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

In the Matter of	)	
	)	
Wireless Operations in the 3650-3700 MHz Band	)	ET Docket No. 04-151
	)	
Rules for Wireless Broadband Services in the 3650-3700 MHz Band	)	WT Docket No. 05-96
	)	
Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band	)	ET Docket No. 02-380
	)	
Amendment of the Commission's Rules With Regard to the 3650-3700 MHz Government Transfer Band	)	ET Docket No. 98-237

REPORT AND ORDER
AND
MEMORANDUM OPINION AND ORDER

Adopted: March 10, 2005 **Released: March 16, 2005**

By the Commission: Chairman Powell, Commissioners Copps and Adelstein issuing separate statements.

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I. INTRODUCTION

1. By this Report and Order (Order), we adopt rules that provide for nationwide, non-exclusive, licensing of terrestrial operations, utilizing technology with a contention-based protocol, in the 3650-3700 MHz band (3650 MHz) band. We also adopt a streamlined licensing mechanism with minimal regulatory entry requirements that will encourage multiple entrants and stimulate the rapid expansion of wireless broadband services -- especially in rural America -- and will also serve as a safeguard to protect incumbent satellite earth stations from harmful interference. We establish licensing, service and technical rules that allow fixed and base-station-enabled mobile terrestrial operations. Finally, we maintain the existing Fixed Satellite Service (FSS) and Fixed Service (FS) allocations and modify the Mobile Service (MS) allocation to delete the restriction against mobile operations in the 3650 MHz band.[1] We also maintain the international/intercontinental operation requirements for FSS earth stations.

2. We affirm our belief that the 3650 MHz band is well-suited to respond to the needs expressed by the growing number of entrepreneurial wireless internet service providers (WISPs), that currently bring broadband services to consumers particularly those living in rural areas of the United States. Today, rural consumers often have fewer choices for broadband services than consumers in more populated areas. The licensing scheme that we adopt for this band will provide an opportunity for the introduction of a variety of new wireless broadband services and technologies, such as WiMax.[2] Furthermore, the actions we take herein for the 3650 MHz band will allow further deployment of

[1] The existing prohibition against aeronautical mobile operation is retained. *See* Table of Frequency Allocations, 47 C.F.R. § 2.106.

[2] The Wireless Microwave Access (WiMAX) Forum promotes the introduction or of new products and services using the IEEE 802.16 standard.

advanced telecommunications services and technologies to all Americans, especially in the rural heartland, thus promoting the objectives of Section 706 of the Telecommunications Act of 1996.[3]

3. In the Memorandum Opinion and Order (MO&O), we address several petitions for reconsideration and a motion for stay that were filed in response to the First Report and Order (3650 MHz *Allocation Order*) in ET Docket No. 98-237. We deny the petitions for reconsideration. We also deny the emergency motion for stay.

II. BACKGROUND

4. Historically, the 3650 MHz band was exclusive Federal Government spectrum allocated on a primary basis for radiolocation services and, later, was also allocated to the non-government radiolocation service on a secondary basis.[4] Subsequently, this band has been subject to a number of regulatory and statutory proceedings that we briefly recount here, and which are more fully described in the most recent Notice of Proposed Rulemaking on the 3650 MHz band preceding this order.[5]

5. In 1984, the Commission added a primary allocation in the 3650 MHz band for non-government FSS (space-to-Earth) operations, but adopted footnote US245 to restrict use of this FSS allocation "to international inter-continental systems . . . subject to case-by-case electromagnetic compatibility analysis."[6] In February 1995, the NTIA identified, pursuant to 1993 budget legislation, the 3650-3700 MHz band for transfer, effective January 1999, to mixed-use status, thus permitting Non-Government operations much more extensive than FSS earth stations.

6. In December 1998, in ET Docket No. 98-237, the Commission released a Notice of Proposed Rulemaking (*3650 MHz Allocation Notice*) proposing to allocate the 3650 MHz band to the non-government fixed service on a primary basis and tentatively concluding not to allocate the band to land mobile service.[7] In a companion Order (*FSS Application Freeze Order*), the Commission stated that it would no longer accept applications in the band for new FSS earth stations, major amendments to

[3] *See* Pub.L. 104-104, Title VII, § 706, Feb. 8, 1996, 110 Stat. 153, reproduced in the notes under 47 U.S.C. § 157 (*Section 706*). Section 706(c)(1) defines "advanced telecommunications capability . . . without regard to any transmission media or technology, as high-speed, switched, broadband telecommunications capability that enables users to originate and receive high-quality voice, data graphics, and video telecommunications using any technology." *See, generally,* Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, CC Docket 98-146, *Second Report*, FCC 00-290, (rel. Aug. 21, 2000) (*Section 706 Second Report*).

[4] Table of Frequency Allocations, 47 C.F.R. § 2.106, footnote US110.

[5] *See*, Unlicensed Operation in the Band 3650-3700 MHz; Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band; Amendment of the Commission's Rules With Regard to the 3650-3700 MHz Government Transfer Band, ET Docket Nos. 04-151, 02-380 and 98-237, *Notice of Proposed Rulemaking* (*Unlicensed Operation NPRM*, or *NPRM*), 19 FCC Rcd 7545 (2004), at ¶¶ 4 – 17.

[6] Table of Frequency Allocation, 47 C.F.R. § 2.106, footnote US245. *See also* Amendment of Part 2 of the Commission's Rules Regarding Implementation of the Final Acts of the World Administrative Radio Conference, Geneva, 1979, General Docket 80-739, *Second Report and Order*, FCC 83-511, 49 Fed. Reg. 2,357 (Jan. 19, 1984). In this Report and Order, the Commission also allocated the 5850-5925 MHz band to the FSS (Earth-to-space). The 3625-3700 MHz downlink segment and the 5850-5925 MHz uplink band are traditionally known as "extended C-band" (the 3700-4200 MHz downlink band and the 5925-6425 MHz uplink band are known as C- band).

[7] Amendment of the Commission's Rules with Regard to the 3650-3700 MHz Government Transfer Band, ET Docket No. 98-237, *Notice of Proposed Rule Making and Order*, 14 FCC Rcd 1295 (1998) (*3560 MHz Allocation Notice* and *FSS Allocation Freeze Order*, respectively).

pending FSS earth stations applications, or applications for major changes in existing FSS earth stations.[8] Subsequently, in May 2000, the Commission modified the freeze by allowing applications for new FSS earth stations and major modifications of existing FSS earth stations in the band if the proposed facilities were located within 10 miles or less of an existing grandfathered FSS site operating in the band.[9]

7. In October 2000, the Commission released a First Report and Order (*3650 MHz Allocation Order*) that allocated the 3650 MHz band to fixed and mobile (base station only) terrestrial services (FS and MS respectively) on a co-primary basis.[10] The *3650 MHz Allocation Order* grandfathered existing FSS earth stations on a primary basis, and established that any additional applications for primary earth stations had to be located within 10 miles of existing grandfathered sites and must be submitted prior to December 1, 2000. Pursuant to this grandfathering provision, additional FSS earth station operations could continue to be established in the future - but only on a secondary basis.[11] In addition, in the *3650 MHz Allocation Order*, the Commission deleted the government radiolocation allocation, but grandfathered the three existing government radiolocation sites that were a condition of the transfer.[12] All of the grandfathered primary sites are listed in Appendix E. Finally, the Commission deleted the unused government aeronautical radionavigation service (ground-based) allocation.[13]

8. Concurrently with adoption of the *3650 MHz Allocation Order*, the Commission adopted the *3650 MHz Service Rules Notice* seeking comment on licensing and service rules for fixed and mobile services.[14] In addition, the Commission sought comment on the feasibility of pairing the 3650 MHz band with the 4940-4990 MHz (4.9 GHz) band for mobile services and whether such a pairing would encourage synergies in the use of both portions of the spectrum.

9. In response to the *3650 MHz Allocation Order*, the Commission received four petitions for

[8] *Id.* at 1306 ¶ 14.

[9] *Memorandum Opinion and Order*, 15 FCC Rcd 9340 (2000) (*FSS Freeze MO&O*).

[10] *See* Amendment of the Commission's Rules With Regard to the 3650-3700 MHz Government Transfer Band; The 4.9 GHz Band Transferred from Federal Government Use, *First Report and Order and Second Notice of Proposed Rule Making*, ET Docket No. 98-237, WT Docket No. 00-32, 15 FCC Rcd 20488 (2000) (*3650 MHz Allocation Report & Order* and *3650 MHz Service Rules Notice*, respectively). The Commission's decision not to permit aeronautical mobile operations in the band is also consistent with the international allocation for the band.

[11] In the interim, the Commission has authorized four additional earth stations in the band on a primary basis by waiving the current secondary FSS allocation for new earth stations. New Skies Network, Inc. Request for Permanent Authority to Operate a Fixed Satellite Service Downlink Earth Station in the Extend C Band in the 3625-3700 MHz Band at Bristow, Virginia, Application File No. SES-LIC-20001130-02220 (E000696); Astrolink Request for Modification to its Existing Authority to Conduct Tracking, Telemetry, and Control Operations (TT&C) in the Extend C Band in Brewster, Washington, Application File No. SES-MOD-20011101-02077 (E000727); Lockheed Martin Request for Permanent Authority to Operate a Fixed Satellite Service Downlink Earth Station in the Extend C Band in the 3650-3700 MHz Band at Carpentersville, New Jersey), Application File No. SES-MOD-20001130-02268 (E7541); MCI WorldCom Network Services, Inc. requests for Permanent Authority to Operate a Fixed Satellite Service Downlink Earth Station in the Extend C Band in the 3625-3700 MHz at Yacolt, Washington, application File Nos. SES-MOD-19990820-01536 (KA323) and SES-MOD-19990820-01537 (KA221).

[12] *3650 MHz Allocation Order*, 15 FCC Rcd at 20503 ¶ 34-38. The three sites are St. Inigoes, MD, Pascagoula, MS and Pensacola, FL. *See* 47 C.F.R. § 2.106, US348.

[13] *3650 MHz Allocation Report & Order*, 15 FCC Rcd at 20506 ¶ 39.

[14] *See* n. 10, *supra*.

reconsideration and an emergency motion for stay.[15] These petitions, filed by parties representing FSS interests, challenge the decision to create a primary FS/MS allocation in the band, and to make non-grandfathered FSS earth stations secondary.[16] We address these petitions and the stay motion in the companion MO&O below.

10. In 2002, in the *4.9 GHz Order*, the Commission designated the 4.9 GHz band for exclusive public safety use and, thus, it is no longer available for commercial use.[17] Prior to this Order, the Commission had not taken any further action with respect to adopting licensing and service rules for the fixed and mobile service allocations in the 3650 MHz band.

11. In April 2004, the Commission released the Notice of Proposed Rulemaking (*Unlicensed Operation NPRM*, or *NPRM*) in the instant proceeding and proposed to allow the operation of unlicensed devices in the 3650 MHz band.[18] In the *NPRM*, we tentatively concluded that permitting unlicensed operation in the 3650 MHz band would foster the introduction of new and advanced services to the American public, especially in rural areas, and would result in a more efficient use of spectrum. We proposed to allow unlicensed devices to operate in this band with higher powers (up to 24 Watts EIRP) than typically allowed for Part 15 devices, and proposed requiring the use of smart/cognitive safeguards designed to avoid causing interference to licensed satellite services. We also sought comment on whether to restore a uniform primary allocation for all FSS earth stations in the band, and whether to delete the existing co-primary FS and MS allocations in this band - - - both as means to foster the development of new broadband services by unlicensed use in this spectrum.

12. Finally, the *NPRM* also sought comment on alternative options for providing licensed or a combination of unlicensed and licensed terrestrial services in this band. We asked whether it would be feasible for both FSS and FS licensed operations to share the band while still allowing for the operation of unlicensed devices. For example, one approach described in the *NPRM* would have split the band to allow separate spectrum for unlicensed devices and terrestrial licensed use in different segments, all in conjunction with FSS operations.

III. REPORT AND ORDER

13. In the *NPRM*, we found, among other things, that a growing number of WISPs are providing wireless broadband service in many areas where few alternatives are available. We observed that WISPs have expressed a clear need for additional spectrum for broadband use - - - including backhaul and subscriber connectivity - - - especially in rural areas. In light of the demonstrated need for additional spectrum for wireless broadband delivery, we concluded that the 3650 MHz band (with its grandfathered earth stations located mostly along the coasts[19]) appears to provide a unique opportunity to satisfy this demand. We tentatively concluded that permitting unlicensed devices to operate in the band would be the

[15] Petitions for Reconsideration were filed by: The Extended C-Band Ad Hoc Coalition, Echostar, Inmarsat Ltd., and Lockheed Martin Corp, all on December 18, 2000. The Extended C-Band Ad Hoc Coalition filed its Emergency Motion for Stay Pending Reconsideration on November 28, 2000.

[16] In the *Unlicensed Operation NPRM*, we deferred action on these petitions pending adoption of final rules regarding unlicensed operations in the 3650 MHz band and any resulting changes that might be made to the FSS/FS/MS allocations in this proceeding.

[17] *See* The 4.9 GHz Band Transferred from Federal Government Use, WT Docket No. 00-32, Second Report and Order and Further Notice of Proposed Rule Making (*4.9 GHz Order*), 17 FCC Rcd 3955 (2002).

[18] *See Unlicensed Operation NPRM*.

[19] The FSS earth station operations in the 3650-3700 MHz band are conducted in a receive-only mode. Many of these earth stations, however, also conduct transmit operations with paired frequencies in the 6 GHz FSS bands.

most beneficial approach, but also sought comment on alternative licensed approaches as well.

14. Over 100 parties reflecting a diverse range of opinion submitted responses to the *NPRM*. Broadly speaking, we received substantial confirmation that WISPs require additional spectrum for backhaul, especially in rural areas; and that it needs to be available with low upfront costs, and minimal burdens in order to be viable. However, a number of parties, including WISPs, express concern about the risk that intense use of spectrum by a variety of devices under a traditional unlicensed approach could result in mutual interference, thereby reducing the utility of this band. To address this concern, many WISPs suggest, for example, that we limit unlicensed use of the band to outdoor-only use. Commenters who support the development of community networks argue for low power unlicensed use of the band, with various techniques to encourage cooperative use of the spectrum such as the registration of high power fixed stations and the use of a "listen-before-talk" protocol built into equipment.[20] Many advocates of unlicensed access argue that a "first-in-time, first-in-rights" licensing or registration scheme would deny community networks the flexibility they need to deploy low power networks or high power backhaul stations, depending on the community's needs.[21] On the other hand, various corporate entities and industry trade groups prefer a licensed approach, in large part due to the enhanced quality of service that they argue would result from interference avoidance predictability and certainty under such an approach.[22] Some parties[23] also argue that the band should be made available for the introduction of new services and technologies, such as WiMax.[24] These parties support a range of options, including site-by-site licensing,[25] block licensing in small geographic areas,[26] and assignment by auction.[27] Finally, satellite interests express reservations about the *NPRM's* proposal to allow unlicensed operations due to their concern over interference protection issues.[28]

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[20] *See, e.g., ex parte* comments of Media Access Project, filed Jan. 31, 2005, and Champaign-Urbana Community Wireless Network/Southern California Tribal Digital Village (joint comments), filed Feb. 1, 2005.

[21] *Id.*

[22] API recommends that the Commission adopt an exclusive (rather than shared) use approach, pursuant to which applications for use of the spectrum would be subject to prior frequency coordination, and licensees would be protected against interference from other later-in-time licensees.

[23] *See, e.g.,* Intel comments.

[24] WiMAX technology, which is based on the IEEE 802.16 standard, would enable the wireless transmission of large amounts of information over long distances, including non-line of sight operations using a variety of bandwidths, that could enable a complete wireless solution for delivering high speed Internet access for businesses and residences. WiMAX could be used, for example, to backhaul information from WiFi "hot spots," which rely on the IEEE 802.11 standard, or enable the development of metropolitan area networks that provide last mile broadband access in competition with cable, DSL and T1 services. The standards process is ongoing with additional protocols under consideration that could provide the opportunity for WiMAX products to operate in this band.

[25] API and Comsearch favor this approach.

[26] For example, Motorola argues that the potential exists to utilize the band for wide-area mobile broadband services using some form of TDD technology and that consideration of unlicensed operations should be deferred until all licensed options are explored. Motorola recommends a licensing approach that includes block licensing in small geographic areas, and providing for secondary markets leasing, with exclusive use preferred over a 'commons model.'

[27] Some parties indicate that the approach to licensing should allow for aggregation via combinatorial auction and permit block sizing (e.g., two blocks of 20 megahertz and 30 megahertz per area). API believes that a Band Manager approach could be utilized to the extent that the Commission considers it appropriate or advisable to assign some or all of any licensed allocation in the 3650 MHz band on a geographic area basis by competitive bidding.

[28] SIA, in particular, raises concerns that a traditional Part 15 unlicensed regime under the technical criteria proposed in the *NPRM* would not provide sufficient protection from interference to its grandfathered earth stations.

15. The record clearly supports use of the 3650 MHz band for a variety of FS and MS operations. We conclude that it would serve the public interest to maintain primary FS and MS allocations and a secondary FSS allocation in the band and to devise a regulatory scheme that provides flexibility for a variety of new terrestrial uses. Further, the public interest is best served by establishing minimal regulatory barriers to encourage multiple entrants in the 3650 MHz band and to stimulate the rapid expansion of broadband services - - - especially in America's rural heartland. At the same time, we must ensure that incumbent grandfathered satellite earth stations and Federal Government radiolocation stations in this band are protected from harmful interference.

16. To accomplish these objectives, we conclude that new terrestrial operations in the band should be licensed on a nationwide, non-exclusive basis, with all licensees registering their fixed and base stations in a common data base. This streamlined licensing and registration process will provide additional spectrum to WISPs and other potential users suitable for backhaul and other broadband purposes such as community networks - - - at low entry costs and with minimal regulatory delay. While terrestrial licensees in this band will not have interference protection rights of primary, exclusive use licensees, the licensing scheme imposes on all licensees the mutual obligation to cooperate and avoid harmful interference to one another. To ensure efficient and cooperative shared use of the spectrum, we further require all terrestrial operations in the 3650 MHz band to use technology that includes a contention-based protocol. Such systems allow multiple users to share the same spectrum by defining the events that must occur when two or more devices attempt to simultaneously access the same channel and establishing rules by which each device is provided a reasonable opportunity to operate. Under this approach, terrestrial operations can operate in geographic areas of their own choosing and, because a contention-based protocol will control access to spectrum, terrestrial operations will avoid interference that could result from co-frequency operations. Interference caused by radiofrequency (RF) energy from a fixed or base station transmitter into a nearby fixed or base station received will be addressed by the process we adopt to register fixed and base stations so that they can operate at locations and with technical parameters that will minimize the potential for interference between stations. By requiring use of contention-based technologies, we conclude that we do not have to limit terrestrial operations to outdoor-only or adopt other limiting measures to address possible contention among these new operations. As discussed more fully below, we also conclude that a contention-based protocol will allow the band to be used for a variety of base-station-enabled mobile terrestrial operations, thus providing additional flexibility in the use of the band as many commenters requested.

17. Licensing and registration of terrestrial fixed and base stations will also enable them to be easily identified and located to ensure the protection of incumbent FSS earth stations and Federal Government radiolocation stations. Under the approach we adopt here, new terrestrial operations will have to protect satellite earth station receive-mode operations and Federal Government radiolocation stations in the 3650 MHz band in substantial areas of the country. To simplify this process, we are establishing protection zones around the grandfathered FSS earth stations, similar to the protection areas already designated around the grandfathered radiolocation stations. New terrestrial operations are to avoid operating within these zones, but we will allow new terrestrial operations to negotiate agreements with earth station operators for operations within these protection zones.[29] The technical requirements we place on fixed and mobile operations, along with our licensing/registration regime, should allow as much flexibility as technically possible at this point, and both prevent interference to the protected earth stations and facilitate the quick resolution of any interference issues that may arise.

[29] Our rules already allow operations within the 80 km zone around grandfathered radiolocation stations provided the stations are coordinated through the Commission-NTIA process. *See* 47 C.F.R. § 2.106, US348.

18. In short, the actions we take in this Order for the 3650 MHz band should facilitate the rapid deployment of advanced telecommunications services and technologies to all Americans, thus promoting the objectives of Section 706 of the Telecommunications Act of 1996.[30] We also believe that the 3650 MHz band provides an ideal setting to build on the current successes of WISPs in providing broadband service to users not otherwise served, and to respond to calls by the Federal Advisory Committee on *Diversity for Communications in the Digital Age* to increase the opportunity for new entrants, including minorities, in emerging technology sectors of the communications industry.[31]

A. Allocation Issues

19. *Background.* In the *NPRM*, we proposed, in conjunction with our proposal to allow unlicensed operations in the 3650 MHz band, to delete the FS and MS (base station only) allocations. We also sought comment on whether we should retain the FS and MS allocations for licensed operations, and whether we should remove the "base station only" limitation for the MS allocation. Further, we sought comment on whether we should segment the band between licensed and unlicensed use and whether we should pair band segments. Regarding the FSS allocation, we sought comment on whether we should modify the FSS allocation to allow new facilities on a co-primary basis, regardless of whether we decided to allow unlicensed or licensed use of the band. Nonetheless, we also proposed to retain the application of footnote US245 to the Table of Frequency Allocations, which restricts FSS use of the band to international intercontinental operations. We further sought comment on whether we should recast footnote US 245 as a new footnote for the 3650 MHz band (*e.g.*, as footnote NGxxx), without the requirement for case-by-case electromagnetic compatibility analysis.[32]

20. As we noted above, a significant number of WISPs favor use of the 3650 MHz band on an unlicensed basis. IEEE 802 believes that unlicensed use of the band would benefit by deleting the FS and MS allocations, limiting operations to fixed point-to-point, and retaining footnote US 245. The Coalition of C-Band Constituents asserts that only operations from fixed or stationary locations should be allowed to facilitate sharing with FSS earth stations. On the other hand, Intel and Motorola favor use of this band by wide area mobile or portable devices such as low cost, client devices (*e.g.*, mobile computers). API favors a site-by-site licensing approach for fixed and mobile services would have the advantage of

[30] *See* Pub.L. 104-104, Title VII, § 706, Feb. 8, 1996, 110 Stat. 153, reproduced in the notes under 47 U.S.C. § 157 (*Section 706*). Section 706(c)(1) defines "advanced telecommunications capability . . . without regard to any transmission media or technology, as high-speed, switched, broadband telecommunications capability that enables users to originate and receive high-quality voice, data graphics, and video telecommunications using any technology." *See, generally,* Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, CC Docket 98-146, *Second Report*, FCC 00-290, (rel. Aug. 21, 2000) (*Section 706 Second Report*).

[31] *See New Technologies Subcommittee Recommendations to the Federal Advisory Committee on Diversity for Communications in the Digital Age* (June 10, 2004). The Advisory Committee has recommended that the Commission increase the amount of spectrum that is set aside for unlicensed use (*e.g.*, adopt the proposals for unlicensed use in the 3650-3700 MHz band) and increase the power levels for unlicensed operations as a means to increase the opportunity for new entrants, including minorities, to develop communications services and products without having to secure a spectrum license. Although we are not increasing the amount of unlicensed spectrum in this Order as recommended by the Advisory Committee, we believe that our actions herein are consistent with the spirit of those recommendations. For example, the streamlined, non-exclusive licensing approach we adopt makes this spectrum available at low entry costs and with minimal regulatory delay. Furthermore, the approach adopted herein provides for higher operating powers and interference protection for such operations.

[32] We note that the electromagnetic compatibility analysis was required in this band for the purpose of sharing with the Federal Government radiolocation service, which, for the 3650 MHz band, is now covered by footnotes US348 and US349.

"allow[ing] access to the spectrum and entry into the market at a relatively low upfront cost." Finally, *SIA supports allowing new FSS earth stations in the band on a co-primary basis and deleting footnote* US245.

21. *Decision.* We maintain the existing FSS and FS allocations in the 3650 MHz band and modify the MS allocation to remove the "base station only" restriction. These allocations will ensure that the potential widespread use of the band by new terrestrial operations will not be impeded by the introduction of new co-primary FSS earth stations.[33] We also conclude that our decision to use nationwide, non-exclusive licensing for new terrestrial facilities will be easier to administer if we maintain the FSS allocation whereby new earth stations will have secondary status.[34] Further, the record supports deleting the "base station only" restriction for the MS allocation, and we discuss in detail below the types of mobile applications that will be permitted in this band.

22. As proposed in the *NPRM*, we retain the international/intercontinental operating requirement on FSS earth stations by deleting the reference in the Table of Allocations to footnote US 245 in the 3650 MHz band, and recasting it as a new 'NG' footnote specifically for the 3650 MHz band. As we noted in the *NPRM*, we conclude that deletion of this restriction could result in more extensive FSS use and further curtail the use of this band by terrestrial operations. Finally, by providing for streamlined licensing of terrestrial operations under the existing allocations in the 3650 MHz band, we resolve the questions posed in the *NPRM* regarding segmentation of the band. Among other benefits, the licensing approach we are adopting avoids splitting the band between licensed and unlicensed terrestrial operations, thus making the full 50-megahertz of spectrum in the 3650-3700 MHz band more attractive to potential service providers.

B. Licensing Provisions

23. *Background.* In the *Unlicensed NPRM*, the Commission sought comment on whether the spectrum should be licensed using geographical area licensing or site-by-site licensing.[35] With regard to geographic area licensing, the Commission sought comment on what size licensing areas should be employed and whether the spectrum should be divided into spectrum blocks.[36] The Commission specifically sought comment on whether the entire band, or the part to be licensed, should be licensed as one block of spectrum on a nationwide basis.[37] The Commission also sought to develop a record on the advantages of licensing this spectrum using site-by-site licensing.[38] The Commission noted that one advantage to this approach might be that it allows access to spectrum with relatively low upfront costs.[39]

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[33] In the *NPRM*, we also proposed to revise Section 15.250(a) by removing the restriction against unlicensed operations in the 3650-3700 MHz band. *See NPRM* at ¶ 58. In view of the streamlined licensing approach adopted herein for terrestrial operations, we maintain the restriction. Consequently, unlicensed devices will continue to be limited to spurious emissions only in this band.

[34] Prior coordination between co-primary services would be difficult to administer when all of the terrestrial stations would be of equal status regardless of when they begin operation.

[35] *See Unlicensed NPRM*, 19 FCC Rcd at 7569-7574 (¶¶ 76-96).

[36] *Id.* at 7571 (¶ 86).

[37] *Id.* at 7571-7572 (¶ 87).

[38] *Id.* at 7571-7572, 7574 (¶¶ 87, 94-95).

[39] *Id.* at 7574 (¶ 94).

24. In response, we received a number of comments proposing that access to the 3650 MHz band for wireless broadband services should be on a licensed basis.[40] Some commenters suggest that we should use small geographic licensing areas while others request nationwide licensing.[41] In addition, some commenters favor site-by-site licensing.[42] For instance, API states that site-by-site licensing allows "entities to license precisely the amount of spectrum that they need to cover their specific geographic areas of operations."[43] Some commenters who support an unlicensed approach object to a "first-in-time, first-in-rights" licensing approach, particularly for high power stations,[44] and some commenters suggest that the location and technical parameters of operation for unlicensed devices should be entered into a database readily accessible to all other users of the band as a way to identify potential sources of interference.[45]

25. *Discussion.* We conclude that allowing wireless providers access to the entire 3650 MHz band through a non-exclusive, nationwide licensing scheme that includes the registration of fixed and base stations, serves the public interest best. We base this conclusion on comments in the record which supported non-exclusive access to the band by multiple parties as well as on certain characteristics of this spectrum, including the need to protect grandfathered FSS earth station operations against harmful interference (which precludes ubiquitous use of this spectrum for other purposes throughout the United States, particularly in major population centers along much of the east and west coasts), the fact that this band offers no obvious pairing opportunities with other spectrum bands for duplex operations, and the comments in the record showing that this band is well suited for high power broadband operations using contention-based technologies, which allow multiple users to share spectrum in the same geographic area without interference.[46] We believe that this licensing approach will enable us to best provide for the introduction of a variety of new broadband services and technologies in the band.

26. The non-exclusive licensing approach we adopt here incorporates many of the characteristics of the shared use licensing method that we outlined in the *NPRM*. As we noted in the *Unlicensed NPRM*, one way to allow access to the 3650 MHz band for wireless services and operations is to use an approach similar to the licensing scheme used for the shared private land mobile radio (PLMR) frequencies.[47] Under this approach, multiple licensees operate on the same frequencies in the same geographic areas without having exclusive spectrum usage rights and interference protections. Our experience in the shared PLMR frequencies shows that non-exclusive use of frequencies can work well in some circumstances from an interference management perspective. Shared use in PLMR frequencies also allows for effective and efficient use of the spectrum and enables providers with limited resources access to spectrum for nominal application and licensing fees. We believe that adoption of a similar licensing scheme would be most appropriate for the 3650 MHz band.

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[40] *See, e.g.*, API Comments at 4; ITA Comments at 1; Intel Comments at 1; Motorola Comments at 3; Navini Comments at 3; SIA Reply Comments at 4.

[41] *See, e.g.*, Intel Comments at 2; Motorola Comments at 6.

[42] *See, e.g.*, API Comments at 7; Comsearch Comments at 13; SIA Reply Comments at 4.

[43] API Comments at 6.

[44] *See, e.g., ex parte* comments of Media Access Project, filed March 1, 2005; M.R. Rantanen, Tribal Digital Village/SCTCA, filed March 2, 2005; D.K. Irmiger, Trinity Health, filed March 2, 2005.

[45] *See, e.g., ex parte* comments of Media Access Project, filed Jan. 31, 2005; Coalition of C-Band Constituents Comments at 3; Comsearch Comments at 7.

[46] *See* ¶¶ 16-20, *supra.*

[47] *Unlicensed NPRM*, 19 FCC Rcd at 7574 (¶ 95).

27. We believe that a non-exclusive nationwide licensing scheme, coupled with a fixed and base station registration requirement, will ensure open access to this spectrum for nominal application fees and allow effective and efficient use of this spectrum in response to market forces. This will allow opportunities for rapid deployment of broadband technologies and will advance our goal of bringing broadband services to all Americans including consumers living in less densely populated rural and suburban areas. As the record indicates, we believe that the use of contention-based technologies will allow efficient use of this spectrum by multiple users without significant degradation of service. Thus, it is appropriate and in the public interest to have a licensing scheme that facilitates the sharing of this spectrum among multiple users. Such an approach will also allow licensees in this spectrum maximum flexibility to evolve their systems to meet uncertain future needs and requirements.

28. We wish to emphasize that the licensing requirements that we are adopting here for wireless operations in the 3650 MHz band are minimal in nature. The record in this proceeding indicates that service providers who typically operate on an unlicensed basis under our Part 15 rules are interested in using this spectrum for the development of wireless broadband services particularly in underserved and rural communities. We applaud these efforts and wish to encourage them. With this end in mind, and as discussed in further detail below, we are not imposing any eligibility restrictions other than the foreign ownership restriction imposed by statute. We also are not imposing any in-band or out-of-band spectrum aggregation limits. In short, this band will be open to all potential wireless service providers, including those with limited resources.

29. While the licensing and registration requirements we are adopting for wireless broadband operations in the 3650 MHz band are minimal in nature, it does provide benefits to licensees and the public. These requirements will ensure that all terrestrial wireless systems operating in the 3650 MHz band are identified, which will facilitate cooperation among users and ensure that the Commission can monitor the development and usage of this spectrum. While terrestrial licensees in this band will not have interference protection rights of primary, exclusive use licensees, the licensing scheme imposes on all licensees the mutual obligation to cooperate and avoid harmful interference to one another. [48] Should a licensee become aware of harmful interference, even if not intentionally caused, it must act in good faith to help eliminate the interference.[49] In addition, our licensing approach will protect grandfathered FSS earth station and Federal Government operations that will continue to operate in the band on a primary basis. In addition, under the licensing scheme we adopt today, two principal concerns identified by commenters -- the need for high power operations and the need to identify users operating in this band -- will be met.[50] Further, the licensing scheme we adopt will allow the Commission the opportunity to obtain contact information, should the need arise. We believe that site registration will facilitate voluntary interference avoidance and mitigation efforts among users and enable both the Commission and the public to monitor the intensity of spectrum usage in the band.

30. We recognize that some commenters have advocated exclusive licensing for the 3650 MHz band.[51] These commenters contend that exclusive licensing and interference protection are necessary to provide spectrum users with sufficient incentive to invest in the development of the band. However, we believe that on balance, the non-exclusive licensing approach adopted in this order, combined with

[48] The statute also prohibits willful or malicious interference, *see* 47 U.C.S. § 333, thus subjecting any party intentionally causing harmful interference to enforcement action.

[49] Interference avoidance also will be facilitated by the requirement that fixed and mobile stations employ a contention based protocol, as we discuss below.

[50] *See e.g.*, NYC Wireless Comments at 14; Tribal Digital Village Comments at 1; Coalition Comments at 1.

[51] *See, e.g.*, Intel comments at 1-2; Motorola comments at 2-3.

technical safeguards, is more suitable to the unique characteristics of this band.[52] Although a non-exclusive approach may require voluntary coordination efforts to avoid in-band terrestrial interference, the licensing regime we adopt herein obligates licensees to cooperate to avoid harmful interference, and makes the information necessary to conduct such coordination available via a site registration database. While commenters have also raised contention as an issue, the record indicates that this band is well-suited for high power broadband operations using contention-based technologies that facilitate sharing, and that provided entry barriers are low, parties are prepared to use these technologies to operate in the band on a non-exclusive basis. We believe that our licensing scheme and technical rules adopted herein will result in investments in this band. In addition, because of the limitations on the use of this band in coastal areas near FSS earth stations, and because of the lack of obvious pairing opportunities with other spectrum bands for duplex operations, much of the interest in development of the band is focused on smaller markets and less densely populated areas of the US where there is less likelihood of congestion and interference. Even in those larger markets that will be open for terrestrial use, we believe that licensees in the band will have the incentive to develop spectrum sharing practices based on the use of contention-based technologies that will promote efficient use of the band. In short, we believe that our decision strikes the best balance for all the competing interests in a manner that best serves the public interest.[53]

1. Nationwide Non-Exclusive Licensing

31. Each terrestrial licensee in the 3650 MHz band will have a non-exclusive nationwide license and be required to register its fixed and base stations.[54] The licensee will be allowed to register all of its fixed and base stations under one license. A non-exclusive nationwide wireless license does not authorize operation of a fixed or base station in this band until that station is registered. Each wireless licensee will be authorized to operate on all 50 megahertz of the 3650 MHz band on a co-primary basis with other wireless licensees, and there will be no spectrum aggregation limits. As a result, wireless licensee in the 3650 MHz band will be able to use as much of this spectrum as needed for their operations as long as they comply with all applicable licensing, service, and operating rules.[55] All wireless licensees in the 3650 MHz band will have equal rights to the use of this spectrum (*i.e.*, no priority for first-in users), but all these licensees will have a mutual obligation to cooperate and avoid harmful interference to each another.

32. Applicant qualification for non-exclusive nationwide wireless licenses in the 3650 MHz band will be assessed in accordance with FCC Form 601 and Commission rules.[56] There will be no limit to the

[52] We note that other bands, such as the 2500-2690 MHz band, are available for the development of new broadband services under an exclusive rights licensing regime. *See* Amendment of Parts 1, 21, 73, 74 and 101 of the Commission's Rules to Facilitate the Provision of Fixed and Mobile Broadband Access, Educational and Other Advanced Services in the 2150-2162 and 2500-2690 MHz Bands, WT Docket No. 03-66, *Report and Order and Further Notice of Proposed Rulemaking*, 19 FCC Rcd 14165 (2004).

[53] *See also* discussion in para. 45, *infra.*

[54] As we discuss below, mobile and portable stations that operate with a peak EIRP of 1 Watt/25 megahertz and receive and decode an enabling signal from a base station are not required to be registered. Consistent with that approach, mobile stations used in a fixed mode need not be registered as fixed stations so long as they meet the same requirements as mobile stations because the power limitation and operation within close proximity of a registered station will be adequate to protect grandfathered stations from interference.

[55] This is similar to the approach we took in the 4.9 GHz proceeding, where licensees are authorized to operate on any spectrum within the fifty megahertz band, but must follow a spectrum utilization plan. *See* In the Matter of the 4.9 GHz Band Transferred from Federal Government Use, *Memorandum Opinion and Order and Third Report and Order*, WT Docket No. 00-32, 18 FCC Rcd 9152, 9167-69 (2003) (*4.9 GHz Third R&O*).

[56] 47 C.F.R. §§ 1.913-1.917. FCC Form 601 - *Application for Authorization in the Wireless Radio Service.*

number of non-exclusive nationwide wireless licenses that may be granted for this spectrum, and these licenses will serve as a prerequisite for registering individual fixed or base stations. We note that registration process is simple and streamlined.[57] It will be done electronically.[58] The initial filing date for these wireless licenses, along with directions on how to use the Universal Licensing System (ULS), will be announced in a future Wireless Telecommunications Bureau (WTB) Public Notice. We note that in order to keep the ULS licensing and registration data base accurate and up-to-date, we delegate to the WTB the authority to adopt rules regarding the reporting of data base information including reporting of any license or station transfers. The WTB will issue a Public Notice seeking comment on these issues, if needed.

2. Other Licensing Provisions

33. The *3650 MHz Service Rules NPRM* sought comment on licensing, operating and service rules related to wireless operations in the 3650 MHz band.[59] In our subsequent *Unlicensed NPRM*, we sought to refresh the record on these issues.[60] Below we address these issues in terms of how they relate to the non-exclusive nationwide licensing scheme with fixed and base station registration provisions that we have adopted for this spectrum.

34. *Rule Part and Regulatory Status.* The *3650 MHz Service Rules NPRM* sought comment on the rule part that should be utilized to govern wireless operations and services in the 3650 MHz band and noted that wireless broadband service licensees in the 3650 MHz band could be subject to other rule parts depending on the types of operations and services that they offered.[61] The Commission stated that it would be necessary to modify whatever rule part was chosen to reflect the particular characteristics and circumstances of this spectrum and the services that could be offered in this spectrum. This observation was supported by commenters.[62] The *3650 MHz Service Rules NPRM* also sought comment on how the Commission should fulfill its enforcement obligations and ensure compliance with the requirements of the Communications Act.[63]

35. Upon consideration of the record and given the non-exclusive nationwide nature of the licenses we are creating in the 3650 MHz band, we will place the licensing, service, and operation provisions for this spectrum in Part 90 of our rules.[64] This rule part contains licensing, service and operating provisions for the PLMR services, including services that operate on certain frequencies on a

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[57] Applicants will be required to provide information necessary for identification and location of fixed and base stations (*e.g.*, latitude and longitude) and technical information on the station's operation to facilitate interference analysis (*e.g.*, bandwidth, frequency and antenna characteristics).

[58] Pursuant to Section 1.913(d) of the Commissions Rules certain categories of applicants are permitted to file their license applications manually. We urge, however, all applicants to file electronically using ULS because "[l]icensees who continue to file applications manually risk dismissal of their applications for routine errors." *See* Wireless Telecommunications Bureau Revises and Begins Phased Implementation of its Unified Policy for Reviewing License Applications and Pleadings, *Public Notice*, 14 FCC Rcd 11182, 11186 (WTB 1999).

[59] *See 3650 MHz Service Rules NPRM*, 15 FCC Rcd at 20505-20539 (¶¶ 40-133).

[60] *See Unlicensed NPRM*, 19 FCC Rcd at 7571,7574 (¶¶ 86, 96).

[61] *See 3650 MHz Service Rules NPRM*, 15 FCC Rcd at 20508-20509 (¶¶ 45-47).

[62] *See, e.g.*, Global Comments in ET Docket No. 98-237 in response to the *3650 MHz Service Rules NPRM* at 2 (housekeeping revisions will be needed in order to accommodate new devices in this band).

[63] *3650 MHz Service Rules NPRM*, 15 FCC Rcd at 20509-20511 (¶¶ 50-53).

[64] 47 C.F.R. Part 90.

shared use basis.[65] As with wireless services in the 3650 MHz band, this means that multiple licensees in these shared use bands operate on the same frequencies in the same geographic areas without exclusive spectrum usage rights and interference protections.[66] We are creating a new subpart under Part 90 that will be entitled 3650 MHz Wireless Broadband Services.

36. Licensees in the 3650 MHz band may provide services on a common carrier or non-common carrier basis[67] and will have flexibility to designate their regulatory status based on any services they choose to provide.[68] Such an approach will provide them with the greatest flexibility to use the spectrum for service applications that are best suited for their needs.[69] In other words, wireless licensees in the 3650 MHz band will be able to provide all allowable services anywhere within their service area at any time, consistent with whatever regulatory status they choose. We believe that this approach is likely to achieve efficiencies in administrative process and provide flexibility to the marketplace.

37. While wireless licensees in the 3650 MHz band will be subject to specific licensing and operating provisions adopted in this order, other rules may also apply to these licensees depending on the type of the service they provide. For instance, if a wireless licensee provides Commercial Mobile Radio Services (CMRS), which makes the licensee a common carrier, other obligations attach as a result of that decision under Title II of the Communications Act or the Commission's rules (*e.g.*, universal service, CALEA).[70]

38. *Spectrum Aggregation Limits, Eligibility, and Foreign Ownership Restrictions.* The *3650 MHz Service Rules NPRM* did not propose any in-band or out-of-band spectrum aggregation limits nor did it propose any eligibility restrictions on who can acquire a wireless license for this spectrum, other then the statutory foreign ownership restrictions.[71] These proposals are consistent with the non-exclusive nature of the wireless licensing scheme we are adopting for the 3650 MHz band. As a result, we will not impose any spectrum aggregation limits, either in-band or out-of-band, or eligibility restrictions other

[65] 47 C.F.R. § 90.173(a).

[66] *Id.*

[67] Regulatory status as a common carrier or non-common carrier depends on the services provided pursuant to the Communications Act, not the issuance of a license or authorization by the Commission. Generally, common carriers are telecommunications providers (*i.e.*, an entity that holds itself out for hire indiscriminately for the purposes of carrying transmissions provided by the customer) in so far as it provides telecommunications services (*i.e.*, the transmission of information of the user's choosing without change in the form or content of the information). *See* 47 U.S.C. § 153. This means that a non-common carrier does not hold itself out for hire indiscriminately for the purposes of carrying transmissions provided by the customer.

[68] We note that applicants may request common carrier status as well as non-common carrier status for authorization in a single license. *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 Local Multipoint Distribution Service and for Fixed Satellite Services, CC Docket No. 92-297, *Second Report and Order, Order on Reconsideration, and Fifth Notice of Proposed Rulemaking*, 12 FCC Rcd 12545, 12636-38 (¶¶ 205-208), 12644-45 (¶¶ 225-226), 12652-53 (¶¶ 245-251) (1997) (*LMDS Second Report and Order*); *aff'd, Melcher v. FCC*, 134 F.3d 1143 (D.C. Cir. 1998).

[69] *See* Rural Carriers Comments in ET Docket No. 98-237 in response to the *3650 MHz Service Rules NPRM* at 4-5.

[70] 47 C.F.R. Part 20. In addition, certain rules may be applicable generally to all wireless services. *See, e.g.*, 47 C.F.R. Part 1, 17 (provisions implementing NEPA, antenna structure registration requirements).

[71] *3650 MHz Service Rules NPRM*, 15 FCC Rcd at 20512-20516 (¶¶ 57-63).

than the statutory foreign ownership restrictions.[72] All potential wireless service providers will have equal access to this band. We believe that opening this spectrum to as wide a range of applicants as possible will encourage new entry and investment as well as entrepreneurial efforts to develop new technologies and services, while helping to ensure efficient spectrum use. We further believe that this approach will promote economic opportunity and competition in the subject bands.

39. *License Term and Renewal Expectancy.* The *3650 MHz Service Rules NPRM* sought comment on a 10-year license term for wireless licenses in the 3650 MHz band and the standard that should be used for granting a renewal of that license.[73] Certain commenters supported a 10-year license term.[74] We agree with these commenters and conclude that it is in the public interest to adopt a 10-year license term. Our action is consistent with license terms adopted for other services including certain services in Part 90.[75] A ten year license term will provide regulatory certainty and encourage investments in the band. At the end of 10 years, licensees will be required through ULS to renew their non-exclusive nationwide license for wireless operations in the 3650 MHz band. Since there is no limit on the number of wireless licenses that will be granted for the 3650 MHz band, existing licensees can expect to receive license renewals as long as they are in compliance with the Commission's rules. In addition, renewal of a non-exclusive nationwide license will automatically renew registration of all fixed and base stations associated with that license.

40. *Performance Requirements.* The *3650 MHz Service Rules NPRM* sought comment on whether wireless licensees in the 3650 MHz band should be subject to any performance or build-out requirements.[76] Build-out in this band will be driven by market demand and the ability to meet this demand will not be restricted by a limited number of wireless licenses or an exclusive licensing structure. As a result, there is no need to impose a performance or build-out requirement. Any interested party is free to meet this demand at any time, as long as it has a valid wireless license, registers its fixed and base stations, and complies with other applicable rules. Although we do not impose a performance requirement, we will require that licensees delete registrations for unused fixed and base stations in order to maintain database integrity and facilitate efficient coordination between licensees.

41. *Disaggregation, Partitioning, and Secondary Markets.* The *3650 MHz Service Rules NPRM* sought comment on whether wireless licensees in the 3650 MHz band should be able to partition their own service areas and disaggregate their respective spectrum.[77] Typically, wireless licensees with exclusive licensing areas are permitted to partition and disaggregate[78] and commenters supported

[72] Sections 310(a) and 310(b) of the Communications Act, as modified by the Telecommunications Act of 1996, impose foreign ownership and citizenship requirements that restrict the issuance of licenses to certain applicants. 47 U.S.C. § 310(a), (b). We note that under the Act, an applicant requesting authorization for services other than broadcast, common carrier, aeronautical en route, or aeronautical fixed services would be subject to only section 310(a), which states "[t]he station license required under this Act shall not be granted to or held by any foreign government or the representative thereof." 47 U.S.C. § 310(a).

[73] *Id.* at 20518-20520 (¶¶ 72-74).

[74] *See, e.g.*, Rural Carriers Reply Comments in ET Docket No. 98-237 in response to the *3650 MHz Service Rules NPRM* at 4.

[75] *See, e.g.*, 47 C.F.R § 90.149.

[76] *3650 MHz Service Rules NPRM*, 15 FCC Rcd at 20522-20525 (¶¶ 82-88).

[77] *Id.* at 20519-20523 (¶¶ 75-81).

[78] *See, e.g*, 47 C.F.R. § 27.15.

allowing wireless licensees in the 3650 MHz band to be able to take advantage of these provisions.[79]

42. We note that the use of partitioning and disaggregation is pertinent in geographic licensing settings where the licensee has *exclusive* use of a particular area. In the exclusive licensing context, partitioning and disaggregation encourage spectrum efficiency by enabling licensees to transfer or assign *portions of their spectrum holdings to other users that the licensee does not intend to use.*[80] Such mechanisms are unnecessary in this case because no licensee will hold exclusive rights to the spectrum, and any interested party may apply at any time for a license in the band regardless of the presence of other licensees in the geographic area were it intends to use the spectrum. Our decision, therefore, to license the 3650 MHz band for wireless services on a non-exclusive nationwide basis obviates the need to adopt partitioning and disaggregation provisions. Wireless licensees in the 3650 MHz band, however, may assign or transfer their non-exclusive nationwide licenses with all the fixed and base stations registered under those licenses.[81] We note that a licensee can transfer affixed or base station registered under its non-exclusive nationwide license to another non-exclusive nationwide licensee so long as the first licensee deletes the registered fixed or base station from its license and the second licensee registers the station under its license.

43. For similar reasons, we need not make our spectrum leasing rules applicable to wireless licensees in the 3650 MHz band. The non-exclusive licensing scheme we employ here, coupled with the required use by all licensees of contention-based technology, permits a high degree of access and spectrum re-use in these bands by multiple users, while minimizing the likelihood of harmful interference. Accordingly, the spectrum leasing arrangements described in the *Secondary Markets Report and Order* are not applicable,[82] and we do not see a need to apply those spectrum leasing rules and policies to this spectrum at this time.

3. Statutory Compliance for Licensing Approach

44. Our decision herein to adopt a licensing scheme that avoids mutual exclusivity comports with the competitive bidding approach set forth in the Commission's Balanced Budget Act proceeding. In the *BBA Report and Order*, the Commission established a framework for exercise of the Commission's auction authority, as expanded by the Balanced Budget Act.[83] The *BBA Report and Order* affirmed that, in identifying which classes of licenses should be subject to competitive bidding, the Commission must pursue the public interest objectives set forth in Section 309(j)(3).[84] Although Balanced Budget Act did not amend Section 309(j)(3)'s directive to consider certain public interest objectives in identifying classes

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[79] *See, e.g.*, Comments in ET Docket No. 98-237 in response to the *3650 MHz Service Rules NPRM*, including ATG Comments at 6; Global Comments at 5-6; Rural Carriers Reply Comments at 4.

[80] *See* In the Matter of Geographic Partitioning and Spectrum Disaggregation by Commercial Mobile Radio Services Licenses, *Report and Order and Further Notice of Proposed Rulemaking*, WT Docket No. 96-148, 11 FCC Rcd 21831, 21843 (1996) (*Partitioning and Disaggregation Report and Order).*

[81] *See* FCC Form 603.

[82] *See* In the Matter of Promoting Efficient Use of Spectrum through Elimination of Barriers to the Development of Secondary Markets, *Report and Order and Further Notice of Proposed Rulemaking*, WT Docket No. 00-230, 18 FCC Rcd 20604, 20643-44 (2003) (*Secondary Markets Report and Order)* (spectrum leasing policies apply to services in which licensees hold exclusive use rights with respect to the spectrum).

[83] *See* Implementation of Section 309(j) and 337 of the Communications Act of 1934 as Amended, *Report and Order and Further Notice of Proposed Rulemaking*, WT Dcoket No. 99-87, 15 FCC Rcd 22709, 22718-22723 (2000) (*BBA Report and Order).*

[84] *Id.*

of licenses and permits to be issued by competitive bidding,[85] pursuant to that statute, Section 309(j)(1) did include a reference to the Commission's obligation to avoid mutual exclusivity under Section 309(j)(6)(E), which directs the Commission to use engineering solutions, negotiation, threshold qualifications, service regulations, or other means to avoid mutual exclusivity where it is in the public interest to do so.[86] Accordingly, the *BBA Report and Order* affirmed that the Commission has a continuing obligation to attempt to avoid mutual exclusivity by the methods prescribed in Section 309(j)(6) only when doing so furthers the public interest goals set forth in Section 309(j)(3).[87]

45. As a general matter, in determining whether to assign licenses through the use of competitive bidding, the Commission consistently has concluded that its obligation to avoid mutual exclusivity does not preclude it from adopting licensing processes in the non-exempt services that result in the filing of mutually exclusive applications where it determines that such an approach would serve the public interest.[88] In adopting the appropriate licensing scheme for any particular spectrum band, the Commission has interpreted its statutory obligation in a manner consistent with the opinion of the U.S. Court of Appeals for the D.C. Circuit which stated, "Section 309(j)(6)(E) imposes an obligation only to minimize mutual exclusivity 'in the public interest' and 'within the framework of existing policies.'"[89] Our decision regarding the appropriate licensing scheme for this particular spectrum centers around the unique characteristics of the 3650-3700 MHz band, including the need to protect grandfathered FSS earth station operations against harmful interference, the lack of pairing opportunities with other spectrum bands limiting the possibility of duplex operations, and the goal of enabling multiple users to share spectrum in the same geographic area without interference through the use of contention based technologies. As the record reflects, this band is well suited for high power broadband operations through such technology, and this approach is therefore likely to lead to the introduction of new and innovative broadband services in this band.[90] With respect to the 3650 MHz band, as discussed fully above, we have determined that it serves the public interest and the Commission's policy objectives to promote the rapid deployment of broadband services to assign non-exclusive nationwide licenses for the use of this spectrum. Insofar as this licensing scheme will not result in mutual exclusivity, the use of competitive bidding is not required.[91]

C. Technical Requirements

46. *Background.* In the *Unlicensed Operation NPRM*, we proposed to permit fixed unlicensed devices to operate with a maximum EIRP of 25 Watts.[92] In order to protect incumbent FSS earth stations, we proposed to prohibit the operation of fixed unlicensed devices within a keyhole-shaped protection zone derived using standard propagation models.[93] Furthermore, in order to ensure that fixed unlicensed

[85] *See* 47 U.S.C. §§ 309(j)(3).

[86] *See* 47 U.S.C. §§ 309(j)(1), 309(j)(6)(E).

[87] *See BBA Report and Order*, 15 FCC Rcd at 22718-22723.

[88] *Id.*

[89] *See Benkleman Telephone Co. et al v. FCC*, 220 F.3d 601,606 (D.C. Cir. 2000), *petition for rehearing on other grounds pending* (citing *DIRECTV, Inc. v. FCC*, 110 F.3d 816, 828 (D.C. Cir. 1997)).

[90] *See* paras 24-25, *supra.*

[91] Because we are not utilizing competitive bidding to assign licenses in this band, we have no need to address the various competitive bidding related issues that were raised in the Service Rules NPRM. *See also* discussion in para. 30, *supra.*

[92] *See Unlicensed Operation NPRM* at ¶ 43.

[93] *Id.* at ¶ 46.

devices were established outside these protection zones and operated in a manner that would avoid causing interference to FSS earth stations, we proposed to require that a professional install such devices.[94] We also tentatively concluded that fixed unlicensed devices should not be prohibited from using any particular type of antenna, provided that devices using sectorized, scanning spot-beam, or other antenna types with multiple beam capability would be required to limit the EIRP in any direction to no more than 25 Watts.[95] With regard to non-fixed unlicensed devices, we noted that the challenge of protecting satellite earth stations is more complex because a non-fixed device would not be limited to a single location, but may move around from one site to another.[96] Consequently, in order to protect the FSS and Federal Government operations in the 3650 MHz band, we proposed that non-fixed unlicensed devices be limited to a peak EIRP of 1 Watt.[97] Furthermore, we proposed that non-fixed devices be required to employ a DFS-like, listen-before-talk mechanism that would prohibit transmission when in proximity to a satellite earth station.[98] We also sought comment on whether a mobile station should listen for a dedicated beacon signal emanating from the earth station, have the cognitive capability to detect the absence or presence of the beacon signal, and make decisions on whether to transmit.[99] We tentatively concluded that these proposals should allow for most types of unlicensed use and, along with the other limitations discussed in the *NPRM*, afford adequate protection for FSS and Federal Government operations.

47. *Discussion.* In arriving at the technical criteria that we adopt here, we strike a balance among a number of competing factors in a manner that we conclude will best serve the public interest and foster the expeditious introduction of new terrestrial services in the 3650 MHz band. Of primary significance, we are mindful of the necessity to provide adequate interference protection to grandfathered FSS earth stations and Federal Government radiolocation stations operating in the band. In addition, we recognize the desirability of dealing with one of the predominant concerns expressed by a number of commenters - - - namely that unbridled terrestrial operations could result in levels of mutual interference that would impede efficient use of the spectrum. These two key factors, among others, lead us to consider the interplay between both *inter*-service (FS/MS with respect to FSS) as well as *intra*-service (mutual FS or MS) interference avoidance scenarios. Thus, our goal is to adopt criteria that will adequately protect grandfathered FSS and Federal Government stations, but at the same time, will also provide sufficient operating power and flexibility to make terrestrial operations an attractive proposition for potential service providers.

48. In broad terms, therefore, and as discussed more fully below, we adopt the same magnitude of power limits for terrestrial operations proposed in the *NPRM*, but qualify the limit in terms of power

[94] *Id.* at ¶ 41

[95] *Id.* at ¶ 44

[96] *Id.* at ¶ 48.

[97] *Id.* at ¶ 49. We noted that handheld unlicensed devices in the 2.4 GHz and 5.8 GHz bands normally operate well below the maximum of 1 Watt due to battery power limitations and human exposure to RF radiation limitations.

[98] DFS refers to dynamic frequency selection. As the literal meaning implies, a DFS signal threshold is often used to trigger a change in operating frequency by a transmitter to avoid causing interference. In this case, however, a signal threshold would be detected in a similar manner to DFS circuitry but used, instead, to adjust the EIRP of the unlicensed device. This approach is similar to that used to protect government radar systems in the 5 GHz band from unlicensed devices. *See Report and Order* in ET Docket No. 03-122, 69 Fed. Reg. 2677 (2004). We note that National Telecommunications and Information Administration (NTIA), FCC, National Aeronautical and Space Administration (NASA) and Department of Defense (DoD), along with input from the industry, worked to develop acceptable sharing conditions between unlicensed devices in the 5 GHz band and the sensitive government installations. *See Unlicensed Operation NPRM* at ¶ 50, n. 70.

[99] *See Unlicensed Operations NPRM* at ¶ 71.

density over a bandwidth. We conclude that FSS protection zones that are somewhat modified from those proposed in the *NPRM* remain a viable tool for avoiding interference scenarios that might arise from FS/MS operations. We also conclude that mobile terrestrial operations can be accommodated while protecting grandfathered FSS and Federal Government stations so long as such operation is enabled by transmissions from a nearby fixed or base station. We also conclude that technologies using a contention-based protocol are available that control access to spectrum and thereby mitigate the possibility of interference that could result from co-frequency operation of fixed and mobile stations, particularly in congested operating environments. In that connection, we adopt equipment certification provisions to ensure that both fixed and mobile stations incorporate the requisite contention-based technologies. Interference caused by radiofrequency (RF) energy from a fixed or base station transmitter into a nearby fixed or base station received will be addressed by the process we adopt to register fixed and base stations so that they can operate at locations and with technical parameters that will minimize the potential for interference between stations. We adopt out-of-band emission limits for terrestrial operations and specify criteria for operations in proximity to Canadian and Mexican borders. Finally, we retain the same 80 km coordination zone already established in the rules for the protection of the three grandfathered Federal Government stations operating in the band.

49. We will leave it up to the industry to determine flexible and efficient methods for meeting the technical requirements we adopt herein. In particular, the industry will need to address issues such as contention-based protocols and base-station enabled mobile operations.

50. *Fixed Station Operating Power.* In the *NPRM*, we proposed an EIRP limit of 25 Watts for fixed stations operating in the 3650 MHz band. We adopt a *peak* power limit, expressed as a power density, of 25 Watts per 25 megahertz bandwidth.[100] We adopt this limit for the following reasons. First, we note that the majority of commenters generally support the use of 25 watts for fixed operations. Additionally, we note that the potential for a system to cause interference is related to bandwidth in addition to power. In this respect, we recognize that different systems operating in the 3650-3700 MHz band may utilize various operating bandwidths.[101] Consequently, we believe that EIRP limits should be specified not simply as a maximum power, but rather in terms of power density (*i.e.*, power per unit of occupied bandwidth). By specifying our power limit in this way, protection of FSS earth stations is simplified because a single separation distance can be specified regardless of the bandwidth used. For example, a system using a bandwidth of 25 megahertz may use the full 25 Watts peak EIRP, but a system using only 1 megahertz bandwidth may only use 1 watt peak EIRP; in either case, the power density is equivalent. If we did not specify the EIRP limit in this manner, the 1 megahertz system could use the full 25 watts and consequently because all the power would be concentrated in a relatively small bandwidth, the separation distance necessary to protect FSS earth stations would be much larger than for a system with 25 megahertz bandwidth.[102] Therefore, we adopt a fixed station peak power density of 25 Watts EIRP in any 25 megahertz band. Furthermore, to promote additional flexibility in system design, any combination of transmitter output power and antenna gain will be permitted, so long as the peak 25

[100] We note that, at frequency ranges above one-gigahertz, a power density measurement bandwidth of one-megahertz would typically be specified. Consistent with that practice, and the intent of the rules adopted here, the maximum peak power density in any one-megahertz slice of spectrum in this band shall not exceed 1 Watt.

[101] For example, the Wi-Max standard specifies various bandwidths.

[102] For free space propagation, distance is proportional to the square of the distance or in terms of decibels distance doubles for each additional 6 dB of power. Because 25 watts is 14 dB more than 1 watt (*i.e.*, $10\log_{10}25=14$), a system operating with 25 watts over 1 megahertz of bandwidth would have the ability to successfully operate over distances approximately five times larger than a system that spreads 25 watts of power over 25 megahertz of bandwidth.

Watt/25 megahertz EIRP limit is not exceeded.[103] We believe that the power density requirement we adopt here facilitates our goal of ensuring efficient use of the band. As detailed below, this limit results in reasonably sized protection zones around FSS earth stations[104] to maximize the area in which terrestrial licensees can operate while also providing enough power for these terrestrial operations to operate over sufficient ranges to provide service to a large number of users.

51. *Mobile station operations.* Mobile operations, including mobile-to-mobile, will be permitted under the rules we adopt in this Order. We are mindful, however, that mobile operations pose a greater risk of causing interference to FSS earth stations than fixed stations. In the NPRM we sought comment on a variety of ways that a mobile device could operate in the band without causing harmful interference to grandfather incumbent stations. Many commenters found the suggestions in the NPRM, such as the beacon signal, complex and impracticable.[105] Others suggested having mobile devices rely on a signal from a fixed or base station as a simpler method to implement.[106] Based on the record, we conclude that, before it can transmit, a mobile station (including those operating in mobile-to-mobile mode) will be required to positively receive and decode an enabling signal transmitted by a base station.[107] Thus, mere spurious emissions from other RF sources, such as another mobile transmitter, cannot enable a mobile to transmit. We believe that this approach will ensure that spurious emissions from nearby devices will not inadvertently trigger the transmit ability of a mobile station. Furthermore, this approach will ensure that any mobile station will be within a reasonable distance of a base station[108] and, thus, far from an FSS earth station (or federal government station) before it can transmit. As noted above the rules we adopt will also allow for mobile-to-mobile operations. For example, a subscriber can place several devices upon its premises and use the 3650 MHz band to network them together as long as each device is within range of a fixed or base station. Beyond the basic requirement for the use of base station trigger, we conclude that we should not adopt additional rigid requirements regarding the characteristics of the signal needed to trigger mobile transmissions (*e.g.*, signal level and content). Instead, we will leave it up to the industry to determine flexible and efficient methods for meeting this requirement.[109] We note, however, that meeting this requirement should not pose any undue burden upon manufactures as much equipment deployed today already incorporates a similar mechanism. For example, the receiver in a Wi-Fi device or a cellular telephone scans for an available network and, upon locating a network, the device "handshakes" and authenticates on that network in order to have the proper permission to transmit.

[103] Because interference potential is directly related to a device's EIRP density, specifying this parameter rather than separate output power and antenna gain limits more directly reflects the potential for interference in the band.

[104] *See* para. 60, *infra.*

[105] *See, e.g.*, Comsearch Comments at 6-7; IEEE 802 Comments at 30.

[106] Navini Comments at 7.

[107] Under the rules we adopt, mobile-to-mobile communications may occur even if each mobile receives the required enabling signal from different base stations. The enabling signal requirement is designed to ensure that mobile stations are sufficiently far from a FSS earth station to avoid causing interference, not to limit the other mobile units with which a given mobile unit may communicate.

[108] We expect service areas around base stations to be no more than approximately 8-9 miles.

[109] The industry will need to address several issues as part of this process, including the characteristics of the enabling signal and an appropriate time limit within which a mobile may transmit before it must again receive and decode the enabling signal.

52. *Mobile operating power.* In the *NPRM*, we proposed to limit mobile devices to a peak EIRP of 1 Watt.[110] This power limit was supported by commenters.[111] Accordingly, we conclude that a maximum peak EIRP of 1 Watt over a 25 megahertz bandwidth will provide a reasonable balance between interference protection goals and fostering the most flexible use of mobile stations in the 3650 MHz band.[112] In the same manner as the power limits for fixed stations, we specify the mobile power limit in terms of bandwidth density in order to accommodate systems with various bandwidths while assuring predictable protection of incumbent stations. We also note that this power/bandwidth level is consistent with existing wireless mobile equipment operating in other bands, and with proposed wireless mobile systems under consideration by IEEE 802.16.[113]

53. *Antennas.* In the *NPRM*, we observed that sectorized and phased array antennas could be used to create highly spectrum efficient networks and could enable an application like a broadband local area network to serve a number of spatially separated clients from a single fixed antenna site.[114] Such antennas allow systems to use spectrum more efficiently by making it possible to re-use a given frequency to communicate with different devices along non-overlapping paths. We believe that allowing such flexibility encourages both new and novel antenna technologies that will foster more intensive spectrum use.

54. In that light, we conclude that transmitters installed at fixed locations should not be prohibited from using any particular type of antenna design. As a general requirement, the EIRP in any antenna beam must be limited to 25 Watts per 25 megahertz. However, transmitters using sectorized, scanning spot-beam, or other antenna types with multiple beam capability shall be required to limit their EIRP in any direction to no more than the limit we are adopting for fixed systems (*i.e.*, 25 Watts per 25 megahertz). Thus, the aggregate power transmitted simultaneously on overlapping beams will have to be reduced such that the EIRP in the area of overlap does not exceed the limit for a single beam. In addition, to allow flexibility in deployment of advanced antenna systems, including sectorized and adaptive array systems, we will allow systems using these antennas to operate with an aggregate transmit output power transmitted simultaneously on all beams of up to 8 dB above the limit for an individual beam.[115] We believe that these rules will provide flexibility for licensees to employ a wide variety of advanced antennas to meet their needs while still ensuring protection to FSS earth stations. Applications for equipment authorization must include the algorithm that confirms that this requirement is met.

55. *Protection of terrestrial stations.* Under the licensing scheme being adopted for terrestrial transmitters in the 3650-3700 MHz band, it will be possible for both base and mobile stations to operate virtually anywhere - - - except near FSS earth stations and Federal stations as described below. Mechanisms must therefore be in place to ensure operation on an interference-free basis. We are concerned about two different kinds of interference in the 3650-3700 MHz band. The first could occur if

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[110] *Unlicensed Operation NPRM* at para. 49.

[111] *See, e.g.*, Motorola Reply Comments at 5; Tropos Comments at 8 (which specifies that a 1 Watt limit is reasonable due to limitations of battery power).

[112] As with the power limit for fixed stations we limit the peak EIRP of the mobile device in any one megahertz of spectrum. Thus, the peak EIRP of a mobile device shall not exceed 40 milliwatts in any one-megahertz slice of spectrum.

[113] The Institute for Electrical and Electronic Engineers (IEEE) has designated the Wi-Max family of standards as 802.16.

[114] *See Unlicensed Operation NPRM* at ¶ 44, citing ET Docket No. 03-201 at paragraphs 5-15.

[115] This is consistent with the rules adopted in ET Docket No. 03-201 for unlicensed systems under Part 15. *See* 47 C.F.R. § 15.247(c)(2).

the radiofrequency (RF) energy from a fixed or base station transmitter interferes with the performance of a nearby fixed or base station receiver. The second type of interference could take place if two or more stations are competing with each other for access to the spectrum. With regard to the former, we will provide, at <http://wireless.fcc.gov/uls>, information regarding the location of all registered stations in the band. Parties seeking to register a new station should examine this database, and then make every effort to ensure that their station operates at a location, and with technical parameters, that would minimize the potential for mutual interference between both the new and existing stations.

56. We believe the best way of preventing the second form of interference from occurring is to require systems operating in the 3650-3700 MHz band to incorporate a contention-based protocol. Such protocols can be characterized by having the following properties: procedures for initiating new transmissions, procedures for determining the state of the channel (available or unavailable), and procedures for managing retransmissions in the event of a busy channel.

57. Systems using a contention-based protocol have been common for quite some time for both licensed and unlicensed systems. For example, licensees operating in the private land mobile radio bands under Part 90 of our rules have employed contention based systems in its simplest form. That is, prior to transmitting, an operator would listen to the traffic on the radio and wait until the channel was free before transmitting (*i.e*, listen before talk).[116] More complex schemes also exist, such as that used by unlicensed Wi-Fi devices (also know as IEEE 802.11). Wi-Fi uses a contention-based protocol known as Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA). This protocol, like the simple Part 90 model, also uses a listen before talk scheme. This means that a station wishing to transmit must first sense the radio channel to determine if another station is transmitting. If the channel is not busy, the transmission may proceed. The CSMA/CA protocol avoids collisions among stations sharing the medium by utilizing a random backoff time if the station senses a busy channel. This process is repeated until the station is allowed to transmit. Such a scheme ensures channel sharing while avoiding collisions. Because such a scheme inherently incorporates unpredictable delay as the transmitter waits until the channel is idle, it is often not the best choice for time sensitive applications such as voice communications.

58. Because we are not according terrestrial licensees exclusive use of the spectrum in any area and because we wish to provide for widespread deployment of equipment, we believe that a contention-based protocol is a reasonable, cost effective method for ensuring the ability of any user to access the spectrum. A contention based protocol also will have to ensure that all users will have a reasonable opportunity to operate, so that no operator can block others' access to the spectrum.[117] Accordingly, we will require fixed, base and mobile equipment designed for use in the 3650 MHz band to incorporate

[116] Because we expect data communications in this band, a simple listen before talk approach relying on aural sensing would not be appropriate here.

[117] We also note that each licensee has an obligation to act in good faith to help eliminate interference, as discussed above.

some type of contention based protocol.[118] As has been our practice, we will not specify a specific protocol, but leave it to the industry and standards bodies to determine appropriate protocols. The incorporation of such a protocol will be a requirement of the equipment certification process, and equipment that appears to be designed to preclude others from using this spectrum will not be approved. In monitoring the use of this spectrum, the Commission remains free to modify the rules if there appears to be significant problems in this regard. We also will add the following definition of contention-based protocol into the rules:

> Contention based protocol: A protocol that allows multiple users to share the same spectrum by defining the events that must occur when two or more transmitters attempt to simultaneously access the same channel and establishing rules by which a transmitter provides reasonable opportunities for other transmitters to operate. Such a protocol may consist of procedures for initiating new transmissions, procedures for determining the state of the channel (available or unavailable), and procedures for managing retransmissions in the event of a busy channel.

59. *FSS Earth Station Protection.* In the *NPRM*, we proposed to define protection zones around each FSS earth station within which, operation of fixed transmitters would be prohibited.[119] Specifically, we proposed that installation of a fixed transmitter be prohibited within a plus-or-minus 15-degree arc of any earth station's main antenna beam if the separation distance between the fixed device and the earth station was within 180 km.[120] At azimuths outside this main beam protection arc, a fixed transmitter

[118] The requirement for the use of contention protocol for the terrestrial services is unrelated to the potential use of contention protocols by the earth stations in the FSS. Very small aperture (VSAT) network operators in the FSS may use contention protocols to manage the traffic within their VSAT networks. In that context, there is an increase in power levels and an increased potential for harmful interference during collisions. Petition of Spacenet, Inc. for a Declaratory Ruling that Section 25.134 of the Commission's Rules Permits VSAT Remote Stations in the Fixed Satellite Service to Use Network Access Schemes that Allow Statistically Infrequent Overlapping Transmissions of Short Duration, or, in the Alternative, For Rulemaking to Amend that Section, *Order*, 15 FCC Rcd 23712 (Int'l Bur., 2000) (*Spacenet Order*). Accordingly, the Commission has proposed rules to limit VSAT network power levels during collisions, most recently in an NPRM adopted concurrently with this Order. *See* 2000 Biennial Regulatory Review -- Streamlining and Other Revisions of Part 25 of the Commission's Rules Governing the Licensing of, and Spectrum Usage by, Satellite Network Earth Stations and Space Stations, *Notice of Proposed Rulemaking*, IB Docket No. 00-248, FCC 05-xxx (adopted Mar. 10, 2005) (*Part 25 Streamlining Third Further Notice*). We conclude that, in the context of terrestrial operations in the 3650-3700 MHz band, the requirements we adopt in Section 90.1321(b) as set forth in Appendix A are adequate to prevent harmful interference.

[119] We observed that FSS earth stations in the 3650 MHz band use high gain antennas that are very susceptible to interference from undesired signals directed toward the main beam. As a result, operation of a fixed unlicensed device located close to the earth station's main beam azimuth, even with relatively low EIRP, could cause interference at large distances. Conversely, an unlicensed device located outside the earth station's main beam azimuth could operate with relatively higher power and at closer separation distances without causing interference. *See NPRM* at ¶ 45.

[120] The 180 kilometer distance proposed in the *NPRM* was derived from the 200 kilometer coordination zone that the Commission previously proposed as appropriate for much higher powered licensed fixed operations to protect FSS earth stations in the 3650 MHz band. In the *3650 MHz Service Rules Second Notice*, the Commission tentatively concluded that within 200 kilometers of a FSS site it would be necessary for a licensed fixed operation to coordinate with the FSS operation. Outside of this coordination zone, the licensed operation would not need to coordinate and could operate with up to 1640 Watts EIRP. The 200 kilometer licensed coordination zone was based on line of sight protection to FSS earth stations and took into account elevation angle, and terrain shielding and over the horizon distances from the FSS earth station sites. [cite] Outside of the main beam, the required separation distance (or exclusion zone) of 25 kilometers assumes that a noise-to-interference ratio of 10 dB is acceptable to the FSS operators and that the ITU-R large FSS antenna roll-off gain pattern is appropriate.

would be prohibited if the separation distance from the earth station was within 25 km. At all other locations outside these zones, we proposed that fixed transmitters could be installed and be permitted to transmit with a total maximum EIRP of 25 Watts unless the specifics of such operation would cause harmful interference to FSS earth stations. Finally, we proposed that such terrestrial operations be permitted on an unlicensed basis.

60. Under the streamlined licensing approach adopted here, terrestrial FS/MS operations must continue to protect satellite earth stations that retain their primary status under our FSS grandfathering provisions for the 3650 MHz band. Consequently, as we discuss further below, we adopt herein circular protection zones of 150 km around the grandfathered earth stations.[121] We recognize that the simplified circular protection zone that we are imposing here employs a high degree of worst-case conservatism that, in many instances, could result in prohibiting the use of transmitters in less-than-worst-case circumstances where, in reality, there would be no likelihood of interference to FSS earth stations. To provide additional flexibility in the face of our conservative protection zones, we will allow terrestrial operations within these protection zones, so long as they negotiate agreements with the earth stations operators.

61. SIA argues in its comments that permitting unlicensed operations will, as a general premise, cause harmful interference to co-channel and adjacent channel FSS receivers because the location of such users are unknown and cannot be tracked.[122] As an initial matter, in this Order, we have elected to adopt a streamlined licensing scheme with a site registration requirement. In adopting this approach coupled with the technical requirements that establish earth station protection zones and restricts the areas in which mobiles can operate, we are taking steps to ensure that the locations of all terrestrial users are known. Thus, the aspects of SIA's criticisms that go to our proposals for an unlicensed approach are rendered moot and need not be further considered. However, SIA makes additional arguments regarding the protection necessary for FSS earth stations that are applicable regardless of whether operations occur on a licensed or unlicensed basis. We address those comments below.

62. SIA opines that the proposals made in the *NPRM* will not adequately protect FSS earth stations in the 3650 MHz band.[123] For example, SIA claims that we the Commission has underestimated: 1) the protection that a device must afford FSS earth stations in the 3650 MHz band, 2) the aggregate interference from users of the 3650 MHz band, 3) the areas in which devices must be excluded, and 4) the potential for interference to FSS earth stations in the adjacent 3700-4200 MHz band.[124] SIA does accede however, that revised separation distances for fixed devices might offer a viable alternative.[125] Finally, SIA notes that the Commission must adopt adequate enforcement mechanisms.

[121] A list of grandfathered FSS earth stations is attached in Appendix E. This list is based upon information available in our official licensing data bases. It may be updated by future Public Notice to correct omissions. The technical parameters for each of the listed stations can be found in the International Bureau Filing System at *http://www.fcc.gov/ib*.

[122] SIA Comments at 29

[123] SIA Comments at 10.

[124] SIA Comments at 18.

[125] SIA Comments at 26.