of interstellar oxygen is ongoing and that NASA and several other entities have plans for future space-based observation of oxygen molecules.[118] CORF asserts that, although space-based observations would not be affected by unlicensed and fixed or mobile terrestrial devices operated on or near the Earth's surface, ISS operations could cause problems for space-based radio telescopes. Therefore, CORF requests footnote protection for these seven 50 megahertz sub-bands.

(Continued from previous page)
with such agreements and the U.S. would then have to negotiate individual agreements with affected countries or seek a country specific footnote from the ITU.

[110] *Notice*, 14 FCC Rcd at 12491-92, para. 21.

[111] In this order we allocate the 51.4-52.6 GHz, 58.2-59 GHz, and 64-66 GHz bands to the fixed and mobile services on a primary basis. *See supra.* para. 20. We also revise footnote US246. *See supra.* para. 22.

[112] *Notice, 14 FCC Rcd at 12491-92, para. 21; see* ITU-R Document 7D-9D/30-E, dated August 11, 1998.

[113] *Notice*, 14 FCC Rcd at 12492, para. 21 n.68 and accompanying text.

[114] CORF Comments at 3.

[115] CORF Comments at 4.

[116] CORF Comments at 3.

[117] CORF Comments at 3; *see supra* paras. 42-45.

[118] CORF Comments at 3.

54. As proposed in the *Notice*, we are deleting the radio astronomy service allocations from the 51.4-54.25 GHz and 64-65 GHz bands. However, since CORF, which represents the interests of Federal and non-Federal Government radio astronomy users of the radio spectrum, has determined that there is no need for a national arrangement for radio astronomy observations in the 51.4-54.25 GHz and 64-65 GHz bands, we decline to adopt international footnote S5.556 at this time. In addition, we are deleting the radio astronomy allocation from the 58.2-59 GHz band because CORF asserts that this band cannot be used for terrestrial radio astronomy observations.

55. With regard to CORF's request, we have consulted with NTIA and are providing the following informational footnote to alert ISS applicants that space-based radio astronomy observations may occur in the future:

> US353 In the sub-bands 56.24-56.29 GHz, 58.422-58.472 GHz, 59.139-59.189 GHz, 59.566-59.616 GHz, 60.281-60.331 GHz, 60.41-60.46 GHz, and 62.461-62.511 GHz, space-based radio astronomy observations may be made on an unprotected basis.

Because emissions from spaceborne or airborne stations can be particularly serious sources of interference to radio astronomy observations, we are precluding such operations in the 50 megahertz sub-band that is within the former primary radio astronomy allocation at 58.2-59 GHz.

> US354 In the sub-band 58.422-58.472 GHz, airborne stations and space stations in the space-to-Earth direction shall not be authorized.

56. Finally, as proposed in the *Notice*, we correct a typographical error in the United States Table of Frequency Allocations by adding a reference to footnote S5.559 in the 59-64 GHz band.[119] This footnote reference had been inadvertently dropped from the Table.[120]

V. PROCEDURAL INFORMATION

A. Effective Date for the non-Federal Government ISS Allocation in the 65-71 GHz Band

57. We are currently in the process of considering requests for ISS spectrum in the 65-71 GHz band from various non-Federal Government applicants. For this reason, we will make the non-Federal Government ISS allocation in the 65-71 GHz band effective upon publication in the Federal Register. The benefit of this action would be to facilitate licensing of various satellite systems in this band. This is particularly important for certain Ka-Band systems because, under ITU rules, certain U.S. filings for ITU frequency coordination may be forfeited if operational Ka-band satellites are not "brought into use" by October 2004. Therefore, we find that the public interest will best be served by immediately allocating the 65-71 GHz band to the non-Federal Government inter-satellite service on a primary basis. *See* 5 U.S.C. § 553(d)(3); *Omnipoint Corp. v. FCC*, 78 F.3d 620, 630 (D.C. Cir. 1996). Because there are currently no users in the 65-71 GHz band, we find that no parties will be harmed.

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[119] *Notice* at 12492, para. 22.

[120] The Commission had previously added a reference to footnote 910 (re-numbered as S5.559) in the 59-64 GHz band. *See Amendment of Parts 2, 15, and 97 of the Commission's Rules to Permit Use of Radio Frequencies Above 40 GHz for New Radio Applications*, First Report and Order and Second Notice of Proposed Rule Making, 11 FCC Rcd 4481 (1996). The text of footnote 910 reads as follows: "In the bands 59-64 GHz and 126-134 GHz, airborne radars in the radiolocation service may be operated subject to not causing harmful interference to the inter-satellite service (see No. 435)." When footnote 910 was re-numbered as S5.559, the cross reference in the text was updated to "(see No. S5.43)."

B. Final Regulatory Flexibility Certification

58. This *Report and Order* finalizes the spectrum realignment proposed in the *Notice* issued by the Commission in July of 1999.[121] We received no comments in response to the Initial Regulatory Flexibility Analysis in the *Notice*. The Regulatory Flexibility Act ("RFA")[122] requires that a regulatory flexibility analysis be prepared for rulemaking proceedings, unless the agency certifies that "the rule will not have a significant economic impact on a substantial number of small entities."[123] The RFA generally defines "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction."[124] In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act.[125] 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 Small Business Administration ("SBA").[126]

59. In this *Report and Order*, we realign allocations in the frequency range 50.2-71 GHz. One of the results of this realignment is a net gain of 2.27 gigahertz of spectrum allocated on a primary basis to the fixed and mobile services.[127] We also designate 2 gigahertz of spectrum at 57-59 GHz for Part 15 unlicensed devices.[128] We believe that this net increase in fixed and mobile spectrum and the designation of a new unlicensed band will provide new opportunities for small entities. In addition, the realignment affects allocations for the Earth exploration-satellite (passive), space research (passive), radio astronomy, and inter-satellite services. There are no small entities affected by this action because only Federal agencies currently make use of these services. In addition, future inter-satellite service licensees are not expected to be small entities because of the cost inherent in satellite networks. Because the realignment adopted in this *Report and Order* provides more spectrum for *future* fixed and mobile service licensees and for manufacturers of *future* unlicensed devices and because the realignment does not impact any current non-Federal Government users, we hereby certify that the realignment will not have a significant economic impact on a substantial number of small entities.

60. The Commission will send a copy of this *Report and Order*, including a copy of this final certification, in a report to Congress pursuant to the Small Business Regulatory Enforcement

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[121] *Notice*, 14 FCC Rcd 12473.

[122] The RFA, *see* 5 U.S.C. § 601 *et. seq.*, 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").

[123] 5 U.S.C. § 605(b).

[124] 5 U.S.C. § 601(6).

[125] 5 U.S.C. § 601(3) (incorporating by reference the definition of "small business concern" in Small Business Act, 15 U.S.C. § 632). Pursuant to 5 U.S.C. § 601(3), 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."

[126] Small Business Act, 15 U.S.C. § 632.

[127] *See* paras. 13-19, *supra*.

[128] *See* paras. 31-41, *supra*.

Fairness Act of 1996.[129] In addition, this *Report and Order* and this certification will be sent to the Chief Counsel for Advocacy of the Small Business Administration, and will be published in the Federal Register.[130]

VI. ORDERING CLAUSES

61. Accordingly, IT IS ORDERED that 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), the REPORT AND ORDER is hereby ADOPTED.

62. IT IS FURTHER ORDERED that the amendments to Parts 2 and 15 of the Commission's Rules, 47 C.F.R. Part 2 and 15, as set forth in Appendix A, are effective 30 days after publication in the Federal Register, except that the primary non-Federal Government ISS allocation in the 65-71 GHz band is effective upon publication in the Federal Register.

63. IT IS FURTHER ORDERED that the Commission's Consumer Information Bureau, Reference Information Center, SHALL SEND a copy of this REPORT AND ORDER, including the Final Regulatory Flexibility Certification, to the Chief Counsel for Advocacy of the Small Business Administration.

FEDERAL COMMUNICATIONS COMMISSION

Magalie Roman Salas

Magalie Roman Salas
Secretary

[129] *See* 5 U.S.C. § 801(a)(1)(A).

[130] *See* 5 U.S.C. § 605(b).

Appendix A: Final Rules

Parts 2 and 15 of title 47 of the Code of Federal Regulations are amended 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. Amend Section 2.106, the Table of Frequency Allocations, as follows:

a. Revise pages 79, 80, and 81.

b. Revise footnote S5.547 and add footnote S5.557A.

c. Revise footnotes US246 and US263 and add footnotes US353 and US354.

d. Add footnote G128.

The additions and revisions read as follows:

§ 2.106 Table of Frequency Allocations.

* * * * *

International Table			United States Table		FCC Rule Part(s)
Region 1	Region 2	Region 3	Federal Government	Non-Federal Government	
50.2-50.4 EARTH EXPLORATION-SATELLITE (passive) SPACE RESEARCH (passive) S5.340 S5.555A			50.2-50.4 EARTH EXPLORATION-SATELLITE (passive) SPACE RESEARCH (passive) US246		
50.4-51.4 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Mobile-satellite (Earth-to-space)			50.4-51.4 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE MOBILE-SATELLITE (Earth-to-space) G117	50.4-51.4 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE MOBILE-SATELLITE (Earth-to-space)	
51.4-52.6 FIXED MOBILE S5.547 S5.556			51.4-52.6 FIXED MOBILE		
52.6-54.25 EARTH EXPLORATION-SATELLITE (passive) SPACE RESEARCH (passive) S5.340 S5.556			52.6-54.25 EARTH EXPLORATION-SATELLITE (passive) SPACE RESEARCH (passive) US246		
54.25-55.78 EARTH EXPLORATION-SATELLITE (passive) INTER-SATELLITE S5.556A SPACE RESEARCH (passive) S5.556B			54.25-55.78 EARTH EXPLORATION-SATELLITE (passive) INTER-SATELLITE S5.556A SPACE RESEARCH (passive)		
55.78-56.9 EARTH EXPLORATION-SATELLITE (passive) FIXED S5.557A INTER-SATELLITE S5.556A MOBILE S5.558 SPACE RESEARCH (passive) S5.547 S5.557			55.78-56.9 EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE S5.556A MOBILE S5.558 SPACE RESEARCH (passive) US263 US353		
56.9-57 EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE S5.558A			56.9-57 EARTH EXPLORATION-SATELLITE (passive) FIXED	56.9-57 EARTH EXPLORATION-SATELLITE (passive) FIXED	

MOBILE S5.558 SPACE RESEARCH (passive) S5.547 S5.557	INTER-SATELLITE G128 MOBILE S5.558 SPACE RESEARCH (passive) US263	MOBILE S5.558 SPACE RESEARCH (passive) US263	
57-58.2 EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE S5.556A MOBILE S5.558 SPACE RESEARCH (passive) S5.547 S5.557	57-58.2 EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE S5.556A MOBILE S5.558 SPACE RESEARCH (passive) US263		RF Devices (15)
58.2-59 EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE SPACE RESEARCH (passive) S5.547 S5.556	58.2-59 EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE SPACE RESEARCH (passive) US353 US354		
59-59.3 EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE S5.556A MOBILE S5.558 RADIOLOCATION S5.559 SPACE RESEARCH (passive)	59-59.3 EARTH EXPLORATION-SATELLITE (passive) FIXED INTER-SATELLITE S5.556A MOBILE S5.558 RADIOLOCATION S5.559 SPACE RESEARCH (passive) US353	59-59.3 EARTH EXPLORATION-SATELLITE (passive) FIXED MOBILE S5.558 RADIOLOCATION S5.559 SPACE RESEARCH (passive) US353	
59.3-64 FIXED INTER-SATELLITE MOBILE S5.558 RADIOLOCATION S5.559 S5.138	59.3-64 FIXED INTER-SATELLITE MOBILE S5.558 RADIOLOCATION S5.559 S5.138 US353	59.3-64 FIXED MOBILE S5.558 RADIOLOCATION S5.559 S5.138 US353	RF Devices (15) ISM Equipment (18)
64-65 FIXED INTER-SATELLITE MOBILE except aeronautical mobile S5.547 S5.556	64-65 FIXED INTER-SATELLITE MOBILE except aeronautical mobile	64-65 FIXED MOBILE except aeronautical mobile	

International Table			United States Table		FCC Rule Part(s)
Region 1	Region 2	Region 3	Federal Government	Non-Federal Government	
65-66 EARTH EXPLORATION-SATELLITE FIXED INTER-SATELLITE MOBILE except aeronautical mobile SPACE RESEARCH S5.547			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	
66-71 INTER-SATELLITE MOBILE S5.553 S5.558 MOBILE-SATELLITE RADIONAVIGATION RADIONAVIGATION-SATELLITE S5.554			66-71 MOBILE S5.553 S5.558 MOBILE-SATELLITE RADIONAVIGATION RADIONAVIGATION-SATELLITE S5.554	66-71 INTER-SATELLITE MOBILE S5.553 S5.558 MOBILE-SATELLITE RADIONAVIGATION RADIONAVIGATION-SATELLITE S5.554	
71-74 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE MOBILE-SATELLITE (Earth-to-space) S5.149 S5.556			71-74 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE MOBILE-SATELLITE (Earth-to-space) US270		
74-75.5 FIXED FIXED-SATELLITE (Earth-to-space) MOBILE Space research (space-to-Earth)			74-75.5 FIXED FIXED-SATELLITE (Earth-to-space) US297 MOBILE		
75.5-76 AMATEUR AMATEUR-SATELLITE Space research (space-to-Earth)			75.5-76	75.5-76 AMATEUR AMATEUR-SATELLITE	Amateur (97)
76-81 RADIOLOCATION Amateur Amateur-satellite Space research (space-to-Earth)			76-81 RADIOLOCATION	76-77 RADIOLOCATION Amateur	RF Devices (15)
				77-77.5 RADIOLOCATION Amateur Amateur-satellite	Amateur (97)

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INTERNATIONAL FOOTNOTES

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I. New "S" Numbering Scheme

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S5.547 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 Resolutions 75 (WRC-2000) and 79 (WRC-2000)). 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, administrations should further take into account potential constraints to high-density applications in the fixed service, as appropriate (see Resolution 84 (WRC-2000)).

* * * * *

S5.557A In the band 55.78-56.26 GHz, in order to protect stations in the Earth exploration-satellite service (passive), the maximum power density delivered by a transmitter to the antenna of a fixed service station is limited to -26 dB(W/MHz).

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UNITED STATES (US) FOOTNOTES

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US246 No station shall be authorized to transmit in the following bands:
608-614 MHz, except for medical telemetry equipment[1],
1400-1427 MHz,
1660.5-1668.4 MHz,
2690-2700 MHz,
4990-5000 MHz,
10.68-10.7 GHz,
15.35-15.4 GHz,
23.6-24 GHz,
31.3-31.8 GHz,
50.2-50.4 GHz,
52.6-54.25 GHz,
86-92 GHz,
100-102 GHz,
105-116 GHz,
164-168 GHz,
182-185 GHz,
217-231 GHz.

* * * * *

[1] Medical telemetry equipment shall not cause harmful interference to radio astronomy operations in the band 608-614 MHz and shall be coordinated under the requirements found in 47 C.F.R. § 95.1119.

US263 In the bands 21.2-21.4 GHz, 22.21-22.5 GHz, 36-37 GHz, 56.26-58.2 GHz, 116-126 GHz, 150-151 GHz, 174.5-176.5 GHz, 200-202 GHz, and 235-238 GHz, the space research and the Earth exploration-satellite services shall not receive protection from the fixed and mobile services operating in accordance with the Table of Frequency Allocations.

* * * * *

US353 In the sub-bands 56.24-56.29 GHz, 58.422-58.472 GHz, 59.139-59.189 GHz, 59.566-59.616 GHz, 60.281-60.331 GHz, 60.41-60.46 GHz, and 62.461-62.511 GHz, space-based radio astronomy observations may be made on an unprotected basis.

US354 In the sub-band 58.422-58.472 GHz, airborne stations and space stations in the space-to-Earth direction shall not be authorized.

FEDERAL GOVERNMENT (G) FOOTNOTES

* * * * *

G128 Use of the band 56.9-57 GHz by inter-satellite systems is limited to transmissions between satellites in geostationary orbit, to transmissions between satellites in geostationary satellite orbit and those in high-Earth orbit, to transmissions from satellites in geostationary satellite orbit to those in low-Earth orbit, and to transmissions from non-geostationary satellites in high-Earth orbit to those in low-Earth orbit. For links between satellites in the geostationary satellite orbit, the single entry power flux-density at all altitudes from 0 km to 1000 km above the Earth's surface, for all conditions and for all methods of modulation, shall not exceed -147 dB ($W/m^2/100$ MHz) for all angles of arrival.

PART 15 – RADIO FREQUENCY DEVICES

3. The authority citation for Part 15 continues to read as follows:

Authority: 47 U.S.C. 154, 302, 303, 304, 307 and 544A.

4. Section 15.255 is amended by revising the section heading; by revising paragraphs (b), (b)(4), (c)(1), (d), and (e)(2); by revising the last sentence of paragraph (b)(2); by revising the note following paragraph (d); and by replacing paragraph (i).

§ 15.255 Operation within the band 57-64 GHz.

* * * * *

(b) Within the 57-64 GHz band, emission levels shall not exceed the following:

* * * * *

(2) * * * In addition, the average power density of any emission outside of the 61-61.5 GHz band, measured during the transmit interval, but still within the 57-64 GHz band, shall not exceed 9 nW/cm^2, as measured 3 meters from the radiating structure, and the peak power density of any emission shall not exceed 18 nW/cm^2, as measured three meters from the radiating structure.

* * * * *

(4) Peak power density shall be measured with an RF detector that has a detection bandwidth that encompasses the 57-64 GHz band and has a video bandwidth of at least 10 MHz, or using an equivalent measurement method.

* * * * *

(c) * * * * *

(1) The power density of any emissions outside the 57-64 GHz band shall consist solely of spurious emissions.

* * * * *

(d) Only spurious emissions and transmissions related to a publicly-accessible coordination channel, whose purpose is to coordinate operation between diverse transmitters with a view towards reducing the probability of interference throughout the 57-64 GHz band, are permitted in the 57-57.05 GHz band.

NOTE: The 57-57.05 GHz is reserved exclusively for a publicly-accessible coordination channel. The development of standards for this channel shall be performed pursuant to authorizations issued under part 5 of this chapter.

(e) * * * * *

(2) Peak transmitter output power shall be measured with an RF detector that has a detection bandwidth that encompasses the 57-64 GHz band and that has a video bandwidth of at least 10 MHz, or using an equivalent measurement method.

* * * * *

(i) For all transmissions that emanate from inside of a building, within any one second interval of signal transmission, each transmitter with a peak output power equal to or greater than 0.1 mW or a peak power density equal to or greater than 3 nW/cm^2, as measured 3 meters from the radiating structure, must transmit a transmitter identification at least once. Each application for equipment authorization for equipment that will be used inside of a building must declare that the equipment contains the required transmitter identification feature and must specify a method whereby interested parties can obtain sufficient information, at no cost, to enable them to fully detect and decode this transmitter identification information. Upon the completion of decoding, the transmitter identification data block must provide the following fields:

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Appendix B: List of Commenters

Comments (due 21SEP99):

The National Academies' Committee on Radio Frequencies ("CORF")
Fixed Wireless Communications Coalition ("FWCC")
Harmonix Corporation ("Harmonix")
Hewlett Packard Company ("HP")
International Microwave Power Institute ("IMPI")
KaStar Satellite Communications Corp., KaStarcom World Satellite, LLC and @Contact, LLC ("KaStar")
Lockheed Martin Corporation ("Lockheed")
Loral Space and Communications Ltd. and Globalstar, L.P. ("Loral/Globalstar")
Nokia Telecommunications, Inc. ("Nokia")

Reply Comments (due 06OCT99):

FWCC
GE American Communications, Inc. ("GE Americom")
Harmonix
License Exempt Spectrum Subcommittee ("LESS")
National Telecommunications and Information Administration ("NTIA"), late-filed on 08NOV99 (Fourth NTIA Letter)
Nokia
Satellite Industry Association ("SIA")

Ex Parte:

Nokia filed on 10FEB00
National Aeronautics and Space Administration ("NASA") (Remote Sensing Spectrum Manager, NASA Spectrum Management Office) e-mail received on 02AUG00
Fifth NTIA Letter filed on 27SEP00.