

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

REPLY COMMENTS OF O3B LIMITED

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REPLY COMMENTS OF O3B LIMITED

O3b Limited (“O3b”) submits this reply to comments filed in response to the Notice of Proposed Rulemaking (“NPRM”) for the Use of Spectrum Bands Above 24 GHz For Mobile Radio Services and, *inter alia*, Establishing a More Flexible Framework to Facilitate Satellite Operations in the 27.5-28.35 GHz and 37.5-40 GHz Bands.

I. INTRODUCTION AND SUMMARY

The comments reflect widely differing views on whether and how the FCC should amend its licensing rules and policies to introduce 5G mobile and unlicensed services into the millimeter wave (“mmW”) bands at issue. But the comments reveal agreement on a number of factors that are critically important in guiding policy:

- The mmW bands have fundamentally different propagation characteristics than do other bands that are used for mobile service.
- The first deployments of terrestrial 5G service will not occur for several years and will be significantly more limited in coverage areas than commercial mobile deployments to date.
- The mmW bands will provide an adjunct to existing mobile networks in lower bands, but are not likely to support stand-alone or ubiquitous 5G mobile services.
- Fixed Satellite Service (“FSS”) operators are providing advanced broadband services in some of the mmW bands today, and are continuing to expand service through substantial innovation and investment.

The record reflects significant differences of opinion on other points. Parties representing the interests of terrestrial licensees argue that the FCC should apply the same licensing paradigm (e.g., large, exclusive geographic licenses and forgiving performance requirements) to mobile service in the mmW bands that it has historically applied to other mobile bands. Others (including O3b) believe that such an approach would deter innovation, throttle investment, and leave spectrum unused in vast areas of the country. While many parties (including O3b) acknowledge the need for rules to provide for existing and future expansion of satellite services in the 27.5-28.35 GHz band (the “28 GHz band”), there is disagreement as to the appropriate level of accommodation. Some terrestrial commenters advocate rules that would, for practical purposes, preclude future deployment of satellite earth stations in the 28 GHz band. Other commenters propose rules that, while different from those O3b proposed, would be superior to those proposed in the Commission’s NPRM.

Commenters supporting authorization of mobile service in the 28 GHz band argue for issuance of exclusive licenses for large geographic areas with long license terms and very forgiving performance requirements. These commenters have offered only conclusory rationales that do not justify excluding or limiting future FSS operations, especially since mmW band mobile service is unlikely to reach the vast majority of the country. Other supporters of mobile service in the 28 GHz band assert that FSS operators assumed the risk that their service would be preempted later by mobile operations because the FCC treats FSS as secondary to FS. Not so. Though the FCC once surmised that it might one day authorize mobile operations, it did not reverse its previous order stating that any future services authorized at 28 GHz would be required to protect FSS.

Many mobile service advocates argue that auctions allow the market to determine the highest and best use of the mmW bands. But they also ask the FCC *not* to auction the mobile licenses with by far the greatest value. They argue that mobile licenses should be handed out to LMDS incumbents for free, and that the beneficiaries should be allowed to hold those rights for ten years or more, excluding use by FSS operators, whether or not the LMDS licensees deploy mobile service. Even the less valuable licenses that would be auctioned would be defined in a way that puts FSS at a decisive auction disadvantage. Under the regulatory approach the market itself would have almost nothing to say about the efficient assignment of spectrum usage rights in the 28 GHz band.

The less extreme comments recognize that if the FCC permits mobile operations in the 28 GHz band it must also define a clear and sure path for FSS operations to continue and expand. But it is also clear from the comments that existing uses make authorization of 5G mobile service in the 28 GHz band much more challenging than in other mmW bands the NPRM considers. If

the FCC proceeds to authorize 5G mobile operations in the 28 GHz band, whether on a co-primary or secondary basis, it should initiate a further notice of proposed rulemaking to further develop the record before adopting technical rules for those mobile operations in the 28 GHz band.

As explained in our opening comments,¹ the best approach would be to decline to authorize co-primary mobile operations in the 28 GHz band. Comments in this proceeding echo our technical concerns about the proposed licensing regime, as well as concerns about inter-service compatibility and of aggregate interference into in-orbit satellite receivers. If the Commission proceeds to adopt rules that authorize 5G mobile services in the 28 GHz band, on a co-primary or secondary basis, those mobile operations should not be allowed to constrain existing FSS site-licensed earth stations, to unreasonably constrain future FSS deployment of site-licensed earth stations, or to cause harmful interference into co-frequency spacecraft serving the same geographic area.² If the FCC then awards mobile licenses for exclusive geographic area licenses in the 28 GHz band, the geographic areas should be small and portions of licensed areas not served after a reasonable time should be relinquished.

In all cases FSS operators must have a clear path to deploy protected, site-licensed⁴ earth stations and to operate related space stations without experiencing harmful interference from any mobile 5G services in the 28 GHz band . Requiring FSS operators or their customers to obtain large geographic area licenses through auction simply to ensure their earth stations may operate with certainty and within their site-licensed parameters is not a workable solution.

¹ Comments of O3b Limited, GN Docket No. 14-177, *et al.* (filed Jan. 28, 2016) (“*O3b Comments*”).

² A template for mixed use, including coordination zones and other technical issues, should be developed, as part of a further notice of proposed rulemaking.

⁴ The NPRM refers to “gateway” earth stations, and many of the comments also refer to gateways. Because there does not appear to be a universally agreed upon definition of what “gateway” means, O3b prefers to define FSS earth stations that should be protected in all instances as those that are site or individually licensed.

II. DISCUSSION

A. The Existing Mobile Services Licensing Framework is Inappropriate for the mmW Bands

Wireless interests advocate awarding mmW mobile licenses under a framework that is substantially identical to that applied to lower frequency bands with much longer wavelengths and vastly different propagation characteristics – one that was devised largely to accommodate first generation digital voice services. Their arguments in favor of this approach are vague: they simply contend, without elaboration, that the existing licensing paradigm has worked well and that the mmW bands are “too important” for the FCC to “experiment” with new licensing approaches.

But many other commenters, citing advances in technology and the inherently small terrestrial coverage areas for mmW stations, agree with O3b that application of the traditional mobile service paradigm to these bands would serve only the private interests of the wireless industry incumbents.⁸ In particular, we agree with SES’s view that “[w]ithout material changes, however, the framework set forth in the NPRM will stand as a barrier to robust spectrum use by a variety of providers.”⁹ The FCC should not force 21st century spectrum policy into a 20th century licensing model.

B. 28 GHz Band Rules Must Assume and Accommodate Existing and Future Deployment of FSS Earth Stations With Fully Protected Status

1. The FCC Should Not Authorize 5G Mobile Services in the 28 GHz Band

As stated in our opening comments,¹⁰ O3b agrees with Boeing that by far the best

⁸ E.g., Comments of Microsoft Corp., GN Docket No. 14-177, *et al.* at 15–16 (filed Jan. 27, 2016) (“*Microsoft Comments*”).

⁹ Comments of SES Americom, Inc., GN Docket No. 14-177, *et al.* at i (filed Jan. 28, 2016) (“*SES Comments*”).

¹⁰ O3b Comments at 16.

approach would be to decline to authorize mobile operations in the 28 GHz band, and to identify other mmW bands for “green field” mobile deployments.¹¹ This approach would have no impact on the timing of launch of 5G mobile services in the mmW bands, because the first deployments of 5G service, even in the sub-6 GHz bands of paramount importance for 5G mobile service,¹² are still years in the future. No harmonized equipment, standards or service topographies exist today, and even the use cases for 5G in the mmW bands are still being postulated.

In contrast, the benefits of many recent groundbreaking Ka-band innovations by satellite companies are already being realized. Increasingly powerful spot beams provide enterprise-level reliability, fiber-like latency, and very high capacity. Steerable spot beams dynamically focus capacity where it is needed most (including for response to natural disasters and for military operations). Innovative flat panel and phased array antennas reduce cost and improve quality of service. These are just three of many examples of the dynamic and extraordinary innovation behind the Ka-band satellite marketplace in the U.S. and abroad.

In the 28 GHz band, FSS operators are already sharing with terrestrial fixed services in the U.S., as they have for decades in other frequency bands. We recognize that productive uses of the mmW bands may be found for terrestrial services. But given that billions of dollars have been invested to build and operate advanced satellite systems that are now providing service across the U.S. and worldwide in the 28 GHz band (which is globally harmonized for satellite services), the FCC should eliminate existing barriers to further investment in FSS service at 28 GHz and focus on developing different bands for future “green field” mobile use.¹³

¹¹ Comments of The Boeing Company, GN Docket No. 14-177, *et al.* at 6 (filed Jan. 28, 2016) (“*Boeing Comments*”).

¹² Comments of AT&T, GN Docket No. 14-177, *et al.* at 3 (filed Jan. 28, 2016) (“*AT&T Comments*”).

¹³ The presence of existing and potential future FS links in the band (in areas currently licensed to LMDS operators) would ensure even more intensive use of the 28 GHz band. The FCC might also consider whether unlicensed operations should be permitted indoors on an unprotected, non-interference basis in the 28 GHz band. *Cf.*

If the FCC does authorize 5G mobile operations in the 28 GHz band, those operations should be secondary to existing and future site-licensed FSS earth stations and to the fixed service. A few wireless industry commenters argue that FSS earth stations should not be protected at all from future mobile operations because the FSS operators built earth stations with the understanding that their operations would be secondary.¹⁴ Those arguments are disingenuous. As ViaSat points out,¹⁵ when the FCC adopted the existing licensing priorities in 1996, it clearly stated that services then-treated by rule as secondary (specifically including FSS) would have “licensing priority vis-à-vis *any third service allocated domestically or internationally in the band.*”¹⁶ O3b designed and built its global system with the understanding that, in the United States, its earth stations would operate on a *secondary-to-FS* basis in the 28 GHz band. O3b had no reason to expect that incumbent FS licensees might be authorized to deploy mobile services and that it might be required to decommission multi-million dollar earth stations that have long been in use in order to allow an FS operator to exploit a new windfall right to deploy mobile service on a primary basis in the 28 GHz band.¹⁷

Comments of Open Technology Institute and Public Knowledge, GN Docket No. 14-177, *et al.* at 24-25 (filed Jan. 28, 2016) (“*Open Technology Institute and Public Knowledge Comments*”) (advocating for indoor-only unlicensed use or general authorized access for the 28 GHz band).

¹⁴ Comments of XO Communications LLC, GN Docket No. 14-177, *et al.* at 15 (filed Jan. 28, 2016) (“*XO Communications Comments*”); Comments of CTIA, GN Docket No. 14-177, *et al.* at 32 (filed Jan. 28, 2016) (“*CTIA Comments*”); Comments of Cisco Systems Inc., GN Docket No. 14-177, *et al.* at 5-6 (filed on Jan. 28, 2016) (“*Cisco Comments*”); Comments of Samsung Electronics America, Inc and Samsung Research America, GN Docket No. 14-177, *et al.* at 22 (filed Jan. 27, 2016) (“*Samsung Comments*”).

¹⁵ Comments of ViaSat, GN Docket No. 14-177, *et al.* at 11-12 (filed Jan. 28, 2016) (“*ViaSat Comments*”).

¹⁶ *Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission’s Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies for Local Multipoint Distribution Service and for Fixed Satellite Services*, CC Docket No. 92-297, First Report and Order, 11 FCC Rcd 19005, 19024 ¶ 44 (1996) (“*First Report and Order*”) (emphasis added).

¹⁷ A number of pro-mobile commenters note that the *Second LMDS Report and Order* stated that the FCC might at some future time consider authorizing mobile service in the 28 GHz band if the record supports doing so. But that speculative statement about what the FCC might do did not overrule the prior firm ruling of the FCC from the *First Report and Order* that FSS would have licensing priority over any third service later authorized in the band. Moreover, when the FCC mused in the *Second LMDS Report and Order* that it might one day permit mobile service it also stated that it would reconsider, at the same time, whether the that spectrum should be included in calculation

2. **Contrary to Baseless Claims in Comments, Satellites Are Exceptionally Efficient Users of Spectrum**

Apparently to justify their position that the FCC should reverse course and make mobile primary without any protection for FSS earth stations or arrangements for future growth, some commenters argue that terrestrial mobile services use spectrum with greater “efficiency” than do FSS systems.

Such arguments are specious. The “efficiency” of a system cannot be determined simply by adding up the number of bits moved from one place to another. For example, Straight Path offers simplistic calculations to argue that a hypothetical terrestrial mmW service (which does not exist) is “150,000 times more efficient” than O3b’s global network of highly focused satellite spot beams.¹⁹ Among the considerable number of flaws in Straight Path’s logic and factual understanding, most of which we will not address, is its failure to explain what it means for a system to “use” spectrum. Its “analysis” (for lack of a better term) implies that O3b “uses” all of its spectrum throughout all of the United States simultaneously.²⁰ In fact, all of the spectrum O3b “uses” is also used at the same time by several other satellite operators, and some of it is used by LMDS operators, including Straight Path itself. O3b and other satellite operators are in the process of adding far more satellite capacity in the Ka band. And while satellites are capable of providing national, anywhere / anytime coverage, terrestrial mmW sites, even 300,000 of the

of a spectrum cap. *See Rulemaking to Amend Parts 1, 2, 21, and 25 of the Commission’s Rules to Redesignate the 27.5-29.5 GHz Frequency Band, to Reallocate the 29.5-30.0 GHz Frequency Band, to Establish Rules and Policies For Local Multipoint Distribution Service and For Fixed Satellite Services*, CC Docket No. 92-297, Second Report and Order, Order on Reconsideration and Fifth Notice of Proposed Rulemaking, 12 FCC Rcd. 12545, ¶ 207 n.322 (1997) (“*Second LMDS Report and Order*”). If the FCC does authorize mobile service in the 28 GHz band, it should include that spectrum in the spectrum screen and for all purposes in calculating each licensee’s mobile spectrum holdings.

¹⁹ Comments of Straight Path Communications, Inc., GN Docket No. 14-177, *et al.* at 28 (filed Jan. 27, 2016).

²⁰ As noted, O3b’s current generation of satellites uses the Earth to Space spectrum of 27.5-28.35 GHz and 28.6-29.1 GHz. Each satellite’s ten spot beams are continuously pointing and repointing to O3b’s customer sites in the northern and southern hemispheres as they orbit “overhead” any given longitudinal region.

mobile cells Straight Path posits (assuming they are eventually deployed) will provide service to only a tiny portion – much less than 1% – of the country.

While Straight Path’s comments do not show that mobile is a more efficient use of mmW spectrum than satellite, its projection of 300,000 mobile mmW cells precisely illustrates the importance of not permitting terrestrial licensees to exclude or unreasonably limit FSS operations. Given the technical characteristics of mmW bands, it is abundantly clear that terrestrial mobile deployments in the mmW band will serve just a tiny portion of the country. In Straight Path’s hypothetical, “mobile” service to less than one percent of the area of the country would give the mobile licensees the right to exclude satellite operations in the other 99+ percent.

This cannot be called “efficient” use of spectrum. The U.S. is not well served with super-high bandwidth in a few small high demand areas and little or no use of the same spectrum everywhere else. A fast-growing broadband economy demands many kinds of capacity. The FCC need not and should not choose a single transmission path or technology to the exclusion of others. Satellite is already making highly efficient uses of the 28 GHz band, uses that are globally harmonized and growing fast. No FSS licensee has exclusive access to any of the mmW bands in any geographic areas. In all cases, FSS satellite operators share with each other.

O3b recognizes that national policy must allow a variety of operators providing a mix of radio access (spectrum-based) services to meet the demands of a fast-growing global broadband ecosystem. The central promise of 5G services is to do just this – to seamlessly and dynamically integrate disparate physical layer links to allow networks to follow demand, rather than the opposite. The unique capabilities of the innovative satellite services that have been deployed in the 28 GHz band now, and their ongoing upgrades to add capacity and capability, will be integral

to full realization of the promise of 5G.²³ Indeed, the European Union has acknowledged that “5G networks should encompass optical, cellular and satellite solutions.”²⁴ The communications market has grown well beyond one-size-fits-all paradigms.

As the domestic and global broadband ecosystems grow, O3b believes that greater flexibility provided by satellite systems to deliver high capacity anywhere, including remote areas and challenging use cases, such as on board vessels, will be at least as important as delivering more capacity to certain places. As the 28 GHz band is already essential to satellite’s ability to provide extremely flexible, very high capacity links to governments, telecom operators, mobile companies, private enterprises, and mobility customers, and because FSS operators have shown that they can share the 28 GHz band with LMDS fixed links as currently defined, O3b urges the FCC not to disturb the balance that fostered this dynamic and highly productive spectrum use environment.

Although specific proposals differ, most commenters agree that if the FCC does authorize new types of service in the 28 GHz band, those new uses must respect pre-existing users and services.²⁷ Although O3b would go much further, we agree with commenters, including AT&T, who support granting incumbent FSS licensees co-primary status.²⁸

²³ See, e.g., E.U. 5G Infrastructure Public Private Partnership, *5G and Media & Entertainment Whitepaper* 4 (2016) (“5G comes as the union of point-to-point and point-to-multipoint (including broadcast) capabilities and networks that are currently considered rather vertically integrated like cellular, wireless, fixed, satellite, air platforms, and digital terrestrial television (DTT). This will deliver a seamless, integrated and optimised solution to M&E, with the aim of maximizing end-user M&E experience. 5G will enhance the capabilities experienced in networks today.”) available at <https://5g-ppp.eu/wp-content/uploads/2016/02/5G-PPP-White-Paper-on-Media-Entertainment-Vertical-Sector.pdf> (last visited Feb. 24, 2016).

²⁴ Mobile World Congress 2015: EU unveils its vision for 5G (March 3, 2016), available at <https://ec.europa.eu/digital-agenda/en/news/5g-european-research-and-vision-showcased-blueprint-showcased-mobile-world-congress-2015> (last visited Feb. 24, 2016).

²⁷ AT&T Comments at 12-13; Boeing Comments at 3; Comments of Satellite Industry Association, GN Docket No. 14-177, *et al.* at 18-19 (filed Jan. 28, 2016) (“*SIA Comments*”); SES Comments at 5; Comments of Google Inc., GN Docket No. 14-177, *et al.* at 2 (filed Jan. 28, 2016) (“*Google Comments*”) (proposing licensing frameworks that accommodate both traditional and new users); Comments of National Cable and Telecommunications Association, GN Docket No. 14-177, *et al.* at 19 (filed Jan. 28, 2016) (“*NCTA Comments*”) (acknowledging the importance of

3. If Mobile Service is Authorized Under Exclusive Geographic Area Licenses the License Areas Should be Small, Terms Should be Shorter, and Interim Performance Requirements Should be Enforced

A number of FS and mobile industry commenters assert that mobile licenses should have long initial license terms and be subject to minimal buildout obligations. Some parties advocate initial terms of at least ten years.²⁹ XO asks for a term of 15 years.³⁰ Some parties argue that performance should only be assessed at the end of a ten-year term.³¹ Stripped to essentials, what these parties seek is a minimum ten year (or longer) right to exclude further satellite deployment (or at least to introduce so much new risk that satellite deployment is stifled in fact) while they “wait and see” if technology and use cases for mobile service in the 28 GHz bands emerge. For the reasons explained in our opening comments, O3b supports shorter terms for terrestrial licenses.³² If the FCC adopts long, ten-year license terms, performance requirements should be staged to ensure that a reasonable amount of service is provided by the third year with additional benchmarks until the end of the first term.

By the same token, if the FCC proceeds to award exclusive geographic areas, it must adopt appropriate rules to ensure that the 28 GHz band, if not used (or to the extent not used) by the terrestrial licensee within a reasonable timeframe, is available for use by FSS earth stations or

accommodating incumbent users). O3b does not propose that incumbent FS licensees that do not seek to offer mobile service should be required to accept additional obligations with respect to FSS earth stations. But they should not be simply granted new mobile rights that would allow and incentivize them to block or limit future FSS site-licensed earth stations, or force FSS operators even to shut down existing earth stations. *See* O3b Comments at 19 (explaining that the use of geographic-based license areas could “incentive [licensees] to exclude use in a much larger area”); Comments of Inmarsat, GN Docket No. 14-177, *et al.* at 6 (filed Jan. 28, 2016) (“*Inmarsat Comments*”) (arguing that some proposed rules could result in FSS operators having to shut down).

²⁸ *See, e.g.*, AT&T Comments at 11-12.

²⁹ Cisco Comments at 10.

³⁰ XO Communications Comments at 22.

³¹ Cisco Comments at 12.

³² Unlike terrestrial licenses for exclusive geographic areas, FSS site-licensed facilities do not exclude others from using spectrum, except to the extent that the other use would interfere with the FSS facility or require a change of FSS-licensed operations.

other allocated services. Numerous commenters suggest alternative tools to provide the right balance of flexibility for the exclusive licensee and certainty for FSS operators. They include smaller geographic license blocks³³ and variations on a “use it or lose it” or “use it or share” approach.³⁴ We agree with SES that the Commission’s proposal for sequential auctions would be more likely to incentivize warehousing than to deter it.³⁵

a. Smaller Geographic Licenses

Many commenters observe that the very short distances that the mmW bands will propagate terrestrially require the FCC to consider smaller geographic units for initial mobile licenses. Wireless industry commenters brush aside suggestions that the very different deployment scenarios and use cases require the FCC to re-think its legacy mobile service licensing approach. Their arguments are simple: the existing paradigm “works”, mobile licensees need “certainty”, smaller license areas will be hard to administer (and to enforce performance requirements) and the need to coordinate will cause service to be reduced along license area borders.

None of these conclusory arguments has merit. More than a few commenters have convincingly explained why the existing paradigm is inappropriate.³⁶ Mobile licensees should have a reasonable degree of certainty, but that can be provided through inter-service sharing rules and should not translate into a right to exclude. Certainty does not require cookie-cutter licenses that are ill-suited to the mmW bands. The opening comments of O3b and others explain

³³ Open Technology Institute and Public Knowledge Comments at 7.

³⁴ *Id.* at 26; Comments of Facebook Inc., GN Docket No. 14-177, *et al.* at 6-7 (filed Jan. 27, 2016) (“*Facebook Comments*”); SES Comments at 14.

³⁵ SES Comments at 15.

³⁶ O3b Comments at 7-10; Microsoft Comments at 15-16; Open Technology Institute and Public Knowledge Comments at 7-10; ViaSat Comments at 7-10; SES Comments at 7; NCTA Comments at 10-11; Google Comments at 1-4.

that administration of larger numbers of geographic licenses is entirely workable, and that, in any case, it is better to have some non-performing licensees initially slip through the cracks, so to speak, than to adopt an ill-suited licensing regime simply because it is easier to administer.

Finally, arguments that coordination at license boundaries will unduly constrain mobile service are hollow. First, the record reflects broad consensus that coordination, even among disparate services, is relatively easier in the mmW bands than in lower bands. Second, since mobile service will not be ubiquitously deployed in the mmW bands (because mobile cells will be small and deployed only in certain locations), the actual zones of coordination will be much smaller than the entire regions surrounding all license borders. Third, in many or most cases, the same mobile licensee will most likely seek to hold or acquire licenses for the adjacent areas, regardless of the granularity of the geographic license areas. This would in fact be the default in areas with an LMDS incumbent, because the incumbent, under the FCC's proposal, would simply step into a coterminous mobile license. Based on O3b's analysis, existing LMDS licensees already hold terrestrial rights in least 48 of the top 50 markets, and the NPRM states that active LMDS licensee service areas cover about 75 percent of the U.S. population.³⁷ These already-licensed service areas encompass most, if not all, of the urban areas where 5G mobile service will be concentrated (if not exclusively deployed). If these LMDS incumbents are given mobile licenses for each of the counties (or smaller units, if licensed that way) in their existing BTA license areas, they will have the exact same borders that they would have if the FCC awards mobile licenses on a BTA basis.

Border coordination, if required at all, should be straightforward. The record amply reflects that mobile interests are working towards global standards, and that the coverage area of

³⁷ NPRM ¶ 25.

any site will be very small. Any concerns about smaller license areas complicating inter-service coordination along borders are minimal when the characteristics of the mmW bands are considered. In contrast, the concerns of many commenters that large, exclusive mmW license areas will result in large-scale warehousing are serious policy matters that the FCC must consider.

b. Performance Requirements

Commenters representing wireless industry and incumbent FS interests support performance requirements drawn from legacy mobile licensing regimes. Some argue in favor of requirements based on a showing of “substantial service”, including legacy safe harbors, rather than requirements that are specifically tailored to the band.³⁸ Other commenters support O3b’s view that the characteristics of these mmW bands require more thoughtful performance requirements.

O3b views the FCC’s proposed “centroid” metric as too liberal because it would allow a local monopoly licensee, by deploying in a small geographic area, to preclude easily coordinated uses in other areas in perpetuity. Mobile and FS commenters contend that the centroid approach is too strict, and some argue for alternative metrics, such as links or devices in use. The one theme common to most comments is that deployment in the mmW bands will take a much different form than deployment in other bands. Given these differences, rather than trying to adapt traditional performance requirements to the mmW bands, the FCC should abandon traditional performance requirements altogether and return to (and regulate from) first principles. The purpose of performance requirements is to ensure that holders of a bundle of rights to use and rights to exclude do not unduly exclude service more than necessary to protect their

³⁸ It is inconsistent that some mobile commenters argue that legacy “substantial service” safe harbors work because they are proven in other bands, while simultaneously contending that the nature of mobile deployment in the mmW bands, while unknown today, will differ greatly from deployment in lower bands.

reasonable and timely use expectations. Exclusive geographic licenses provide many public interest benefits in appropriate contexts, but they come with the risk that spectrum will be not be fully exploited.

In short, performance requirements are proposed for these bands to adjust for what is otherwise a policy flaw in exclusive geographic licenses. In the best case they are imperfect solutions and somewhat arbitrary, in that, however delineated, they still permit one party to exclude the productive use of spectrum that party itself does not use or have any reasonable prospect of using. At least in the 28 GHz band, the FCC should abandon exclusive geographic mobile licenses to the greatest extent feasible.

O3b reiterates its support of site licensing as an appropriate framework. It is well understood and cannot fairly be called “experimental”. It provides strong incentives for prospective licensees to coordinate, and, consistent with the FCC’s auction authority, relies on auctions when coordination fails.³⁹ Other commenters support middle ground approaches such as “use it or lose it” or “use it or share”.⁴¹ If the FCC awards exclusive geographic licenses, O3b urges the FCC to reject traditional performance requirements. Any number of alternatives would be more appropriate. As O3b proposed, mobile licensees might be given a defined period to build and more tailored rights to exclude during that period,⁴² with all facilities reverting to protected, site-licensed status at the end of the exclusive period. Or, the FCC might grant mobile licenses presumptive rights to areas defined by factors other than geography.

³⁹ Auctions of exclusive geographic mobile service licenses would not generate meaningful revenue relative to the value of the rights conferred, since licenses covering 75 percent of the population would be given away rather than auctioned, under the plan proposed in the NPRM. It is conceivable, and even likely, that site licensing would result in far higher auction proceeds.

⁴¹ SES Comments at 14; Facebook Comments at 6-7; Open Technology Institute and Public Knowledge Comments at 26.

⁴² FS licensees given an upgrade to mobile should be required to coordinate with proponents of FSS earth stations, without demanding payment, during the exclusive license period.

Whatever approach is taken in lieu of traditional performance requirements, that approach must provide reasonable certainty that O3b and others will have the ability to deploy protected, site-licensed earth stations. And given the limited propagation of the mmW bands, even in areas where terrestrial service is deployed and protected, FSS operators should continue to have the opportunity to coordinate with the terrestrial licensee for assured access or to deploy terminals that can operate opportunistically.

4. The NPRM Proposal Will Not Allow the Market to Determine the Highest and Best Use of the 28 GHz Band

The NRPM proposes to allow FSS operators to gain access to spectrum for additional 28 GHz earth stations by bidding for terrestrial rights in an auction for new mobile licenses in areas not currently licensed to an LMDS incumbent. The NPRM asserts that doing so would “establish a market-based mechanism for determining the highest and best use of the spectrum in a given area.”⁴³ But even assuming auctions could do so in theory, the market would not have a chance to express the highest and best use under the NPRM’s approach. First, rights to already-licensed LMDS service areas in which three quarters of the population lives would be assigned by rule, not by the market. FSS operators would have no opportunity – market-based or otherwise – to acquire rights representing the lion’s share of the rights being conferred. Second, even in areas where licenses would be available at auction, the rights offered – exclusive rights to very large, irregular geographic areas – are bespoke for mobile service. They are not technology neutral: they pre-suppose a particular use, a particular category of technology, and a particular kind of buyer. Satellite operators have little use for BTA or even county-sized license areas. In fact, FSS operators do not need exclusive geographic rights at all – multiple FSS operators can and do use the same frequency bands in substantially the same locations on the

⁴³ NPRM ¶ 133.

surface of the earth, and have done so for decades. Much smaller geographic license areas would reduce the extreme auction bias favoring terrestrial users, but the “market” supposedly determining the highest and best use would still be overwhelmingly biased in favor of mobile use.

If the FCC authorizes mobile service and wants to allow the market to “determine the highest and best *use* of the spectrum in a given *area*”⁴⁴ it should allow the market to define both the *use* and the *area*. Licensing *facilities* rather than areas allows the highest and best use, or uses, to emerge in every given area. When rights to operate mutually exclusive facilities are sought, auctions can be used if coordination fails.

5. Harmonization Matters

Several commenters argue that the FCC should not be influenced by the approach taken by other administrations to the 28 GHz band as reflected in the results of WRC-15.⁴⁵ Other commenters agree with O3b that the FCC must be cognizant of plans elsewhere.⁴⁶ AT&T and Samsung, for example, echo O3b’s view that global harmonization is critical to promoting 5G development by reducing equipment cost, promoting greater economies of scale, and making the use of services outside of the United States more accessible.⁴⁷ Many comments support O3b’s view that an approach that provides assured access for existing and future FSS earth stations in the 28 GHz band is far more likely to be compatible with approaches taken by most other administrations and thus far more likely to lead to global harmonization.

⁴⁴ *Id.*

⁴⁵ *See, e.g.*, XO Comments at 14; *see also* Cisco Comments at 4; *see also* Samsung Comments at 10-11.

⁴⁶ Comments of ESOA, GN Docket No. 14-177, *et al.* at 8 (filed Jan. 27, 2016); Boeing Comments at 6.

⁴⁷ AT&T Comments at 10-11; Samsung Comments at 4; Comments of Huawei Technologies, Inc. (USA), Huawei Technologies Co., Ltd., GN Docket No. 14-177, *et al.* at 6 (filed Jan. 28, 2016); CTIA Comments at 9.

C. If the FCC Decides to Authorize Mobile Service in the 28 GHz Band it Should Further Develop the Record Before Adopting Technical Rules

If the FCC concludes that it should authorize mobile service in the 28 GHz band, it should, in the same order, announce a policy consistent with the FCC's stated goal of technology neutrality. Regardless of the mechanism the FCC uses to facilitate FSS access (whether O3b's proposal for site-licensing or some other approach), if the FCC permits mobile services in the 28 GHz band, it will be necessary for the FCC to adopt at least some rudimentary rules governing interference between mobile and FSS. While some wireless industry commenters propose that the FCC deliver certainty by adopting rules that would effectively stifle further investment in satellite services in the 28 GHz band, most commenters (including even many wireless industry commenters) acknowledge that the 28 GHz band, at least, must and should remain a mixed use band in some form.⁴⁸

The existing mixed use occupancy of the 28 GHz band has worked, if imperfectly, because FSS operators have coordinated effectively with FS licensees or deployed in areas in which there is no terrestrial licensee. For the many reasons explained in O3b's and other parties' comments, this paradigm is unworkable in the presence of a mobile licensee with primary status in all cases vis-à-vis FSS. More thoughtful inter-service sharing rules are absolutely essential.⁴⁹

Yet it is impossible to adopt practical inter-service rules based on the record presently before the Commission, which says nothing concrete about what sorts of mobile transmitters and receivers might actually be deployed in the band. If the FCC authorizes mobile service in the 28

⁴⁸ Cisco Comments at 5-6; Samsung Comments at 22; Facebook Comments at 5.

⁴⁹ The E.U. 5G Infrastructure Public Private Partnership acknowledges in its Vision Brochure that the need for wide contiguous bandwidths must be balanced with "careful assessment and recognition of other services using, or planning to use, these bands" because "[m]aintaining a stable and predictable regulatory and spectrum management environment is critical for the long term investments. Research on this spectrum has to take into account long-term investments so that they can be preserved." 5G Infrastructure Public Private Partnership, *Vision Brochure* 4 (2015), available at <https://5g-ppp.eu/wp-content/uploads/2015/02/5G-Vision-Brochure-v1.pdf> (last visited Feb. 25, 2016).

GHz bands, it should issue a further notice of proposed rulemaking to consider the appropriate rules for inter-service operation. At the same time, it should encourage all stakeholders to present a consensus approach for the FCC to consider.⁵¹ We discuss below some matters that a further notice should address.

The time needed – a matter of a few months – to develop inter-service rules for the 28 GHz band would not delay the introduction of 5G “mobile” service at all. The NPRM and comments of wireless industry advocates stress that licensees and their suppliers need regulatory certainty to make the large investments necessary to fully exploit the potential of the mmW bands. Satellite operators, too, need certainty. And in contrast to wireless operators, which may use the 28 GHz band in some places, for some services, at some time in the future, satellite operators have invested billions of dollars in this band in recent years, and are presently investing billions more. Those FSS investments have already yielded advanced broadband services – for fixed service (including “last mile” broadband service and backhaul for wired broadband), to mobile platforms (such as ships), and even to facilitate terrestrial mobile service by providing backhaul for remote cell sites – in places where they were not available before, both in the US and worldwide.

All licensees need certainty, but FSS operators need certainty *now*. Just as wireless operators are planning their role in the 5G world five, ten and twenty years hence, so are satellite operators. But satellite operators like O3b are *also* planning the evolution and growth of their services five, ten and twenty *months* from today. We are writing code, fabricating chips, and designing and ordering even newer generations of satellites, earth stations, air interfaces, traffic

⁵¹ *Cf.* Cisco Comments at 10 (“The Commission should further make clear that the onus should be on market participants to reach accommodation” on co-existence of different services). As other commenters have noted, affected parties have been informally discussing sharing frameworks. *See, e.g.*, Viasat Comments at 9. FCC should allow time for those negotiations to proceed and should not skew the outcome by favoring one technology over another before the affected parties have had time to find solutions.

optimization software and other system elements. The NOI and the NPRM have created great uncertainty for FSS operators, their investors, and their customers. The FCC should promptly resolve that uncertainty by announcing a clear policy that satellite industry and the customers it serves will have a path to deploy protected earth stations in most, if not all, of the country, now and in the future, consistent with inter-service operating rules to be adopted following a further notice of proposed rulemaking.

D. Other Issues

1. Mobile Platforms

O3b agrees with Boeing⁵³ that the FCC can make the most efficient use of limited spectrum by extending its rules for authorization of satellite earth stations on mobile platforms to include those operating in the 28 GHz band. Satellite operators can use the mmW bands to provide broadband service in places and under conditions that no terrestrial platform can provide. Any allocation of terrestrial mobile in the 28 GHz band should protect not only FSS individually licensed earth stations, existing and future, but also be done in such a way as not to preclude, either actually, or practically, satellite earth stations on mobile platforms.

O3b is already operating a highly successful and rapidly growing maritime service via 28 GHz FSS terminals onboard cruise ships. In obtaining FCC authorizations for its ESOMP operations in the 28 GHz band, O3b has, at its own expense, notified its operations and communicated with a number of incumbent FS operators. As a result of these efforts and a system designed to mitigate interference to fixed terrestrial systems, O3b has received no complaints of harmful interference to date, despite ESOMP operations in proximity to a number of FS licensees.

⁵³ Boeing Comments at 10-11.

O3b supports commenters who advocate a follow-on proceeding to adopt rules for satellite earth stations on mobile platforms (“ESOMPs”) in the Ka-band in order to ensure that U.S. consumers have access to the benefits of broadband applications even while travelling on vessels or aircraft.⁵⁴

2. Technical Matters for Consideration in a Further Notice of Proposed Rulemaking

O3b, along with other Ka-band satellite companies, are also part of the 5G mmW ecosystem, operating and providing advanced services today in the 28 GHz band. As such, if the Commission decides to introduce 5G mobile services in the mmW bands, notably in the 28 GHz band, it should require that those new mobile networks be designed to avoid potential interference from existing FSS satellite earth stations. Numerous commenters, both terrestrial and satellite, have already calculated boundary distances at which they believe mobile stations would be safe from FSS interference.⁶⁶ Coordination zones will be different for the earth stations of different satellite systems, for example, varying based on GSO orbital position (or NGSO orbital plane), location of the earth station, size of the antenna, power levels, terrain, etc. A more thorough analysis of these factors is required before mobile services are permitted to commence deployment, but as Inmarsat stated in its comments, “there is simply no evidence on the record which suggests that FSS earth stations operating on a protected basis would derail efforts to deploy terrestrial 5G networks.”⁶⁷

O3b agrees with other commenters that the Commission must also address a second interference scenario, namely, the potential for aggregate interference from 5G mobile stations

⁵⁴ *Id.*; Inmarsat Comments at 8.

⁶⁶ *See* ViaSat Comments at 16; SES Comments at 6.

⁶⁷ *See* Inmarsat Comments at 10.

into an FSS receiver on the spacecraft. The Commission sought comment on whether or not to allow higher transmission power limit for the in-band application when mobile service and backhaul service use the same equipment.⁶⁸ The Commission further sought comments on technical information needed to determine if it would be necessary or beneficial to limit the skyward emissions from terrestrial mmW stations and if so, at what thresholds.⁶⁹ These separate requests for comment are each related to the potential for any increase in power allowed for terrestrial mobile service or in-band backhaul service to cause harmful interference the satellite receiver.

O3b does not support an increase in the allowed transmission power of mmW stations without more analysis in the record of the impact of skyward limits should the FCC decide to introduce mobile mmW stations in the 28 GHz band. This matter has been analyzed by a few satellite companies operating in the 28 GHz band.⁷⁰ Initial studies are already indicating that there is serious cause for concern. If the Commission adopts the proposal to introduce mobile terrestrial services in the 28 GHz band, it should also adopt measures that minimize the potential for harmful aggregate interference from mobile emissions into in-orbit satellite receivers.

III. CONCLUSION

The FCC should announce a clear policy of *promoting* ongoing deployment of new FSS facilities in the 28 GHz band. Rather than debating whether and to what extent existing FSS deployments should be protected in light of the “legitimate” expectations of FSS licensees, the FCC should celebrate the many successes of technology developers, equipment manufacturers,

⁶⁸ See *NPRM* ¶ 276.

⁶⁹ *Id.* ¶ 299.

⁷⁰ See Reply Comments of ESOA, GN Docket No. 14-177, *et al.* at Annex (filed Feb. 26, 2016) (“Potential Interference from 5G Systems to Satellite Uplinks in the Band 27.5-28.35 GHz”); Reply Comments of ViaSat, GN Docket No. 14-177, *et al.* (filed Feb. 26, 2016).

investors, service providers and others in using the 28 GHz band to bring new and innovative satellite services to market in the last decade and a half. Unlike other cases in which the FCC seeks to clear inefficient, incumbent users from a particular band to enable new technologies and services to grow, there are no obsolete users in the 28 GHz band.

Investment and innovation in satellite systems and services are thriving in the 28 GHz band today, and satellite operators are providing a wide range of services that are increasingly integral to the global broadband ecosystem. Essentially all of the FSS systems described in the record were purpose-built in the last 15 years, or are in the process of being developed and launched, specifically to support the next generation broadband economy. The earliest launched FSS systems have already been upgraded multiple times. Services launched more recently, like O3b, are planning substantial sequential upgrades. All Ka-band systems using the 28 GHz band were built in reliance on the FCC's 1996 decision that subsequently authorized services would be required to protect FSS,⁷¹ and its 28 GHz band plan from 2000⁷².

⁷¹ See *First Report and Order* ¶ 44.

⁷² *Redesignation of the 17.7-19.7 GHz Frequency Band, Blanket Licensing of Satellite Earth Stations in the 17.7-20.2 GHz and 27.5-30.0 GHz Frequency Bands, and the Allocation of Additional Spectrum in the 17.3-17.8 GHz and 24.75-25.25 GHz Frequency Bands for Broadcast Satellite-Service Use*, Report and Order, IB Docket No. 98-172, FCC 00-212 ¶ 17 (2000).

Naturally, at a bare minimum the legitimate expectations of FSS operators must be respected if the FCC re-writes the rules. But the FCC should not merely accommodate the legitimate expectations of FSS operators simply because equity requires as much. It should affirmatively promote the growth of innovative satellite services in the 28 GHz band because doing so manifestly serves the public interest.

Respectfully submitted,

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