Before the
Federal Communications Commission
Washington, DC 20554

In the Matter of	)	
	)	
Use of Spectrum Bands Above 24 GHz for Mobile Radio Services	)	GN Docket No. 14-177
	)	
Establishing a More Flexible Framework to Facilitate Satellite Operations in the 27.5-28.35 GHz and 37.5-40 GHz Bands	)	IB Docket No. 15-256
	)	
Petition for Rulemaking of the Fixed Wireless Communications Coalition to Create Service Rules for the 42-43.5 GHz Band	)	RM-11664
	)	
Amendment of Parts 1, 22, 24, 27, 74, 80, 90, 95, and 101 To Establish Uniform License Renewal, Discontinuance of Operation, and Geographic Partitioning and Spectrum Disaggregation Rules and Policies for Certain Wireless Radio Services	)	WT Docket No. 10-112
	)	
Allocation and Designation of Spectrum for Fixed-Satellite Services in the 37.5-38.5 GHz, 40.5-41.5 GHz and 48.2-50.2 GHz Frequency Bands; Allocation of Spectrum to Upgrade Fixed and Mobile Allocations in the 40.5-42.5 GHz Frequency Band; Allocation of Spectrum in the 46.9-47.0 GHz Frequency Band for Wireless Services; and Allocation of Spectrum in the 37.0-38.0 GHz and 40.0-40.5 GHz for Government Operations	)	IB Docket No. 97-95

PETITION FOR RECONSIDERATION OF SES AMERICOM, INC. AND O3B LIMITED

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SUMMARY

SES Americom, Inc. ("SES") and O3b Limited ("O3b") look forward to playing a significant role in the 5G environment currently under development in the United States and around the world. The *Spectrum Frontiers Report and Order* ("*R&O*") represents the Commission's initial efforts to define a framework in which all of the potential 5G players, including terrestrial and satellite operators, may use spectrum above 24 GHz to develop innovative services without impinging on each other's growth. In creating its framework, the Commission recognized the value current satellite investments and services provide to consumers and implemented measures that give satellite operations in the 27.5-28.35 GHz ("28 GHz") band some level of protection.

Some of the rules adopted are based on conclusions that were reached without thorough analysis of the impact they will have on satellite earth stations and space stations. Without revision and refinement, these rules will have the effect of undermining the Commission's stated goals for the future of both 5G and satellite services. As a result, SES and O3b request the Commission reconsider the following aspects of the R&O.

The earth station siting restrictions imposed under new Section 25.136(a) must be revised to provide sufficient, viable options for both Geostationary and non-Geostationary earth stations operating in the 28 GHz band. To accomplish this, the 0.1 percent population coverage limit applied to each county-based Upper Microwave Flexible Use Service ("UMFUS") license area must be revised. SES and O3b propose a three-tier approach and pooling of population data for UMFUS areas within a BTA to encourage new earth stations to be sited in counties with low population densities while according flexibility to locate facilities in less populated regions of counties with high density. In counties that do not attract UMFUS license bids at auction, spectrum should be made immediately available for new FSS operations.

SES and O3b urge the Commission to repeal the additional prohibitions against locating earth stations near "transient population" areas, such as highways and passenger railways. These limitations unduly restrict the flexibility to site earth stations in areas where necessary infrastructure is available. The Commission must also clarify its definition of "gateway-type" services and provide a database or other mechanism to identify existing UMFUS facilities, so that earth station applicants know what areas to avoid and can adjust the proposed facility's operations or locate another site.

The Commission must also revise Section 25.136 to ensure that earth station operators can colocate new antennas with grandfathered earth stations. Colocation provides a means for expansion of satellite capacity with a minimal impact on UMFUS licensees.

Finally, the Commission should reconsider the technical evidence satellite operators submitted in the initial proceeding demonstrating the risk of aggregate interference into satellite receivers from a multitude of terrestrial devices operating in the 28 GHz. Reliable mechanisms must be put in place to ensure any future interference that does arise can be quickly and adequately resolved.

SES and O3b believe strongly that satellite and terrestrial service each have an important role to play in developing 5G services for the benefit of all consumers, including individuals, corporations and the U.S. government. The Commission's rules should be modified to encourage proponents of both satellite and terrestrial networks to invest and provide these services quickly.

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PETITION FOR RECONSIDERATION OF SES AMERICOM, INC. AND O3B LIMITED

SES Americom, Inc. ("SES") and O3b Limited ("O3b") hereby petition for reconsideration of the *Spectrum Frontiers R&O*, which adopted rules for the use of certain frequency bands above 24 GHz for mobile services by the newly-created Upper Microwave Flexible Use Service ("UMFUS").[1]

[1] *See Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, et al.*, Report and Order and Further Notice of Proposed Rulemaking, 31 FCC Rcd 8014 (2016) ("*Spectrum Frontiers R&O*" or "*R&O*").

I. BACKGROUND

SES and O3b have invested billions of dollars in satellite networks to meet market demand for telecommunications services, both domestically and throughout the world. Even as it seeks to open the 28 GHz band (27.5-28.35 GHz) for terrestrial mobile use, the Commission has recognized the investments made by the satellite industry and the value of the services provided by both Geostationary ("GSO") and non-Geostationary ("NGSO") satellite systems.[2]

In this proceeding the Commission announced a regulatory policy of enabling continued fixed-satellite service ("FSS") use of the 28 GHz band without constraining the development of newly authorized UMFUS operations. In furtherance of this goal, the Commission grandfathered all 28 GHz FSS earth stations authorized or applied for by the date of the *R&O*, July 14, 2016. Grandfathered stations are authorized to operate under the terms of their existing authorizations without taking into account possible interference to UMFUS operations.[3]

In addition, the Commission created new Section 25.136, which establishes a mechanism for licensing new earth stations in the 28 GHz band without the need to protect future UMFUS deployments. Under this new rule, in order to obtain an earth station license in the 28 GHz band, FSS operators must comply with *each* of the following requirements:

1. FSS earth station operators may in the aggregate deploy FSS earth stations in no more than three locations in a county.[4]

2. FSS permitted interference zones, along with interference zones for any other FSS earth stations in the county, may not cover more than 0.1 percent of the population of the county license area where the earth station is located.[5]

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[2] *See R&O* ¶ 51.

[3] *See id.* ¶ 59.

[4] *See id.* ¶ 54; new 47 C.F.R. § 25.136 (a)(4)(i).

[5] *See R&O* ¶ 54; new 47 C.F.R. § 25.136 (a)(4)(ii). The Commission noted that the International Bureau "will issue a public notice seeking comment on the appropriate methodology to calculate the 0.1 percent population limit and

3. FSS interference zones may not cover any major event venue, arterial street, interstate or U.S. highway, urban mass transit route, passenger railroad, or cruise ship port.[6]

4. If an UMFUS operator has existing facilities "constructed and in operation" in the county where an FSS operator proposes to locate its earth station, the FSS operator must coordinate with the UMFUS licensee.[7]

If an earth station operator does not choose to take advantage of the options set out above, it may buy a UMUFS license during the auction, negotiate with an UMFUS licensee or operate on a secondary basis.[8]

These limitations are unjustified and will undercut efficient spectrum use. The restrictions on new earth stations in Section 25.136 reflect a proposal submitted by Verizon Wireless just three weeks before the record closed and one month before the Commission adopted the nearly 300-page *R&O*.[9] The Verizon Letter did not provide an analysis of the impact of its proposal on FSS earth station operations and did not appear to consider NGSO systems at all. The *R&O* provides for a separately docketed proceeding to address the grave concerns of FSS operators that UMFUS operations pose a substantial risk of causing harmful interference to existing and future FSS satellites. The *R&O*, however, does not provide for measures to implement protection should the risk be substantiated. The Commission should reconsider these limitations.

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further details regarding earth station interference zone calculation (including propagation models, *e.g.* free space versus probabilistic), and will also seek comment on best practices for earth station siting to minimize the impact on UMFU services, colocation of earth stations, and accommodating multiple earth station interference zones without exceeding 0.1 percent of population in a given county." *Id.* ¶ 54 n.120.

[6] *R&O* ¶ 54; new 47 C.F.R. § 25.136 (a)(4)(iii).

[7] *R&O* ¶ 54; new 47 C.F.R. § 25.136 (a)(4)(iv).

[8] *R&O* ¶ 55; new 47 C.F.R. § 25.136 (a)(1).

[9] *Ex Parte* Letter from Charla Rath, Vice President, Wireless Policy Development, Verizon, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 14-177, *et al.* (filed June 14, 2016) ("Verizon Letter").

II. THE COMMISSION MUST REVISE SECTION 25.136(A) TO PROVIDE VIABLE OPTIONS FOR GSO AND NGSO EARTH STATIONS

The rules authorizing limited future FSS gateway earth stations in the 28 GHz band are a welcome protection for FSS growth, but the intent is undermined by the strict limits imposed on new earth station locations. While SES and O3b acknowledge that UMFUS licensees must not be overly constrained in their ability to deploy terrestrial facilities in their licensed areas, the Commission should reconsider and revise the earth station siting provisions in Section 25.136 so that they create viable siting options for all FSS operations, including NGSO earth stations.[10]

The *R&O* acknowledges that FSS earth stations can share the 28 GHz band with minimal impact on terrestrial operations.[11] SES and O3b agree. However, Commission rules intended to limit the impact of FSS earth stations on prospective UMFUS operations must accommodate, at a minimum, the types of earth stations that are already authorized and operating in the 28 GHz band. Earth station siting limits must be based on evidence and analysis of whether they in fact support the Commission's stated goals for continued FSS operations and expansion. The restrictions in Section 25.136 do not meet these criteria. Instead, they were imported from Verizon's unsubstantiated, last-minute proposal.[12] Further analysis by satellite companies shows that these conditions make it virtually impossible for GSO and NGSO operators such as SES and O3b to site new 28 GHz earth stations in the United States. Moreover, the Commission has

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[10] The Commission should revisit how it accommodates NGSO satellite constellations given the demonstrated demand for the low-latency satellite services in the recent Ka-band NGSO processing round. *See OneWeb Petition Accepted for Filing; IBFS File No. SAT-LOI-20160428-00041; Cut-Off Established for Additional NGSO-Like Satellite Applications or Petitions for Operations in the 10.7-12.7 GHz, 14.0-14.5 GHz, 17.8-18.6 GHz, 18.8-19.3 GHz, 27.5- 28.35 GHz, 28.35-29.1 GHz, and 29.5-30.0 GHz Bands*, Public Notice, DA 16-804 (July 15, 2016). Twelve current and future satellite operators filed applications, of which nine included the 28 GHz band. Given this high level of market interest, the Commission must recognize the public benefits of NGSO systems, not treat them as an outlier. To facilitate the further deployment of cutting edge NGSO systems, the Commission must modify the restrictions on FSS earth station siting for the 28 GHz band.

[11] *See R&O* ¶ 45.

[12] *See* Verizon Letter at 2.

provided no evidence to demonstrate that such limitations are required to ensure that UMFUS licensees can fully develop their services.

A. The 0.1 Percent Population Limit Does Not Provide Realistic Opportunities to Site New GSO and NGSO FSS Earth Stations in the 28 GHz Band

Under Section 25.136(a), new FSS earth stations may be licensed without the need to protect future UMFUS deployments only if the earth station's interference zone, along with interference zones for any other FSS earth stations in the county, covers no more than 0.1 percent of the population of the county license area where the earth station is located.[13] The *R&O* notes that the limits would not unduly hinder terrestrial deployment in the band,[14] but there is no assessment or evidence in the record demonstrating that UMFUS licensees require unfettered access to 99.9% of a county's population to fully implement UMFUS services. The Commission's adopted rules require an UMFUS licensee to cover only 40% of the license area population, and many UMFUS proponents sought even less stringent build-out rules with no population coverage requirements.[15] Furthermore, the Commission did not perform any analysis to determine whether the proposed population coverage limit, by itself or in conjunction with the other restrictions on siting near highways and other landmarks discussed below, would unreasonably constrain the number of suitable siting locations for GSO and NGSO earth stations.

According to the *R&O*, in establishing the 0.1 percent standard the Commission assumed an even population distribution throughout every county and an earth station interference zone of 0.08 square kilometers, considering ViaSat's 160-meter radius estimate to be a typical value.[16] Based on these assumptions, the Commission calculated that the interference zone for one

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[13] *See R&O* ¶ 54; new 47 C.F.R. § 25.136 (a)(4)(ii).

[14] *R&O* ¶ 56.

[15] *See id.* ¶¶ 198-99, 206.

[16] *Id.* ¶ 55.

28 GHz earth station would cover 0.1 percent of the population of any county larger than 80 square kilometers. This assessment is flawed in several respects. First, the 0.08 square kilometer zone cannot be considered to be typical even for GSO systems, as it is based on the characteristics of a very specific system that is not representative of the systems to be deployed by the rest of the satellite industry. Second, the calculation only considered the size of a GSO earth station coverage area and failed to consider that NGSO earth stations will produce a larger coverage area for limited portions of time.

Furthermore, the *R&O* does not provide any justification for its finding that 0.1 percent is an appropriate threshold, and commenters explained that this threshold did not support the Commission's goals for continued operation and growth of FSS services. The 0.1 percent limit was proposed in an *ex parte* notice submitted just one month prior to issuing of the *R&O*, and that document provided only a cursory rationale for the number.[17] O3b explained that Verizon's proposed siting limits were "unworkable" and proposed alternatives supported by a technical discussion and analysis – elements absent from the Verizon proposal – demonstrating that the 0.1 percent limit would essentially preclude siting of NGSO terminals such as O3b's.[18] Similarly, Inmarsat noted that "[i]mposing arbitrary restrictions on the number or placement of earth stations without respect to the impact on actual or planned UMFU deployment, or limiting earth station deployment to only a tiny percentage of the geography of an area of which an UMFU licensee is only expected to cover 40 percent, would unnecessarily restrict the growth of

[17] *See* Verizon Letter at 4 ("These density criteria will help ensure that within any particular market, satellite users may construct earth stations only in its relatively less-densely populated areas.").

[18] *See Ex Parte* Letter from Suzanne Malloy, Vice President, Regulatory Affairs, O3b, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 14-177, *et al.*, at 3-6 (filed July 4, 2016) ("O3b July 4 Letter").

satellite services."[19] Inmarsat also observed that the last-minute restrictions proposed by Verizon "counter-intuitively would discourage deployment in less densely populated areas," although keeping FSS away from more densely populated areas was ostensibly a primary goal of siting restrictions.[20]

The Commission ignored these concerns in adopting the proposed 0.1 percent population coverage limit. In more rural counties, where UMFUS operators are less likely to deploy, the 0.1 percent population figure is so low that an earth station operator cannot site an antenna close to a fiber facility without exceeding the population limit. For example, in 50% of U.S. counties the population limit is 26 persons or less.[21]

The limit is also problematic for less densely populated areas in more populated counties. SES analyzed a hypothetical earth station site in Woodbine, MD, which is located in Carroll County, where SES is licensed for a grandfathered earth station. The county has 167,134 people, so all 28 GHz earth stations located in the county may not cover more than 167 people in aggregate under the 0.1 percent limit. As demonstrated in Attachment 1, the coverage of SES's grandfathered earth station would exceed that number depending on the calculation method used,[22] despite the fact that it is clearly in a sparsely populated area, exactly where the

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[19] *Ex Parte* Letter from Giselle Creeser, Director, Regulatory, Inmarsat Inc., to Marlene H. Dortch, Secretary, FCC, GN Docket No. 14-177, *et al.*, at 4-5 (filed July 7, 2016) ("Inmarsat Letter").

[20] *Id*. at 4; *see also Ex Parte* Letter from Petra Vorwig, Senior Legal and Regulatory Counsel, SES, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 14-177, *et al.*, at 1 (filed July 6, 2016) (stating that the proposed 0.1 percent population limit "may actually encourage earth station operators to focus on counties with higher populations, where it will be easier to identify locations that meet the 0.1% population threshold").

[21] *See TIGERweb Decennial State-Based Data Files, County – Census 2010 (Data as of January 1, 2010)*, United States Census Bureau, https://tigerweb.geo.census.gov/tigerwebmain/TIGERweb2010_counties_census2010.html ("*2010 Census Data*").

[22] In calculating population coverage for mobile networks, the Commission applies two methods. Under the centroid method, a census block is considered "covered" if the calculated center point of the census block is within the network's coverage area. If the center point is covered, then all of the population in the corresponding census block is considered covered. Alternatively, under the proportional method, the Commission calculates the

Commission and terrestrial stakeholders presumably would want earth stations to be located. SES determined the interference zone of its hypothetical earth station depicted in Attachment 1 based on the Commission's formula, -77.6 dBm/m^2/MHz at 10 meters above the ground, used an EIRP towards the horizon of 13.4 dBm/MHz, and included an additional attenuation of 20 dB, leading to an interference zone with a 1000 meter radius. The resulting interference zone would cover about 272 people under the proportional method and 123 people under the centroid method for calculating population coverage. The number obtained under the centroid method, however, would dramatically increase if the additional attenuation in the direction of adjacent blocks was slightly less than 20 dB, as the contour would overlap with the centroid of adjacent blocks which have more than 200 people, for a total coverage exceeding 300 people. The fact that the 0.1 percent limit is too low to accommodate one, let alone three, GSO satellite earth stations in rural areas of more populated counties is a significant issue, as 93 percent of U.S. counties have fewer than 300,000 people.[23]

Even more problematically, the rule has made it virtually impossible for NGSO earth stations, which must operate with lower elevation angles than GSO earth stations, to find any suitable locations. Prior to this proceeding, O3b sited one gateway earth station in the continental U.S.[24] This site was chosen for (among other reasons) low cost Internet connectivity, reliable power, ease of access, minimal precipitation, and low risk of causing interference to primary operators. As demonstrated below, under the Commission's new rules, O3b would not be permitted to site an earth station at the existing O3b location.

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percentage of the census block covered by the network and then considers that percentage of the census block's population to be covered. *See FCC Releases Data on Mobile Broadband Deployment as of December 31, 2015, Collected Through FCC Form 477*, Public Notice, DA 16-1107, Attachment at 5-6 ¶¶ 12-13 (rel. Sept. 30, 2016).

[23] *See 2010 Census Data*.

[24] O3b Limited, File No. SES-MOD-20140814-00654, Call Sign E130021 (granted Jan. 22, 2015).

Specifically, as shown in Attachment 2, the existing O3b gateway earth station is in Vernon, Texas. Wilbarger County, in which Vernon is located, has a total population of 13,535 people, so no more than 13.5 people can be covered under the 0.1 percent limitation. Due to the nature of NGSO operations and the fairly flat terrain, the gateway produces a relatively large interference zone (approximately 70 km^2); however, that footprint does not encumber the county's population center. O3b estimates that the entire gateway footprint covers approximately 90 people, roughly 2 households per square kilometer, but it still exceeds the very low population coverage limit of 13.5 people. Additionally, the O3b Vernon interference zone covers small portions of U.S. Route 287, which may be prohibited by the Commission's unnecessarily expansive restrictions for siting near interstates or U.S. highways in Section 25.136(c)(3). The Commission should be encouraging FSS operators to choose sites like Vernon that are well outside densely populated areas. The fact that the location does not meet the Section 25.136 requirements is a testament to the impracticality of this element of the rules.

In short, the 0.1 percent limit was arbitrarily chosen and effectively makes it impossible to identify new earth station locations in areas that have access to broadband infrastructure. Accordingly, SES and O3b urge the Commission to reconsider the limit and adopt an alternative framework to permit licensing of protected 28 GHz earth stations that will allow GSO and NGSO earth stations viable siting options for new facilities. If the Commission decides to retain siting restrictions based on population coverage, it clearly must draw a line somewhere. But the line must reflect an effort to achieve the stated policy goals of the *R&O* and address the concerns raised in the record.[25]

[25] *See Time Warner Entertainment Co. v. FCC, et al.*, 240 F.3d 1126, 1137 (D.C. Cir. 2001) ("We recognize that in drawing a numerical line an agency will ultimately indulge in some inescapable residue of arbitrariness; even if 40% is a highly justifiable pick, no one could expect the Commission to show why it was materially better than 39% or

B. The Percentage Method Should Be Refined to Allow Siting of 28 GHz Earth Stations in Both High Density and Low Density Counties

The Commission should revise the rules on earth station siting. By modifying the 0.1 percent population limit adopted in the *R&O*, the Commission can provide realistic siting choices for FSS operators without materially constraining UMFUS development.

To provide growth opportunities for FSS without significantly restricting future UMFUS deployments, SES and O3b propose a three-tiered approach that would encourage new earth station applicants to locate stations in less densely populated counties but would also accord flexibility for sites in less densely populated areas of highly populated counties. The three tiers are defined as follows:

Tier 1 - high density counties (greater than 300,000 people);

Tier 2 - low to medium density counties (6,000 to 300,000 people) and

Tier 3 - very low density counties (fewer than 6,000 people).

SES and O3b calculate that 7% of counties would qualify as Tier 1 areas, 81% would qualify as Tier 2 areas, and 12% would qualify as Tier 3 areas.[26]

A new FSS earth station should be allowed to deploy in Tier 1 license areas on a protected basis if the applicant demonstrates the interference zone would cover no more than 0.2 percent of the license area's population. In Tier 2, FSS earth stations should be allowed to cover 600 people without reference to the license area's population. And in Tier 3, FSS earth stations should be allowed to cover 10 percent of the license area's population.

41%); *see also Missouri Public Service Comm'n v. FERC*, 215 F.3d 1, 5 (D.C. Cir. 2000). But to pass even the arbitrary and capricious standard, the agency must at least reveal 'a rational connection between the facts found and the choice made.' *Dickson v. Secretary of Defense*, 68 F.3d 1396, 1404-05 (D.C. Cir. 1995) (quoting *Motor Vehicle Mfrs. Ass'n v. State Farm Mut. Auto. Ins. Co.*, 463 U.S. 29, 43 (1983))").

[26] *See 2010 Census Data.*

Unlike the 0.1 percent population coverage limit imposed in the *R&O*, the three-tiered approach would encourage earth station applicants to look for areas in less densely populated counties without concern that they would be hamstrung by a low population coverage threshold. Such an incentive is consistent with the Commission's intent to provide earth stations limited protected access to the 28 GHz band and would reduce the likelihood that an earth station would be sited in a densely populated area. The approach does, however, continue to provide earth station operators a means of locating earth stations in high density license areas if they are able to limit the population they cover.

SES and O3b believe a 0.2 percent population coverage threshold would be more appropriate than a raw number in the Tier 1 highest density counties to ensure both GSO and NGSO earth stations can take advantage of the pockets of sparse population that exist and are not likely to be exploited by UMFUS licensees. Applying a 0.2 percent threshold will still ensure UMFUS licensees have access to 99.8 percent of the population in a license area.

In Tier 2 low to medium density counties, an absolute population limit will reverse the disincentive created by a pure percentage calculation to site in lower density counties. As described above, under the current rule, many counties that would seem to be ideal for earth station deployment and of low value to UMFUS licensees would not be not available because 0.1 percent of their population is too low to accommodate an earth station.

In very low density Tier 3 counties, SES and O3b recognize that a raw number, such as 600 could have the effect of sterilizing a county for UMFUS deployment, which would run counter to the Commission's intent and the public benefit. Therefore, SES and O3b recommend applying a 10 percent calculation factor. This approach would continue to allow earth stations suitable options in very low density counties without unduly constraining UMFUS deployments.

The FCC emphasized in its *R&O* that its approach would create thousands of potential sites for earth stations to operate,[27] but the reality is that the current rule severely limits viable earth station sites. By adopting the three-tiered approach, the Commission can enhance FSS flexibility and provide an incentive for earth station operators to build in less populated areas.

C. The Commission Should Tailor the Rules to Better Align with Likely UMFUS Licensee Deployment

No matter how the Commission chooses to calculate the relevant population coverage, it should implement a three-pronged licensing scheme that takes into account the potential impact UMFUS licensees would experience from earth station deployments in each of the three UMFUS license area categories – (1) county licenses converted from LMDS Basic Trading Area ("BTA") licenses, (2) county licenses purchased at auction, and (3) county licensed areas that are not purchased at auction.

1. UMFUS Licenses Converted from BTAs Should Be Pooled for Any Population-Based Earth Station Siting Threshold

In areas where the Commission converts an incumbent BTA license into multiple county-wide UMFUS licenses, the Commission should permit FSS operators to base the population coverage limit calculation on the entire population of the BTA. The resulting population figure could then be applied in one or more counties, cumulatively, within the former BTA. Similarly, to the extent the Commission continues to limit the number of earth stations allowed in one county, that limit should also be pooled within the BTA. Calculating coverage limits based on pooling will give FSS operators the means and the incentive to site earth stations in more sparsely populated areas. In turn, incumbent terrestrial licensees will bear the same FSS sharing

[27] *See R&O* ¶ 55 ("Since there are over 3,000 counties in the United States, with a potential for up to three locations in each county, FSS licensees would have many choices for earth station locations. Furthermore, even with the conditions we have imposed, FSS operators will have great flexibility in selecting earth station locations that meet their needs."). As noted above, this simple arithmetic assumption is simply false.

burden without a materially increased risk that an FSS earth station will be located near the higher value, densely populated areas in the BTA.

Such a modification would be particularly effective for NGSO earth stations. Under this approach an operator seeking a site in a rural area for a new NGSO earth station, which will produce an interference footprint that is larger than a typical GSO earth station, would have access to a greater number of viable options without constraining future UMFUS deployment.

For example, BTA 461 covering Manassas, Virginia, in Prince William Country represents an area favorable for FSS earth station siting due to its proximity to backbone infrastructure, yet is relatively distant from the dense urban areas likely to be served by UMFUS operations. Section 25.136 would prohibit siting of a new earth station in Prince William County unless the interference zone affected no more than 38 people, and O3b cannot comply with that limit. However if 0.1 percent of the entire population in BTA 461 were considered, all FSS earth stations located in BTA 461 would be limited to covering no more than a pooled population of 2,471.[28] Rather than severely limiting GSO earth station deployment in each county and eliminating NGSO siting from nearly the entire county, this method would allow FSS operators to take better advantage of less densely populated areas and incentivize the use of spectrum that is unlikely to be needed by terrestrial licensees.

For UMFUS licensees who purchase a county license at auction, the Commission's existing Section 25.136 provisions should apply, subject to the revisions to the 0.1 percent and transient population metrics discussed herein.

[28] This is the same population total that FSS operators would be permitted to encumber in BTA 461 under the existing Commission rules.

2. The Commission Should Allow Immediate FSS Licensing in UMFUS Areas Not Purchased at Auction

In counties where there is no UMFUS licensee following the upcoming auction, SES and O3b strongly encourage the Commission to establish a mechanism for FSS operators to access the available spectrum quickly. Specifically, the Commission should adopt a first-come, first-served approach to licensing the 28 GHz band in UMFUS license areas that are not purchased at auction.[29] SES and O3b believe that in areas where there is no interest in purchasing an UMFUS license, the public interest will best be served by a first-come, first-served licensing scheme that grants FSS or terrestrial network operators the rights to only the spectrum that will be put to use, protects their investments, and ensures that spectrum will not lie fallow.

D. The Transient Population Restrictions Are Overly Constraining and Unnecessary

In addition to limiting population coverage to 0.1 percent, the Commission has further restricted earth stations by requiring applicants to demonstrate that the earth station interference zone "does not infringe upon any major event venue, arterial street, interstate or U.S. highway, urban mass transit route, passenger railroad, or cruise ship port"[30] ("transient population restriction"). While the 0.1 percent population coverage threshold as currently written is by far the most limiting element of the Commission's approach, SES and O3b have found that in many cases an optimum earth station location with proximity to fiber nodes is very close to major highways and is likely to cover some of the other categories of prohibited areas.

The Commission should eliminate the prohibition on covering transient population areas because the *R&O* did not include even a minimum assessment of the impact the restriction would

[29] *See* Comments of SES Americom, Inc., GN Docket No. 14-177, *et al.*, at 14 (filed Jan. 28, 2016).

[30] *See R&O* ¶ 54.

have on earth station siting. Other than Verizon's recommendation to limit earth stations near a variety of specific areas,[31] SES and O3b are not aware of any other reference to such a limit or evidence of an attempt by any party to calculate the potential geographic territory that might be prohibited for earth stations by the restriction. As EchoStar and Inmarsat point out in their joint petition for reconsideration, one report on which the Commission relies to argue that earth stations will have sufficient access to fiber concludes that such fiber is often co-located with highways and railroads.[32] As a result, in a large portion of the nation, fiber links may be unavailable at earth station sites permitted under the Commission's rules.

As O3b previously stated, prohibitions on siting near population areas would undermine efforts to "create incentives and opportunities for full and efficient use of the 28 GHz band."[33] These broad restrictions against placing earth stations near interstates and U.S. highways block FSS operators from huge swaths of sparsely populated or used land without justification,[34] and the Commission failed to conduct a thorough assessment of the resulting effect.

E. The Commission Must Clarify the Meaning of "Gateway-Type Services" in the 28 GHz Band

In adopting the FSS earth station siting rules, the Commission rejected O3b's assertion

[31] *See* Verizon Letter at 2.

[32] *See R&O* ¶ 92 n.219; Joint Petition for Reconsideration of EchoStar Satellite Operating Corporation, Hughes Network Systems LLC, and Inmarsat, Inc., GN Docket No. 14-177, *et al.*, at 12-13 (filed Dec. 14, 2016).

[33] *See* O3b July 4 Letter at 4-6; *see also* Inmarsat Letter at 4-5 ("Imposing arbitrary restrictions on the number or placement of earth stations without respect to the impact on actual or planned UMFU deployment . . . would unnecessarily restrict the growth of satellite services, including those relied upon [by] consumers in rural and remote areas.").

[34] While many commenters have stressed the importance of future wireless services for "smart cars" and other Internet of Things applications, few, if any, have argued that such applications will or must be located in the 28 GHz band.

that it may need multiple sites in some counties to serve its customers.[35] In doing so, the Commission asserted that O3b had no expectation that it would be permitted to serve customer locations in the 28 GHz band because the *First LMDS Order*[36] only granted FSS access to the 28 GHz band for "limited Earth-to-space gateway-type services."[37] But this assertion mischaracterizes the rules O3b relied on in deploying its system. The term gateway-type services is a reference to the type of deployment (*i.e.*, individually licensed and non-ubiquitous) rather than the function of earth stations in the band. The 1996 *First LMDS Report and Order* plainly states that "[t]he term 'gateways' as used in this context, means earth stations which are limited in number, and are generally larger and easier to coordinate than widely-deployed user terminals."[38] O3b's customer terminals as well as its gateways precisely meet the definition of "gateway-type" earth stations that has long been authorized in the 28 GHz band.

Similarly reinforcing the interpretation that the term "gateways" is used as a description of deployment rather than a service, the Commission stated in the *Third LMDS Report and Order* that: "As a practical matter, it is unlikely that FSS can operate ubiquitous terminals on an unprotected non-interference basis to LMDS."[39] The Commission's concern with respect to the

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[35] *See Ex Parte* Letter from Suzanne Malloy, Vice President Regulatory Affairs, O3b, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 14-177, at 8 (filed May 31, 2016).

[36] *See Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission's Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed Satellite Services,* First Report and Order and Fourth Notice of Proposed Rulemaking, 11 FCC Rcd 19005 (1996) ("*First LMDS R&O*").

[37] *R&O* ¶ 46.

[38] *First LMDS R&O* ¶ 10 n.13.

[39] *Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission's Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed Satellite Services*, Third Report and Order, 12 FCC Rcd 22310 ¶ 42 (1997). Notwithstanding its concern with ubiquitous user terminals, moreover, the Commission authorized Teledesic to provide services in the 27.5-28.35 GHz band that had ubiquitous elements. In 1997, the Commission authorized Teledesic to operate 27.5-28.35 GHz band NGSO FSS "Gigalink" terminals on a secondary basis that were to be used, among other things, "in privately owned networks and as high-rate terminals." *Teledesic*

28 GHz band has always been with (and only with) ubiquitous user terminals that could interfere with LMDS operations. The Commission's rules reinforce the above interpretation, as in some bands satellite operations are limited to gateway earth stations but this is not the case in the 28 GHz band.[40]

In order to prevent unfounded restrictions of future FSS use of the band, the Commission should clarify that the meaning of "gateway-type services" in the *R&O* is not intended to restrict the types of services provided by earth stations in the 28 GHz band. O3b respectfully asks that the Commission affirm that individually licensed customer terminals fit within the classification of "gateway-type services."

F. Earth Station Operators Must Have a Way to Identify Existing UMFUS Operations Before Initiating Coordination

SES and O3b acknowledge that future 28 GHz earth stations should be required to coordinate with existing UMFUS operations. However, earth station operators in the 28 GHz band have no means to identify existing UMFUS facilities or choose locations that will avoid coordination all together. In other shared bands, such as the conventional C-band, prospective earth station applicants can contact a spectrum coordinator, such as Comsearch, and request an interference assessment with respect to existing terrestrial operations near the proposed earth station location. If the potential coordination requirements would be too onerous or operations would be overly constrained, the earth station operator can look for another location.

Under the rules established in the *R&O*, UMFUS licensees are not required to register or otherwise notify the public when they initiate specific operations until they demonstrate that they

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Corporation Application for Authority to Construct, Launch, and Operate a Low Earth Orbit Satellite System in the Domestic and International Fixed Satellite Service, 12 FCC Rcd 3154 ¶ 4 n.6 (IB 1997).

[40] *See* 47 C.F.R. § 25.202.

have met their performance requirements. As a result, the only way an earth station operator can reliably learn if an UMFUS licensee has an existing facility near the proposed earth station location is to initiate the coordination process. Under Section 101.103(d), a terrestrial licensee has 30 days to respond to a coordination notice.[41] At the end of that 30-day period, the terrestrial licensee could identify an existing facility that purportedly requires coordination or would impose significant constraints on earth station operations, but the terrestrial operator is not required to identify other available options. The party planning the new earth station is then in a bind – it can accept the constraints, or start the entire coordination process over again. This approach can add significant time to earth station licensing and waste resources of both FSS and UMFUS operators.

SES and O3b recommend establishing a Commission managed database that records all existing UMFUS facilities.[42] Earth station operators and spectrum coordinators can use that database to determine locations that will avoid terrestrial deployments or to otherwise design the earth stations so as to minimize the impact on existing terrestrial deployments.

G. The Commission Should Confirm That Antennas Co-Located at Grandfathered Earth Station Sites Are Protected

The Commission should revise Section 25.136 to clarify that additional antennas may be placed at grandfathered 28 GHz earth station sites and will be protected to the same degree. The Commission recognized the value that grandfathered earth station sites provide to consumers. Expanding service at such locations, where much of the infrastructure has already been built, will allow satellite operators to improve service while minimizing costs and the impact to UMFUS licensees. Further, adding a new earth station antenna at an existing grandfathered site will

[41] *See* 47 C.F.R. § 101.103(d).

[42] *See* Comments of O3b Limited, GN Docket No. 14-177, *et al.*, at 16-17 (filed Sep. 30, 2016).

minimize the number of earth station locations in the UMFUS licensed area that terrestrial deployments will have to work around. Considering the benefits on both sides, such co-location should be expressly encouraged in the Commission's rules. This clarification can be achieved with the following two minor revisions to Section 25.136(a):

> (a) FSS is secondary to the Upper Microwave Flexible Use Service in the 27.5-28.35 GHz band. Notwithstanding that secondary status, an earth station in the 27.5-28.35 GHz band that meets one of the criteria listed below may operate consistent with the terms of its authorization without providing any additional interference protection to stations in the Upper Microwave Flexible Use Service:
>
> . . .
>
> (2) The FSS earth station was authorized prior to July 14, 2016 <u>or is located within 1 second of latitude and longitude of such an earth station</u>; or
>
> (3) The application for the FSS earth station was filed prior to July 14, 2016 and has been subsequently granted, <u>or is located within 1 second of latitude and longitude of such an earth station</u>; or
>
> . . . .

III. THE COMMISSION MUST ADDRESS THE RISK OF HARMFUL AGGREGATE INTERFERENCE TO SATELLITES

SES and O3b ask the Commission to reconsider its determination that specific technical limits on UMFUS stations are not necessary "at this time" to address aggregate interference.[43] SES and O3b have two primary concerns with this conclusion. First, the Commission's assessment that the risk of interference is too remote to require any restrictions on UMFUS deployment or operations is contrary to the record. Second, the lack of constraints on skyward emissions in licensing and service rules for 28 GHz UMFUS operations leave the Commission with no practical method to identify and mitigate interference should it occur. Various satellite

[43] *R&O* ¶ 294.

operators have provided solid technical evidence that the risk of harmful aggregate interference to satellites is substantial. The Commission should not authorize UMFUS operations absent a mechanism to address UMFUS interference into satellites in the 28 GHz Band.

We ask the Commission to reconsider its decision to authorize UMFUS operations independent of a full assessment of the risk of interference and consideration of reliable measures to eliminate any interference that occurs, and to condition UMFUS licenses on any future rules adopted to protect FSS from harmful interference from UMFUS operations.

The *R&O*'s assessment of the uplink interference risk rests upon the assumption that UMFUS licensees will employ operating characteristics to limit skyward emissions. In fact, the R&O codifies UMFUS' full flexibility not to adhere to any such mitigation techniques, and relies on the supposition that the deployments involving a higher incidence of skyward emission simply will not proliferate or dominate UMFUS deployments.[44] This rationale implies that the record clearly reflects the sorts of deployments that will exist, yet elsewhere the *R&O* explains that it is too early to determine how the 28 GHz band will be used.[45]

Though an agency's predictive judgments about the likely effects of a rule are entitled to deference, deference to such judgments must be based on some logic and evidence, not sheer

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[44] *See id.* ("[T]he systems *contemplated* for these bands have several characteristics that will *tend to limit* transmissions towards satellite receivers" and "most industry evaluations of potential mmW mobile base station deployments *appear to assume* that such stations' antennas will be tilted downward at a slight angle.") (emphasis added). The *R&O* acknowledges ViaSat's concern that mobile base stations "might be directed skyward to provide coverage to users in the upper floors of tall buildings" but suggests that "mobile providers *can* rely on wired in-building facilities where necessary." *Id.* (emphasis added). The Commission goes on to state that mobile base stations "will *probably* use antenna systems that employ dynamic beamforming techniques" with narrow beamwidths that would "substantially reduce the likelihood that such beams will point directly at satellite receivers." *Id.* (emphasis added). The Commission also mentions the possible use of dynamic power control and the fact that "base stations and user equipment *could be* entirely silent much of the time." *Id.* (emphasis added). In addition, the Commission asserts that because smartphones are predominantly used in buildings or vehicles, "most mmW transmissions will likely not occur in environments that have line of sight to satellites." *Id.* ¶ 66

[45] *See id.* ¶ 354.

speculation.[46] The fact that mobile providers "can" take measures to avoid pointing emissions skyward does not establish whether interference is in fact likely to occur.[47] The Commission's optimistic assumptions about undefined and fully flexible UMFUS deployments do not "articulate a satisfactory explanation for its action."[48]

Moreover, the assumptions on which the Commission relies to dismiss the risk of aggregate interference are not supported by the record. Terrestrial proponents project the use of billions of 5G devices globally.[49] If there are many millions of transmitting devices in the 28 GHz band, even network loading that rarely exceeds 30 percent will involve hundreds of thousands (and perhaps millions or tens of millions) of devices transmitting at the same time.[50] An unknown percentage of those transmissions may be intentionally directed skyward; numerous terrestrial interests urged the Commission not to mandate antenna beam downtilt.[51] The Commission must seriously evaluate the use cases being promoted by terrestrial interests and the

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[46] *See Sorenson Communications v. FCC*, 755 F.3d 702, 709 (2014).

[47] Here, the Commission's reasons for concluding that uplink interference will not occur are written in terms of speculation and possibility rather than those of prediction. *R&O* ¶ 65. The only actual prediction the Commission makes is that all of the possibilities about which it speculates, taken together, "will limit the extent of skyward transmissions from terrestrial mobile systems." This explanation is the logical twin of the Commission's rationale in *Sorenson* – rejected upon appeal -- that a certain problem "would simply go away."

[48] *See Sorenson*, 755 F.3d at 707.

[49] *See, e.g.*, Reply Comments of CTIA, GN Docket No. 14-177, at 4 (filed Feb. 26, 2016) ("5G also will provide the scale needed for wireless networks to support billions of devices and unlock the potential of the Internet of Things.").

[50] *See* Comments of Mobile Future, GN Docket No. 14-177, *et al.*, at 4 (filed Jan. 27, 2016) ("It is estimated that there are more than nine billion connected devices around the world today and that number will grow rapidly, with estimates ranging from 25 billion to 50 billion devices by 2025."); *Ex Parte* Letter from Patricia Paoletta, Counsel, 5G Americas, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 14-177, *et al.*, at 2 (filed Apr. 8, 2016) ("Security is now a market imperative, since security is vital to today's use cases, including the billions of Internet of Things (IoT) and connected devices in use around the globe.").

[51] *See* Comments of 5G Americas, GN Docket No. 14-177, at 23-24 (filed Sept. 30, 2016); Comments of Ericsson, GN Docket No. 14-177, at 2 and Annex 2 (filed Sept. 30, 2016); Comments of Qualcomm, GN Docket No. 14-177, at 14-15 (filed Sept. 30, 2016). One terrestrial operator explicitly expressed the probability of pointing its base station antennas upwards to get better signal strength. *See* T-Mobile Comments at 29-30 ("It is possible that the base station antenna may steer to higher elevation angles to find stronger non-line-of-sight ("NLOS") paths to users, such as diffraction paths along buildings.").

Commission itself before concluding that harmful aggregate interference towards satellite receivers is in fact unlikely.[52]

A more balanced approach in the *R&O* would have afforded greater weight to the technical analyses by O3b and others showing that relatively modest numbers of UMFUS transmitters within a satellite receive beam could cause harmful interference.[53] The Commission criticized these studies for not including various assumptions about limitations on UMFUS operations, such as indoor operations and downtilt of some transmitters, even though the entire point of the satellite operator's submissions was to illustrate why some controls are needed. The deployment of an entirely foreseeable number of UMFUS 28 GHz transmitters would be sufficient to create harmful interference at the satellite receiver in the absence of mitigating rules.[54]

This is particularly concerning because satellite beams can cover tens or even hundreds of thousands of square miles and may be impacted by the collective transmissions of thousands or millions of UMFUS terminals licensed to different operators and providing different types of service. It may be impossible or impractical to identify the main contributors to the interference and to quickly modify the operation of potentially thousands of emitters as needed to eliminate

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[52] The Commission reasons that its LMDS rules already permit some operations at power levels similar to those authorized for UMFUS. However, the rules in place for LMDS fixed service did not and could not have addressed whether the introduction of millions of transmitters associated with a mobile service might create harmful interference to satellite operations in the 28 GHz band.

[53] *See Ex Parte* Letter from Suzanne Malloy, Vice President, Regulatory Affairs, O3b, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 14-177, at 7 (filed Mar. 24, 2016); *see also Ex Parte* Letter from Petra Vorwig, Senior Legal & Regulatory Counsel, SES, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 14-177, at Attachment 1 (filed May 5, 2016); *Ex Parte* Letter from Jennifer A. Manner, Senior Vice President, Regulatory Affairs, EchoStar Corporation, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 14-177, at Attachment (filed May 12, 2016) (Joint filing by EchoStar, Inmarsat, Intelsat, O3b, OneWeb, SES, and ViaSat) ("Joint Operators Letter").

[54] *See Ex Parte* Letter from Suzanne Malloy, Vice President, Regulatory Affairs, O3b, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 14-177, at 7 (filed Mar. 24, 2016).

the interference. SES, O3b, and other commenters raised this enforcement concern in comments and *ex parte* filings and suggested approaches to address it.[55] For example, O3b argued that the obligation to protect FSS satellites should be shared jointly and severally by all UMFUS operators within a satellite receive beam.[56] Those operators should develop a system that satisfies their obligation in the most workable and efficient way.

The *R&O* correctly observes that, with respect to modeling interference, "the assumptions made can lead to vastly different conclusions."[57] Respectfully, since 5G use cases are still not fully defined for the 28 GHz band and UMFUS proponents for the most part rejected any material use limitations, the "worst case scenario" is the only objective reference for what conditions should be anticipated. The Commission's decision to reject out-of-hand studies of UMFUS operations that the Commission's rules will permit, while giving great weight to assumptions regarding operating parameters that the Commission has expressly refused to require, is not supported by the record and should be reconsidered.

The Commission should make UMFUS authorizations subject to the resolution of the technical and regulatory issues implicated by aggregate interference into FSS satellites. Furthermore, UMFUS authorizations should include a condition requiring the licensee to take any and all steps necessary to eliminate harmful interference, including immediate cessation of transmissions from UMFUS stations within the receive beam of an FSS satellite.

The development of such a mechanism is especially critical because the Commission

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[55] *See, e.g.*, Joint Operators Letter; *Ex Parte* Letter from Petra Vorwig, Senior Legal and Regulatory Counsel, SES, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 14-177 (filed May 5, 2016).

[56] *See Ex Parte* Letter from Suzanne Malloy, Vice President, Regulatory Affairs, O3b, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 14-177, at 6 (filed May 31, 2016).

[57] *R&O* ¶ 296.

acknowledges that the U.S. must protect non-U.S. licensed FSS networks in the 28 GHz band to fulfill its international obligations.[58] In order to meet those obligations, further study of aggregate interference and developing a reasoned resolution of the potential risk of harmful interference from UMFUS to FSS operations in the 28 GHz band is essential. To meet its international obligations, and to establish a mechanism by which to address occurrences of harmful interference, Commission must address the question of aggregate interference more concretely, as indicated here, to ensure compliance.[59]

[58] *See R&O* ¶ 62 n.135.

[59] *See* Comments of O3b Limited, GN Docket No. 14-177, *et al.*, at 20 (filed Jan. 28, 2016); *see also* Comments of SES Americom, Inc., GN Docket No. 14-177, *et al.*, at 14 (filed Jan. 28, 2016).

IV. CONCLUSION

SES and O3b agree with the Commission that FSS operators can site earth stations in the 28 GHz band with UMFUS operators without constraining terrestrial deployment in the band. However, the Commission's rules as currently constructed overly and arbitrarily restrict FSS deployment and must be reconsidered in order to enable the efficient use of the 28 GHz band. The Commission has also failed in its obligation to protect satellites from the risk of harmful aggregate interference. To correct those flaws, the Commission should revise its rules as set forth above.

Respectfully submitted,

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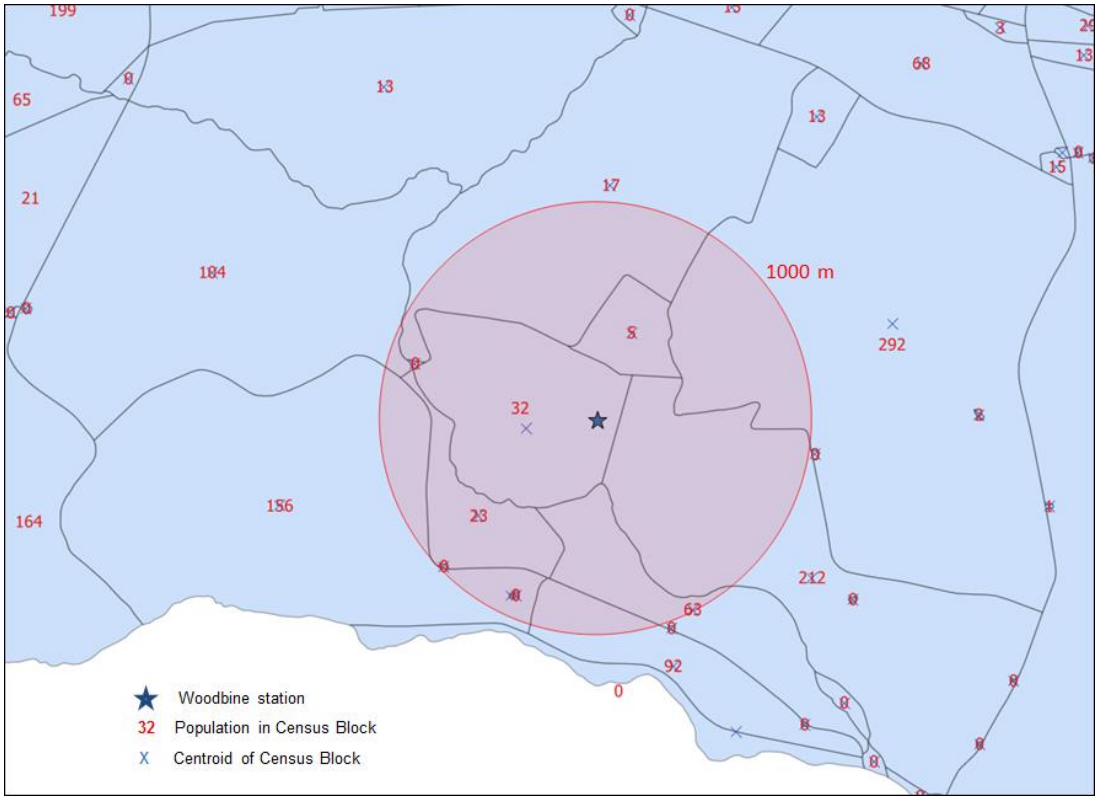
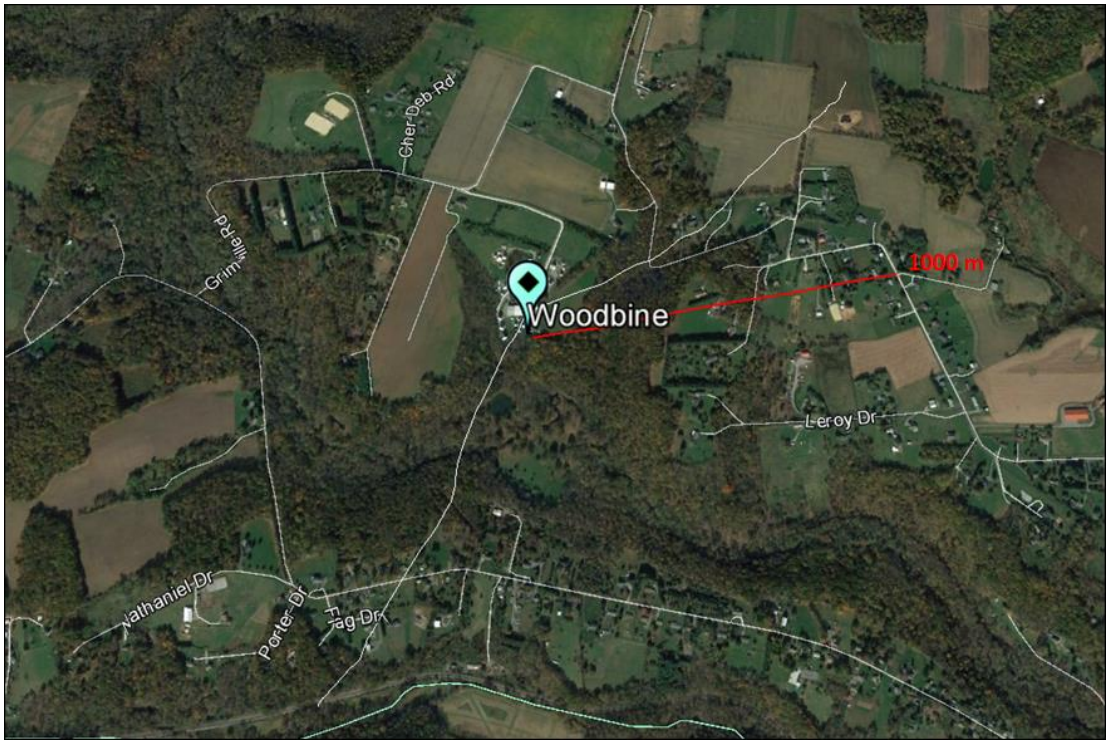
December 14, 2016

Attachment 1
SES Woodbine, Maryland Facility





Attachment 2
O3b Vernon, Texas Facility

In the above attachment, the red shaded area reflects the approximate area over which the pfd produced by the O3b Vernon, TX earth station will exceed -77.6 dBm/m^2/MHz. O3b's earth stations track the O3b satellites as they pass over head, causing the "interference zone" on the ground to shift. As a result, the above footprint represents the overlapping interference zones for the Vernon earth station at all possible elevation and azimuth angles. The actual interference zone at any instant in time will only cover a portion of the red area above based on the elevation and azimuth angles of the earth station antenna. O3b estimates that the entire footprint is roughly 70 square kilometers and covers the homes of about 90 people, although never at one time.