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FEDERAL COMMUNICATIONS COMMISSION

47 CFR Parts 1, 2, 15, 25, 30, and 101

[GN Docket No. 14-177, IB Docket Nos. 15-256 and 97-95, WT Docket No. 10-112; FCC 17-152]

Use of Spectrum Bands above 24 GHz for Mobile Radio Services

AGENCY: Federal Communications Commission.

ACTION: Final rule.

SUMMARY: In this document, the Federal Communications Commission (Commission or FCC) adopts rules for specific millimeter wave bands above 24 GHz. A Proposed Rule document for the Second Further Notice of Proposed Rulemaking (Second FNPRM) related to this Second Report and Order is published in this issue of the Federal Register.

DATES: Effective **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**, except for § 25.136, which contain information collection requirements that are not effective until approved by the Office of Management and Budget. The Commission will publish a document in the Federal Register announcing the effective date for the section. Changes to the secondary market threshold for millimeter wave spectrum, detailed in SUPPLEMENTARY INFORMATION, apply as of **[INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER]**.

FOR FURTHER INFORMATION CONTACT: John Schauble of the Wireless Telecommunications Bureau, Broadband Division, at (202) 418-0797 or John.Schauble@fcc.gov, Michael Ha of the Office of Engineering and Technology, Policy and Rules Division, at 202-418-2099 or Michael.Ha@fcc.gov, or Jose Albuquerque of the International Bureau, Satellite Division, at 202-418-2288 or Jose.Albuquerque@fcc.gov. For information regarding the PRA information collection requirements

contained in this PRA, contact Cathy Williams, Office of Managing Director, at (202) 418-2918 or Cathy.Williams@fcc.gov.

SUPPLEMENTARY INFORMATION: This is a summary of the Commission's Second Report and Order (Second R&O), Order on Reconsideration, and Memorandum Opinion and Order, GN Docket No. 14-177, FCC 17-152, adopted on November 16, 2017 and released on November 22, 2017. The complete text of this document is available for public inspection and copying from 8 a.m. to 4:30 p.m. Eastern Time (ET) Monday through Thursday or from 8 a.m. to 11:30 a.m. ET on Fridays in the FCC Reference Information Center, 445 12th Street S.W., Room CY-A257, Washington, DC 20554. The complete text is available on the Commission's Web site at http://wireless.fcc.gov, or by using the search function on the ECFS Web page at http://www.fcc.gov/cgb/ecfs/. Alternative formats are available to persons with disabilities by sending an e-mail to fcc504@fcc.gov or by calling the Consumer & Governmental Affairs Bureau at (202) 418-0530 (voice), (202) 418-0432 (tty).

Supplemental Final Regulatory Flexibility Analysis

As required by the Regulatory Flexibility Act of 1980, as amended (RFA), an Initial Regulatory Flexibility Analysis (IRFA) was incorporated in the Notice of Proposed Rulemaking (NPRM) released in October 2015 in this proceeding. A Final Regulatory Flexibility Analysis (FRFA) was incorporated in the Report and Order and Further Notice of Proposed Rulemaking (R&O/FNPRM) released in July 2016 in this proceeding. The Commission sought written public comment on the proposals in NPRM, including comments on the IRFA. No comments were filed addressing the IRFA. This present Supplemental Final Regulatory Flexibility Analysis (Supplemental FRFA) supplements the FRFA in the R&O/FNPRM and conforms to the RFA.

Congressional Review Act

The Commission will send a copy of this Report and Order in a report to be sent to Congress and the Government Accountability Office pursuant to the Congressional Review Act (CRA), see 5 U.S.C. 801(a)(1)(A).

Synopsis

I. SECOND REPORT AND ORDER

1. The Commission will take further actions in this proceeding to make available millimeter wave (mmW) spectrum, at or above 24 GHz, for fifth-generation (5G) wireless, Internet of Things (IoT), and other advanced spectrum-based services. In doing so, the Commission helps ensure continued American leadership in wireless broadband, which represents a critical component of economic growth, job creation, public safety, and global competitiveness.

2. In particular, the Commission makes available an additional 1700 megahertz of mmW spectrum for flexible wireless use, in the 24.25-24.45 and 24.75-25.25 GHz band (24 GHz band) and the 47.2-48.2 GHz band. When added to the mmW spectrum already made available for flexible wireless use in the 27.5-28.35 GHz (28 GHz), 37-38.6 GHz (37 GHz), 38.6-40 GHz (39 GHz band), and 64-71 GHz bands, the Commission has now made available approximately 13 gigahertz of mmW spectrum in this proceeding, and it will continue to evaluate additional mmW bands in this proceeding and in a separate proceeding on bands above 95 GHz.

3. At the same time, the Commission adopts rules that will allow the mmW bands to be shared with a variety of other uses, including satellite, fixed, and Federal government uses. Specifically, the Commission targets the 40-42 GHz and 48.2-50.2 GHz bands for expansion of Fixed Satellite Service (FSS), and it adjusts previously adopted earth station requirements in the 28 GHz and 39 GHz bands to permit greater satellite flexibility, particularly in rural areas. The Commission also preserves the 70 and 80 GHz bands for traditional and innovative fixed wireless uses, which it will continue to explore in a

separate proceeding. In addition, the Commission allows for expanded unlicensed use of the 57-71 GHz band on-board aircraft.

4. In addition, the Commission reconsiders several mmW band service rules previously adopted in this proceeding to ensure that it maximize flexibility and encourage innovation in the mmW bands. For example, the Commission proposes to eliminate the ex ante auction limit on spectrum holdings in the 28, 37, and 39 GHz bands, consistent with its decision not to adopt an ex ante auction limit for the 24 GHz and 47.2-48.2 GHz bands. Further, the Commission concludes that it would serve the public interest to rescind the previously adopted cybersecurity reporting requirements, and instead to seek input through the Communications Security, Reliability, and Interoperability Council (CSRIC) process.

5. The Commission also affirms a number of the decisions previously made in this proceeding to provide certainty so that licensees can continue to invest in networks that provide high speed and low latency services available to consumers and businesses. The Commission notes that major carriers and smaller operators are beginning to develop the mmW frequencies' potential for low-cost wireless equivalents of fiber to homes and small businesses.

6. The Commission believes that it is important to move forward as quickly as possible to auction the non-Federal, exclusive use mmW spectrum made available by this proceeding, to bring the benefits of new broadband services to American consumers. The Commission notes that the Communications Act requires upfront auction payments to be deposited in an interest-bearing account, but no financial institution is willing to accommodate the holding of upfront payments for a large spectrum auction currently. Accordingly, the Commission is unable to hold a large spectrum auction until this is resolved, and it cannot commit to a timeframe for a future auction of the mmW frequencies at this time.

7. The Commission's efforts in this proceeding to make mmW spectrum for wireless broadband available are part of the its broader initiative to make available additional spectrum for

wireless broadband across a range of frequencies. For example, 65 megahertz of AWS-3 spectrum was won at auction in 2015, while 70 megahertz of 600 MHz spectrum was won in the recently concluded broadcast television incentive auction. Earlier this year, the Commission sought input on potential opportunities in spectrum bands between 3.7 GHz and 24 GHz. The Commission will continue these efforts to facilitate access to low-band, mid-band, and high-band spectrum for the benefit of American consumers.

II. BACKGROUND

8. Recent technological advances have unlocked the potential of mmW frequencies to support fixed and mobile wireless services that need flexible access to spectrum. While mmW bands feature short transmission paths and high propagation losses, those features can be useful in developing high-capacity networks because cells can be placed close to each other without causing interference to each other. In addition, where longer paths are desired, the extremely short wavelengths of mmW signals make it feasible for very small antennas to concentrate signals into highly focused beams with enough gain to overcome propagation losses. The short wavelengths of mmW signals also make it possible to build multi-element, dynamic beam-forming antennas that will be small enough to fit into handsets – a feat that might not be possible at the lower, longer, wavelength frequencies below 6 GHz where cell phones operate.

9. On July 14, 2016, the Commission adopted and released the Report and Order (R&O) and Further Notice of Proposed Rulemaking (FNPRM) in this proceeding. *See* 81 FR 58270. The R&O made mmW spectrum available through both licensed and unlicensed mechanisms. The Commission created a new Upper Microwave Flexible Use Service (UMFUS), which authorized both fixed and mobile operations in the 28 GHz and 39 GHz bands using geographic area licensing. In the 28 GHz band, the Commission adopted county-sized geographic area licenses. In the 39 GHz band, it adopted Partial Economic Area (PEA) licenses. The Commission also adopted geographic area licensing using PEAs for the 37.6-38.6 GHz band. In the 37-37.6 GHz band, it established coordinated co-primary shared access

between Federal and non-Federal users. The Commission also protected a limited number of Federal military sites across the full 37 GHz band and maintained the existing Federal fixed and mobile allocations throughout the band. In the 64-71 GHz band, the Commission authorized unlicensed operations under part 15 based on the rules for the adjacent 57-64 GHz band. This action provided more spectrum for unlicensed uses such as Wi-Fi-like "WiGig" operations and short-range devices for interactive motion sensing.

10. In the R&O, the Commission also established licensing and operating rules for the UMFUS. It granted mobile operating rights to existing Local Multipoint Distribution Service (LMDS) and 39 GHz band licensees, while subdividing their existing licenses to either the county or PEA level. The Commission revised the 39 GHz band plan to provide licensees with wider blocks of contiguous spectrum, and established a mechanism for existing licensees to transition to the new band plan. It adopted service and technical rules designed to facilitate full and complete use of the bands, including an operability requirement for equipment. It adopted spectrum holdings policies for the 28 GHz, 37 GHz, and 39 GHz bands that apply to licenses acquired through auctions and the secondary market. The Commission also adopted performance requirements for mobile, point-to-multipoint, and fixed uses. The Commission adopted a requirement that UMFUS licensees submit a statement describing their security plans and related information prior to commencing operations. Finally, it deleted the broadcasting and broadcasting-satellite service allocations from the 42-42.5 GHz band (42 GHz band) and declined to allocate the band to the FSS (space-to-Earth).

11. The FNPRM sought comment on authorizing fixed and mobile use of the following bands: 24.25-24.45 GHz together with 24.75-25.25 GHz (24 GHz band), 31.8-33 GHz (32 GHz band), 42-42.5 GHz (42 GHz band), the 47.2-50.2 GHz (47 GHz band), 50.4-52.6 GHz (50 GHz band), and the 71-76 GHz band together with the 81-86 GHz bands (70/80 GHz bands). The Commission also sought comment on use of bands above 95 GHz. The Commission notes that it is seeking further comment on bands above 95 GHz in a separate Further Notice. It sought comment on the details of the sharing

framework adopted for the 37-37.6 GHz band, both among non-Federal operators and with the Federal government. It also sought comment on circumstances under which Federal government users could gain coordinated access to spectrum in the 37.6-38.6 GHz band (in addition to the protected sites) in the future.

12. The FNPRM also sought comment on possible changes to the licensing and technical rules. The Commission sought comment on establishing performance requirements for innovative uses associated with the IoT such as machine-to-machine communications, healthcare devices, autonomous driving cars, and home and office automation. It also sought comment on adding a use-or-share obligation to its performance requirements. It asked questions about supplementing the spectrum holdings policies adopted in the R&O, and on applying spectrum holdings policies as new "frontier" spectrum bands become available. The Commission also sought comment on whether it would be possible for satellites in the 37.5-40 GHz band to radiate a higher power flux density (PFD) without harming terrestrial operations and to allow user terminals to receive transmissions in the band. The FNPRM also included questions about the feasibility and desirability of a digital station identification requirement for UMFUS licensees. Comment was also sought on various refinements to the UMFUS technical rules, including (1) whether antenna height limits are necessary, (2) how to apply power limits to bandwidths less than 100 megahertz, (3) whether to modify the coordination criteria for fixed point-to-point operations at market borders, and (4) the state of development of mmW band propagation models. Finally, the Commission asked whether it was possible to allow part 15 operation on-board aircraft in the 57-71 GHz band.

13. Petitions for reconsideration of the R&O were due on December 14, 2016. The Commission received thirteen petitions for reconsideration.

14. Comments on the FNPRM were due September 30, 2016, and reply comments were due October 31, 2016. The Commission received 57 comments and 38 reply comments. The Commission received many comments expressing concerns about radiofrequency (RF) electromagnetic field

exposure and health in GN Docket No. 14-177. The Commission declines to consider the merits of these comments here for three reasons. First, the Commission already decided in the Report and Order that consideration of alternative exposure limits is beyond the scope of this proceeding, and no party sought reconsideration of that determination. *See* 81 FR 79894. Second, the comments do not otherwise address the other technical issues that are properly the subject of this decision (e.g., those raised in the FNPRM). Third, the Commission has an ongoing review of the Commission basic exposure limits and RF and health issues in ET Docket No. 13-84. See Reassessment of Federal Communications Commission Radiofrequency Exposure Limits and Policies, Notice of Inquiry, ET Docket No. 13-84, 28 FCC Rcd 3498, 3570 (2013). The Commission has therefore added those comments to ET Docket No. 13-84, and those comments will be considered part of the record in that proceeding.

A. Additional Bands

15. The Commission will not act on the 32 GHz, 42 GHz, or 50 GHz bands at this time. The Commission also will not act on petitions for reconsideration or issues raised in the FNPRM relating specifically to the 37-38.6 GHz band (37 GHz band) or the operability requirement adopted by the Commission. The record on these bands and issues remains open, and the Commission will act on those bands and issues in a future phase of this proceeding.

1. 24 GHz Bands (24.25-24.45 GHz and 24.75-25.25 GHz)

16. In view of the extensive support in the record, and the Commission's analysis, the Commission finds 24 GHz suitable for mobile and flexible use, and therefore add the proposed mobile and fixed allocations. As explained in further detail below, the Commission finds that issuing flexible use licenses that authorize both fixed and mobile use will address its prior concerns about compatibility between fixed and mobile use. The Commission also concludes, as discussed below, that mobile and Broadcasting Satellite Service (BSS) feeder links can coexist. The Commission also notes that these frequencies are part of the bands being studied internationally for mobile use. After these changes, 24.25-24.45 GHz will be allocated for non-Federal Fixed and Mobile services on a co-primary basis, and

24.75-25.25 GHz will be allocated for non-Federal Fixed, Mobile, and FSS on a co-primary basis, subject to the existing footnote. CORF and Echodyne do not generally oppose mobile use in the specific frequencies the Commission acts on. Nevertheless, acknowledging specific CORF concerns, the Commission notes that ongoing international studies include analyses to determine IMT-2020 out-of-band (OOB) emission limits necessary to protect passive sensors onboard weather satellites in the 23.6-24.0 GHz band. The Commission recognizes the need to protect these passive satellite operations that provide important data necessary for weather predictions and warnings. Once the international studies have been completed, interested parties may propose revisions to the Commission's rules as necessary for protection of weather satellites operating in the 23.6-24.0 GHz band. The Commission also rejects CCA's suggestion that it holds back new bands until further mmW development has occurred. The Commission's priority is making spectrum available quickly so that it can be utilized by potential users, technology developers, and innovators. Given the present demand for both mobile and mmW spectrum, the Commission sees no reason to artificially delay this process.

a. Licensing the 24 GHz Band - Use of Geographic Area Licensing

17. The Commission adopts the proposal in the FNPRM to implement geographic area licensing throughout the 24 GHz band, by adding both the upper and lower segments to UMFUS. Geographic area licensing will provide licensees with the flexibility to provide a variety of services, will expedite deployment, and will be consistent with the existing licensing scheme in previously-adopted mmW bands. In addition, adding the 24 GHz band to UMFUS will speed development and deployment by harmonizing the Commission's requirements with the nearby 28 GHz band. As part of UMFUS, the 24 GHz band will be subject to the rules established for UMFUS both here and in the R&O regarding construction requirements, geographic partitioning and spectrum disaggregation, discontinuance of service, and license term.

18. The Commission will adopt PEAs as the license area size for UMFUS licenses in the 24 GHz band. The Commission's goal is to harmonize the regulatory environment of the various mmW

bands as much as possible, in order to encourage and streamline development of equipment and deployment of services in these bands. Using PEAs as the license area is consistent with the Commission's existing rules for the 39 GHz band. In contrast, in the 28 GHz band, there were special circumstances involving incumbent licenses that supported the use of counties. In addition, PEAs provide a balance between the larger areas that might encourage more investment, and the smaller areas that more efficiently accommodate mmW propagation characteristics. To the extent licensees are interested in smaller areas, partitioning is an available option.

19. The Commission declines to adopt a part 96-style or SAS-based framework for the band. Unlike the 3.5 GHz band, with its complex incumbent coordination considerations, this band does not require the functionality of a SAS to enable or enhance meaningful spectrum use. There is also a benefit to harmonizing the regulatory environment of nearby bands as much as possible. Adopting the same licensing scheme in 24 GHz as the Commission previously implemented in 28 GHz would facilitate deployment by making it easier to incorporate spectrum from both bands into the same network. In short, implementing a SAS-based system in the 24 GHz band presents clear challenges and is of questionable benefit, and the Commission therefore declines to do so.

20. Similarly, the Commission declines to adopt the proposals of Microsoft to authorize unlicensed use in 24 GHz. The 24 GHz band is near other licensed bands, and the band is being studied internationally for mobile use. Changing to unlicensed use could delay development and deployment significantly. In addition, the Commission has already made a further seven gigahertz of spectrum available for use by unlicensed devices in the 64-71 GHz band, and it is not convinced that additional unlicensed spectrum is needed in the mmW bands at this time.

b. Band Plan

21. The Commission will license the 24 GHz band as 100 megahertz channels. The lower segment (24.25-24.45 GHz) will be licensed as two 100 megahertz channels, and the upper segment

(24.75-25.25) will be licensed as five 100 megahertz channels. The Commission notes in response to Cambridge Broadband that this arrangement will not foreclose FDD use of this band.

22. This band plan allows for standardized channels across the band, at a size consistent with developing industry standards. This arrangement will maximize efficiency of spectrum use, especially in the upper segment. It also offers an alternative to the 200 megahertz and 425 megahertz channel widths offered elsewhere in the UMFUS bands. This variety of channel sizes will help to facilitate a variety of uses in the UMFUS bands, consistent with the Commission's intent to support various innovative services. The Commission notes that the 100-megahertz channel size will still allow licensees to aggregate to larger channels if they prefer 200 megahertz blocks.

c. Satellite Sharing in the Upper Segment of the 24 GHz Band

23. The Commission declines to make any changes to the current rules for earth station siting at this time. The record on these points is not sufficiently developed or cohesive to indicate the best approach. Instead, the Commission seeks further comment on this issue in the FNPRM, published elsewhere in this issue of the **Federal Register**, in connection with a proposal to allow wider FSS use of the band for earth stations.

24. In the interim, satellite operators may continue to apply for and deploy any earth station facilities consistent with the Commission's current rules. This means that new BSS feeder link earth stations may be authorized across the entire upper segment (24.75-25.25 GHz), while non-BSS FSS earth stations may be authorized in the 24.75-25.05 GHz portion. All earth stations either authorized or for which applications have been filed as of the release date of this Second R&O will be grandfathered into the eventual sharing regime on a co-primary basis. Earth stations whose applications are filed after release of this Order may be processed subject to compliance with any rules the Commission adopts as a result of the proposals in the Second FNPRM. It is the Commission's intention to finalize sharing rules prior to any auction of terrestrial licenses in this band.

d. Mobile Rights for Incumbents

25. The Commission will convert existing licenses in the 24 GHz band to UMFUS. This is consistent with the Commission's treatment of incumbents in the 28 GHz and 39 GHz bands, and will allow already-licensed spectrum to be developed for mobile or flexible use as soon as possible.

26. Converting existing licenses to UMFUS will also subject incumbent licensees to the performance requirements applicable to part 30. Consistent with the treatment of 28 GHz and 39 GHz licensees, the Commission will apply the part 30 buildout requirements at the next license renewal, but allow incumbents with renewals in the near future additional time to meet those standards. Specifically, licensees whose license terms end between the date of publication of this order in the Federal Register, and June 1, 2024, will have until that later date to demonstrate fulfillment of the part 30 buildout requirements. This approach will allow current licensees to focus on growing and transitioning their networks in line with new and developing industry standards, which will support earlier and more robust deployment of next-generation services in these bands.

2. 47.2-48.2 GHz Band

27. In the FNPRM, the Commission proposed to authorize fixed and mobile operations in the entire 47 GHz band under the part 30 UMFUS rules. The 47 GHz band potentially offers 3 gigahertz of spectrum and is being studied internationally for possible mobile use. As discussed below, the Commission is not establishing terrestrial service rules in the 48.2-50.2 GHz band, and that band will be discussed below in the MO&O.

a. Suitability for Mobile Service

28. The Commission will establish UMFUS service rules in the 47.2-48.2 GHz band, as discussed below, and the Commission will issue UMFUS licenses in that band with both fixed and mobile rights. The Commission will address the 48.2-50.2 GHz band below in the MO&O. The 47.2-48.2 GHz band has existing fixed and mobile allocations, and there are no Federal allocations in this band. The Commission also believes that the significant amount of bandwidth available in this band will help to

accommodate the expected continued increase in demand for mobile data. Commenters, including incumbent terrestrial licensees and the Satellite Broadband Operators in their joint ex parte, support mobile operations in the 47.2-48.2 GHz band. The Commission acknowledges Microsoft's concern about sharing between mobile operations and HAPS stations, but since there is no HAPS designation for this band in the domestic Table of Allocations, the Commission sees no reason to delay issuing UMFUS rules for this band. The Commission will continue to monitor ITU developments concerning HAPS.

b. Licensing the 47.2-48.2 GHz Band

29. The Commission will license the 47.2-48.2 GHz band using geographic area licensing using PEAs, because it finds that use of this license mechanism will facilitate access to spectrum and rapid deployment of service in the band. Given that this band does not involve sharing among multiple classes of primary users, the Commission concludes that it is not necessary to develop the functionality of an SAS for this band." Given the record, now is the appropriate time to move forward with making an additional one gigahertz of spectrum available, allowing CCA members and others to accommodate a wide variety of innovative use cases for the 47.2-48.2 GHz band. As Samsung suggests, licensing the 47.2-48.2 GHz spectrum using geographic area licensing with PEAs is consistent with license areas for the 39 GHz band and the upper segment in the 37 GHz band. Licensing the 47.2-48.2 GHz band on a PEA basis strikes an appropriate balance between facilitating access to spectrum by both large and small providers and simplifying frequency coordination, while incentivizing investment in, and rapid deployment of, new technologies. The Commission believes PEAs are more appropriate than larger geographic areas because of the limited propagation range of this band. Geographic area licensing will provide users with flexible, exclusive use licenses.

c. Non-Federal Satellite Terrestrial Sharing – Licensing of Gateway Earth Stations

30. The record demonstrates that individually licensed earth stations in the 47.2-48.2 GHz band can share the band with minimal impact on terrestrial operations. The Commission notes that

there are similarities between the 28 GHz band and the 47.2-48.2 GHz band, both of which will be used for Earth-to-space transmissions. Therefore, the Commission finds that it is in the public interest to add the 47.2-48.2 GHz band to § 25.136(d) of the Commission's rules, which allows for sharing between terrestrial operations and FSS earth stations in uplink bands. Under that rule a limited number (three in each county, up to a maximum of 15 in each PEA) of FSS earth stations will be permitted to deploy under similar conditions as in the 28 GHz band without having to protect UMFUS stations. The Commission is also adopting a U.S. Table of Allocations footnote specifying the relative interference protection obligations of FSS and UMFUS stations in this band.

31. The Commission declines to provide any mechanism for satellite user equipment in this band. Boeing has not provided any engineering studies to support its claim that it needs access to the full 47 GHz band for user equipment. In contrast, most other satellite operators believe that use of 47.2-48.2 GHz by individually licensed earth stations would be sufficient. As noted below, the Commission is not adopting UMFUS rules for 48.2-50.2 GHz, so satellite user devices will have 2 by 2 gigahertz of spectrum available for satellite end user devices.

32. In addition, the Commission recognizes that concerns regarding aggregate interference to satellite receivers from UMFUS operations in the 28 GHz band also could apply in the context of the 47 GHz band, which similarly is an uplink band for satellites. Consistent with the long-term designation of the 47 GHz band for terrestrial use, the Commission intends that this band will remain predominantly a terrestrial band. UMFUS licensees will be permitted to operate in conformance with the technical rules contained in 47 CFR part 30, and FSS licensees should expect to have to coexist with these operations. Unlike the 28 GHz band, where there are currently operational satellites, satellites receiving in the 47 GHz band are either currently being designed or still to be designed. As in the context of the 28 GHz band, the Commission encourages both industries to continue working cooperatively on coexistence in this band. Parties should submit any relevant data demonstrating changes in the amount of aggregate interference as UMFUS services are deployed in the docket the International Bureau, the

Office of Engineering and Technology, and the Wireless Telecommunications Bureau have jointly established regarding aggregate interference in the 28 GHz band.

d. Band Plan

33. The Commission will license the 47.2-48.2 GHz band as five 200 megahertz blocks. The Commission believes that 200 megahertz channels will be sufficient for a licensee to provide the type of high rate data services and other innovative uses and applications contemplated for this spectrum. Several carriers support dividing the band into multiple blocks. Since the Commission is making one gigahertz available at this time, establishing five 200 megahertz channels represents a reasonable balance of channel size and number of channels. To the extent that licensees are interested in having a contiguous block of one gigahertz of spectrum, they are free to acquire all five licenses, subject to compliance with the Commission's spectrum aggregation policies.

B. Performance Requirements – Additional Metrics

34. The Commission declines to adopt usage-based metrics at this time. The Commission agrees with commenters that it is premature to predict the uses of innovative, IoT-type services with sufficient specificity to calculate a meaningful usage-based metric. Though IoT-type services nonetheless are required to meet the UMFUS buildout rules, the Commission acknowledges that some IoT-type services may have difficulty meeting the population-based metrics that the Commission adopted for fixed and mobile services. In that regard, in the Second FNPRM, published elsewhere in this issue of the **Federal Register**, the Commission proposes a more traditional, geographic area coverage metric for fixed and mobile services that is intended to provide a more viable option for IoT-type services to demonstrate performance, without the complications of predicting usage.

35. In addition, the Commission recognizes the possibility that, rather than facing challenges in meeting the buildout metrics for fixed and mobile services, certain IoT-type services may be able to avoid meaningful buildout by taking advantage of a potential loophole in the buildout rules for mmW services. In order to allow licensees as much flexibility as possible to design and construct their

networks, these rules have not placed any limits on what types of licensees or services must use which performance metric. However, in the case of IoT-type services, including networks of sensors and "smart" devices, a licensee using the buildout metric for fixed services could fulfill the performance requirements for an entire multi-county license area (in 39 GHz) with a deployment spanning a single building, by counting each connection between the sensors as a fixed point-to-point link. For example, suppose a licensee wants to equip an office building with environmental sensors to increase the efficiency of its HVAC system. A building with ten floors, and one sensor on each corner of each floor, would have forty sensors. If each sensor were connected to its four neighbors (those in adjacent corners, and in the same corner on adjacent floors) over UMFUS spectrum, this sensor network would have 152 connections (32*4 + 8*3; the sensors on the first and tenth floor would have only 3 connections each). Under the performance metric, the Commission adopted for fixed point-to-point services, which requires one link per 67,000 population, this sensor network would fulfill buildout requirements for a license area of up to 10.1 million people. According to 2010 Census data, that limit encompasses every county, and thus every 28 GHz license area, in the United States. The Commission does not believe this result is consistent with its obligation to prevent spectrum warehousing.

36. To address this issue, the Commission modifies its existing part 30 rules to adopt a specific definition of "fixed point-to-point link," which includes the use of point-to-point stations as already defined in part 30 and is based on power level. This definition is intended to separate "traditional" point-to-point links from the sensor and device connections. The Commission anticipates will be part of new IoT networks in these bands. This definition would not apply to a network of fixed sensors or smart devices operating at low power over short distances.

37. Traditional point-to-point links use relatively high power, while the details that currently exist for IoT services indicate that most sensor or smart device networks will use very low power and are not likely to incorporate highly directional antennas due to size and cost constraints. The Commission therefore believes that power level is an appropriate metric to distinguish between traditional fixed links

and IoT deployments. To the extent that any sensor networks do use higher power, it is likely that they will be connecting over longer distances, and therefore resemble a more traditional fixed network in terms of magnitude of deployment and scope of service provided.

38. Specifically, the Commission defines a "fixed point-to-point link" as "a radio transmission between point-to-point stations (as already defined in part 30), where the transmit power exceeds +43 dBm." This power limit is the limit the Commission previously adopted for mobile handsets transmitting in UMFUS bands. The maximum power (average Effective Isotropic Radiated Power (EIRP) allowed for fixed point-to-point stations in UMFUS bands under the Commission's current rules is +55 dBW, which is equivalent to +85 dBm. Under this definition, stations or devices transmitting using lower power levels will not count towards the number of fixed links required under that performance metric. Licensees whose networks include such low-power connections must either rely on another part of their network to demonstrate buildout (e.g., mobile area coverage or higher-power fixed backhaul links), or offer detailed responses to the Commission's proposal in the Second FNPRM, published elsewhere in this issue of the **Federal Register**, to work out a more suitable alternative.

39. Performance requirements for point-to-point services have always been calculated assuming that point to point links consist of communications between specified points using highly directional antennas and relatively high power; this definition merely makes that assumption explicit. This explicit statement is necessary in light of new technological developments, in order to prevent unintended consequences and gamesmanship of the Commission's rules. The Commission reminds commenters that it continues to explore new metrics that will accommodate innovative services in UMFUS bands, including a proposal in the Second FNPRM.

C. Mobile Spectrum Holdings Policies

40. The Commission finds that it is unnecessary to set pre-auction limits on the amount of spectrum an entity may acquire at auction in the bands proposed for flexible terrestrial wireless use in the FNPRM. The Commission also concludes that the bands that it makes available for flexible terrestrial

wireless use in this Second R&O – the 24 GHz and 47 GHz bands – should be newly included as part of the total mmW spectrum threshold for reviewing proposed secondary market transactions. In the Second FNPRM, the Commission proposes to eliminate the pre-auction limits on the amount of spectrum in the 28 GHz, 37 GHz and 39 GHz bands that an entity may acquire at auction. In addition, the Commission seeks comment on whether there is a need to review mmW band holdings (24 GHz, 28 GHz, 37 GHz, 39 GHz, and 47 GHz) on a case-by-case basis when applications for initial licenses are filed post-auction to ensure that, while providing flexibility to bidders and assigning licenses to those who value them the most, the public interest benefits of having a threshold on mmW spectrum applicable to secondary market transactions are not rendered ineffective. The Commission takes an incremental approach in relieving only certain restrictions in connection with acquisition of spectrum at auction at this time. This accounts for the fact that spectrum in additional bands (24 GHz and 47 GHz) will become available as a result of the decisions in this Second R&O and for the possibility that spectrum subject to new uses on the secondary market is available, or may become available, from existing spectrum holders in the mmW bands. The Commission wishes to encourage such new uses, if they are in the public interest, as quickly as possible, including in advance of the Commission's resolution of issues in the Second FNPRM and any future auction making more spectrum available in the mmW bands, respectively.

41. The Commission declines to adopt a pre-auction limit, as proposed in the FNPRM and suggested by certain commenters, on the amount of 24 GHz and 47 GHz band spectrum that an entity can acquire through competitive bidding in an auction. Generally, bright-line, pre-auction limits may restrict unnecessarily the ability of entities to participate in and acquire spectrum in an auction, and the Commission is not inclined to adopt such limits on auction participation absent a clear indication that they are necessary to address a specific competitive concern. In the case of the mmW bands, the Commission is not persuaded by commenters' generalized assertions that a bright-line, pre-auction limit in these bands is necessary to protect competition in the provision of wireless services. First, the

Commission notes that the 24 GHz and 47 GHz bands that it makes available in this Second R&O will add 1700 megahertz to the 3250 megahertz of mmW spectrum made available in the R&O, for a total of 4950 megahertz of mmW spectrum for flexible terrestrial wireless use. Furthermore, the spectrum in these new bands, as well as the 3250 megahertz of spectrum previously made available, will be licensed in multiple blocks of different sizes and geographic areas, providing many spectrum opportunities for various types of auction bidders. In addition, as indicated in the record, development of the 24 GHz and 47 GHz bands and the mmW bands overall is still in the early stages, with a myriad of potential use cases that may require varying amounts of bandwidth for providers to offer consumers innovative services. Under these circumstances, the Commission finds that establishing pre-auction limits for the 24 GHz and 47 GHz bands would not serve the public interest.

42. Although the Commission declines to adopt a pre-auction limit for the 24 GHz and 47 GHz bands, it concludes that it is in the public interest to include these two bands as part of the previously-adopted mmW spectrum threshold for reviewing proposed secondary market transactions. This pre-auction limit may unnecessarily restrict competition at auction by automatically precluding a provider from acquiring spectrum. This secondary market mmW spectrum threshold, in contrast to a pre-auction limit, does not establish a bright line that would prohibit a provider from acquiring spectrum. Rather, the mmW spectrum threshold for secondary markets review merely identifies those markets that may warrant further competitive analysis, similar to the Commission's spectrum screen for review of secondary market transactions involving other lower frequency spectrum bands. Given that the 24 GHz and 47 GHz bands share similar technical characteristics and potential uses with the 28 GHz, 37 GHz, and 39 GHz bands already included in the mmW spectrum threshold, the Commission will group all five bands together for purposes of applying the mmW spectrum threshold to review secondary market transactions. Taking into consideration the additional 1700 megahertz of mmW spectrum that the Commission is making available in the 24 GHz and 47 GHz bands, it adds 600 megahertz, or approximately one-third of this additional spectrum, to the 1250 megahertz mmW spectrum threshold,

for a combined threshold of 1850 megahertz for proposed secondary market transactions. As noted, the Commission has adopted previous changes in this area through a variety of mechanisms, including rulemaking and orders approving transactions. Policies Regarding Mobile Spectrum Holdings Expanding the Econ. & Innovation Opportunities of Spectrum Through Incentive Auctions, Report and Order, 29 FCC Rcd 6133, 6135, para. 4 (2014); Sprintcom, Inc., Shenandoah Personal Communications, LLC & Ntelos Holding Corp., Memorandum Opinion and Order, 31 FCC Rcd 3631, 3637-38, para. 15 (WT/IB 2016); Applications of AT&T Mobility Spectrum LLC, New Cingular Wireless Pcs, LLC, Comcast Corp., Horizon Wi-Com, LLC, Nextwave Wireless, Inc., & San Diego Gas & Elec. Co. for Consent to Assign & Transfer Licenses, Memorandum Opinion and Order, 27 FCC Rcd 16459, 16470–71, para. 31 (2012). To the extent necessary, we clarify that the Commission retains the discretion to do so in the future (including as we authorize service in additional mmW bands). For purposes of this proceeding, we provide that this specific change will apply as of publication in the Federal Register.

D. Part 15 Operation On-board Aircraft in the 57-71 GHz Band

43. The Commission is adopting rules to allow unlicensed operation on-board most aircraft in the 57-71 GHz band under part 15 of its rules. The Commission's decision opens this band for unlicensed use on-board aircraft and would allow up to six (6) non-overlapping WiGig channels of 2160 megahertz each. The Commission finds that allowing 60 GHz unlicensed transmitters to operate in all flight phases of aircraft operation in the 57-71 GHz spectrum, with the limitations described herein, will not cause harmful interference to other authorized radio services, including Earth Exploration Satellite Service (EESS) and the radio astronomy service (RAS), while facilitating expanded access to broadband services in flight.

44. The Commission is modifying its part 15 rules to allow unlicensed operation on-board most aircraft during flight in the 57-71 GHz band. The Commission finds that allowing unlicensed use of this spectrum on-board aircraft while airborne, with certain limitations, will facilitate air travelers' expanded access to broadband/internet services during flight and provide an opportunity to reduce

aircraft weight from connecting wires, all without causing harmful interference to authorized radio services, as the Commission elaborates further below.

45. In the R&O in this proceeding, the Commission determined that the record did not reflect a clear perspective of the types of unlicensed applications envisioned on-board aircraft that would provide an adequate assessment of their harmful interference profile. Thus, in the FNPRM in this proceeding, the Commission set out to request further information and analyses with respect to the various types of unlicensed applications envisioned on-board aircraft, the priority/order of their planned introduction, as well as their associated potential harmful interference profile with respect to passive sensor services. The use cases outlined in the AVSI Study suggest that planned WiGig systems use access point stations affixed to the interior ceiling in commercial passenger transport aircraft to deliver internet/entertainment products wirelessly to travelers' laptops/tablets, or to in-seat display monitors on the aircraft. The Commission is also aware that wireless avionic intra-communications (WAIC) applications (as studied by the ITU in lower frequency bands) would be highly useful in providing wireless back-up connections for primary wired connections between various electrical systems of the aircraft, to lighten the aircraft's total weight. WAIC systems provide radio communications between two or more stations on a single aircraft and constitute exclusive closed on-board networks required for the operation of an aircraft. The Commission is therefore adopting unlicensed technical rules herein with these two types of applications, broadband internet/entertainment access in closed networks on-board aircraft, and certain WAIC applications, in mind.

46. As the Commission observed in the R&O, the existing ITU studies on wireless avionics applications only cover frequency bands lower than the 60 GHz band. However, the Commission expects that the propagation characteristics of radio waves in the 57-71 GHz band would result in even greater attenuation than was documented in these ITU studies of lower frequency bands. The Commission notes that extensive simulations and actual measurement data presented in the AVSI Study

confirm that typical aircraft effective fuselage attenuation is 40 dB in the 57-71 GHz frequency range, which is in line with the ITU findings of up to 45 dB aircraft fuselage attenuation at other frequencies.

47. The Commission finds that use of the 57-71 GHz spectrum on-board aircraft would not cause harmful interference to authorized services for several reasons. First, signals at these frequencies have high propagation losses and are easily blocked by obstacles, including seats, bulkheads and human bodies on the aircraft. Second, the aircraft fuselage provides significant attenuation of signals, as supported by the ITU studies and the AVSI Study, discussed above. Third, although unshielded aircraft windows provide significantly less attenuation than the aircraft fuselage, the risk of these beams being misdirected out of a window is minimal because 60 GHz transmitters use directional antenna beams to deliver the signals to the intended receivers inside the airplane. The Commission observes that the AVSI Study data indicate that the average effective aircraft attenuation (including transmissions through windows and inside aircraft cabin at multiple antenna steering angles) is on the order of 40 dB and is by and large independent of antenna location and antenna type used by either access point stations or mobile devices inside the aircraft. The Commission further finds that because the aircraft fuselage attenuation plays an important role in the link budget for the prevention of harmful interference caused by 60 GHz signals on-board aircraft to EESS (as computer-modeled and measured on commercial passenger transport aircraft by the AVSI Study; and as assessed by the ITU-R studies), the Commission will exclude use of 60 GHz unlicensed transmitters on-board aircraft where there is little attenuation of RF signals by the body/fuselage of the aircraft. These aircraft include, for example, toy/model aircraft, unmanned aerial vehicles (UAV) such as drones, small/light crop-spraying aircraft and aerostats.

48. With respect to WAIC applications, CORF strongly urges the Commission to prohibit this type of operation in the band to protect vital weather forecasting data collection. The Commission finds that the combination of high fuselage attenuation in commercial passenger transport aircraft and free-space propagation loss along with the directionality of the WiGig antenna beams inside the aircraft cabin will prevent harmful interference to passive sensor services. However, the Commission notes that

WAIC applications could encompass external structural sensors or external cameras mounted on the outside of the aircraft structure to monitor the different phases of aircraft operation. These externally located transmitters may generate RF signals that would not be attenuated by the fuselage while the aircraft is in flight; thus, 60 GHz signals have the potential to escape into the air at various altitudes of flight and may present a potential for harmful interference to passive sensors. The Commission is therefore addressing CORF's concern by prohibiting operation of 60 GHz transmitters in WAIC applications on the outside of the aircraft body/fuselage while airborne, to ensure that passive services continue to be protected.

49. On the other hand, the Commission denies CORF's recommendations that any aeronautical use of the 57-71 GHz bands must require strict OOB emission limits at the harmonic frequencies (which fall into passive service spectrum such as RAS) and should be considered in the aggregate within the airplane, as well as aggregated over multiple planes within the beam and side lobes of the passive service telescope. The Commission notes that the AVSI Study generally addressed CORF's concerns by analyzing via dynamic simulation the effects of OOB and spurious emissions of on-board aircraft WiGig devices on passive services, both in a single aircraft with aggregate multiple equipment factor and worst-case emission levels; and in multiple aircraft in the aggregate during worst-case peak air traffic; the results demonstrated that passive services continue to be protected by a significant margin. This study suitably supplements the Wi-Fi Alliance Industry Interference Report (Wi-Fi Alliance Report) previously submitted in the record of this proceeding, in which it found comparable results while assuming a more conservative aircraft attenuation of 25 dB, instead of 40 dB.

50. The Commission finds that the existing spurious emission limits in § 15.255(c) of the rules are sufficient to protect passive services. Section 15.255(c) already restricts spurious emissions to a very low power density limit of 90 pW/cm^2 at a distance of 3 meters for frequencies between 40 GHz and 200 GHz, and to the general limit for intentional radiators in § 15.209 for frequencies below 40 GHz. The Commission determines that RF signals in this spectrum suffer from severe propagation losses, and

are blocked easily by obstacles inside the aircraft, as well as heavily attenuated by the aircraft fuselage; therefore, 60 GHz operation on-board aircraft would not increase the potential for harmful interference to passive services, when compared to 60 GHz operation on the ground, indoors or outdoors. The Commission also determines that spurious and harmonic emissions generally roll off (i.e., reduce in amplitude) the further they are in frequency from the fundamental emission; therefore, if fundamental emissions are severely attenuated, harmonics would be affected proportionally; thus, the Commission finds that unlicensed operations in the 57-71 GHz spectrum would not adversely affect passive services operating in frequency bands that contain the harmonics of this spectrum. The Commission further finds that, depending on their angle of escape out of the aircraft fuselage, the probability of any of these stray harmonic emissions finding their way into the main beam/side lobes of the victim telescope is virtually non-existent. The AVSI Study results generally confirm the Commission's assessments by its dynamic simulations supported by corroborating measurements, as discussed above. The Commission therefore denies CORF's request for rule changes with respect to specific conditions on spurious emissions limits.

51. Based on the above, the Commission finds that, absent any record evidence to the contrary, it is the Commission's predictive judgment that 60 GHz transmitters operating on-board an aircraft in the 57-71 GHz band, with the limitations that the Commission is imposing herein, will not cause harmful interference, which is defined not to protect against isolated occurrences, but only against interference that "seriously degrades, obstructs, or repeatedly interrupts."

E. Amendments to Certain Part 1 Rules

52. The Commission amends §§ 1.901 and 1.902 of the Commission's rules to include part 30 in the list of s to which the part 1, subpart F, rules apply. The R&O clearly expressed the Commission's intent to apply the part 1, subpart F rules to UMFUS. Amending §§ 1.901 and 1.902 to include UMFUS will be consistent with that intent. Notice and comment is not required for this change because the changes go to rules of practice and procedure. In addition, the Commission is amending §

101.115 of our rules to fix a footnote numbering error in the Antenna Standards table in § 101.115. The change clarifies that the footnote applicable to the 70 GHz and 80 GHz bands should be labelled footnote 14.

III. ORDER ON RECONSIDERATION

A. Security

53. In the R&O, the Commission adopted rules requiring licensees, prior to commencing operations, to submit to the Commission security plans and related information indicating how confidentiality, integrity, and availability principles are applied in its network security design processes. Several parties filed petitions for reconsideration, which ask the Commission to eliminate the security reporting requirements.

54. The Commission acknowledges that there may be other mechanisms that foster more secure networks without imposing the burden of additional regulation. The Commission therefore believes that more flexible security mechanisms should be fully explored, including ones employing voluntary means, in order to achieve a narrowly tailored fit with the Commission's goal of secure 5G networks and devices.

55. By exploring flexible security mechanisms as the Commission's next step, it can avoid the costs of implementing the R&O's reporting and security requirements, which could slow the development of innovative 5G services. For example, NCTA claims that these requirements would "impose substantial compliance costs on 5G network operators with no meaningful corresponding benefit in light of the fact that network providers already have enormous incentives to adopt measures to protect their networks." NCTA further argues that "a band-by-band approach to cybersecurity . . . would increase compliance costs."

56. The Commission also believes that a regulatory approach to 5G security is premature at this time. As CTIA states, the "supporting architecture for 5G is presently in development and is likely to remain in flux." Similarly, TIA maintains that it is not clear yet how 5G networks will operate. Given

these considerations, the Commission believes that it would serve the public interest to rescind the reporting and security requirements. To reduce the risk to network reliability and security, the Commission instead seeks industry input through the CSRIC process. The Commission believes that CSRIC is an appropriate vehicle to explore these network security issues given its track record of addressing cybersecurity issues through flexible, voluntary means. As CTIA states, the Commission generally favors a "business-driven cybersecurity risk management" approach because a "flexible, adaptable approach" offers a "workable strategy for securing commercial networks." The Commission expects tangible, practical security benefits from the CSRIC processes as part of the public-private partnership which, as NCTA notes, already exist to address best practices. The Commission has asked CSRIC to identify the network reliability and security risks associated with 5G networks and develop best practices to mitigate those risks. The Commission may also use CSRIC recommendations to help inform any additional steps that may be necessary.

B. Earth Station Siting Rules

1. Background

57. The 27.5-29.5 GHz band has had long-standing allocations for the fixed, mobile, and FSS (Earth-to-space) services. In the 1996 LMDS First Report and Order, the Commission designated the 27.5-28.35 GHz band for LMDS on a primary basis and determined that satellite services would be permitted in that band on a non-interference basis to LMDS systems, and only for the purpose of providing limited gateway-type services.

58. The U.S. Table of Frequency Allocations accords co-primary status to FSS earth stations (space-to-Earth) in the 37.5-40 GHz band. Under the rules in effect prior to the Notice of Proposed Rulemaking (NPRM) (*see* 81 FR 1802), gateway earth stations in the 39 GHz band could be deployed only if the FSS licensee obtained a 39 GHz license for the area where the earth station would be located, or if it entered into an agreement with the corresponding 39 GHz licensee.

59. In the R&O, the Commission found that "FSS earth stations in the 28 GHz band can share the band with minimal impact on terrestrial operations." Based upon that finding, the Commission grandfathered all existing 28 GHz FSS earth stations authorized as of the adoption date of the Report and Order and granted them the right to operate under the terms of their existing authorizations without taking into account possible interference to UMFUS operations. It also grandfathered pending applications for 28 GHz earth stations filed prior to the adoption date of the R&O if such applications were subsequently granted pursuant to the existing part 25 rules. The Commission also gave FSS operators multiple mechanisms for deploying earth stations. First, it granted status to any FSS earth stations for which the FSS operator also holds the UMFUS license, whether through participation in an auction or the secondary markets, that covers the earth station's permitted interference zone. To the extent FSS operators and UMFUS licensees enter into private agreements, the Commission held that their relationship will be governed by those agreements. The Commission also determined that FSS earth stations may continue to be authorized without the benefit of an interference zone, i.e., on a secondary basis.

60. Finally, the Commission decided that it would continue to authorize satellite earth stations on a first-come, first-served basis in the 28 GHz band, but adopted guidelines for their deployment. First, it would authorize no more than three locations in each county where FSS would be allowed to deploy earth stations that do not have to protect UMFUS stations from interference. Second, an FSS applicant would be required to demonstrate in its license application that the permitted interference zone around its earth station would cover no more than 0.1 percent of the population of the county license area where the earth station was to be located. Third, the applicant would be required to show that the permitted interference zone would not infringe upon any major event venue, arterial street, interstate or U.S. highway, urban mass transit route, passenger railroad, or cruise ship port. Fourth, to ensure that the earth station would not interfere with existing facilities operating under

a 28 GHz UMFUS license, the Commission required that the satellite operator coordinate with the UMFUS licensee in the county where it proposed to locate its earth station using the coordination procedures contained in § 101.103(d) of the Commission's rules.

61. In contrast to the 28 GHz band, where FSS earth stations transmit, FSS earth stations in the 37.5-40 GHz band receive. Accordingly, earth stations in that band need protection against interfering signals from terrestrial operations. Prior to the NPRM, Commission rules for the 39 GHz band provided that gateway earth stations would be allowed only if the satellite licensee obtained a license for the terrestrial geographic service area where the earth station would be located, or if the satellite operator entered into an agreement with the corresponding terrestrial licensee. In the R&O, the Commission allowed FSS operators to place earth stations using any of the market-based mechanisms adopted for the 28 GHz band.

62. The Commission further determined that it would authorize non-Federal satellite earth stations in the 37.5-40 GHz band on a first-come, first-served basis and give them protection from terrestrial transmissions subject to the following conditions. First, the earth station applicant must define a protection zone in its application around its earth station where no terrestrial operations may be located. The FSS applicant may self-define this protection zone, but it must demonstrate using reasonable engineering methods that the designated protection zone is no larger than necessary to protect its earth station. Second, the Commission determined that it would authorize a maximum of three protection zones in each Partial Economic Area (PEA). Accordingly, the applicant was required to demonstrate either that there are no more than two existing protection zones in the PEA or to demonstrate that its protection zone would be contiguous to any preexisting satellite protection zone. Third, the applicant must demonstrate that the existing and proposed protection zones, in the aggregate, would not cover more than 0.1 percent of the PEA's population. Fourth, the Commission required the applicant to show that the protection zone would not infringe upon any major event

venue, arterial street, interstate or U.S. highway, urban mass transit route, passenger railroad, or cruise ship port. Finally, the earth station applicant is required to coordinate with terrestrial fixed and mobile licensees whose license areas overlap with the protection zone, in order to ensure that the protection zone does not encompass existing terrestrial operations. If the earth station is authorized, the Commission's rules prohibit UMFUS licensees from placing facilities within the protection zone absent consent from the FSS operator, and the FSS operator must respond in good faith to requests to place facilities within a protection zone.

63. In petitions for reconsideration, some satellite operators seek a relaxation of the 0.1 percent limits on populations affected by exclusion zones around their earth stations, curtailment of the rules that limit the impact of satellite operations on the provision of terrestrial services to users in transit, and elimination of the rules that limit earth station zones to three per geographic area. Parties also seek various clarifications, which the Commission addresses below.

64. The burden of proof falls upon petitioners to demonstrate that FSS needs additional flexibility to locate earth stations in the 28 GHz and 37.5-40 GHz bands, which primarily are designated for terrestrial use. They fail to meet that burden, except in the limited instances discussed below.

2. 0.1 Percent Population Limit

65. Satellite petitioners and their supporters propose various ways to relax the rules that limit earth station exclusion zones to 0.1 percent of the population of UMFUS license areas. Their proposals include applying the 0.1 percent limit to the entire country or Basic Trading Areas (BTAs) rather than to counties or PEAs, increasing the limit to 0.2 percent, allowing satellite operators to deploy earth stations anywhere outside of urban cores, and modifying the rule's limits with respect to small and medium-sized markets.

66. The Commission rejects the request to increase 0.1 percent population to 0.2 percent in larger markets. As Nextlink argues, that change could have a significant adverse impact on terrestrial

service in urban areas. Moreover, none of the proponents of this change have demonstrated that increasing the population threshold in larger markets is necessary to provide sufficient opportunity for siting earth stations in these bands. As the Commission observed in the R&O, satellite operators will not necessarily need to deploy earth stations in the more densely populated markets. Indeed, the Satellite Broadband Operators have indicated that they can accept a limit of 0.1 percent in the largest markets. In addition, ViaSat, the FSS operator that appears to be most interested in locating earth stations in urban markets, supports the existing 0.1 percent limit.

67. On the other hand, the Commission concludes that for smaller markets, relaxing the 0.1 percent population metric is consistent with the Commission's goal of creating meaningful, targeted opportunities to deploy additional FSS earth stations without harming terrestrial operations. Maintaining the 0.1 percent limit in smaller markets could make it more difficult for FSS operators to site earth stations in those markets, which could drive earth station siting towards more heavily populated places and centers of commercial activity. In contrast, relaxing the 0.1 percent limit in smaller markets is more consistent with the Commission's goal of providing targeted opportunities for siting earth stations in more remote, less-densely populated areas.

68. On the other hand, the Commission believes that SES and O3b have not justified the level of impact on terrestrial service that they seek. In the smallest markets, they have not justified limiting access to terrestrial services to up to 10 percent of the population in the 28 GHz band. Since many of the smallest markets cover large geographic areas, FSS operators should have sufficient flexibility with a 7.5 percent population limit. In the middle tier of markets, the Commission notes the concern of the Rural LMDS Operators that losing even 600 potential customers could make providing service uneconomic. While SES and O3b attempt to justify the 600-person limit based on an analysis of one of their existing, grandfathered earth station, given the trend towards smaller, lower impact earth stations identified by ViaSat and others, it is equitable to require FSS operators to make additional

efforts to limit their impact on UMFUS in bands that are designated primarily for terrestrial use. The Commission anticipates that satellite operators will substantially reduce the sizes of the exclusion zones that they require by constructing artificial site shields or by taking advantage of naturally occurring terrain features.

69. Taking the entire record into account, the Commission will adopt a modified version of the SES/O3b proposal for providing additional flexibility in second- and third-tier markets. For the 28 GHz band, the limits will be as follows:

Population within UMFUS License Area	Maximum permitted aggregate population within PFD contour of earth stations
Greater than 450,000	0.1 percent of population in UMFUS license area
Between 6,000 and 450,000	450 people
Fewer than 6,000	7.5 percent of population in UMFUS license area

For the 37.5-40 GHz band, the population limits will apply on a PEA basis as follows:

Population within Partial Economic Area (PEA) where earth station is located	Maximum permitted aggregate population within PFD contour of earth stations
Greater than 2,250,000	0.1 percent of population in PEA
Between 60,000 and 2,250,000	2,250 people
Fewer than 60,000	3.75 percent of population in PEA

The additional flexibility will encourage siting of earth stations in areas with less population, decrease potential conflicts between FSS and UMFUS, and maintain the primacy of UMFUS in the 28 GHz and 39 GHz bands.

3. Other Limits on Earth Station Siting

70. Some satellite operators request that the Commission repeal, modify, and clarify the R&O's limitations on deployment of earth stations in places where they preclude terrestrial service to people or equipment that are in transit or are present at mass gatherings. EchoStar and Inmarsat also argue that the Commission's transient population rules impair their ability to deploy gateway stations in places with ready sources of electricity, adequate roads to permit access for maintenance, neighborhoods with appropriate commercial zoning, sufficient space for installation and expansion of large satellite antennas with an unobstructed view of the sky, and sufficient cooling capacity for large amounts of computing equipment. The Satellite Broadband Operators, which include the petitioners, recommend that the Commission's prohibition against earth station interference with passenger railroads be limited to Amtrak trains. The petitioners also urge us to eliminate or curtail sharply the rule barring FSS deployments near major event venues in the 28 and 37.5-40 GHz bands. The Satellite Broadband Operators ask that they be allowed to extend their exclusion zones over major event venues except for those with a seating capacity exceeding 10,000 people.

71. The Commission denies the requests to modify the additional limits on earth station siting, with certain exceptions discussed below. EchoStar and Inmarsat contend that one of the reports cited in the R&O demonstrates that fiber connectivity needed by earth station facilities is highly correlated with major roadways and railways. The Commission disagrees. The authors of the InterTubes Report, which petitioners cite, emphasize that they are exclusively interested in the long-haul fiber-optic portions of the Internet and do not even attempt to portray any of the short-haul fiber routes that are used to add or drop off network services in many different places within metropolitan

areas. Moreover, the Commission notes that in the 28 GHz band, where there are incumbent earth stations, no licensed earth station is co-located with a long-haul Internet node and the average distance by road from a 28 GHz earth station to the nearest long-haul Internet node is 37.5 miles, with a median distance of 22.4 miles. Notably, a recent application for 20 gateway earth stations states that they will be "at sites distributed throughout the United States that comply with the Commission's 28 GHz siting rules and have sufficient electrical facilities, reliable fiber-delivered broadband capacity, and ease of access for personnel to provide operational support."

72. Furthermore, the Commission continues to believe that the limitations that it has placed on earth station siting provide incentives for FSS operators to avoid areas where there is going to be high demand for terrestrial service using mmW bands. The wide bandwidths that are available to terrestrial services in the 28 GHz and 37.5-40 GHz bands will support vital new terrestrial services on roads, railroads, and mass transit routes, and at ports, major event venues, homes and offices. The current need for wireless service along transit routes is clear for a variety of uses, including navigation, and demand is likely to increase with advances in technology. Like people in transit, many who attend major events use cell phones to obtain information, to exchange text and images with others, and to engage in other forms of communication. That is why mobile carriers often deploy temporary cellular base stations at major events. The Commission anticipates that 5G services supported by millimeter-wave spectrum will engender more use of mobile telecommunications at live events.

73. The Commission agrees with the petitioners, however, that it would be helpful to clarify the types of roads that earth station siting should avoid. The R&O restricted earth station interference zones from infringing upon any arterial streets or interstate or U.S. highway. On review, the Commission finds that limitation may be unclear. The Commission therefore clarifies this prohibition to include only the following types of roads, as they are defined and classified by the U.S. Department of Transportation:

- Interstate
- Other Freeways and Expressways
- Other Principal Arterial.

74. Regarding the R&O's restrictions on earth station interference to "major event venues," the record does not provide a sufficient basis to specify which locations are considered such venues. Generally speaking, the Commission considers a major event venue to be any location where large numbers of people could gather on a regular basis in a setting where they would expect to use wireless service. The Commission recognizes that there are multiple types of locations that could qualify, including popular venues that seat less than 10,000 persons. For example, the Commission agrees with Verizon that an arbitrary limit of 10,000 persons would improperly exclude venues such as the arena where the Minnesota State Mavericks play ice hockey games (a venue seating 5,280 person). The Commission declines to unnecessarily restrict these locations to venues seating more than 10,000 people, as advocated by the Satellite Broadband Operators. To the extent that an UMFUS licensee is concerned that the interference or protection contour of a proposed FSS earth station might encompass a major event venue, the Commission expects that the UMFUS licensee will identify the venue as part of the coordination process, and the Commission expects that the parties will work cooperatively to identify and avoid major event venues.

75. For similar reasons, the Commission also declines to modify the R&O's limitations on earth station siting that would impair passenger railroads by narrowing that restriction to encompass only Amtrak, as advocated by the Satellite Broadband Operators. This limitation properly encompasses any passenger railroads where there is going to be high demand for terrestrial service using mmW bands, such as key commuter rail lines.

4. Numerical Limits on Earth Stations

76. As noted above, the R&O limited the number of earth station locations to three per county in the 28 GHz band and three per PEA in the 37.5-40 GHz band. Satellite operators urge us to eliminate those limits on the grounds that they are redundant, that it would be impractical for multiple satellite operators to share the same sites, that the thousands of small footprints produced by large fleets of NGSO satellites will each require a gateway earth station, and that a numeric limitation might have the perverse effect of forcing satellite operators to deploy gateway stations in urban areas before they have exhausted the siting opportunities of rural geographic service areas with wide expanses of thinly populated territory. Straight Path argues that the Commission should continue to apply numeric limits to earth station deployments because there is no data in the record to support the claim that the satellite industry will need more than 1,200 ground stations in the 39 GHz band. FWCC says that it is not opposed in principle to dropping the numeric earth station limits if the Commission maintains reasonable limits on population coverage.

77. In the 28 GHz band, which is licensed for terrestrial use on a county basis, the Commission declines to eliminate the numeric limit of three earth station locations per license area. The numerical limitations that the Commission imposed are part of the framework that it adopted "to provide FSS licensees with substantial opportunities to expand their limited use of the 28 GHz band to deploy earth stations that do not have to protect terrestrial services, while minimizing the impact on terrestrial operations." FSS operators have not demonstrated that they have a substantial need to exceed the numeric location limits imposed in the R&O. Furthermore, eliminating those limits would be inconsistent with the decision to prioritize terrestrial deployment in these bands. In particular, eliminating the numerical limits in smaller markets where the Commission grants additional flexibility to FSS providers could inappropriately hinder deployment of terrestrial service in less populated areas. The Commission notes that in the smallest markets, allowing FSS providers to have an interference zone

covering up to 10 percent of the population could impact a substantially larger amount of area, since populations may not be evenly distributed in rural areas.

78. The Commission will, however, increase the three locations per license area limit on earth stations in the 37.5-40 GHz band, which is licensed for terrestrial use on a PEA basis. In that band, where the FSS allocation is space-to-Earth, the function of earth stations is to receive signals from satellites, not to transmit. An earth station location in that context represents the protection zone around one or more earth stations from which terrestrial operations are excluded, in order to prevent them from causing interference to the earth stations. The existing limit on earth station locations in that band was based on the Commission's calculations of populations that they were likely to cover, based on the size of the protection zone that would be required to protect 37.5-40 GHz receiving earth stations. The protection zone area that the Commission used for these calculations was provided in comments from EchoStar, which stated that the radius of the exclusion zone around a 37.5-40 GHz earth station would be up to two kilometers. Recently, Inmarsat, SES and O3b provided an analysis that represents a separation distance of less than 1100 meters from the center of a terrestrial mobile deployment area that occupies an area of 3.8 square kilometers would be sufficient to protect an FSS earth station. In another study, ViaSat purports to show that moderately sized stations on roof tops, with appropriate shielding, could be embedded in urban or suburban settings where 5G systems are deployed without requiring interference protection from the 5G system. Boeing analyzes both studies, and concludes that each is based on valid assumptions and employs appropriate technical analysis, but believes that the Inmarsat/SES/O3b submission used unnecessarily conservative assumptions and that a separation distance of less than 500 meters would be sufficient. While the assumptions ViaSat uses will not apply to every earth station (not every earth station will be located on a roof or will be shielded), based on the Commission's analysis of the contribution submitted into the record of this proceeding by Inmarsat, SES and O3b, and the ViaSat filing, it now appears that earth stations can be designed that require substantially smaller exclusion zones than the two-kilometer radius estimate available to the

Commission at the time of the R&O. With smaller exclusion zones, the Commission can justify allowing more satellite earth stations in a given area because the impact in terms of geographic area will be smaller.

79. Taking into account the Commission's current understanding of the required exclusion zone and the fact that this band is primarily a terrestrial band, the Commission believes that it would be reasonable to increase the permissible number of earth station locations in the 37.5-40 GHz band from three to 15 per PEA, but with no more than three earth station locations per county. The Commission's grant of relief on the numerical limits in the 37.5-40 GHz band is premised on the idea that the exclusion zones required by FSS to protect their earth stations are substantially smaller than the Commission originally believed. If, in reviewing FSS earth station applications, the Commission sees that FSS providers are claiming substantially larger protection zones, the Commission reserves the right to take appropriate action.

80. The Commission also declines to adopt ViaSat's request to modify § 25.136 to allow the deployment of additional "zero impact" earth stations on a protected basis, regardless of the numerical earth station limits otherwise applicable in a given county or PEA. These deployments may not have "zero impact." In light of the greater flexibility the Commission is granting above with respect to the absolute number limit on earth station locations, the Commission finds that ViaSat has not demonstrated that the additional requested flexibility would be in the public interest.

81. In addition, the Commission takes the opportunity to clarify the determination in the R&O that, for purposes of complying with the limit on the absolute number of earth station locations within an UMFUS license area, each location can accommodate multiple earth stations that are either collocated with each other or at locations contiguous to each other. As stated in the R&O, a "location" in this context refers to either, in the case of earth stations transmitting in the band, the contour within which one or more earth stations generate a PFD no more than -77.6 dBm/m^2/MHz at 10 meters above ground level, or, in the case of earth stations receiving in the band, the self-defined protection zone

around one or more earth stations within which no terrestrial operations may be located. The Commission clarifies that, although adding an earth station to a location will in most cases expand the relevant contour, the R&O does not preclude the expansion of such contours, nor does it apply any numeric limit to the number of earth stations to be deployed at a location, provided that the deployment complies with other earth station siting limits in the Commission's rules. Although the R&O does not limit the number of earth stations per se, it does limit the proliferation of protection zones surrounding those earth stations, and that serves an important policy objective.

5. Placement of Additional Antennas at Grandfathered 28 GHz Sites

82. EchoStar and Inmarsat ask us to clarify the extent to which additional earth station antennas may be placed at grandfathered 28 GHz earth station sites, and SES and O3b specifically request that the Commission exempts additional earth stations from the 0.1 percent population limitation rule if they are located within one second of latitude and one second of longitude of grandfathered sites. EchoStar and Inmarsat argue that, if the Commission requires grandfathered sites to count against the 0.1 percent cap, other FSS operators will be unable to deploy precisely in those areas that have been identified as most attractive to date. The Satellite Broadband Operators also argue that the Commission should exclude grandfathered 28 GHz band earth stations from counting toward the population limits.

83. The Commission rejects the petitioners' requests for three reasons. First, the modifications that the Commission is making to the 0.1 percent population limit provide substantial and adequate relief to the requesting parties. Second, no material purpose would be served by adding a de minimis exception: one second of latitude equals about 31 meters, and one second of longitude in any of the contiguous 48 states would be fewer than 30 meters. Third, EchoStar and Inmarsat state elsewhere in their petition that it would be impractical in any case for multiple satellite operators to share the same sites. If it is true that other operators would be reluctant in any case to deploy their

antennas at a grandfathered site that is licensed to another operator, the Commission needs not be concerned that they would be deterred from doing so by the absence of a further exception to its rules.

C. Secondary Status of FSS in 28 GHz Band

84. In the R&O, after evaluating in detail prior rulemakings involving the 28 GHz band, the Commission rejected arguments from FSS providers and determined that FSS would be secondary to both fixed and mobile terrestrial operations in the 28 GHz band. SIA asks the Commission to clarify that certain protected FSS operations are in fact co-primary with respect to the new UMFUS.

85. SIA simply repeats arguments that it submitted earlier in response to the NPRM, and it presents no new theory or new reason for why FSS should be given co-primary status. The R&O thoroughly considered this issue and concluded that, "the 28 GHz band will play a vital role in the deployment of advanced mmW services, and fully upgrading FSS under the Commission's service rules to co-primary status would be inconsistent with this goal and would be unnecessary to meet the FSS community's needs." Accordingly, the Commission rejects that aspect of SIA's petition as repetitious, pursuant to § 1.429 of its rules. Moreover, the Commission has again reviewed the record in the light of the arguments urged in SIA's petition and the Commission finds no reason to depart from the findings of fact and conclusions contained in the decision.

D. 28 GHz Aggregate Interference

86. Commenters have expressed concern that upward transmissions from large numbers of terrestrial stations will, in the aggregate, generate enough power to be received at the satellite's receiver, thus degrading the satellite's performance. In the R&O, the Commission, after noting that FSS was secondary to both fixed and mobile services, concluded that, "the record in this proceeding does not demonstrate that the rules that we adopt today would significantly risk harmful interference to satellite operations because of aggregate interference received at the satellite receiver." The Commission rejected requests from FSS providers to limit the aggregate skyward transmissions of

UMFUS providers in the 28 GHz band. In petitions for reconsideration, satellite operators argue that we should reconsider our earlier decision and set an overall limit on aggregate interference to satellite receivers.

87. The Commission denies the petitions for reconsideration on this issue because none of the petitions for reconsideration make the requisite showing under § 1.429 of its rules with respect to the aggregate interference issue. The petitions filed by satellite operators are deficient in two significant respects. First, they fail to acknowledge the defects identified in the R&O in the technical studies that formed the basis for their arguments. Second, and more fundamentally, the requests of the satellite operators are inconsistent with the Commission's goal of providing UMFUS licensees with a flexible rules framework that could allow them to provide a variety of services. Boeing and SES/O3b ask the Commission to embed into its rules certain characteristics that are under development for mmW mobile systems, such as beamforming, antenna downtilt, and power control. The Commission adopted technical rules that were as flexible as possible, while at the same time preventing harmful interference. By doing so, the Commission maximized the ability of licensees to design and evolve their networks according to their own judgement and thereby offer new and innovative services to the public. Establishing specific technical parameters in the Commission's rules based on its understanding of technological developments at one point in time would risk preventing licensees from developing new services to meet market demand. The limits on emissions that the satellite operators seek could limit the ability of UMFUS licensees to operate certain types of networks.

88. Finally, the Commission rejects petitioners' argument that the Commission's failure to adopt rules to limit aggregate interference to satellites licensed by countries that are adjacent to the U.S constitutes a breach of its country's obligations under international agreements. As Intel and CTIA point out, the rules adopted in the R&O already provide more protection to other countries' satellites than is required by ITU rules.

89. The Commission retains the authority to monitor developments and intervene to prevent unacceptable interference to satellites if that becomes necessary, but it finds no evidence to date that suggests that any such intervention will be necessary. The R&O explained why it is unlikely that the addition of mobile services to the 28 GHz band will cause significant interference to satellites in the 28 GHz band, and petitioners have provided no basis to revisit that conclusion at this time.

E. Base Station Power Limit

90. In the Report and Order, the Commission adopted a base station power limit of 75 dBm/100 MHz EIRP for UMFUS. For channel bandwidths less than 100 megahertz, the permitted EIRP was reduced below 75 dBm in proportion to the amount of bandwidth involved. Boeing asks the Commission to reconsider the 75 dBm limit and adopt the 62 dBm limit proposed in the NPRM.

91. The Commission denies Boeing's petition on this issue. Boeing claims that the Commission adopted the 75 dBm power limit without a "real technical or policy foundation . . ." That characterization is inaccurate. As noted above, the 75 dBm power limit made the UMFUS rules consistent with rules for other mobile services and reflected a consensus of parties involved in developing equipment and service. To the extent Boeing and O3b are concerned about the ability to place earth stations in the 37.5-40 GHz band, the Commission notes that UMFUS licensees will be required to protect earth station facilities pursuant to § 25.136 of the Commission's rules. To the extent that Boeing's advocacy is based on its desire to operate user equipment in the 37.5-40 GHz band, the Commission's decision denying its request to allow operation of FSS user equipment in 37.5-40 GHz makes this concern irrelevant. While Boeing's technical study assumed that UMFUS base stations were operating continuously at 75 dBm, that deployment scenario is unrealistic because UMFUS facilities will have incentives to operate at the minimum power necessary. The Commission acknowledges that many terrestrial service proponents have described systems that have lower transmitted power, but its UMFUS rules are designed to facilitate the deployment of a wide variety of mmW technology. The

Commission does not believe it would be appropriate to limit the development of new technology or deployment of novel services by needlessly limiting the power of UMFUS equipment.

92. The Commission also denies Boeing's request to establish a separate total radiated power limit. The Commission agrees with Intel and T-Mobile that such a limit is unnecessary and burdensome. Boeing has not explained why the UMFUS bands are meaningfully different from other bands where the Commission has only adopted EIRP limits.

F. Base Station Location Disclosure

93. EchoStar/Inmarsat and SES/O3b ask the Commission to require the creation of a database of UMFUS facilities to facilitate coordination between FSS and UMFUS. Given the potentially huge number of deployments in these bands, it would be extremely burdensome to require UMFUS licensees to maintain and update information on each deployment. On the other hand, FSS providers would only need this information when they were planning to coordinate an earth station location. The Commission disagrees with SES/O3b that the existing coordination procedures are inadequate for them to obtain the information they need to coordinate with existing UMFUS licensees. The part 101 coordination rules, which apply to coordination of proposed earth stations, require UMFUS licensees to specify the technical details relevant to any objection. The Commission concludes that the burden of the disclosure requirement would far outweigh any benefit. The Commission therefore denies the petitions on this issue.

G. 64-71 GHz

94. The Commission affirms the Commission's decision to authorize unlicensed operations across the entire 64-71 GHz band. Contrary to petitioner's arguments, the Commission thoroughly articulated the public interest benefits of making 64-71 GHz available for unlicensed use, and the Commission's decision took into account the needs of both licensed and unlicensed services. In contrast, petitioners have provided no explanation as to how they would make use of this band as a

licensed band, and they mostly repeat arguments previously considered and rejected by the Commission.

95. Petitioners' focus on the amount of spectrum made available for licensed versus unlicensed use is misguided. The Commission has previously explained that this was not a valid comparison when responding to claims of "gigahertz parity" from commenters who shared the same view as CTIA. Furthermore, the Commission makes additional spectrum available for licensed use, and it will continue to work to make more licensed spectrum available.

96. The Commission's expectation that unlicensed services would quickly serve the public interest in the 64-71 GHz band, based on the band's adjacent location to the 57-64 GHz band where WiGig devices are being actively deployed, is supported by the fact that the FCC Equipment Authorization Database shows close to 200 product certification grants for operation in the 57-64 GHz band. Furthermore, the Commission notes that the technical specifications for 802.11ad unlicensed devices to operate in the 64-71 GHz band are already supported in the approved IEEE 802.11-2016 standard, using the same communication protocols for six 2160-megahertz wide channels.

H. Mobile Spectrum Holdings (In-Band Aggregation Limits)

97. CCA requests reconsideration of the Commission's decision not to adopt band-specific limits for each of the 28 GHz, 37 GHz and 39 GHz bands. In the R&O, the Commission found that band-specific limits were unnecessary, stating because any technical differences between these three bands is not sufficient to significantly affect how these spectrum bands might be used. The Commission finds that CCA merely restates general arguments previously considered and rejected, and the Commission therefore denies its request for reconsideration.

I. 28 and 39 GHz License Area Sizes

1. 28 GHz Band

98. In the R&O, the Commission selected counties as the base geographic unit for UMFUS license areas in the 28 GHz band and subdivided existing Basic Trading Area (BTA) licenses into counties.

Several petitioners seek reconsideration of the Commission's choice of counties in the R&O. Their arguments in favor of reconsideration largely involve what they see as an increased monetary, administrative and technological burden created by switching to counties as opposed to BTAs.

99. The Commission denies these arguments because they were fully considered and rejected by the Commission in its R&O, and petitioners have failed to present any basis for revisiting its decision. The Commission fully considered and rejected the following concerns before reaching its decision, namely that (1) counties did not fit the contemplated services to be offered using mmW spectrum; (2) counties would result in more border areas requiring greater coordination; (3) the number of counties would impose administrative burdens on licensees and the Commission; and (4) requiring buildout showings on a county basis would increase licensees' costs. The Commission also noted that it had moved towards license areas based on EAs and that counties were more consistent with EAs. Finally, it noted that using BTAs for UMFUS would require a new licensing agreement with Rand McNally, the owner of BTAs. It concluded that county-based licenses would afford a licensee the flexibility to develop localized services, target deployment based on market forces and consumer demand, and facilitate access by both smaller and larger carriers – and that these benefits outweighed any administrative burden on licensees or the Commission. The Commission, rejecting the arguments that many counties previously included in BTAs would be abandoned because it was not economically viable or administratively cost-effective to build them out, concluded that it would be better to allow new providers to obtain licenses and make use of that spectrum. The Commission believes this logic applies equally to rural areas, tribal land, counties containing military bases, or counties that contain federal lands such as the National Parks. To the extent licensees previously acquired these areas under the expectation that they would provide service, it is inconsistent for licensees to now deny such intent. If there is no intent to provide service in an area, they should surrender these license rights and give others the opportunity to provide service in those areas.

100. The Commission considered the move to a county-based license fair to incumbents because they not only retained their fixed license rights but also would gain valuable mobile rights by virtue of acquiring UMFUS licenses. The Commission concluded generally that the benefits of these smaller license areas outweighed any administrative burden on licensees and on the Commission. To the extent Petitioners are now making new arguments, such claims would appear to be barred because they have not justified why they failed to raise such arguments previously or why it is incumbent upon us to review them in the public interest.

101. The Commission rejects the takings argument raised by Nextlink and CCA. "[C]ourts have concluded that licensees do not have property rights in any license that the Commission issues to them, and so are not protected by the Fifth Amendment." It is also "undisputed that the Commission has always retained the power to alter the term of existing licenses by rulemaking." Nor is there anything inherently unfair in the Commission's action. LMDS licenses have received mobile use rights they previously lacked and these licensees were given extra time to fulfill their buildout requirements.

2. 39 GHz Band

102. CCA requests that we reconsider the Commission's decision to divide the 39 GHz band into PEAs from previous EA-based license areas because it allegedly will harm incumbents by increasing the burdens and costs of buildout. The Commission rejects these arguments for most of the same reasons it rejects these arguments with respect to the 28 GHz band. One distinction the Commission observes between the 28 GHz bands and 39 GHz bands, however, is that in the 39 GHz band, the decision to allocate license areas by PEA should address many of the petitioners' concerns. Specifically, the magnitude of change between EAs and PEAs is far smaller than the change from BTAs to counties in the 28 GHz band. There are 176 EAs and 416 PEAs, whereas there are 493 BTAs and 3,174 counties or county-like areas. The Commission correctly concluded that use of the PEA formed the appropriate middle ground between counties and EAs because PEAs were small enough to permit access to licenses by smaller carriers while still large enough to incentivize investment in new technologies. The PEA

license size should thus address many of the monetary and administrative cost burdens that Petitioners decry.

J. Performance Requirements for Incumbent Licenses

103. As an alternative to reconsidering its decision to divide the current 28 GHz BTA-based LMDS license areas into counties, several petitioners argue the Commission should either reduce its performance requirements or provide incumbent licensees with greater flexibility in meeting these requirements. Parties also seek similar relief for incumbent 39 GHz licenses. We decline to adopt either of these proposals.

104. The Commission continues to believe that extending the deadline for meeting the new performance requirements to 2024 for incumbent licensees provides sufficient relief. Petitioners ignore the fact that buildout obligations serve the important purpose of ensuring that scarce spectrum resources are put to use and deployed in a manner that serves all communities. Indeed, the Commission's construction obligations promote the Commission's objective of making spectrum "available, so far as possible, to all the people of the United States" regardless of where they live. The Commission rejects as unsupported and contrary to the public interest the idea that, in this instance, allowing licensees to hold on to unused spectrum indefinitely would promote service. In the R&O, the Commission noted the various proposals by parties that would have permitted incumbent licensees to meet their then existing performance requirements before the end of their license terms. Petitioners largely repeat the same arguments and the Commission denies them on the ground they are plainly repetitious. To the extent petitioners attempt to craft variations on those previous performance proposals or propose entirely new performance standards, they have not adequately explained why they could not have raised these arguments at the earlier stage of the proceeding, and the Commission sees no reason to review its performance requirements on public interest grounds.

105. The Commission continues to believe that the 2024 deadline for incumbents to meet buildout requirements is reasonable. Indeed, developments since release of the R&O indicate that the

Commission's 2020 estimate for availability of equipment may have been pessimistic. Both Verizon and AT&T have commenced trials for roll-out of commercial 5G services. Verizon has begun offering 5G mobile and broadband service to pilot customers in 11 cities, and AT&T conducted its first 5G business customer trial in 2016 and states that it is currently pursuing 5G video trials with DirecTV NOW as well as additional fixed and mobile 5G trials with Qualcomm and Ericsson. Furthermore, it is estimated that 3GPP standards for Non-Standalone New Radio (NSA NR) will be completed by March 2018, and that full Standalone New Radio with Next Generation Core will be completed by September 2018. The Commission believes these developments belie petitioners' claims that they will not have sufficient time to meet performance requirements by 2024 due to the inability to obtain equipment.

106. Finally, the Commission rejects the argument that parity requires that incumbent licensees receive the same amount of time as new licensees to meet their buildout requirements. Incumbents have an advantage over potential new UMFUS licensees because they have immediate access to spectrum and can begin planning for deployments now.

K. Splitting of 28 GHz Band into Two Licenses

107. Nextlink asks that the Commission reconsider its decision to split the 850 MHz A1 Band into two 425 MHz segments and instead make this spectrum available for UMFUS as a single band. We deny this request both because it is plainly repetitive and because petitioners have failed to rebut the reasoning of the R&O which found that a split band would increase competition.

108. The Commission denies Nextlink's request on the merits and because Nextlink seeks to reargue matters that the Commission thoroughly considered. Nextlink's assertion that the Commission does not provide a valid basis for splitting the A1 band into two 425 megahertz licenses is incorrect. As T-Mobile argued in response to the NPRM, "where available bandwidth is more limited, as it is at 28 GHz and may be in other lower bands, smaller license blocks should be licensed in order to preserve competition." AT&T and NSMA also support smaller channels in the 28 GHz band. Nextlink previously had alleged that bifurcating the A1 band would exacerbate the problems it had raised against county

based licensing, such as increased costs and 'stranding' deployments in different halves of the A1 band, but those arguments were considered and rejected by the Commission. On balance, the Commission continues to believe that the benefits to competition of having multiple licenses in an area outweigh any marginal increase in costs to licensees.

L. Applicability of Part 30 Rules to Satellite Operations

109. EchoStar and Inmarsat note that § 30.6 of the Commission's rules states that when providing FSS services, UMFUS licensees must operate consistent with part 25 of our rules governing satellite communications. EchoStar and Inmarsat ask for a clarification that FSS operators holding licenses "for the purpose of protecting FSS operations" would only be subject to the following UMFUS service rules: (1) Section 30.5 (Service Areas); Section 30.104 (License Term); and (3) Section 30.106 (Geographic partitioning and spectrum disaggregation).

110. EchoStar and Inmarsat are correct that the Commission did not intend to apply part 30 technical rules to satellite operations. Accordingly, the Commission will revise § 30.6 to state explicitly that part 30 technical rules do not apply when UMFUS licenses are used in connection with satellite operations. The part 30 licensing rules do apply, however, to all UMFUS licenses, regardless of use. For example, if a satellite operator acquired an UMFUS license at auction, it would acquire those licenses pursuant to the competitive bidding rules in part 30, subpart D. Furthermore, the Commission buildouts requirements apply to all UMFUS licenses, but there is a special provision in the rules allowing FSS operators to comply with those requirements in a given county by demonstrating that an earth station is in service, operational, and using the spectrum associated with the license. Accordingly, the Commission denies the petition to the extent it seeks to broadly exclude FSS operations from the UMFUS licensing rules.

IV. MEMORANDUM OPINION AND ORDER

A. 48.2-50.2 GHz

111. At this time, the Commission declines to authorize fixed and mobile use in the 48.2-50.2 GHz band, but rather retain the broad flexibility of satellite systems to operate in that band. The Commission believes the satellite broadband services that could be delivered over the networks proposed by Boeing, SpaceX, and others could play a useful role in bringing the benefits of broadband to more Americans. Given the current state of satellite technology, these systems would need access to spectrum where satellite end user devices can operate. The Commission's actions will provide FSS operators with 2 gigahertz of both uplink and downlink spectrum where they can operate satellite end user devices and earth stations without having to share with terrestrial licensees. In addition, the Commission recognizes the importance to the satellite industry of having spectrum to freely deploy uplink user terminals across the United States. Further, the Commission notes that there is no explanation in the record for how the V-band could work successfully for both satellite and terrestrial providers without dedicated spectrum for FSS end-user terminals. Accordingly, while the Commission is making additional spectrum, including the 47.2-48.2 GHz band, available for terrestrial use, it will reserve the 48.2-50.2 GHz band for FSS use at this time, pursuant to the existing part 25 rules, in order to give satellite operators an opportunity to provide services in the V-band.

B. 40-42 GHz

112. The Commission declines to authorize mobile use in the 40-42 GHz band at this time. No proponent of mobile use for this band has explained how such use would be consistent with the operation of satellite user devices in this band. This analysis is different from the sharing analysis between UMFUS and individually licensed earth stations because the number and location of individually licensed earth stations can be controlled. As with 48.2-50.2 GHz, the Commission will reserve the 40-42 GHz band for FSS use at this time, pursuant to the existing part 25 rules, in order to give satellite operators an opportunity to provide services in V-band.

113. The Commission acknowledges the ongoing international studies at the ITU-R for mobile (IMT) use in the band 37-43.5 GHz. The Commission notes that the benefits of global harmonization are not limited to situations where all regions have identical spectrum allocations and can be facilitated through the use of radio tuning ranges. Radio tuning ranges allow manufacturers to develop equipment that can operate across multiple bands within a contiguous range while allowing regulators flexibility to manage spectrum resources for domestic requirements. The Commission will continue to follow the ongoing studies in this band leading up to WRC-19.

C. 71-76 and 81-86 GHz Bands (70/80 GHz Band)

1. Introduction

114. On October 16, 2003, the Commission adopted a Report and Order establishing service rules to promote non-Federal development and use of the mmW spectrum in the 71-76 GHz (70 GHz), 81-86 GHz (80 GHz), and 92-95 GHz (90 GHz) bands, which are allocated to non-Federal and Federal users on a co-primary basis. Based on the determination that highly directional, "pencil-beam" signal characteristics permit systems in these bands to be engineered so that many operations can co-exist in the same vicinity without causing interference to one another, the Commission in 2003 adopted a flexible and innovative regulatory framework for the bands. Specifically, the Commission created a two-pronged authorization scheme for non-Federal entities for the entire 12.9 GHz of spectrum in the band. First, a licensee applies for a non-exclusive nationwide license; second, the licensee registers individual point-to-point links. Under this licensing scheme, a non-exclusive license serves as a prerequisite for registering individual point-to-point links. Licensees may operate a link only after the link is both registered with a third-party database and coordinated with NTIA. This flexible and streamlined regulatory framework was designed to encourage innovative uses of the mmW spectrum, facilitate future development in technology and equipment, promote competition in the communications services, equipment, and related markets, and advance sharing between non-Federal and Federal systems.

115. As of June 12, 2017, there were 454 active non-exclusive nationwide licenses covering the 70 GHz, 80 GHz, and 90 GHz bands. Based upon information available from the third-party database managers that are responsible for registering links in those bands, as of June 10, 2016, there were approximately 11,882 registered fixed links in the 70 GHz and 80 GHz bands.

116. Access to these bands is based on a set of spectrum rights and sharing mechanisms between Federal and non-Federal users, and among different types of non-Federal uses (fixed and satellite). In these bands, non-Federal operations may not cause harmful interference to, nor claim protection from, Federal FSS operations located at 28 military bases. In addition, in the 80 GHz band, licensees proposing to register links located near 18 radio astronomy observatories must coordinate their proposed links with those observatories. Third-party database managers are responsible for recording each proposed non-Federal link in the third-party database link system and for coordinating with NTIA's automated "green light/yellow light" mechanism, under which a non-federal link entered into NTIA's system is either approved for 60 days (green light) or subject to further coordination (yellow light), to determine the potential for harmful interference to Federal operations and radio observatories.

2. Mobile Use

117. The Commission declines to authorize mobile use in the 70 GHz and 80 GHz bands under UMFUS rules at this time. There is broad support in the record for focusing on and enhancing the existing rules for fixed use of the band, while there is little consensus among the proponents of mobile use as to how to coexist with fixed links. Under the existing licensing mechanism, these bands can play an important role in 5G development by facilitating backhaul and other fixed uses. It is important not only to protect existing links but also to provide an opportunity for future growth of FS in these bands as demand for backhaul and other related services increases.

118. The Commission has several proposals pending in its Wireless Backhaul proceeding (WT Docket No. 10-153) to modify the existing rules for these bands. The proposals include adjustments to

the antenna standards, allowing +/- 45 degree polarization, establishing a channelization plan, requiring construction certifications for registered links, and allowing minor modifications to link registrations. The Commission also notes that companies such as Aeronet, Google, and The Elefante Group have proposed different uses for these bands which neither fit the traditional mobile broadband nor fixed link models. The Commission's best course of action is for it to consider those proposals and possible future uses in the Wireless Backhaul proceeding. Once the Commission decides what changes, if any, to make to the existing rules, it encourages interested parties to discuss possible methods of promoting coexistence between fixed links and mobile operations. The Commission reserves the right to revisit this issue as mobile use deploys in other mmW bands, technology develops, and as further thought is given to mobile/fixed coexistence.

3. Indoor-only Unlicensed Use under Part 15

119. The Commission declines at this time to authorize indoor-only unlicensed use under part 15 of its rules in the 70 GHz and 80 GHz bands. The Commission finds that little has changed since it rejected the use of unlicensed devises in the 70 GHz and 80 GHz bands in 2003. The Commission further finds that, given the risks of interference to existing fixed uses, additional studies are warranted before considering indoor unlicensed use in the 70 GHz and 80 GHz bands. Parties supporting unlicensed indoor use in the 70 GHz and 80 GHz bands fail to provide sufficient evidence that such use would cause no interference to authorized uses. Rather, they rely on general references to the propagation characteristics in these bands, building materials, device limitations (e.g., a requirement that equipment comply with § 15.257 of the rules), or they advocate the adoption of an SAS framework to protect authorized uses from interference.

120. The Commission further finds that the current availability of 14 gigahertz of contiguous spectrum for unlicensed operations immediately below the 70 GHz band reduces the urgency to introduce unlicensed indoor use in the 70 GHz and 80 GHz bands. In this regard, the Commission notes that, while unlicensed indoor use is permitted under part 15 at 90 GHz, no equipment has been

authorized for use as of June 12, 2017, so it would be premature to extend the rules of a yet-to-be successful service to the bands immediately below it that, as demonstrated by the record, support a thriving mmW service. The Commission further finds that it is neither necessary nor cost-effective to establish a geolocation database to facilitate coordination of unlicensed devices at this time, as proposed by OTI and Public Knowledge. The Commission's decision to delay introducing unlicensed indoor use at this time furthers the public interest by protecting existing operations and successful services in the 70 GHz and 80 GHz bands without foreclosing future innovations in these bands.

D. 37.5-40 GHz Band Satellite Issues

1. Satellite Power Flux Density Limits

121. The Commission concludes that the record does not establish conditions under which FSS could operate at a higher power flux density (PFD) consistent with terrestrial use of the band. The Commission recognizes that Boeing has devoted considerable effort to address its questions about the rain fading issue. At this time, however, the Commission believes that allowing FSS to operate with a higher PFD would be inconsistent with its decisions to designate 37.5-40 GHz as an UMFUS band and to grant UMFUS licensees the flexibility to provide a wide variety of fixed and mobile technologies. UMFUS technologies are new, rapidly evolving, and proliferating. Boeing's studies emphasize coexistence with mobile broadband systems, but that is not the only use case being developed for this band. Verizon announced that it will begin offering 5G fixed wireless service to pilot customers in 11 cities in the first half of 2017, and AT&T conducted its first 5G business customer trial in 2016 and states that it is currently pursuing 5G video trials with DirecTV NOW as well as additional fixed and mobile 5G trials with Qualcomm and Ericsson. The Commission notes that the existing PFD limits for satellite signals were designed to protect fixed systems. Another use case is IoT devices, which Boeing did not specifically consider. By one informed estimate, the IoT market could grow from an installed base of 15.4 billion devices in 2015 to 30.7 billion devices in 2020 and 75.4 billion in 2025. The most salient issue, however, is not the sheer number of IoT devices that are likely but the plethora of designs being developed.

122. Boeing's analysis proposes to impose limits on equivalent power-flux density (EPFD) instead of PFD on the ground. EPFD limits have been used in the Commission's rules to address the interference from NGSO FSS systems to GSO space stations as well as to earth stations receiving from such space stations. In these situations, the pointing direction of the interfered-with earth station antenna is fixed, the antenna pattern of the earth station is known, and the radio propagation conditions can be approximated by line of sight propagation. By contrast, UMFUS receivers use phased array antennas to dynamically form beams in the direction of the transmitter over the relative path of motion, and the received signals are generally subject to multipath propagation conditions. Boeing's analysis addressed the dynamic nature of UMFUS beamforming by modeling the random pointing of UMFUS antennas while using a 3GPP-suggested antenna pattern, and Boeing also presented computer simulation results for multipath environments in nine cities. Boeing's computer simulations illustrate the complexity of characterizing the interference performance of these systems and, even if the Commission was to adopt EPFD-based limits, additional work would be required. Furthermore, UMFUS receivers are in the early stage of development and have not yet been manufactured for deployment. Any EPFD limit set at this time based on a 3GPP-suggested antenna pattern may limit the future development of antenna reception technology for known applications or for applications that have not even been conceived.

123. Boeing has made a good faith effort to model a broadly representative range of UMFUS devices and pointing conditions, but at this nascent stage of the technology it would be impossible to capture all variants of UMFUS use cases that could yet emerge. Under these circumstances, Boeing and others have not yet met the burden of proving that they can strengthen their satellite signals during rain storms without interfering with terrestrial systems in the 37.5-40 GHz band. Accordingly, the Commission will not make any changes to § 25.208(q) or (r) of its rules.

2. Authorizing Satellite User Equipment

124. The Commission finds that allowing satellite earth stations in the 37.5-40 GHz band has the potential to result in a negative customer experience for satellite broadband consumers. It is true that no earth stations in the 37.5-40 GHz band will generate any direct interference because earth stations operate in a receive-only mode in that band, where satellite operations are authorized only in a space-to-Earth mode. In general, however, consumer earth stations tend to need stronger satellite signals than larger, more sophisticated gateway earth stations. The Commission has denied Boeing's request for increased power levels at this time, but Boeing could renew its request. If the Commission allowed satellite user equipment to use 37.5-40 GHz on an opportunistic basis, but the buildout of terrestrial systems eventually required FSS operators to relinquish their use of channels below 40 GHz, customers could experience a reduction in service quality. The Commission does not agree with Boeing's argument that consumers could simply narrow their usage to bands above 40 GHz, where satellite is primary. If it is true, as Boeing argues, that additional bandwidth below 40 GHz is necessary to provide adequate high-speed Internet service to consumers, then surely those same consumers would experience a decline in the quality of their services if they were required to relinquish those channels. Alternatively, if those consumers would not experience a decline in the quality of their service upon relinquishing channels below 40 GHz, the implication is that those channels are not necessary for the delivery of high-quality satellite service.

125. The Commission agrees with Boeing that satellites could complement terrestrial services by providing assured coverage to rural areas, and it acknowledges that mmW mobile services will likely appear first in high-traffic areas. Recent developments, however, suggest that the same technologies that will support non-line-of-sight service to mobile users over short distances will also be able to support non-line-of-sight service to fixed users over longer distances. For example, Starry says that it can provide fixed mmW service to consumers at distances up to 1 kilometer. However, the Commission finds that FSS proponents have not met their burden of demonstrating that allowing satellite end user

devices in 37.5-40 GHz is necessary and appropriate. FSS will retain the 40-42 GHz band where satellite end user devices can be located without restriction. In addition, FSS can use the 37.5-40 GHz band for a limited number of individually licensed earth stations. The Commission believes this framework promotes efficient spectrum use while providing both UMFUS and FSS with the opportunity to provide service.

E. Performance Requirements – Non-Federal Use-or-Share

126. The Commission declines to adopt any use or share regime for any of the part 30 bands at this time. This only addresses use-or-share between non-Federal licensees. The Commission's decision here does not limit or prejudge any actions it may take concerning sharing mechanisms with Federal users in shared bands. Furthermore, the Commission's decision herein does not encompass the Lower 37 GHz Band, either between Federal and non-Federal users or between non-Federal users.

127. The record reflects a lack of consensus on whether to adopt a use-or-share approach in the subject bands, and even among those who support the concept, on what specific use-or-share regime would best serve the public interest here. In any event, the Commission's assessment of the record leads us to conclude that the case has not been made that any one of the proposed variants of a use-or-share regime is likely to yield significant benefits. In contrast, commenters opposing implementation of a use-or-share regime in the subject bands have convinced us that whatever the speculative benefits may be, they are greatly outweighed by the likelihood that a use-or-share approach will discourage investment and delay deployment in these bands.

128. In particular, administering the shared areas would appear to be overly burdensome, whether that burden fell on the Commission, the licensee, or the incoming shared users. The Commission notes the burden would be particularly high in mmW bands, given the very large number of possible deployments due to the limited propagation in these bands. Moreover, potential business models in these bands might not necessarily blanket large portions of the geography or population in the licensed areas during the initial term. Some commenters indicated cautious support for a use-or-

share mechanism that would enable the licensee to "claw back" previously-shared spectrum if their future expansion required it, but such clawing back would be difficult to execute in practical terms, and would necessarily cause disruption to the operations of the shared users, potentially including customers among the public. Any SAS the Commission adopted to administer this system would face all the challenges it has discussed in other contexts, including difficulty defining appropriate terms and equitably distributing the cost of establishing and maintaining it. The Commission would also be risking significant delays in deployment of mmW networks during the time required to address these concerns.

129. Discouraging investment is also a serious consideration. A prospective licensee purchases rights to a defined area, subject to a defined license term with defined buildout requirements at the end of it, which are calculated to be reasonably achievable within that timeframe. Prospective licensees plan their auction bids with these specifications in mind. A use-or-share regime divorced from buildout requirements, which opened up the entire portion of the license area not in actual use by the licensee on some date, would undermine this system and introduce uncertainty and instability into the auction process. Given the record on this issue, the Commission finds that imposing a use-or-share regime at this time would discourage investment. The Commission believes its concerns are particularly relevant in these bands given the nascent state of technology and the potential scale and cost of deployments.

130. Given the well-documented challenges that would accompany the adoption of a use-or-share regime, the Commission would need a clear showing of benefits from a use-or-share regime in order to adopt such a regime. No such showing has been made here. In the 3.5 GHz band, the part 96 SAS-based system provides a form of use-or-share. The UMFUS bands that the Commission has established so far generally do not have similar incumbent or Federal coordination issues. Although some commenters argue that use-or-share would increase the efficiency of spectrum use in UMFUS bands, any such increase would require both entities willing and able to take advantage of such a regime, and a mechanism to be in place, while also preserving licensees' rights.

131. The difficulty of crafting such a balanced mechanism is discussed above. In the matter of willing entities, the Commission notes that those commenters supporting use-or-share do not agree on how such a regime should be structured; all others who commented are opposed. With regard to the comments from Inmarsat and O3b, the Commission does not believe that a use-or-share regime that is useful only to the satellite industry, at the cost of complicating terrestrial deployment, is in the public interest. The use-or-share concept was proposed as a way to encourage additional flexible use of the UMFUS bands. That goal certainly encompasses additional sharing opportunities for satellite operators, but not to the extent that it impedes terrestrial deployment. Sharing mechanisms that will allow satellite operators to coexist with terrestrial licensees in the UMFUS bands have already been established, and will continue to be refined.

132. The Commission also rejects O3b's argument that a use-or-share regime is required by the Communications Act. The Communications Act requires us to "include performance requirements, such as appropriate deadlines and penalties for performance failures, to ensure prompt delivery of service to rural areas, to prevent stockpiling or warehousing of spectrum by licensees or permittees, and to promote investment in and rapid deployment of new technologies and services." The Commission has, in fact, included performance requirements in its regulations for the new UMFUS bands. Those requirements include appropriate deadlines and penalties for performance failures. The Commission has promulgated similarly-structured requirements in other bands and services. The Commission has designed the current performance requirements for UMFUS to balance encouraging deployment of potentially novel services with ensuring accountability in terms of actually providing service, and it is satisfied that its requirements meet the requirements of the Communications Act.

133. Wi-Fi Alliance and Intel both suggested that given the difficulties of implementing a use-or-share regime, the best alternative to exclusive geographic area licensing is unlicensed spectrum. The Commission agrees. Unlicensed spectrum provides the low barriers to entry that can encourage innovative business models, while not undermining the substantial investments of which more

established operators are capable. Given that the Commission has already made available a full 14 gigahertz of unlicensed spectrum in the mmW bands, it does not believe that it is in the public interest to complicate terrestrial deployment in the UMFUS bands.

F. Digital Station Identification

134. The Commission declines to require mmW band licensees or operators to transmit digital identifiers. The record provides insufficient support for the adoption of digital ID requirements for these mmW bands, particularly if the Commission was to specify a particular format. In particular, commenters have pointed out that treatment of interference in these mmW bands would differ from how the Commission handles similar issues in most other wireless bands if the Commission were to require transmission of digital ID. The Commission observes that characteristics of the mmW bands at issue in the Report and Order and in the Second R&O make the occurrence of interference less likely in the first instance, relative to other bands. Licensees and operators in the bands being authorized generally will use short-distance transmissions, creating more potential for spectrum reuse by multiple licensees in one area and generally limiting the location of an interfering party to a relatively small area. Further, "pencil-beam" signal characteristics and other technologies being developed specifically for these bands should also make it easier for operations to co-exist in the same vicinity without causing interference to one another. The Commission acknowledges the important role of the agency in identifying and locating devices that cause harmful interference, but it finds that it is unnecessary and unsupported in the case of these mmW bands to adopt a digital ID requirement.

G. Technical Issues

1. Antenna Height

135. Based on the record, the Commission declines to adopt antenna height limits. The Commission agrees with 5G Americas and Qualcomm that there may be uses in these bands that could require higher antenna heights. The Commission also agrees that licensees are in the best position to determine their network configuration and when antenna downtilt is necessary. The Commission finds

that the comments in support of adopting antenna height limits and corresponding power reductions have failed to demonstrate that limits are necessary to avoid interference. The supporters of antenna height limits have not provided any engineering analysis or examples of deployments supporting the need for antenna height limits. In the absence of a clear showing that antenna and power limits are necessary, the Commission believes that it should minimize regulatory burdens and maximize flexibility for licensees to deploy diverse systems and to coordinate with adjacent licensees to avoid interference.

136. While Samsung and T-Mobile argue that adopting antenna height restrictions would be consistent with how other wireless technology services are regulated, antenna height limits do not apply to all part 27 radio services. For instance, the 305 meter threshold limitation does not apply to the Advanced Wireless Services (AWS), the Broadband Radio Service (BRS), or the Educational Broadband Service (EBS). The Commission also notes that antenna height thresholds and corresponding power reductions primarily apply to lower frequency bands, while higher frequency bands generally do not have such limits.

137. The Commission agrees with Boeing that there is an increased likelihood of clear line of sight conditions as the base station tower height increases. As 5G Americas and Qualcomm note, however, service providers also may operate facilities in these bands that require line of sight operations hundreds of meters above ground level. The Commission does not want to adopt rules that would unnecessarily restrict licensee's flexibility to deploy diverse systems. Further, as 5G Americas notes, licensees can work together coordinating height of facilities, beam tilt and angular discrimination as needed to protect each other in the same market, and meet the power levels at a given border to protect adjacent service. In the absence of clear evidence that PFD limits and licensee to licensee coordination are insufficient to prevent interference, the Commission concludes that additional regulatory requirements are not necessary.

138. Finally, while Starry asks that specific language be added to part 27 rules to account for the variations in technical characteristics between mmW and low band spectrum, it has not provided

sufficient detail or an explanation of what this proposed language should include. For the reasons noted above, the Commission declines to adopt antenna height thresholds and corresponding power reductions.

2. Coordination Criteria at Market Borders for Fixed Point-to-Point Operations

139. The Commission declines to revise the coordination criteria for point-to-point operations. While the Commission appreciates Nextlink's and Starry's efforts to develop alternative coordination criteria, no party has identified any concrete defect or problem with the existing coordination criteria. While it is true that the Commission has established smaller license areas in these bands, no showing has been made that changes in coordination criteria are needed to accommodate those smaller license areas. Indeed, T-Mobile believes the existing criteria work well. Furthermore, under Nextlink's and Starry's proposals, applicants would have to conduct an engineering analysis in order to determine whether a link needed to be coordinated. The Commission does not believe the benefit of having to avoid coordination in certain circumstances justifies requiring applicants to do an engineering analysis to identify whether links require coordination. The existing rules provide clear standards that licensees can readily apply to determine when coordination is needed.

140. Another problem with the Nextlink and Starry proposals is that they are not supported by the technical analysis requested in the FNPRM. Starry's proposal lacks specific details as to how the contour zone would be calculated, what protection threshold would be provided within the contour zone, or how the 50-meter height was derived. Because of the lack of details in Starry's proposal, the Commission is not able to determine whether it would adequately mitigate interference and therefore cannot adopt it. Nextlink's proposal, while more developed than Starry's, also was not supported with technical analysis that describes how their method would ensure adequate mitigation of interference between adjacent area licensees. Specifically, Nextlink's methodology appears to assume that the signal level produced by a transmitter operating at maximum EIRP oriented directly at the market border, taking into account free space loss at 20 km, will not cause interference to adjacent licensees. This may

not be the case. Given the lack of technical analysis and the failure to demonstrate a need for revised criteria, the Commission concludes that retaining the existing coordination criteria at market borders for fixed point-to-point operations is most appropriate.

3. Minimum Bandwidth for Given BS/MS/Transportable Transmit Power Levels

141. At this time, the Commission maintains its current power limit rules for mobile and transportable classes without scaling. While the Commission recognizes that power scaling can potentially help limit interference among UMFUS providers and other services using these bands, it also recognizes that there are other methods that can help limit interference, such as power control. Furthermore, UMFUS providers have an incentive to maintain a balanced power spectral density among all their network components if they wish to avoid interference within their own networks. The Commission agrees with Nextlink and Qualcomm that at this nascent stage of 5G technological development establishing power scaling factors could inadvertently preclude some yet-to-be-developed use cases and prematurely constrain development of the next generation of devices.

142. The Commission declines to establish a minimum bandwidth requirement because there is no need for such a requirement and establishing such a requirement could accidentally preclude uses of this spectrum. These bands can facilitate data exchange for a great number of devices embedded with electronics, software, sensors, and actuators (e.g., IoT). Different types of devices may have significantly different bandwidth requirements. For example, a utility meter that exchange s data on monthly or even daily bases requires far less bandwidth than a live video streaming device monitoring an inter. Given the early stage of 5G technological development, the Commission chose not to impose a regulatory requirement and provide equipment developers with flexibility to design equipment to meet market needs. Consequently, the Commission will not adopt a minimum bandwidth for UMFUS devices.

4. Sharing Analysis and Modeling

143. The Commission will remain flexible with respect to the appropriate propagation model to apply when analyzing sharing in the mmW bands. As many commenters pointed out, the appropriate

sharing model at mmW frequencies will depend on the particular sharing environment, including whether the interference path is terrestrial, air-to-ground or space-to-ground, as well as the technologies deployed. As a general principle, the Commission concurs with the commenters who support models and scenarios that consider a statistical probability of interference based on deployment, propagation, and usage scenarios as opposed to a worse case approach.

V. PROCEDURAL MATTERS

144. As required by the Regulatory Flexibility Act of 1980 (RFA), the Commission has prepared a Final Regulatory Flexibility Analysis (FRFA) and a Supplementary Final Regulatory Flexibility Analysis (Supplemental FRFA) of the possible significant economic impact on small entities of the policies and rules adopted in the *Second Report and Order and Order on Reconsideration*. The analysis associated with the policies and rules in *Second Report and Order* are contained in the FRFA, and the Supplemental FRFA contains the analysis associated with the policies and rules in *Order on Reconsideration*.

VI. FINAL REGULATORY FLEXIBILITY ANALYSIS

A. Need for, and Objectives of, the Final Rules

145. In the Second R&O, the Commission increases the Nation's supply of spectrum for mobile broadband by adopting rules for fixed and mobile services in the 24.25-24.45 GHz and 24.75-25.25 GHz band (24 GHz band), and the 47.2-48.2 GHz band. The Commission includes these bands in the part 30 UMFUS. This additional spectrum for mobile use will help ensure that the speed, capacity, and ubiquity of the nation's wireless networks keeps pace with the skyrocketing demand for mobile service. It will also make possible new types of services for consumers and businesses. The Commission will award PEA-based licenses for these bands to best balance the needs of large and small carriers, with partitioning available for the 24 GHz band.

146. Until recently, the mmW bands were generally considered unsuitable for mobile applications because of propagation losses at such high frequencies and the inability of mmW signals to

propagate around obstacles. As increasing congestion has begun to fill the lower bands and carriers have resorted to smaller and smaller microcells in order to re-use the available spectrum, however, industry is taking another look at the mmW bands and beginning to realize that at least some of its presumed disadvantages can be turned to advantage. For example, short transmission paths and high propagation losses can facilitate spectrum re-use in microcellular deployments by limiting the amount of interference between adjacent cells. Furthermore, where longer paths are desired, the extremely short wavelengths of mmW signals make it feasible for very small antennas to concentrate signals into highly focused beams with enough gain to overcome propagation losses. The short wavelengths of mmW signals also make it possible to build multi-element, dynamic beam-forming antennas that will be small enough to fit into handsets—a feat that might never be possible at the lower, longer-wavelength frequencies below 6 GHz where cell phones operate.

147. The Commission also revises its rules for sharing between UMFUS and satellite services in the 28 GHz, 39 GHz, and 37 GHz bands, and apply the revised rules to the 47 GHz band. Specifically, the Commission revises the population limits and numerical limits on satellite earth stations in those bands. These revisions will facilitate the placement of earth stations in smaller markets and promote coexistence between UMFUS and satellite services.

148. The Commission further revises its rules for the 57-71 GHz band to allow unlicensed operation on board aircraft under part 15 of the Commission's rules. This rule change will facilitate expanded access to broadband services in flight.

149. Overall, the new provisions the Commission is adopting are designed to allow licensees, particularly smaller entities, to choose their type of service offerings, to encourage innovation and investment in mobile and fixed use in this spectrum, and to provide a stable regulatory environment in which fixed, mobile, and satellite deployment will be able to develop through the application of flexible rules. The market-oriented licensing framework for these bands will ensure that this spectrum is efficiently utilized and will foster the development of new and innovative technologies and services, as

well as encourage the growth and development of a wide variety of services, ultimately leading to greater benefits to consumers.

B. Summary of Significant Issues raised by Public Comments in Response to the IRFA

150. No comments were filed that specifically addressed the proposed rules and policies presented in the IRFA.

C. Response to Comments by the Chief Counsel for Advocacy of the Small Business Administration

151. Pursuant to the Small Business Jobs Act of 2010, which amended the RFA, the Commission is required to respond to any comments filed by the Chief Counsel for Advocacy of the Small Business Administration (SBA), and to provide a detailed statement of any change made to the proposed rules as a result of those comments. The Chief Counsel did not file any comments in response to the proposed rules in this proceeding.

D. Description and Estimate of the Number of Small Entities to Which the Final Rules Will Apply

152. The RFA directs agencies to provide a description of, and where feasible, an estimate of the number of small entities that may be affected by the proposed rules and policies, if adopted herein. The RFA generally defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction." In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act. A "small business concern" is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the SBA.

153. Small Businesses, Small Organizations, and Small Governmental Jurisdictions. The Commission's action may, over time, affect small entities that are not easily categorized at present. The Commission therefore describes here, at the outset, three broad groups of small entities that could be directly affected herein. First, while there are industry specific size standards for small businesses that

are used in the regulatory flexibility analysis, according to data from the SBA's Office of Advocacy, in general a small business is an independent business having fewer than 500 employees. These types of small businesses represent 99.9 percent of all businesses in the United States, which translates to 28.8 million businesses. Next, the type of small entity described as a "small organization" is generally "any not-for-profit enterprise which is independently owned and operated and is not dominant in its field." Nationwide, as of 2007, there were approximately 1,621,215 small organizations. Finally, the small entity described as a "small governmental jurisdiction" is defined generally as "governments of cities, towns, townships, villages, school districts, or special districts, with a population of less than fifty thousand." U.S. Census Bureau data published in 2012 indicate that there were 89,476 governmental jurisdictions in the United States. The Commission estimates that, of this total, as many as 88,761 entities may qualify as "small governmental jurisdictions." Thus, the Commission estimates that most governmental jurisdictions are small.

154. Wireless Telecommunications Carriers (except Satellite). This industry comprises establishments engaged in operating and maintaining switching and transmission facilities to provide communications via the airwaves. Establishments in this industry have spectrum licenses and provide services using that spectrum, such as cellular services, paging services, wireless internet access, and wireless video services. The appropriate size standard under SBA rules is that such a business is small if it has 1,500 or fewer employees. For this industry, U.S. Census Bureau data for 2012 show that there were 967 firms that operated for the entire year. Of this total, 955 firms had employment of 999 or fewer employees and 12 had employment of 1,000 employees or more. Thus, under this category and the associated size standard, the Commission estimates that the majority of wireless telecommunications carriers (except satellite) are small entities.

155. Fixed Microwave Services. Microwave services include common carrier, private-operational fixed, and broadcast auxiliary radio services. They also include the UMFUS and the mmW Service where licensees can choose between common carrier and non-common carrier status. At

present, there are approximately 66,680 common carrier fixed licensees, 69,360 private and public safety operational-fixed licensees, 20,150 broadcast auxiliary radio licensees, 411 LMDS licenses, 3324 GHz DEMS licenses, 777 39 GHz licenses, and five 24 GHz licenses, and 467 mmW licenses in the microwave services. The Commission has not yet defined a small business with respect to microwave services. The closest applicable SBA category is Wireless Telecommunications Carriers (except Satellite) and the appropriate size standard for this category under SBA rules is that such a business is small if it has 1,500 or fewer employees. For this industry, U.S. Census Bureau data for 2012 shows that there were 967 firms that operated for the entire year. Of this total, 955 had employment of 999 or fewer, and 12 firms had employment of 1,000 employees or more. Thus, under this SBA category and the associated standard, the Commission estimates that the majority of fixed microwave service licensees can be considered small.

156. The Commission does not have data specifying the number of these licensees that have more than 1,500 employees, and thus is unable at this time to estimate with greater precision the number of fixed microwave service licensees that would qualify as small business concerns under the SBA's small business size standard. Consequently, the Commission estimates that there are up to 36,708 common carrier fixed licensees and up to 59,291 private operational-fixed licensees and broadcast auxiliary radio licensees in the microwave services that may be small and may be affected by the rules and policies adopted herein. The Commission notes, however, that both the common carrier microwave fixed and the private operational microwave fixed licensee categories includes some large entities.

157. Satellite Telecommunications and All Other Telecommunications. This category comprises firms "primarily engaged in providing telecommunications services to other establishments in the telecommunications and broadcasting industries by forwarding and receiving communications signals via a system of satellites or reselling satellite telecommunications." The category has a small business size standard of $32.5 million or less in average annual receipts, under SBA rules. For this

category, U.S. Census Bureau data for 2012 shows that there were a total of 333 firms that operated for the entire year. Of this total, 299 firms had annual receipts of less than $25 million. Consequently, the Commission estimates that the majority of satellite telecommunications providers are small entities.

158. All Other Telecommunications. The "All Other Telecommunications" category is comprised of establishments primarily engaged in providing specialized telecommunications services, such as satellite tracking, communications telemetry, and radar station operation. This industry also includes establishments primarily engaged in providing satellite terminal stations and associated facilities connected with one or more terrestrial systems and capable of transmitting telecommunications to, and receiving telecommunications from, satellite systems. Establishments providing Internet services or voice over Internet protocol (VoIP) services via client-supplied telecommunications connections are also included in this industry." The SBA has developed a small business size standard for "All Other Telecommunications," which consists of all such firms with gross annual receipts of $32.5 million or less. For this category, U.S. Census Bureau data for 2012 shows that there were a total of 1442 firms that operated for the entire year. Of these firms, a total of 1400 firms had gross annual receipts of under $25 million and 42 firms had gross annual receipts of $25 million to $49,999,999. Thus, the Commission estimates that a majority of "All Other Telecommunications" firms potentially affected by its actions can be considered small.

159. Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing. This industry comprises establishments primarily engaged in manufacturing radio and television broadcast and wireless communications equipment. Examples of products made by these establishments are: transmitting and receiving antennas, cable television equipment, GPS equipment, pagers, cellular phones, mobile communications equipment, and radio and television studio and broadcasting equipment." The SBA has established a size standard for this industry of 1,250 employees or less. U.S. Census Bureau data for 2012 shows that 841 establishments operated in this industry in that year. Of that number, 828 establishments operated with fewer than 1,000 employees, 7

establishments operated with between 1,000 and 2,499 employees and 6 establishments operated with 2,500 or more employees. Based on this data, the Commission concludes that a majority of manufacturers in this industry is small.

E. Description of Projected Reporting, Recordkeeping, and Other Compliance Requirements

160. The projected reporting, recordkeeping, and other compliance requirements in the Second Report and Order will apply to all entities in the same manner. The revisions the Commission adopts should benefit small entities by giving them more information, more flexibility, and more options for gaining access to wireless spectrum.

161. Small entities and other applicants for UMFUS licenses will be required to file license applications using the Commission's automated Universal Licensing System (ULS). ULS is an online electronic filing system that also serves as a powerful information tool, one that enables potential licensees to research applications, licenses, and antenna structures. It also keeps the public informed with weekly public notices, FCC rulemakings, processing utilities, and a telecommunications glossary. Small entities, like all other entities who are UMFUS applicants, must submit long-form license applications must do so through ULS using Form 601, FCC Ownership Disclosure Information for the Wireless Telecommunications Services using FCC Form 602, and other appropriate forms.

162. The Commission expects that the filing, recordkeeping and reporting requirements associated with the demands described above will require small businesses as well as other entities that intend to utilize these new UMFUS licenses to use professional, accounting, engineering or survey services in order to meet these requirements. As described below, several steps have been taken that will alleviate the burdens of the requirements on small businesses.

F. Steps Taken to Minimize the Significant Economic Impact on Small Entities, and Significant Alternatives Considered

163. The RFA requires an agency to describe any significant alternatives that it has considered in reaching its approach, which may include the following four alternatives (among others): (1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance or reporting requirements under the rule for small entities; (3) the use of performance, rather than design, standards; and (4) an exemption from coverage of the rule, or any part thereof, for small entities.

164. As noted above, the various construction and performance requirements and their associated showings will be the same for small and large businesses that license the UMFUS bands. To the extent applying the rules equally to all entities results in the cost of complying with these burdens being relatively greater for smaller businesses than for large ones, these costs are necessary to effectuate the purpose of the Communications Act, namely to further the efficient use of spectrum and to prevent spectrum warehousing. Likewise compliance with the Commission's service and technical rules and coordination requirements are necessary for the furtherance of its goals of protecting the public while also providing interference free services. Moreover, while small and large businesses must equally comply with these rules and requirements, the Commission has taken the steps described below to alleviate the burden on small businesses that seek to comply with these requirements.

165. First, the Second Report and Order provides that in the 24 GHz and 47.2-48.2 GHz bands small businesses will have the flexibility to provide any fixed or mobile service that is consistent with their spectrum allocation. This breaks with the recent past in which 24 GHz licensees were limited to only a single use licenses in these bands, and such new flexibility benefits small businesses by giving them more avenues for gaining access to valuable wireless spectrum.

166. Furthermore, the PEA license areas chosen in the Second Report and Order should provide spectrum access opportunities for smaller carriers by giving them access to less densely populated areas that match their footprints. While PEAs and counties are small enough to provide spectrum access opportunities for smaller carriers and PEAs could even be further disaggregated, these units of area also nest within and may be aggregated to form larger license areas. Therefore, the benefits and burdens resulting from assigning spectrum in PEA are the result of the Commission balancing the needs of small and large businesses.

167. Finally, the proposals to facilitate satellite service in the 28 GHz and 37.5-40 GHz bands should also assist small satellite businesses by providing them with additional flexibility to locate their earth stations without causing interference to or receiving interference from UMFUS licensees.

G. Federal Rules that May Duplicate, Overlap, or Conflict with the Final Rules

168. None.

VII. SUPPLEMENTARY FINAL REGULATORY FLEXIBILITY ACT ANALYSIS

A. Need for, and Objective of, the Final Rules

169. In the July 2016 R&O, the Commission made mmW spectrum available through both licensed and unlicensed mechanisms. The Commission authorized both fixed and mobile operations in the 28 GHz and 39 GHz bands using geographic area licensing through the creation of a new UMFUS. The Commission also limited the number of FSS earth station locations to three per county in the 28 GHz band and three per PEA in the 37.5-40 GHz band. It protected a limited number of Federal military sites across the full 37 GHz band and maintained the existing Federal fixed and mobile allocations throughout the band. In the 64-71 GHz band, the Commission authorized unlicensed operations under part 15 based on the rules for the adjacent 57-64 GHz band, providing more spectrum for unlicensed uses like short-range devices for interactive motion sensing and Wi-Fi-like "WiGig" operations.

170. The Commission also set up licensing and operating rules for the UMFUS. It granted mobile operating rights to existing LMDS and 28 GHz band licensees, while subdividing their existing licensees to either the county or PEA level. The Commission adopted service and technical rules to facilitate full and complete use of the bands. It also adopted spectrum holdings policies for the 28GHz, 37 GHz, and 39 GHz bands that apply to licenses acquired through auctions and the secondary market. It also adopted performance requirements for mobile, point-to-multipoint, and fixed uses. The Commission adopted a requirement that UMFUS licensees submit a statement describing their security plans and related information prior to commencing operations. It also restricted earth station interference zones from infringing upon any arterial streets or interstate or U.S. highway. Lastly, it deleted the broadcasting and broadcasting-satellite service allocations from the 42-42.5 GHz band (42 GHz band) and declined to allocate the band to the FSS (space-to-Earth).

171. In this Order on Reconsideration, the Commission rescinds the reporting and security requirements for UMFUS licensees. Instead, the Commission seeks industry input through the CSRIC process. The Commission will also provide additional flexibility in smaller markets. The Commission modifies and limit the prohibition of earth station interference zones from infringing on a specific set of roads, as defined and classified by the U.S. Department of Transportation: Interstate, Other Freeways and Expressways, or Other Principal Arterial. Finally, the Commission increases the three locations per license area limit on earth stations in the 37.5-40 GHz band to 15 in each PEA, subject to an additional limitation of no more than three earth stations per county.

172. The analysis of the Commission's efforts to minimize the possible significant economic impact on small entities as described in the previous FRFA in this proceeding is hereby incorporated into this FRFA. As a result of the Commission's actions in this Order on Reconsideration small entities as well as other licensees will save time and resources that would have been spent complying with the service and technical rules. The cost of compliance with the July 2016 R&O is relatively greater for smaller businesses, however with the rescission of the security measures, some of that compliance cost is

eliminated. The Commission believes this should result in small businesses having an easier time providing service.

B. Summary of Significant Issues Raised by Public Comments in Response to the IRFA

173. No comments were filed that specifically addressed the proposed rules and policies presented in the IRFA.

C. Response to Comments by the Chief Counsel for Advocacy of the Small Business Administration

174. Pursuant to the Small Business Jobs Act of 2010, which amended the RFA, the Commission is required to respond to any comments filed by the Chief Counsel of the Small Business Administration (SBA), and to provide a detailed statement of any change made to the proposed rule(s) as a result of those comments

175. The Chief Counsel did not file any comments in response to the proposed rules in this proceeding.

D. Description and Estimate of the Number of Small Entities to Which the Rules Would Apply

176. The RFA directs agencies to provide a description of, and where feasible, an estimate of the number of small entities that may be affected by the proposed rules and policies, if adopted herein. The RFA generally defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small governmental jurisdiction." In addition, the term "small business" has the same meaning as the term "small business concern" under the Small Business Act. A "small business concern" is one which: (1) is independently owned and operated; (2) is not dominant in its field of operation; and (3) satisfies any additional criteria established by the SBA.

177. As noted above, a FRFA was incorporated into the July 2016 R&O. In that analysis, the Commission described in detail the small entities that might be significantly affected by the rules adopted in the R&O. In this Order on Reconsideration, the Commission hereby incorporates by

reference the descriptions and estimates of the number of small entities from the previous FRFA in this proceeding.

E. Description of Projected Reporting, Recordkeeping, and Other Compliance Requirements for Small Entities

178. The reporting, recordkeeping and other compliance requirements for small entities required by the July 2016 R&O as described in the previous FRFA in this proceeding is hereby incorporated into this FRFA. The actions taken in this Order on Reconsideration revise those requirements by no longer requiring small entities as well as other licensees to submit general statements of their plans for safeguarding their networks and devices from security breaches. The changes to the Earth station siting requirement will not change the reporting and recordkeeping requirements applicable to the rules.

F. Steps Taken to Minimize the Significant Economic Impact on Small Entities, and Significant Alternatives Considered

179. The RFA requires an agency to describe any significant, specifically small business, alternatives, that it has considered in reaching its approach, which may include the following four alternatives (among others): "(1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance or reporting requirements under the rule for such small entities; (3) the use of performance rather than design standards; and (4) and exemption from coverage of the rule, or any part thereof, for such small entities."

180. The analysis of the Commission's efforts to minimize the possible significant economic impact on small entities as described in the previous FRFA in this proceeding is hereby incorporated into this FRFA. As a result of the Commission's actions in this Order on Reconsideration small entities as well as other licensees will save time and resources that would have been spent complying with the security reporting requirement. The Commission believes this should result in small businesses having an easier

time providing service. The changes to the Earth station limits from three per PEA to 15 per PEA should increase competition and allow more opportunities for small businesses.

G. Report to Congress

181. The Commission will send a copy of this Order, including this Supplemental FRFA, in a report to be sent to Congress and the Government Accountability Office pursuant to the Small Business Regulatory Enforcement Fairness Act of 1996. In addition, the Commission will send a copy of this Order, including the Supplemental FRFA, to the Chief Counsel for Advocacy of the Small Business Administration. A copy of this Order and Supplemental FRFA (or summaries thereof) will also be published in the Federal Register.

VIII. ORDERING CLAUSES

182. IT IS ORDERED, pursuant to the authority found in sections 1, 2, 3, 4, 5, 7, 301, 302, 302a, 303, 304, 307, 309, and 310 of the Communications Act of 1934, 47 U.S.C. 151, 152, 153, 154, 155, 157, 301, 302, 302a, 303, 304, 307, 309, and 310, Section 706 of the Telecommunications Act of 1996, as amended, 47 U.S.C. 1302, and § 1.411 of the Commission's rules, 47 CFR 1.411, that this Second Report and Order, Second Further Notice of Proposed Rulemaking, Order on Reconsideration, and Memorandum Opinion and Order IS HEREBY ADOPTED.

183. IT IS FURTHER ORDERED that the provisions and requirements of this Second Report and Order, Second Further Notice of Proposed Rulemaking, Order on Reconsideration, and Memorandum Opinion and Order and the rules adopted herein WILL BECOME EFFECTIVE **[INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER**, except for those provisions which WILL BECOME EFFECTIVE **[INSERT DATE OF PUBLICATION IN THE FEDERAL REGISTER**, and those rules and requirements which contain new or modified information collection requirements that require approval by the Office of Management and Budget under the Paperwork Reduction Act and WILL BECOME EFFECTIVE after the Commission publishes a notice in the Federal Register announcing such approval and the relevant effective date.

184. IT IS FURTHER ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of this Second Report and Order, Second Further Notice of Proposed Rulemaking, Order on Reconsideration, and Memorandum Opinion and Order, including the Final, Supplemental Final, and Initial Regulatory Flexibility Analysis, to the Chief Counsel for Advocacy of the Small Business Administration.

185. IT IS FURTHER ORDERED that the Commission SHALL SEND a copy of the Report and Order to Congress and the Government Accountability Office pursuant to the Congressional Review Act, see 5 U.S.C. 801(a)(1)(A).

List of Subjects in 47 CFR Parts 1, 2, 15, 25, 30, and 101

Communications common carriers, Communications equipment, Reporting and recordkeeping requirements.

FEDERAL COMMUNICATIONS COMMISSION.

Marlene H. Dortch,

Secretary,

Office of the Secretary.

Final Rules

For the reasons discussed in the preamble, the Federal Communications Commission amends 47 CFR parts 1, 2, 15, 25, 30, and 101 as follows:

PART 1—PRACTICE AND PROCEDURE

1. The authority citation for part 1 continues to read as follows:

Authority: 47 U.S.C. 151, 154(i), 154(j), 155, 157, 160, 201, 225, 227, 303, 309, 332, 1403, 1404, 1451, 1452, and 1455.

2. Section 1.901 is revised to read as follows:

§ 1.901 Basis and purpose.

The rules in this subpart are issued pursuant to the Communications Act of 1934, as amended, 47 U.S.C. 151 et seq. The purpose of the rules in this subpart is to establish the requirements and conditions under which entities may be licensed in the Wireless Radio Services as described in this part and in parts 13, 20, 22, 24, 27, 30, 74, 80, 87, 90, 95, 96, 97, and 101 of this chapter.

3. Section 1.902 is revised to read as follows:

§ 1.902 Scope.

In case of any conflict between the rules set forth in this subpart and the rules set forth in parts 13, 20, 22, 24, 27, 30, 74, 80, 87, 90, 95, 96, 97, and 101 of title 47, chapter I of the Code of Federal Regulations, the rules in this part shall govern.

PART 2 – FREQUENCY ALLOCATIONS AND RADIO TREATY MATTERS; GENERAL RULES AND REGULATIONS

4. The authority citation for part 2 continues to read as follows:

Authority: 47 U.S.C. 154, 302a, 303, and 336, unless otherwise noted.

5. Section 2.106, the Table of Frequency Allocations, is amended as follows:

a. Pages 54 and 59 are revised.

b. In the list of non-Federal Government (NG) Footnotes, footnote NG65 is added.

The revisions and addition read as follows:

§ 2.106 Table of Frequency Allocations.

* * * * *

24-24.05 AMATEUR AMATEUR-SATELLITE 5.150			24-24.05 5.150 US211	24-24.05 AMATEUR AMATEUR-SATELLITE 5.150 US211	ISM Equipment (18) Amateur Radio (97)
24.05-24.25 RADIOLOCATION Amateur Earth exploration-satellite (active) 5.150			24.05-24.25 RADIOLOCATION G59 Earth exploration-satellite (active) 5.150	24.05-24.25 Amateur Earth exploration-satellite (active) Radiolocation 5.150	RF Devices (15) ISM Equipment (18) Private Land Mobile (90) Amateur Radio (97)
24.25-24.45 FIXED	24.25-24.45 RADIONAVIGATION	24.25-24.45 FIXED MOBILE RADIONAVIGATION	24.25-24.45	24.25-24.45 FIXED MOBILE	RF Devices (15) Upper Microwave Flexible Use (30)
24.45-24.65 FIXED INTER-SATELLITE	24.45-24.65 INTER-SATELLITE RADIONAVIGATION 5.533	24.45-24.65 FIXED INTER-SATELLITE MOBILE RADIONAVIGATION 5.533	24.45-24.65 INTER-SATELLITE RADIONAVIGATION 5.533		RF Devices (15) Satellite Communications (25)
24.65-24.75 FIXED FIXED-SATELLITE (Earth-to-space) 5.532B INTER-SATELLITE	24.65-24.75 INTER-SATELLITE RADIOLOCATION-SATELLITE (Earth-to-space)	24.65-24.75 FIXED FIXED-SATELLITE (Earth-to-space) 5.532B INTER-SATELLITE MOBILE 5.533	24.65-24.75 INTER-SATELLITE RADIOLOCATION-SATELLITE (Earth-to-space)		
24.75-25.25 FIXED FIXED-SATELLITE (Earth-to-space) 5.532B	24.75-25.25 FIXED-SATELLITE (Earth-to-space) 5.535	24.75-25.25 FIXED FIXED-SATELLITE (Earth-to-space) 5.535 MOBILE	24.75-25.25	24.75-25.25 FIXED FIXED-SATELLITE (Earth-to-space) NG535 MOBILE	RF Devices (15) Satellite Communications (25) Upper Microwave Flexible Use (30)
25.25-25.5 FIXED INTER-SATELLITE 5.536 MOBILE Standard frequency and time signal-satellite (Earth-to-space)			25.25-25.5 FIXED INTER-SATELLITE 5.536 MOBILE Standard frequency and time signal-satellite (Earth-to-space)	25.25-25.5 Inter-satellite 5.536 Standard frequency and time signal-satellite (Earth-to-space)	RF Devices (15)
25.5-27 EARTH EXPLORATION-SATELLITE (space-to-Earth) 5.536B FIXED INTER-SATELLITE 5.536 MOBILE SPACE RESEARCH (space-to-Earth) 5.536C Standard frequency and time signal-satellite (Earth-to-space) 5.536A			25.5-27 EARTH EXPLORATION-SATELLITE (space-to-Earth) FIXED INTER-SATELLITE 5.536 MOBILE SPACE RESEARCH (space-to-Earth) Standard frequency and time signal-satellite (Earth-to-space) 5.536A US258	25.5-27 SPACE RESEARCH (space-to-Earth) Inter-satellite 5.536 Standard frequency and time signal-satellite (Earth-to-space) 5.536A US258	

International Table			United States Table		FCC Rule Part(s)
Region 1 Table	Region 2 Table	Region 3 Table	Federal Table	Non-Federal Table	
(See previous page)			46.9-47 MOBILE MOBILE-SATELLITE (Earth-to-space) RADIONAVIGATION-SATELLITE 5.554	46.9-47 FIXED MOBILE MOBILE-SATELLITE (Earth-to-space) RADIONAVIGATION-SATELLITE 5.554	
47-47.2 AMATEUR AMATEUR-SATELLITE			47-48.2	47-47.2 AMATEUR AMATEUR-SATELLITE	Amateur Radio (97)
47.2-47.5 FIXED FIXED-SATELLITE (Earth-to-space) 5.552 MOBILE 5.552A				47.2-48.2 FIXED FIXED-SATELLITE (Earth-to-space) US297 NG65 MOBILE	Satellite Communications (25) Upper Microwave Flexible Use (30)
47.5-47.9 FIXED FIXED-SATELLITE (Earth-to-space) 5.552 (space-to-Earth) 5.516B 5.554A MOBILE	47.5-47.9 FIXED FIXED-SATELLITE (Earth-to-space) 5.552 MOBILE				
47.9-48.2 FIXED FIXED-SATELLITE (Earth-to-space) 5.552 MOBILE 5.552A					
48.2-48.54 FIXED FIXED-SATELLITE (Earth-to-space) 5.552 (space-to-Earth) 5.516B 5.554A 5.555B MOBILE	48.2-50.2 FIXED FIXED-SATELLITE (Earth-to-space) 5.338A 5.516B 5.552 MOBILE		48.2-50.2 FIXED FIXED-SATELLITE (Earth-to-space) US156 US297 MOBILE US264		Satellite Communications (25)
48.54-49.44 FIXED FIXED-SATELLITE (Earth-to-space) 5.552 MOBILE 5.149 5.340 5.555					
49.44-50.2 FIXED FIXED-SATELLITE (Earth-to-space) 5.338A 5.552 (space-to-Earth) 5.516B 5.554A 5.555B MOBILE	5.149 5.340 5.555		5.555 US342		
50.2-50.4 EARTH EXPLORATION-SATELLITE (passive) SPACE RESEARCH (passive) 5.340			50.2-50.4 EARTH EXPLORATION-SATELLITE (passive) SPACE RESEARCH (passive) US246		

* * * * *

NON-FEDERAL GOVERNMENT (NG) FOOTNOTES

* * * * *

NG65 In the band 47.2-48.2 GHz, stations in the fixed and mobile services may not claim protection from individually licensed earth stations authorized pursuant to 47 CFR 25.136. However, nothing in this footnote shall limit the right of UMFUS licensees to operate in conformance with the technical rules contained in 47 CFR part 30. The Commission reserves the right to monitor developments and to undertake further action concerning interference between UMFUS and FSS, including aggregate interference to satellite receivers, if appropriate.

* * * * *

PART 15 – RADIO FREQUENCY DEVICES

6. The authority citation for part 15 continues to read as follows:

Authority: 47 U.S.C. 154, 302a, 303(r), 304, 307, 336, 544a, and 549.

7. Amend § 15.255 by revising paragraph (a)(1), redesignating paragraphs (b) through (h) as paragraphs (c) through (i), adding new paragraph (b), and revising newly redesignated paragraphs (c)(1)(ii)(A) and (c)(3) to read as follows:

§ 15.255 Operation within the band 57-71 GHz.

(a) * * *

(1) Equipment used on satellites.

* * * * *

(b) Operation on aircraft is permitted under the following conditions:

(1) When the aircraft is on the ground.

(2) While airborne, only in closed exclusive on-board communication networks within the aircraft, with the following exceptions:

(i) Equipment shall not be used in wireless avionics intra-communication (WAIC) applications where external structural sensors or external cameras are mounted on the outside of the aircraft structure.

(ii) Equipment shall not be used on aircraft where there is little attenuation of RF signals by the body/fuselage of the aircraft. These aircraft include, but are not limited to, toy/model aircraft, unmanned aircraft, crop-spraying aircraft, aerostats, etc.

(c) * * *

(1) * * *

(ii) * * *

(A) The provisions in this paragraph (c) for reducing transmit power based on antenna gain shall not require that the power levels be reduced below the limits specified in paragraph (c)(1)(i) of this section.

* * * * *

(3) For fixed field disturbance sensors other than those operating under the provisions of paragraph (c)(2) of this section, and short-range devices for interactive motion sensing, the peak transmitter conducted output power shall not exceed –10 dBm and the peak EIRP level shall not exceed 10 dBm.

* * * * *

PART 25 – SATELLITE COMMUNICATIONS

8. The authority citation for part 25 continues to read as follows:

Authority: Interprets or applies 47 U.S.C. 154, 301, 302, 303, 307, 309, 310, 319, 332, 605, and 721, unless otherwise noted.

9. Amend § 25.130 by revising paragraph (b) and the note to paragraph (g) to read as follows:

§ 25.130 Filing requirements for transmitting earth stations.

* * * * *

(b)(1) Applicants for earth stations transmitting in frequency bands shared with equal rights between terrestrial and space services must provide a frequency coordination analysis in accordance with §25.203(b), and must include any notification or demonstration required by any other relevant provision in §25.203.

(2) Applicants for user transceiver units associated with the NVNG MSS must provide the information required by §25.135.

(3) Applicants for 1.6/2.4 GHz MSS user transceivers must demonstrate that the transceivers will operate in compliance with relevant requirements in §25.213.

(4) Applicants for earth stations licensed in accordance with §25.136 must demonstrate that the transmitting earth stations will meet the relevant criteria specified in that, including any showings required under §25.136(a)(4), (c), and/or (d)(4).

* * * * *

(g) ***

NOTE 1 TO PARAGRAPH (g): This paragraph does not apply to applications for blanket-licensed earth station networks filed pursuant to § 25.115(c) or §25.218; applications for conventional Ka-band hub stations filed pursuant to § 25.115(e); applications for NGSO FSS gateway earth stations filed pursuant to § 25.115(f); applications for individually licensed earth stations filed pursuant to § 25.136;

applications filed pursuant to §§ 25.221, § 25.222, § 25.226, or § 25.227; or applications for 29 GHz NGSO MSS feeder-link stations in a complex as defined in § 25.257.

10. Amend § 25.136 by revising the section heading and paragraphs (a) introductory text, (a)(4), (c), and (d) and adding paragraphs (e) and (f) to read as follows:

§ 25.136 Earth Stations in the 27.5-28.35 GHz, 37.5-40 GHz, and 47.2-48.2 GHz bands.

(a) FSS is secondary to the Upper Microwave Flexible Use Service in the 27.5-28.35 GHz band. Notwithstanding that secondary status, an applicant for a license for a transmitting earth station in the 27.5-28.35 GHz band that meets one of the following criteria may be authorized to operate without providing interference protection to stations in the Upper Microwave Flexible Use Service:

* * * * *

(4) The applicant demonstrates compliance with all of the following criteria in its application:

(i) There are no more than two other authorized earth stations operating in the 27.5-28.35 GHz band within the county where the proposed earth station is located that meet the criteria contained in either paragraph (a)(1), (2), (3), or (4) of this section. For purposes of this requirement, multiple earth stations that are collocated with or at a location contiguous to each other shall be considered as one earth station;

(ii) The area in which the earth station generates a PFD, at 10 meters above ground level, of greater than or equal to -77.6 dBm/m2/MHz, together with the similar area of any other earth station authorized pursuant to paragraph (a) of this section, does not cover, in the aggregate, more than the amount of population of the UMFUS license area within which the earth station is located as noted in table 1 to this paragraph (a)(4)(ii):

Table 1 to Paragraph (a)(4)(ii)

Population within UMFUS License Area	Maximum permitted aggregate population within -77.6 dBm/m^2/MHz PFD contour of earth stations
Greater than 450,000	0.1 percent of population in UMFUS license area
Between 6,000 and 450,000	450 people
Fewer than 6,000	7.5 percent of population in UMFUS license area

(iii) The area in which the earth station generates a PFD, at 10 meters above ground level, of greater than or equal to -77.6 dBm/m^2/MHz does not contain any major event venue, urban mass transit route, passenger railroad, or cruise ship port. In addition, the area mentioned in paragraph (a)(4)(ii) of this section shall not cross any of the following types of roads, as defined in functional classification guidelines issued by the Federal Highway Administration pursuant to 23 CFR 470.105(b): Interstate, Other Freeways and Expressways, or Other Principal Arterial. The Federal Highway Administration Office of Planning, Environment, and Realty Executive Geographic Information System (HEPGIS) map contains information on the classification of roads. For purposes of this rule, an urban area shall be an Adjusted Urban Area as defined in section 101(a)(37) of Title 21 of the United States Code.

(iv) The applicant has successfully completed frequency coordination with the UMFUS licensees within the area in which the earth station generates a PFD, at 10 meters above ground level, of greater than or equal to -77.6 dBm/m^2/MHz with respect to existing facilities constructed and in operation by the UMFUS licensee. In coordinating with UMFUS licensees, the applicant shall use the applicable processes contained in § 101.103(d) of this chapter.

* * * * *

(c) The protection zone (as defined in paragraph (b) of this section) shall comply with the following criteria. The applicant must demonstrate compliance with all of the following criteria in its application:

(1) There are no more than two other authorized earth stations operating in the 37.5-40 GHz band within the county within which the proposed earth station is located that meet the criteria contained in paragraph (c) of this section, and there are no more than 14 other authorized earth stations operating in the 37.5-40 GHz band within the PEA within which the proposed earth station is located that meet the criteria contained in paragraph (c) of this section. For purposes of this requirement, multiple earth stations that are collocated with or at a location contiguous to each other shall be considered as one earth station;

(2) The protection zone, together with the protection zone of other earth stations in the same PEA authorized pursuant to this, does not cover, in the aggregate, more than the amount of population of the PEA within which the earth station is located as noted in table 1 to this paragraph (c)(2):

Table 1 to Paragraph (c)(2)

Population within Partial Economic Area (PEA) where earth station is located	Maximum permitted aggregate population within protection zone of earth stations
Greater than 2,250,000	0.1 percent of population in PEA
Between 60,000 and 2,250,000	2,250 people
Fewer than 60,000	3.75 percent of population in PEA

(3) The protection zone does not contain any major event venue, urban mass transit route, passenger railroad, or cruise ship port. In addition, the area mentioned in the preceding sentence shall not cross any of the following types of roads, as defined in functional classification guidelines issued by

the Federal Highway Administration pursuant to 23 CFR 470.105(b): Interstate, Other Freeways and Expressways, or Other Principal Arterial. The Federal Highway Administration Office of Planning, Environment, and Realty Executive Geographic Information System (HEPGIS) map contains information on the classification of roads. For purposes of this rule, an urban area shall be an Adjusted Urban Area as defined in section 101(a)(37) of Title 21 of the United States Code.

(4) The applicant has successfully completed frequency coordination with the UMFUS licensees within the protection zone with respect to existing facilities constructed and in operation by the UMFUS licensee. In coordinating with UMFUS licensees, the applicant shall use the applicable processes contained in § 101.103(d) of this chapter.

(d) Notwithstanding that FSS is co-primary with the Upper Microwave Flexible Use Service in the 47.2-48.2 GHz band, earth stations in the 47.2-48.2 GHz band shall be limited to individually licensed earth stations. An applicant for a license for a transmitting earth station in the 47.2-48.2 GHz band must meet one of the following criteria to be authorized to operate without providing any additional interference protection to stations in the Upper Microwave Flexible Use Service:

(1) The FSS licensee also holds the relevant Upper Microwave Flexible Use Service license(s) for the area in which the earth station generates a PFD, at 10 meters above ground level, of greater than or equal to −77.6 dBm/m^2/MHz; or

(2) The earth station in the 47.2-48.2 GHz band was authorized prior to [**INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER**]; or

(3) The application for the earth station in the 47.2-48.2 GHz band was filed prior to [**INSERT DATE 30 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER**]; or

(4) The applicant demonstrates compliance with all of the following criteria in its application:

(i) There are no more than two other authorized earth stations operating in the 47.2-48.2 GHz band within the county where the proposed earth station is located that meet the criteria contained in paragraph (d)(1), (2), (3), or (4) of this section, and there are no more than 14 other authorized earth stations operating in the 47.2-48.2 GHz band within the PEA where the proposed earth station is located that meet the criteria contained in paragraph (d)(1), (2), (3), or (4) of this section. For purposes of this requirement, multiple earth stations that are collocated with or at a location contiguous to each other shall be considered as one earth station;

(ii) The area in which the earth station generates a PFD, at 10 meters above ground level, of greater than or equal to −77.6 dBm/m^2/MHz, together with the similar area of any other earth station authorized pursuant to paragraph (d) of this section, does not cover, in the aggregate, more than the amount of population of the PEA within which the earth station is located as noted in table 1 to this paragraph (d)(4)(ii):

Table 1 to Paragraph (d)(4)(ii)

Population within Partial Economic Area (PEA) where earth station is located	Maximum permitted aggregate population within −77.6 dBm/m^2/MHz PFD contour of earth stations
Greater than 2,250,000	0.1 percent of population in PEA
Between 60,000 and 2,250,000	2,250 people
Fewer than 60,000	3.75 percent of population in PEA

(iii) The area in which the earth station generates a PFD, at 10 meters above ground level, of greater than or equal to −77.6 dBm/m^2/MHz does not contain any major event venue, any highway classified by the U.S. Department of Transportation under the categories Interstate, Other Freeways and

Expressways, or Other Principal Arterial, or an urban mass transit route, passenger railroad, or cruise ship port; and

(iv) The applicant has successfully completed frequency coordination with the UMFUS licensees within the area in which the earth station generates a PFD, at 10 meters above ground level, of greater than or equal to −77.6 dBm/m^2/MHz with respect to existing facilities constructed and in operation by the UMFUS licensee. In coordinating with UMFUS licensees, the applicant shall use the applicable processes contained in §101.103(d) of this chapter.

(e) If an earth station applicant or licensee in the 27.5-28.35 GHz, 37.5-40 GHz, or 47.2-48.2 GHz bands enters into an agreement with an UMFUS licensee, their operations shall be governed by that agreement, except to the extent that the agreement is inconsistent with the Commission's rules or the Communications Act.

(f) Any earth station authorizations issued pursuant to paragraph (a)(4), (c), or (d)(4) of this section shall be conditioned upon operation being in compliance with the criteria contained in the applicable paragraph.

PART 30 – UPPER MICROWAVE FLEXIBLE USE SERVICE

11. The authority citation for part 30 continues to read as follows:

Authority: 47 U.S.C. 151, 152, 153, 154, 301, 303, 304, 307, 309, 310, 316, 332, 1302.

12. Amend § 30.4 by redesignating paragraphs (a), (b), and (c) as paragraphs (b), (c), and (d) and adding new paragraphs (a) and (e) to read to read as follows:

§ 30.4 Frequencies.

* * * * *

(a) 24.25-24.45 GHz and 24.75-25.25 GHz bands – 24.25-24.35 GHz; 24.35-24.45 GHz; 24.75-24.85 GHz; 24.85-24.95 GHz; 24.95-25.05 GHz; 25.05-25.15 GHz; and 25.15-25.25 GHz.

* * * * *

(e) 47.2-48.2 GHz band – 47.2-47.4 GHz; 47.4-47.6 GHz; 47.6-47.8 GHz; 47.8-48.0 GHz; and 48.0-48.2 GHz.

13. Amend § 30.6 by revising paragraph (b) to read as follows:

§ 30.6 Permissible communications.

* * * * *

(b) Fixed-Satellite Service shall be provided in a manner consistent with part 25 of this chapter. The technical and operating rules in this part shall not apply to Fixed-Satellite Service operation.

§ 30.8 [Remove and Reserve]

14. Remove and reserve § 30.8.

15. Amend § 30.104 by revising paragraph (a) to read as follows:

§ 30.104 Construction requirements.

(a) Upper Microwave Flexible Use Service licensees must make a buildout showing as part of their renewal applications. Licensees relying on mobile or point-to-multipoint service must show that they are providing reliable signal coverage and service to at least 40 percent of the population within the service area of the licensee, and that they are using facilities to provide service in that area either to customers or for internal use. Licensees relying on point-to-point service must demonstrate that they have four links operating and providing service, either to customers or for internal use, if the population within the license area is equal to or less than 268,000. If the population within the license area is greater than 268,000, a licensee relying on point-to-point service must demonstrate it has at least one link in operation and is providing service for each 67,000 population within the license area. In order to be eligible to be counted under the point-to-point buildout standard, a point-to-point link must operate with a transmit power greater than +43 dBm.

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PART 101 – FIXED MICROWAVE SERVICES

16. The authority citation for part 101 continues to read as follows:

Authority: 47 U.S.C. 154, 303.

§ 101.115 [Amended]

17. Section 101.115 is amended in the table in paragraph (b)(2), in the entries "71,000 to 76,000 (co-polar)," "71,000 to 76,000 (cross-polar)," "81,000 to 86,000 (co-polar)," and "81,000 to 86,000 (cross-polar)," by removing footnote designation "15" and adding footnote designation "14" in its place.

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