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
	)	
Amendment of the Commission's Rules Regarding the 37.0-38.6 GHz and 38.6-40.0 GHz Bands	)	ET Docket No. 95-183 (Terminated)
	)	
Implementation of Section 309(j) of the Communications Act – Competitive Bidding, 37.0-38.6 GHz and 38.6-40.0 GHz Bands	)	PP Docket No. 93-253 (Terminated)
	)	
Petition for Rulemaking of the Fixed Wireless Communications Coalition to Create Service Rules for the 42-43.5 GHz Band	)	RM-11664

To the Commission:

COMMENTS OF O3B LIMITED

O3b hereby submits comments in response to the Commission's Notice of Inquiry ("NOI") in the above-referenced proceeding.[1]

SUMMARY

Incumbent satellite services above 24 GHz are on a strong growth trajectory. In general and in Ka-band in particular, satellite services continue to drive competition and innovation in the U.S. market for broadband connectivity. Satellite services today operate in an environment where fixed and fixed-satellite services, and geostationary and non-geostationary satellite systems, successfully share spectrum in the bands above 24 GHz. In developing policies for the introduction of 5G services in bands above 24 GHz, O3b urges the Commission to take into account the need of incumbent satellite systems for clear and reliable terms of access to spectrum already

[1] *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services,* GN Docket No. 14-177, *et al.,* Notice of Inquiry, FCC 14-154 (rel. Oct. 17, 2014).

allocated for FSS, as well as the ability to count on expansion spectrum to accommodate the increase in uptake of high-bandwidth services that FSS operators are seeing upon the introduction of each new application.

Introduction

O3b Limited ("O3b") today operates a 12-satellite global broadband system of non-geostationary ("NGSO") satellites in medium Earth orbit. The O3b satellite network operates its uplinks worldwide today in the 27.6-28.4 GHz and 28.6-29.1 GHz frequency bands and its downlinks in the 17.8-18.6 GHz and 18.8-19.3 GHz bands. Founded in 2007, O3b commenced global commercial service on eight satellites in September 2014. O3b is already providing revolutionary satellite broadband connectivity to the U.S., Caribbean, South America, Africa, Asia Pacific, and the Middle East. In the United States, two of O3b's key gateway earth stations supporting these global operations are located in Vernon, Texas and Sunset Beach, Hawaii. The Hawaii earth station also provides TT&C control functions for the O3b satellite constellation. In addition to these authorizations, the FCC has granted O3b a maritime blanket license authorization, and numerous applications are pending for earth station operations in bands proposed in this NOI.[2]

O3b's constellation is designed to connect the "other 3 billion" people who do not currently have adequate access to the internet, by enabling very high speed, low latency, and affordable broadband connectivity via Internet Service Providers, telecom operators, large enterprises and governments. In fact, the latency and data speeds provided over the O3b satellite system are comparable to terrestrial fiber services, and the market for O3b's unique this capabilities is developing in unanticipated ways.[3] The take-up of the O3b Ka-band satellite service across all of its frequency bands has been a resounding commercial success. As an active incumbent operator, O3b is pleased to provide its views in this Notice of Inquiry on the proposed allocations for the possible future "Fifth Generation" ("5G") mobile services in spectrum above 24 GHz.

[2] The Commission has also granted operational and experimental earth station authorizations to O3b service partners (e.g., SES Government Solutions and American Samoa Telecommunications Authority) and manufacturing partners (e.g., Kymeta, AvL and Harris Caprock).

[3] The O3b system is capable of providing data rates up to 1.6 Gbps per beam. Each beam provides up to 800 Mbps up and up to 800 Mbps down. With O3b's lower orbital altitude and high power, spot-beam design, O3b reliably provides latency between 120 milliseconds and 150 milliseconds.

I. O3b Supports the Commission's Goal of Ensuring Compatibility with Incumbent Services Above 24 GHz, including Satellite Services

O3b welcomes the opportunity to more clearly depict the potential environment for 5G by more fully addressing the scope of technologies that utilize the spectrum bands above 24 GHz today – in the United States or globally, in conformance with allocations agreed in the International Telecommunications Union ("ITU"). The Commission indicates that, in this NOI, its key focus is looking for new spectrum to satisfy the needs of the prospective 5G mobile services, but that it also aims "to develop a framework that will accommodate as wide a variety of services and uses as possible, and that will promote coexistence between different services in these bands."[4]

Accordingly, the Commission should carefully examine the existing services that are also implementing and developing "new and radically more capable" next generation technologies in the spectrum bands above 24 GHz, such as O3b.[5] Specifically, these include the Fixed Satellite Services sector in the Ka-band in 27.5-28.35 GHz and 29.1-29.25 GHz ("Ka-band Spectrum"), and in the V-band from 37.0-40 GHz and 42.0-42.5 GHz ("V-band Spectrum"). Both the incumbent service providers above 24 GHz and the Commission need to know how introducing 5G services will impact existing operations.

The Commission's ultimate 5G policies should carefully weigh the "…characteristics of the technology [that] are relevant to the manner in which mobile services in the mmW bands might coexist without impact on incumbent services that occupy the relevant frequency bands.[6]" O3b's comments aim to provide the Commission with the clearest possible picture of O3b's existing and planned services in the Ka-band, so that the Commission's 5G policies can "accommodate the widest possible range of technologies and uses, including compatibility with incumbent services."[7]

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[4] NOI, ¶ 15.
[5] NOI, ¶ 13.
[6] NOI, ¶ 17.
[7] *Id.*

A. Incumbent Satellite Services above 24 GHz Are on a Strong Growth Trajectory

The satellite industry has seen strong demand for its Ka-band services, and is bringing significant amounts of capacity to market near-term to meet that demand. Most of the satellite operators around the world have either already launched or are developing Ka-band satellite systems, including operators that serve the United States. The Ka-band is highly important to the industry as capacity constraints and other services pressure satellite services out of lower bands. Ka-band satellites are offering competitive options to terrestrial-based networks for some applications, and for many applications – remote broadband services, transoceanic flight, maritime communications – satellites offer the only means for broadband connectivity. Ka-band broadband satellite services are emerging as completely market-driven networks, employing a range of business models to succeed in markets both in competition with, and in the absence of, terrestrial broadband networks.

O3b commenced global broadband satellite services in the third quarter 2014 with a substantial fill rate of service providers seeking to use the O3b low latency advantage to better serve customers, including those in the United States and U.S. territories. Customer demand, as well as the potential system applications, continue to drive expansion of O3b service offerings beyond original expectations across all of our FSS-allocated frequencies (27.6-28.4 GHz and 28.6-29.1 GHz uplink and 17.8-18.6 GHz and 18.8-19.3 GHz downlink). As of December 2014, O3b serves telecom and enterprise customers on four continents, and many of those have sought additional ramp-up capacity based on the connectivity leaps enabled by O3b Ka-band capacity since the start of service in 2014. One market that O3b did not initially foresee as part of its customer base is the major cruise lines. Royal Caribbean Cruise Lines identified O3b as offering a real breakthrough in delivering guests the kind of technology they expect in a connected world, with speeds that meet or exceed what guests achieve on land.[8] O3b's compelling broadband offering exemplifies the potential for Ka-band satellite applications that meet mobility needs and demands for broadband connectivity in new market sectors.

[8] "Whatever the use at home, they'll be able to use on the ship…that's the kind of bandwidth we are talking about, that shore-like, fiber-like bandwidth onboard the ship… They are going to go 'Wow, this has really changed the game.'" "Bill Martin, CTO Royal Caribbean Cruises Ltd," May 22, 2014, at 1:05. Available at: https://www.youtube.com/watch?v=gaaD1T3vfq8.

As the Commission examines the possibilities of 5G, O3b urges the Commission to consider the role of incumbent services above 24 GHz, like Ka-band satellite services, in maintaining a healthy and balanced broadband ecosystem. As highlighted in Section II below, the Commission's ultimate 5G policies must include spectrum allocations that support continued successful operation and expansion of Ka-band broadband satellite services.

B. Satellite Services Continue to Drive Competition and Innovation

In the United States and around the world, satellite-delivery of news and entertainment that began as an innovative means to reach unserved populations ended up creating competition in established markets, giving consumers improved offerings and better value for money. Satellite-delivered broadband today is on track to follow a similar trajectory, rolling out in ways that ensure vibrant competition in markets for broadband connectivity and video distribution to end-users.

Consumers seeking broadband services today can choose between Ka-band satellite service providers that offer the capability to use a full range of broadband applications, comparable to terrestrial wireline service offerings. In both urban and remote environments, O3b is helping local telcos and ISPs introduce fiber-like connectivity where none existed before. For example, the Cook Islands, with a population of approximately 15,000 citizens, and 100,000 annual visitors, is now using the O3b system via the Hawaii gateway, and Telecom Cook Islands is able to offer end users broadband service with speeds up to 12 Mbps.[9] The new broadband access will have a highly beneficial impact on the local economy, connecting its citizens and entrepreneurs on a par with their peers and business partners elsewhere in the world. Citizens of South Sudan are also benefitting from the O3b service. RCS-Communication, a leading Internet Service Providers in the newly formed Republic of South Sudan, is using O3b to provide high-speed, low-latency capacity where more than 300,000 people until now had

[9] "The results speak for themselves, we're able to match the speed of internet delivered by undersea cable" stated Rob McFadzien Telecoms Chief Technical Officer. O3b Trial Huge Success, Telecom Cook Islands, Dec. 24, 2013, http://www.telecom.co.ck/view/page/media-releases-articles/story/o3b-trial-huge-success/.

limited broadband connectivity.[10] By delivering highly affordable and ubiquitous bandwidth with the performance and speed of fiber, the region will enjoy much improved connectivity, spurring both economic growth and social development. This will benefit a broad range of customers, including corporations and non-governmental organizations.

Broadband satellite services operating above 24 GHz are also innovating to bring next-generation satellite broadband connectivity to end-users in North America. In a demonstration at MacDill Air Force Base in Florida, SES Government Solutions (GS) streamed real-time 4K video for members of the United States armed forces while simultaneously backhauling and disseminating multiple channels of HD full motion video over O3b Network's MEO satellite constellation. The demonstration showed the ability to use high quality video in remote areas without any fiber infrastructure.[11] Because of its lower NGSO orbit, the O3b fleet can offer service with latency of 120-150 milliseconds round trip at affordable rates. This latency makes satellite-based mobile backhaul compatible with all forms of last-mile solutions (2G, 3G, WiMAX, LTE, etc.), and makes O3b a uniquely well-suited platform for broadband connectivity for rural telcos and cellular backhaul.

O3b's Ka-band enabled broadband applications highlight the unique capabilities of satellite for creating new platforms for the kinds of broadband services that are already taken for granted in urban areas. For example, airlines and cruise lines are increasing their reliance on Ka-band spot beam technology. More than 6,000 guests, staff and crew members aboard the cruise industry leader's flagship Quantum of the Seas – under the Royal

[10] "Though fiber options are being considered for South Sudan, we do not currently have fiber connectivity in country. Our WiMAX network in Juba connects to the Internet backbone via geostationary satellite solutions which are reliable, but when compared to fiber offers latency challenges. We believe that O3b brings something new to the satellite industry that uniquely addresses this limitation. O3b will enable us to offer higher speeds and a more responsive user experience to our WiMAX clients." Flippie Odendal, Managing Director, RCS-Communication, O3b's new satellite constellation to provide high speed connectivity to South Sudan, 2013, http://www.o3bnetworks.com/media-centre/press-releases/2013/o3b%E2%80%99s-new-satellite-constellation-to-provide-high-speed-connectivity-to-south-sudan.

[11] Caleb Henry, SES GS and O3b Showcase Live 4K Video Over Satellite to US Government, Dec 9, 2014, http://www.satellitetoday.com/regional/2014/12/09/ses-gs-and-o3b-showcase-live-4k-video-over-satellite-to-us-government/.

Caribbean International brand – can now enjoy O3b's enhanced connectivity at sea as if connected to fiber at home or in the office.[12]

O3b is working directly with manufacturers to incorporate innovations into its operations, to enable seamless telecommunications and broadband service to telecommunications providers, government agencies, and customer end-users. For example, O3b is one of several commercial partners working with Kymeta to demonstrate the capabilities of a flat panel, metamaterials antenna for Ka-band use.[13] New designs for smaller or flat panel antennas, led by manufacturers like Kymeta and AvL, are enabling ground-breaking satellite applications, like low-drag phased-array antennas for planes offering in-flight connectivity, in-motion antennas for avionics, auto-tracking antennas for satcoms that operate while a vehicle is moving, and flat thin satellite antennas that can replace large radomes on vessels. Together with satellite spot beam technologies, these innovations can generate higher efficiencies and lower costs in Ka-band satellite service delivery. Much smaller antennas delivering higher bandwidths are expected to open up markets to meet customer demand for delivery of broadband connectivity on high-speed trains, moving buses or any public transportation, and even for passenger vehicles.[14] On board satellites, spot-beam technology advances are boosting bandwidth availability and expanding markets for Ka-band satellite services. High capacity frequency re-use strategies rely on smaller spot beams, which also boost gain to permit use of smaller ground antennas.[15]

The experience of O3b and that of the satellite sector as a whole has been a virtuous cycle of growth and innovation in services and technologies enabled by access to Ka-band frequencies. In this proceeding, we urge the

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[12] Royal Caribbean International, Ship Fact Sheet – Quantum of the Seas, http://www.royalcaribbeanpresscenter.com/fact-sheet/27/quantum-of-the-seas/.
[13] Caleb Henry, Kymeta Plans Mass Production, September Demonstration with O3b, 11 June 2014, http://www.satellitetoday.com/technology/2014/06/11/kymeta-plans-mass-production-september-demonstration-with-o3b/.
[14] Carol Patton, Innovations in Satellite Antennas Attracting New Markets & Opportunities, October 31, 2014, http://www.satellitetoday.com/publications/2014/10/31/innovations-in-satellite-antennas-attracting-new-markets-opportunities/.
[15] David Alexander, Intel: Interest In Spot Beam Capabilities of Ka-Band Systems, January 2012 edition, http://www.milsatmagazine.com/story.php?number=1772881294.

Commission to adopt policies that provide regulatory certainty and expanded Ka-band access to drive continued growth of important satellite-enabled broadband applications and technologies.

C. Satellite Services above 24 GHz Operate in an Intra- and Inter-service Sharing Environment Today

In this NOI, the Commission should also consider that the current expansion of broadband satellite services and new applications in FSS take place in an environment that already includes significant sharing of the bands above 24 GHz. While fixed services (LMDS) and FSS are co-primary under international allocations in the 27.5-28.35 GHz band, the FSS is only secondary in the U.S. Table of Allocations in this sub-band. Consistent with the principals espoused in the NOI, large portions of the bands above 24 GHz are seeing successful deployments of satellite services in the United States using these frequencies on a shared, albeit secondary, basis. Satellite operators have accessed these bands to provide broadband consumer services in the United States as well as on-board broadband connectivity for airlines, cruise ships and other enterprise-level customers. In other words, current uses by satellite services above 24 GHz exemplify key Commission tenets of spectrum efficiency and re-use, and with great commercial success.

This ability of compatible services to use spectrum above 24 GHz efficiently and effectively is evident in how the spectrum is used today in the United States. There are currently a number of FSS earth stations deployed on a secondary basis in the 27.5-28.35 GHz band, which is allocated on a primary basis to LMDS, because FSS can co-exist with terrestrial fixed services including LMDS via coordination. O3b successfully coordinates and co-exists with LMDS in various parts of the United States. For example, O3b's Network Operations Center, which serves O3b customers worldwide while monitoring and maintaining the O3b constellation, has operated in Bristow, VA in these frequencies since 2012 without a single interference incident. Access to the LMDS bands in the US allows O3b's Hawaii gateway to provide broadband connectivity to areas of the Pacific that lack access to fiber connections, including 3 Pacific Island nations and the U.S. territory of American Samoa. Similarly, the use of LMDS frequencies permits O3b's Texas gateway to support high speed internet connectivity to nations in Latin America as well as to the maritime market in the Caribbean.

Multiple services are also providing competitive, high-bandwidth services through efficient use of spectrum, and spectrum sharing, on a global basis in the Ka-band. On an intra-service basis, satellites efficiently re-use and share FSS spectrum amongst themselves. This is done through orbital separation, beam separation, and advanced coordination procedures. In addition, frequency sharing between NGSO and GSO frequencies has been achieved either through coordination or through the implementation of equivalent power flux density ("epfd") limits as stipulated in Article 22 of the ITU Radio Regulations, for uplink and downlink, respectively. Outside the United States, O3b operates in the 27.6-28.35 bands on a primary basis in bands shared both with GSO FSS systems and the fixed service, and shares with these systems across several other portions of the Ka-band as well.

As noted here, O3b and other FSS operators have relied on the compatibility between fixed services and NGSO FSS and GSO FSS, to make available new services in this segment of the Ka-band. In this proceeding it is important to keep in mind that introducing an incompatible service in the existing sharing environment would unnecessarily limit the benefits that Ka-band FSS satellite systems are already bringing to the U.S. public.

II. 5G Policies Should Take into Account the Need for Expansion Spectrum and Regulatory Certainty for Incumbent Satellite Services Above 24 GHz

A. 5G Policies and Future Allocations Proceedings Should Account for Current and Future Use of Spectrum above 24 GHz for Incumbent Satellite Services

Greater flexibility in accessing bands above 24 GHz is essential for the continued success of incumbent Fixed-Satellite Services and responsiveness to the growing customer demands for these satellite services. In particular, O3b customers have benefited from access to the 27.5-28.35 GHz band even on a secondary basis, in multiple ways: at its U.S. gateways supporting global service; in providing broadband connectivity to U.S. maritime users; to serve U.S. territories directly; and for analyzing critical new innovative earth station technologies. Access to the LMDS band on a more protected or primary basis would allow O3b to bring nearly double its potential capacity to this market, *per* satellite.

Furthermore, using the global FSS allocations in the Ka-band, including 27.6-28.35 GHz, O3b is providing its customers with speeds comparable to fiber, in areas not otherwise reached by terrestrial infrastructure, whether due to cost or geographic location. O3b's combination of low latency, high bandwidth via global access to FSS spectrum allocated by the ITU allows it to support broadband satellite connectivity in unprecedented ways.

- Gulfsat Madagascar, a provider of high performance broadband and telephony services in Madagascar, is using O3b to drive a significant increase in affordable bandwidth, adding new enterprise services at speeds of up to 50 Mbps.
- Raga Sat, based in the Democratic Republic of Congo, now experiences a latency of 150 ms as compared to 500-600 ms before O3b began providing service.[16]
- Maju Nusa in Malaysia is utilizing the O3b network to deliver 3G services to customers over satellite. For many end users, this will mean instantly going from zero connectivity to 3G services.
- E-Networks in Guyana is O3b's first customer in Latin America, uses the O3b network to supplement its current offerings to individual and corporate users while also expanding its service footprint to more remote areas. (press release: http://www.o3bnetworks.com/media-centre/press-releases/2014/e-networks-to-deliver-high-speed-broadband-using-o3b-trunking-solutions)
- In the U.S. O3b has been able to successfully operate in the LMDS bands while demonstrating the system's capabilities to members of the U.S. defense and energy industries.

In recognition of the substantial role that the 27.5-28.35 GHz band plays in supplying and expanding broadband satellite services in the U.S. market, the Commission's spectrum policies need to look to better align U.S. allocations in the band with already harmonized global spectrum for broadband satellite services. Specifically, any consideration of the technical and operational bases for 5G operations that may impact incumbent services above 24 GHz, whether in the 5G NOI proceeding or in any proceedings addressing incumbent services, need to include an assessment of compatibility with the continued growth and expansion of those incumbent services in the United States.

[16] "The O3b technology and the broadband experience it delivers is absolutely mind boggling," said Philippe Israel, Managing Director for Raga Sat. "The difference between the Internet access speeds we could offer before and what we have now with O3b is literally night and day," he explainedO3b Networks Lights up Game-Changing Service, Oct. 2014. Available at: http://www.o3bnetworks.com/media/287931/viasatellite_october-november%202014.pdf. *See also,* O3b OPEN FOR BUSINESS, Raga Sat, DRC LIVE, at 1:03, https://www.youtube.com/watch?v=Hm6qXRWyjzY.

More intensive use of this band, in a manner technically compatible with incumbent terrestrial and satellite services, should include protection of existing and future FSS earth stations operating in the band, in a manner approximating protections afforded primary users of the band.

B. Commission Should Complete Open Ka and V-band Proceedings, Taking Full Account of Existing and Future Uses of 24 GHz

Satellite services are now well established above 24 GHz in the Ka-band. Satellite operators provide a host of services domestically in the 28.35-28.6 GHz (where geostationary (GSO) satellites are allocated on a primary basis, and non-geostationary (NGSO) systems are allocated in the United States on a secondary basis) and in the 28.6- 29.1 GHz bands (NGSO-primary, GSO-primary). As regional and global systems, however, Ka-band satellite operators can and do access a larger portion of spectrum above 24 GHz, including 27.5-28.35 GHz, in order to provide high-bandwidth, high-throughput services. In terms of spectrum efficiency, GSO and NGSO FSS systems to date share well with terrestrial fixed services, illustrating the potential for greater flexibility and sharing based on the technical compatibility of these services.

To date the flexibility of satellite systems to operate using the global ITU allocations for FSS, has proven to be essential to the provision of satellite services operators and customers, including O3b. However, service rules in the U.S. for this band are in some ways outdated and are not fully aligned with the commercial offerings now supported by satellite operations in this band globally. As a result, it is essential that the Commission complete its open proceedings related to Ka-band service rules, and carefully assess its rules for satellite services in the V-band, prior to or, at a minimum, in parallel with any proceedings addressing the potential for 5G in bands above 24 GHz. In other words, full development of service rules to support current and future satellite broadband offerings are a necessary pre-requisite to consideration of any revised allocations schemes for spectrum above 24 GHz.

Specifically, service rules have not yet been completed for the Ka-band FSS bands (GSO and NGSO), nor have service rules been developed for bands that would serve to expand the kinds of satellite services that are now successfully established in the Ka-band. With respect to the type of services O3b provides, the few rules that do

exist were developed years prior to O3b's service launch, and as such do not take account of today's GSO and NGSO FSS deployment and sharing capabilities. The lack of service rules that support the further successful development of these services and more intensive use of the Ka-band hinders the development of an important part of the US and global broadband telecommunications infrastructure.

As with any spectrum-based service, satellite services in the V-band also need regulatory certainty to ensure future access to global markets. Planning for large scale deployment in the band will require more detailed technical and operational rules. Accordingly the NOI and any follow-on proceedings should ensure that 5G spectrum policies take into account the current open proceeding on V-band as well, and the need to finalize rules to support future satellite services in parallel with any rules and allocations for next-generation mobile services. Continued growth and expansion of broadband satellite services depends on having FSS spectrum allocated in a practical and usable manner, and with sufficient bandwidth to support next-generation applications.

As discussed above, in parallel to any proceeding for adoption of 5G policies, the Commission must ensure that it simultaneously acts to update proceedings involving incumbent satellite services. These proceedings are important vehicles for addressing the need for expansion spectrum for satellite services. Broadband satellite services are on a strong growth trajectory – experiencing 20% growth from 2013 to 2014[17] - and new applications are emerging based on this growing demand and on innovations that enable delivery of higher bandwidth in satellite services offerings. O3b urges the Commission to ensure the development of rationale policies for spectrum use and spectrum sharing by addressing the possible future 5G policies in parallel with proceedings addressing incumbent satellite services above 24 GHz.

III. The NOI Record Should Include Technical Data from 5G Proponents on Compatibility with Incumbent Services, including Protection Criteria for Avoiding Harmful Interference

In this proceeding, it is of the utmost importance that commenters proposing 5G systems provide technically detailed information in the NOI on the architecture and parameters of a 5G system. Data on the

[17] State of the Satellite Industry Report, SIA, p. 12, Sept. 2014, http://www.sia.org/wp-content/uploads/2014/09/SSIR-September-2014-Update.pdf.

potential impact of 5G roll-out on the existing radiofrequency environment will allow commenters to provide an informed response to the FCC's questions about potential sharing, licensing and allocation schemes for 5G technology.

Of particular interest will be the power levels of 5G equipment that 5G systems will introduce into a shared spectrum environment. What will be the nature of such transmissions in terms of power density? What type modulation will be used? What would be the size of a typical antenna, and if applicable, of a typical base station? If a range of antenna sizes could be used, what factors will determine the essential parameters of a typical antenna?

In a dynamic sharing environment, directivity of transmissions is an important element in the managing the control or avoidance of harmful interference. For each type of 5G deployment envisioned, it will be important to know whether the equipment will use directive or omni-directional antennas, whether the base and/or user antennas will be mobile, and the estimated impact of proposed antenna deployment on incumbent co-channel or adjacent channel operations.

The nature of antenna deployment in terms of volume and scope are also essential in determining its impact on the existing radiofrequency environment. For any practical assessment of the impact of the introduction of 5G systems, it will be essential to know what the estimated number of terminals might be in a given geographic area, what the main areas of deployment are expected to be (urban, suburban, rural, remote), whether deployment would be primarily fixed or mobile, and whether deployment would be primarily indoor or outdoor.

Furthermore, it is important to understand whether the 5G services contemplated in the NOI are capable of sharing amongst themselves, or whether exclusive spectrum access is necessary. The type of 5G services described in the NOI appear to be more Wi-Fi like than a traditional mobile service. Descriptions available in the public domain suggest that 5G will operate over short ranges and will provide very high data rates in a highly localized manner. It will be helpful to understand architectures envisioned for 5G systems in order to assess its compatibility with other services above 24 GHz.

IV. Conclusion

In addressing whether the above 24 GHz bands offer a suitable environment for 5G services, O3b urges the Commission to consider the ways in which satellite services are well established in the band, in expansion mode, and an integral part of a larger infrastructure for the provision of broadband services. The Commission can help accomplish this goal by completing open Ka-band and V-band proceedings, and by updating the regulations in these bands to reflect current and future deployment and capacity demands of the incumbent satellite services. The NOI recognizes that the demand for data capacity is exploding and satellite, and O3b in particular, is ideally suited to help meet this demand once the Commission provides regulatory clarity in these bands. Accordingly, appropriate policies for the introduction of new services above 24 GHz, like 5G, must take into account the need of incumbent satellite systems for clear and reliable terms of access to spectrum already allocated for FSS, as well as the ability to count on expansion spectrum to accommodate the increase in uptake of high-bandwidth services that FSS operators are seeing upon the introduction of each new application.

Respectfully submitted,

/s/ Suzanne Malloy
Vice President of Regulatory Affairs
O3b Limited
900 17th Street NW, Suite 300
Washington, DC 20006

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