

October 19, 2017

BY ELECTRONIC FILING

Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

Re: *Use of Spectrum Bands Above 24 GHz for Mobile Radio Services*, GN Docket No. 14-177, IB Docket No. 15-256, WT Docket No. 10-112, and IB Docket No. 97-95

Dear Ms. Dortch:

Throughout this proceeding, EchoStar Satellite Operating Corporation, Hughes Network Systems, LLC, Inmarsat, Inc., Intelsat Corporation, The Boeing Company, SES Americom, Inc., O3b Limited, Telesat Canada, and WorldVu Satellites Ltd. d/b/a OneWeb, (collectively, the “Satellite Broadband Companies”) have demonstrated that Fixed-Satellite Service (“FSS”) operators need reliable access to spectrum above 24 GHz. In particular, they continue to make significant progress in developing and deploying high-throughput geostationary (“GSO”) and non-geostationary orbit satellite (“NGSO”) systems operating in the 27.5-28.35 GHz band (“28 GHz” or “Ka-band”) and 38.6-40.0 GHz (“39 GHz”) band, as well as in the 40-42 GHz (“40 GHz”) band and the 47.2-50.2 GHz and 50.4-51.4 GHz bands (collectively, “V-band”). For instance, with respect to GSO systems:

- Inmarsat recently launched its fourth Ka-band GSO satellite to make high-speed mobile broadband services available on a global basis.
- Hughes recently launched the Jupiter 2 satellite to support HughesNet Gen5, offering defined broadband speeds (25 Mbps download and 3 Mbps upload) from coast-to-coast,¹ and has begun design of its Jupiter 3 satellite, with launch and deployment expected in 2021.²

¹ See Press Release, “HughesNet Gen5 Surpasses 100,000 Subscribers in Just Two Months” (June 5, 2017), available at <http://echostar.com/Press/Newsandmedia/HughesNet%20Gen5%20Surpasses%20100000%20Subscribers%20In%20Just%20Two%20Months.aspx>.

² See Application, IBFS File No. SAT-LOA-20170621-00092 (June 21, 2017); see also Press Release, “Hughes Selects Space Systems Loral To Build Next-Generation Ultra High Density Satellite” (Aug. 11, 2017), available at <https://www.hughes.com/who-we-are/resources/press-releases/hughes-selects-space-systems-loral-build-next-generation-ultra>). In addition, the Commission has accepted for filing the Jupiter 3 space station and gateway applications. See Public Notice, Rep. No. SAT-01275 (Oct. 13, 2017), available at http://transition.fcc.gov/Daily_Releases/Daily_Business/2017/db1013/DOC-347217A1.pdf; Public Notice, Rep. No. SES-01998 (Oct. 11, 2017), available at http://transition.fcc.gov/Daily_Releases/Daily_Business/2017/db1011/DOC-347178A1.pdf. This satellite will operate in the 27.5-30 GHz band, as well as the 40-42 GHz, 47.2-50.2 GHz, and 50.4-51.4 GHz bands.

- SES launched its first hybrid wide-beam/HTS satellite, SES-15, earlier this year.³
- Telesat's Telstar 19 Vantage satellite is under construction and scheduled for launch in 2018.
- Intelsat has been launching its next-generation Epic satellites, which operate in the Ku- and Ka-bands to provide broadband services on a near global basis.

With respect to NGSO satellite systems:

- OneWeb received approval from the Commission to serve the United States with its fleet of NGSO satellites using the Ku- and Ka-bands, the first ten of which will be launched in early 2018.⁴ OneWeb also has a currently-pending application for further deployment in the V-band, which will add capacity to its initial service offerings.⁵
- O3b, through a subsidiary, will be launching another eight Medium Earth Orbit satellites in 2018 and 2019 to complement its existing constellation operating in the Ka-band.⁶
- Telesat's Phase 1 LEO satellites are also under construction, with launch and deployment expected later this year.
- The Boeing Company is seeking Commission authority to launch and operate broadband NGSO satellite systems that would use portions of the Ka- and V-bands to provide very high data rate services to consumers.⁷
- The Commission is currently considering applications from a number of other companies for the launch and operation of NGSO satellite systems that would operate in the Ka- and V-bands.

³ See Press Release, "Successful Launch of SES-15" (May 18, 2017), *available at* <https://www.ses.com/newsroom/successful-launch-ses-15>.

⁴ In re WorldVu Satellites Limited, Petition for a Declaratory Ruling Granting Access to the U.S. Market for the OneWeb NGSO FSS System, Order and Declaratory Ruling, FCC 17-77 (rel. June 23, 2017) (granting OneWeb market access for its Ku-/Ka-band system).

⁵ Policy Branch Information: Satellite Space Applications Accepted for Filing, Public Notice, Report No. SAT-01245 (rel. June 16, 2017) (accepting OneWeb market access application for its V-band system).

⁶ SES recently announced a contract with technology partner Boeing Satellite Systems to build seven mPower satellites with dramatically increased throughput, coverage, and flexibility. See Press Release, "SES opens new era in global connectivity with O3b mPOWER" (Sep. 11, 2017), *available at* <https://www.ses.com/press-release/ses-opens-new-era-global-connectivity-o3b-mpower>.

⁷ See The Boeing Company Application for Authority to Launch and Operate a Non-Geostationary Low Earth Orbit Satellite System in the Fixed-Satellite Service (S2966), SAT-LOA-20160622-00058 & SAT-AMD-20170301-00030 (filed June 22, 2016); The Boeing Company, Application for Authority to Launch and Operate a Ka-band Non-Geostationary Satellite Orbit System in the Fixed-Satellite Service and in the Mobile Satellite Service (call sign S2977), SAT-LOA-20161115-00109 (filed Nov. 15, 2016); The Boeing Company, Application for Authority to Launch and Operate a Non-Geostationary Satellite Orbit System in the Fixed-Satellite Service (call sign S2993), IBFS File No. SAT-LOA-20170301-00028 (filed March 1, 2017).

The Satellite Broadband Companies previously submitted a reconsideration proposal to refine the rules through which individually licensed earth stations could be deployed on a protected basis in the 28 GHz and 39 GHz bands without unduly limiting opportunities for deployment of Upper Microwave Flexible Use Service (“UMFUS”) systems. This proposal included common sense definitions to clarify the restrictions on FSS earth station deployment near areas where people gather for events or for travel, elimination of the rule limiting FSS deployment to three earth stations in a UMFUS license area, and the creation of a database for UMFUS deployment to streamline planning for FSS operators.⁸ The Companies also recommended a tiered approach in lieu of the Commission’s requirement that earth stations in the aggregate may not cover more than 0.1 percent of the population in either a 28 GHz county or 39 GHz Partial Economic Area (“PEA”). The tiered approach was designed to increase earth station siting options, affording the flexibility necessary not only to meet network design needs, but also to gain access to important fiber, power and qualified personnel resources.⁹ At the same time, this approach was intended not to significantly increase the burden on UMFUS licensees of sharing this spectrum, especially given that they can be expected to concentrate deployment in the most densely populated portions of the country.¹⁰

As they have continued to evaluate their proposal in light of further information in the record and discussions with Commission staff, the Satellite Broadband Companies have concluded that a further refinement to the population coverage limit for FSS earth stations in the 28 GHz and 39 GHz bands could better tailor the regime to the planned use of the bands by both terrestrial and satellite operators. This model could also be used to support the deployment of earth stations in the 47.2-48.2 GHz (“47 GHz”) and 50.4-52.4 GHz (“50 GHz”) bands using counties as the UMFUS license area, as licensing by counties provides greater flexibility for citing FSS earth stations than larger license areas, such as PEAs, without impacting the urban areas where UMFUS operators are most likely going to operate because of the technical characteristics for the bands.¹¹ As discussed below, this refined approach would better

⁸ See generally Joint Reply to Oppositions of The Boeing Company, EchoStar Satellite Operating Corporation, Hughes Network Systems, LLC, Inmarsat, Inc., Intelsat Corporation, O3b Limited, SES Americom, Inc., and WorldVu Satellites Ltd. d/b/a OneWeb, GN Docket No. 14-177, *et al.* (Feb. 24, 2017).

⁹ See, e.g., Joint Petition for Reconsideration of EchoStar Satellite Operating Corporation, Hughes Network Systems, LLC, and Inmarsat, Inc., GN Docket No. 14-177, *et al.*, at 10-13 (Dec. 14, 2016); Letter from Audrey L. Allison, *et al.* to Marlene H. Dortch, GN Docket No. 14-177, *et al.*, at 2 (June 13, 2017).

¹⁰ See Letter from Scott K. Bergmann (CTIA) to Marlene H. Dortch, GN Docket No. 14-177, *et al.*, at 2 (May 20, 2016). See also Neville Ray, Chief Technology Officer, T-Mobile US, Maintaining US Leadership in 5G with Smart Spectrum Policy (June 30, 2017), available at <https://newsroom.t-mobile.com/news-and-blogs/5g-mid-band-spectrum.htm>:

Millimeter wave spectrum has the promise of massive capacity but only limited range. So, while it will be very useful for meeting traffic requirements in areas with the highest demand and filling in coverage and capacity gaps, it won’t do much to bring 5G to rural America. But 5G is so much more than millimeter wave, and that’s why we’ve announced that T-Mobile will roll out 5G in lower band – 600 MHz – spectrum. It will allow us to provide better 5G coverage inside buildings and, because 600 MHz spectrum travels so well, in rural America, which desperately needs more and higher quality wireless competition.

¹¹ The Satellite Broadband Operators support continuation of the primary FSS designation for the 48.2-50.2 GHz band to ensure sufficient access to spectrum to support user terminals. They have previously demonstrated the need to have primary spectrum to support such terminals. See, e.g., Letter from Jennifer A. Manner, *et al.* to Marlene H. Dortch, GN Docket No. 14-177, *et al.*, at 2-3 (Apr. 13, 2017).

achieve the Commission’s goal of “adopt[ing] rules that will allow both satellite and terrestrial networks to continue to expand in a flexible manner.”¹²

The current rules for the 28 GHz and 39 GHz bands limit FSS earth stations to three per county or PEA and further limit them to an aggregate coverage of 0.1% of population in a UMFUS license area.¹³ This “one size fits all” approach will have the effect of unduly limiting earth station deployment in less populated areas, which are least likely to be of value to UMFUS operators. Absent the Commission’s current restrictions, most individually licensed earth stations would be situated outside of urban areas, given the expense of real estate, zoning restrictions, and obstacles to transmission found there. Rather, individually licensed earth stations are most likely to be deployed in areas of medium to low population density, which provide the best blend of availability, affordability, qualified personnel, and access to fiber, power and other necessary infrastructure.

In crafting a refined proposal for earth station siting in the 28 GHz band, the Satellite Broadband Companies have made three revisions to their prior proposal. First, we started by analyzing the distribution of population among the nation’s counties. Using information from the 2010 Census,¹⁴ we determined inflection points at both the low and high end of the range, which better identified groups of counties that would warrant differential treatment. As shown in Figure 1 below, those inflection points fall at 600,000 on the high end and 6,000 on the low end.

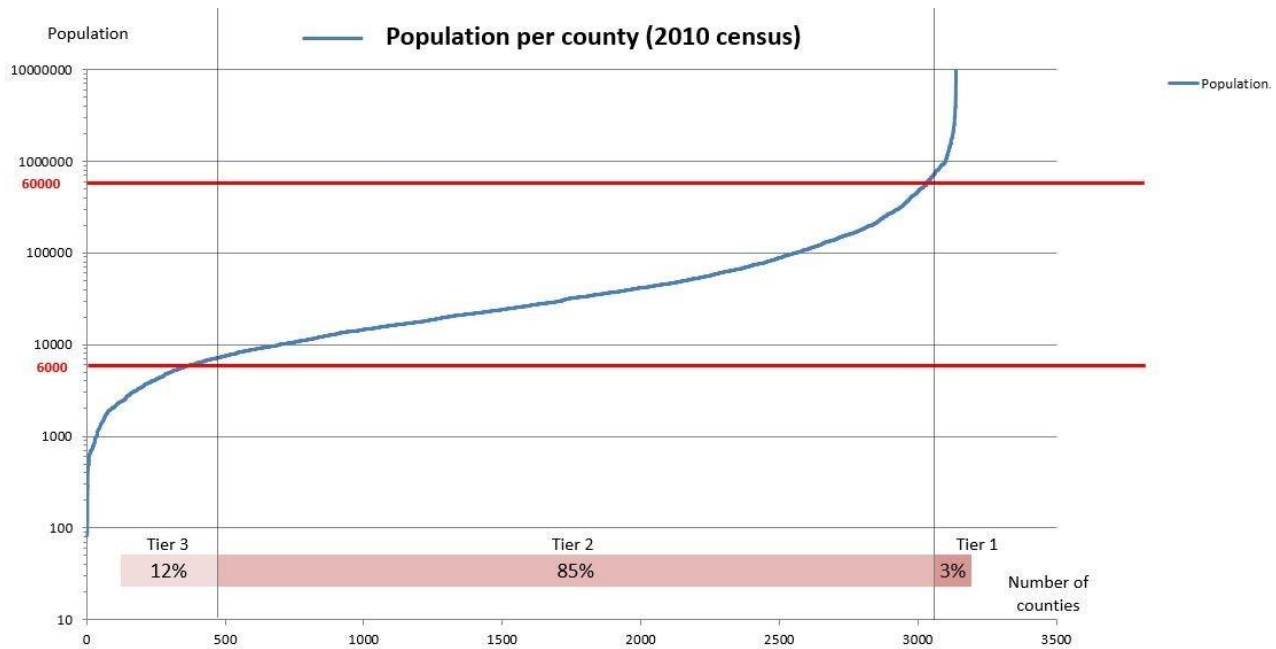


Figure 1. Analysis of U.S. county population

¹² *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services*, 31 FCC Rcd. 8014, ¶ 18 (2016).

¹³ 47 C.F.R. § 25.136.

¹⁴ *See County Population Totals Datasets: 2010-2016* (Data as of January 1, 2010), United States Census Bureau, available at <https://www.census.gov/data/datasets/2016/demo/popest/counties-total.html>. In Figure 1, the population is plotted on a log scale (y axis) versus the number of counties (x axis).

Second, in recognition of the UMFUS operators’ stated intention to use this spectrum for deployment in the densest urban areas, we decided to preserve the existing 0.1% population impact restriction for those counties above the upper inflection point. Such Tier 1 counties represent 43% of the U.S. population. Third, we applied a percentage calculation for population impact in the middle tier of counties, which yields a lower percentage as population increases. The result is the revised three-tier approach for the 28 GHz band set forth in Table 1.

Tier 1 - High population county	Population greater than 600,000	FSS earth stations may cover no more than 0.1% of the license area’s population.
Tier 2 – Low to medium population county	Population between 6,000 and 600,000	FSS earth stations may cover a percentage (P) of the license area that increases as the license area population (N) decreases, expressed by the formula: $P = 60,000/N$ For example, P=0.12% for 500,000 people P=0.2% for 300,000 people P=0.6% for 100,000 people P=1.2% for 50,000 people P=6% for 10,000 people
Tier 3 – Very low population county	Population less than 6,000	FSS earth stations may not cover over 10% of the license area’s population.

Table 1. Proposal for earth station siting in the 28 GHz band

Under this proposal, the 0.1% population impact restriction adopted by the Commission would remain in effect in the large Tier 1 counties. Tier 2, which encompasses mid-sized counties, is subject to a sliding population percentage limitation that increases from 0.1% to 10% as population decreases from 600,000 to 6,000. The more populated counties in Tier 2 would have stricter FSS earth station population impact restrictions than less populated counties in that tier. This will reduce the impact on the UMFUS service area in more densely populated areas where operators are more likely to deploy. In addition, compared to the previous proposal of the Satellite Broadband Companies, this proposal imposes a greater restriction on the population impact of FSS earth stations in counties with a population between 300,000 and 600,000 people.¹⁵ Tier 3, very low population counties, remains unchanged, with a flat 10% population coverage limit to ensure that 90% of the population in a potential UMFUS service

¹⁵ Under the prior proposal, FSS deployments in such counties would have been subject to a 0.2% population impact limit, while the current proposal translates to a sliding scale from 0.2% to 0.1% as population in these counties increases. When these counties are added to those in Tier 1, the total population in which the revised proposal affords a greater restriction on FSS earth station deployment than did the initial proposal jumps to 57.3%.

area is not impacted. This proposal creates a framework that enables FSS operators to site their individually licensed earth station in areas that are likely to be of lower value to UMFUS operators but will give the FSS operators access to the facilities and personnel required to meet the needs of U.S. consumers.

Using a similar analysis, we developed a revised three-tier approach for the 39 GHz band. Here again, we identified inflection points in the population distribution among PEAs (as shown in Figure 2), preserved the 0.1% population impact restriction for the largest PEAs in Tier 1 (covering 46% of the U.S. population), and established a percentage-based restriction for Tier 2 PEAs, as set forth in Table 2.

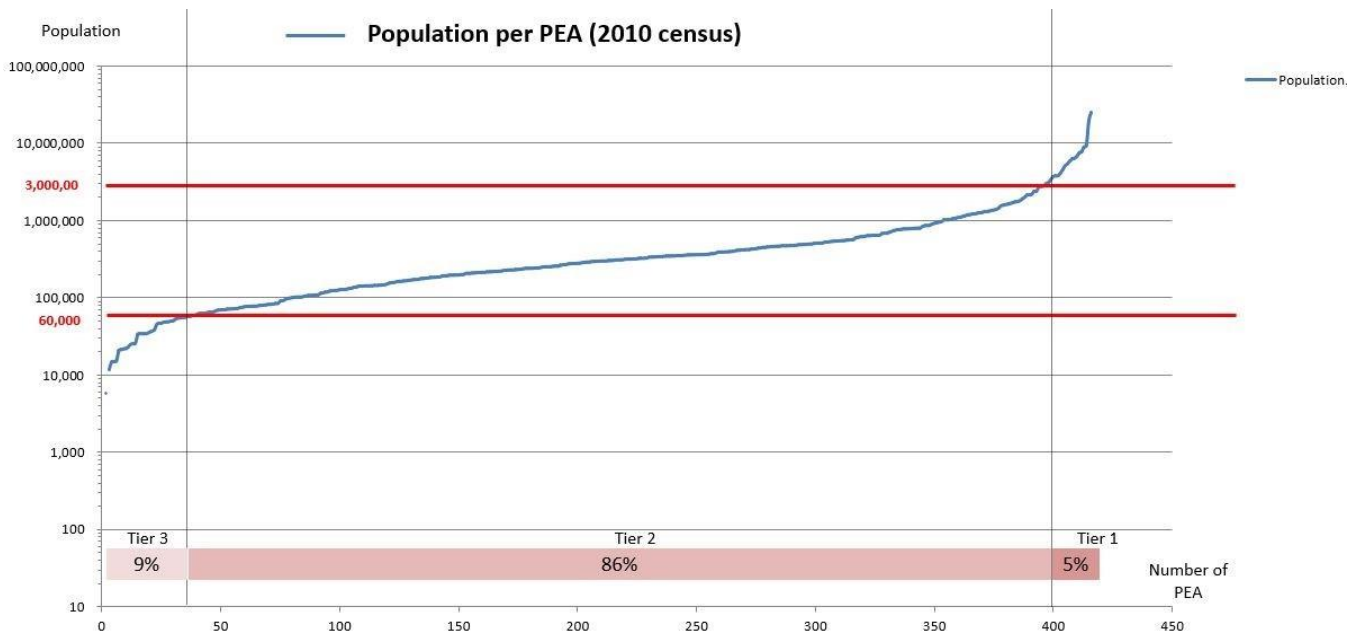


Figure 2. Analysis of Partial Economic Area population

Tier 2, which encompasses mid-sized PEAs, is subject to a sliding population percentage limitation that increases from 0.1% to 5% as population decreases from 3,000,000 to 60,000. The more populated PEAs in Tier 2 would have stricter FSS earth station population impact restrictions for protection zones than less populated counties in that tier. Once again, this will result in less of an impact on the UMFUS service area in more densely populated areas where operators are more likely to deploy. In addition, compared to the previous proposal of the Satellite Broadband Companies, this proposal further restricts the population coverage for FSS earth stations in PEAs with a population between 1,500,000 and 3,000,000 people.¹⁶ Tier 3, very low population PEAs, remains unchanged, with a flat 5% population coverage limit to ensure that 95% of the population in a potential UMFUS service area is not impacted.

¹⁶ As for the 28 GHz band, the prior proposal would have limited FSS deployments to a 0.2% population impact limit per PEA, while the current proposal translates to a sliding scale from 0.2% to 0.1% as population in these PEAs increases. When these PEAs are added to those in Tier 1, the total population in which the revised proposal affords a greater restriction on FSS earth station deployment than did the initial proposal jumps to 58.3%.

Tier 1 - High population PEA	Population greater than 3,000,000	FSS earth stations may cover no more than 0.1% of the license area's population.
Tier 2 – Low to medium population PEA	Population between 60,000 and 3,000,000	FSS earth stations may cover a percentage (P) of the license area that increases as the license area population (N) decreases, expressed by the formula: $P = 300,000/N$ For example, P=0.12% for 2,500,000 people P=0.2% for 1,500,000 people P=0.6% for 500,000 people P=1.2% for 250,000 people P=3% for 100,000 people
Tier 3 – Very low population PEA	Population less than 60,000	FSS earth stations may not cover over 5% of the license area's population.

Table 2. Proposal for earth station siting in the 39 GHz band

This revised proposal¹⁷ addresses the concerns raised by terrestrial interests throughout this proceeding. It strikes a fair and spectrally efficient balance between the needs of FSS and UMFUS operators in the 28 GHz and 39 GHz bands, and provides a framework that is suitable for sharing in the 47 GHz and 50 GHz bands. It also obviates the need for an additional limitation of only three FSS earth stations per county or PEA, enabling the Commission to eliminate that restriction as well. The Satellite Broadband Operators urge the Commission to implement this approach expeditiously in order to facilitate rapid development of satellite and terrestrial components of the 5G ecosystem for the benefit of U.S. consumers.

¹⁷ For ease of reference, the complete proposal of the Satellite Broadband Companies, as revised herein, is set forth in Exhibit 1.

Marlene H. Dortch
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Sincerely,

/s/ Jennifer A. Manner

Jennifer A. Manner
Senior Vice President, Regulatory Affairs
EchoStar Satellite Operating Corporation,
Hughes Network Systems, LLC
11717 Exploration Lane
Germantown, MD 20876
(301) 428-5893

/s/ Giselle Creeser

Giselle Creeser
Director, Regulatory
Inmarsat, Inc.
1101 Connecticut Ave., N.W.
Suite 1200
Washington, D.C. 20036
(202) 248-5150

/s/ Susan H. Crandall

Susan H. Crandall
Associate General Counsel
Intelsat Corporation
7900 Tysons One Place
McLean, VA 22102
(202) 445-7557

/s/ Audrey L. Allison

Audrey L. Allison
Senior Director, Frequency Management
Services
The Boeing Company
929 Long Bridge Drive
Arlington, VA 22202
(703) 465-3215

/s/ Petra A. Vorwig

Petra A. Vorwig
Senior Legal & Regulatory Counsel
SES Americom, Inc.
1129 20th Street, NW
Suite 1000
Washington, DC 20036
(202) 478-7143

/s/ Suzanne Malloy

Suzanne Malloy
Vice President, Regulatory Affairs
O3b Limited
900 17th Street, NW
Suite 300
Washington, DC 20006
(202) 813-4026

/s/ Leslie Milton

Leslie Milton
Senior Counsel, Regulatory Affairs
Telesat Canada
1601 Telesat Court
Ottawa, ON K1B 5P4
(613) 748-8700

/s/ Mariah Shuman

Mariah Shuman
Senior Director, Regulatory Affairs
WorldVu Satellites Ltd. d/b/a OneWeb
1400 Key Boulevard
10th Floor
Arlington, VA 22209
(703) 731-0691

Attachment

Marlene H. Dortch

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cc: Rachel Bender
Kevin Holmes
Travis Litman
Erin McGrath
Louis Peraertz
Thomas Sullivan
Jose Albuquerque
Julius Knapp
Michael Ha
Donald Stockdale
Dana Shaffer

EXHIBIT 1

REVISED SUMMARY OF SATELLITE BROADBAND COMPANY PROPOSALS

1. Adopt revised population coverage limits for FSS earth stations in the 28 GHz and 39 GHz bands.

The current rule limits FSS earth stations to aggregate coverage of 0.1% of population in a UMFUS license area. This may have the perverse effect of driving earth station deployment in *more populated areas*. By adopting a three-tiered approach (with allowed coverage increasing as population density decreases), the Commission would create a framework that encourages FSS operators to site their earth stations in areas that are likely to be of lower value to UMFUS operators.

For 28 GHz:

Tier 1 - High population county	Population greater than 600,000	FSS earth stations may cover no more than 0.1% of the license area's population.
Tier 2 – Low to medium population county	Population between 6,000 and 600,000	FSS earth stations may cover a percentage (P) of the license area that increases as the license area population (N) decreases, expressed by the formula: $P = 60,000/N$
Tier 3 – Very low population county	Population less than 6,000	FSS earth stations may not cover over 10% of the license area's population.

For 39 GHz:

Tier 1 - High population PEA	Population greater than 3,000,000	FSS earth stations may cover no more than 0.1% of the license area's population.
Tier 2 – Low to medium population PEA	Population between 60,000 and 3,000,000	FSS earth stations may cover a percentage (P) of the license area that increases as the license area population (N) decreases, expressed by the formula: $P = 300,000/N$
Tier 3 – Very low population PEA	Population less than 60,000	FSS earth stations may not cover over 5% of the license area's population.

2. Clarify transient population limits.

The current rule restricts FSS earth station deployment near areas where people gather on a transient basis. However, the rule does not define the relevant terms. This undermines regulatory certainty, could severely restrict FSS deployment, and also lead to absurd results. If such limits are to be retained, the relevant terms should be defined as follows:

- “Major event venue” should be defined as one with a capacity of 10,000 or more. This would cover all NFL/MLB/NBA/NHL venues, and major college venues as well.
- “Arterial street, interstate or U.S. highway” should include only principal arterials as defined by the Department of Transportation’s classification system.
- “Passenger railroad” should be defined as railroad track operated by Amtrak, which covers over 21,000 miles of track.
- “Cruise ship port” should apply to the fifteen largest ports in the United States, which handle almost 90% of all cruise ship passenger departures in North America.
- In addition, “urban mass transit route” should be eliminated as duplicative, as such routes typically follow principal arterial roads, share track with Amtrak, or serve highly populated areas.

3. Eliminate the limit on FSS operators to three earth stations in any given county (for 28 GHz) or Partial Economic Area (for 39 GHz).

These rules prevent FSS operators from locating multiple earth station facilities in areas with little or no impact on UMFUS, and are redundant in light of other restrictions.

4. Apply the 70/80/90 GHz band database approach to UMFUS facilities.

This would provide a streamlined way for FSS operators to identify areas of minimal UMFUS deployment for use by earth stations, while obviating the need for UMFUS operators to respond to numerous requests for coordination.