Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
THE BOEING COMPANY	)	IBFS File Nos. SAT-LOA-20160622-00058
	)	& SAT-AMD-20170301-00030
Application for Authority to Launch and	)	
Operate a Non-Geostationary Low Earth Orbit	)	Call Sign: S2966
Satellite System in the Fixed-Satellite Service	)	

To: Chief, International Bureau

OPPOSITION AND RESPONSE OF
THE BOEING COMPANY

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SUMMARY

The Commission should dismiss the petition of CTIA and the opposition of T-Mobile USA, Inc. ("T-Mobile") as irrelevant to the instant public notice process. As CTIA and T-Mobile both acknowledge, Boeing amended its application for the sole purpose of lowering the orbital altitude of its non-geostationary satellite orbit ("NGSO") fixed-satellite service ("FSS") system to resolve a potential conflict with the OneWeb NGSO FSS system. Neither CTIA nor T-Mobile provides any comments on this change of altitude. Therefore, their submissions are irrelevant.

Instead, T-Mobile and CTIA devote almost their entire filings to repeating the arguments they previously made when the Commission originally placed Boeing's NGSO FSS system application on public notice on November 1, 2016. At that time, Boeing provided a detailed response to T-Mobile and CTIA's comments.[1] Rather than attempt to rebut Boeing's detailed response, however, T-Mobile and CTIA make no reference to Boeing's previous filing, apparently expecting the Commission staff to sort through their filings to identify and assess any new arguments that CTIA and T-Mobile have made in between the stale arguments that Boeing previously addressed. Such tactics, of course, do not contribute to the detailed record that is required for the Commission to further its public interest obligation to manage spectrum resources in an efficient manner to benefit all Americans.

Although Boeing has addressed nearly all of T-Mobile and CTIA's arguments previously, Boeing addresses them again briefly herein and provides references in this response to Boeing's other filings in this proceeding and in the *Spectrum Frontiers* docket where these issues were

[1] *See* Opposition and Response of The Boeing Company, IBFS File No. SAT-LOA-20160622-00058 (Dec. 11, 2016) ("*Boeing Response*").

addressed previously. As Boeing has documented repeatedly, Boeing's proposal for an NGSO FSS system operating in the V-band is consistent with the underlying goals of the *Spectrum Frontiers* proceeding and the Commission's statutory public interest mandate to ensure that millimeter wave ("mmW") spectrum is used to benefit all Americans. CTIA has repeatedly conceded that terrestrial 5G mobile networks will not extend broadband availability to those Americans that remain unserved or underserved in rural and remote areas of the country. By offering high-quality satellite-delivered broadband service, with data rates that far exceed the Commission's 25/3 Mbps benchmark, and making it available equally to all areas of the country, Boeing's NGSO FSS system promises to provide not only a tool for closing the persistent broadband gap, but also a new source of competition in the nation's broadband market.

Nearly all of the 37.5-42.5 GHz (space-to-Earth), 47.2-50.2 ("47") GHz and 50.4-52.4 ("50") GHz (Earth-to-space) V-band spectrum that Boeing proposes to use is a longstanding part of the existing FSS allocation, and is recognized as a critical growth band for FSS. Fortunately, Boeing has clearly documented that most of this spectrum can be shared with terrestrial 5G mobile systems in a robust and non-burdensome manner. Since Boeing filed its NGSO FSS system application, many other companies have announced plans for both NGSO and geostationary satellite systems operating in the V-band, clearly documenting the tremendous interest within the industry in constructing V-band satellite systems and the pressing need for such systems to bring very high data rate broadband services to consumers outside the metropolitan areas where terrestrial mobile broadband deployment has focused.

In the 37.5-40.0 GHz bands, Boeing proposes to operate both satellite gateways and end user terminals, the latter on an opportunistic basis. Satellite earth stations would operate passively in these bands, receiving but not transmitting. Boeing also proposes to operate its satellite network using the PFD levels that already exist in the Commission's rules for satellite

operations in clear sky and rain fade conditions. Boeing has thoroughly demonstrated that the operation of its NGSO FSS system at these varying power levels will cause only negligible degradation to UMFUS systems.

In the 40.0-42.0 ("40") GHz band, the Commission has appropriately refrained from considering UMFUS operations due to its longstanding recognition that this is core growth spectrum for the satellite industry. Although the Commission may evaluate the potential for UMFUS operations in the 40 GHz band in some additional proceeding, any use of the band by UMFUS must be on a secondary, non-harmful interference basis to broadband satellite services.

In the 47 GHz band, the Commission has acknowledged that all or most of the spectrum is needed for use by ubiquitously located satellite end user terminals for uplink operations, likely precluding sharing of the band with outdoor UMFUS systems. The *Further Notice* acknowledges the need for at least two gigahertz of the 47 GHz band to pair with the 40 GHz band in order to support end user operations, and Boeing has explained that the Commission should designate the entire three gigahertz of the 47 GHz band satellite end user uplink operations in order to accommodate the tremendous bandwidth requirements of end users and sharing between multiple satellite systems operating with geostationary and NGSO satellites.

In the 50 GHz band, Boeing has shown in this proceeding and in the *Spectrum Frontiers* proceeding that its individually licensed gateway earth stations can easily operate on a shared basis with UMFUS because the gateways will be located only in rural areas, well away from the likely markets for UMFUS. Boeing's gateway earth stations will transmit very narrow directed beams at a high angle (above 45 degrees) and, as a result, the exclusion zones for individually licensed gateways are expected to be minimal.

The waivers requested by Boeing in its NGSO FSS system application are carefully tailored to comply with the Commission's waiver requirements and do not impair the public interest benefits of Boeing's NGSO system. Indeed, many of the waivers that Boeing has sought have already been made moot (or likely soon will be) by changes to the rules already adopted or under consideration by the Commission. With regard to the substance of its remaining waiver requests, Boeing fully expects the Commission to consider them in light of the Commission's *Spectrum Frontiers* proceeding and other relevant rulemaking dockets and Boeing is participating fully in developing a supporting record in these proceedings.

Boeing urges the Commission to promptly grant Boeing's NGSO FSS system application conditioned on the outcome of the relevant portions of the *Spectrum Frontiers* and other applicable rulemaking proceedings. The grant of Boeing's application would serve the public interest by facilitating the launch of a broadband satellite system that could provide very high data rate communications services to all Americans regardless of where they are located.

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OPPOSITION AND RESPONSE OF THE BOEING COMPANY

The Boeing Company ("Boeing") hereby responds to CTIA and T-Mobile USA, Inc. ("T-Mobile") with respect to Boeing's amendment to its non-geostationary satellite orbit ("NGSO") fixed-satellite service ("FSS") system operating in the V-band ("Application"). As both CTIA and T-Mobile acknowledge, Boeing's amended its Application for the sole purpose of lowering the orbital altitude of its satellite constellation to resolve a potential conflict with the OneWeb NGSO FSS satellite system.[2] In taking this step, Boeing has once again demonstrated its willingness as a leading U.S. corporation to assist the Commission in ensuring that very scarce spectrum and orbital resources are used in a highly efficient and shared bases to benefit all Americans.

CTIA and T-Mobile each further acknowledge that they have no comments on Boeing's change in orbital altitude. Since this was the subject of the Commission's public notice, both of their filings should be dismissed as irrelevant to this public notice process.

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[2] *See Petition to Deny of CTIA*, IBFS File Nos. SAT-LOA-20160622-00058 and SAT-AMD-20170301-00030, at 2 (June 19, 2017) ("*CTIA Petition"*); Opposition of T-Mobile USA, Inc., IBFS File Nos. SAT-LOA-20160622-00058 and SAT-AMD-20170301-00030, at 3 (June 19, 2017) ("*T-Mobile Opposition"*).

CTIA and T-Mobile instead focus their filings on largely repeating the arguments they made against Boeing's NGSO FSS system when the Commission placed Boeing's Application on public notice on November 1, 2016.[3] CTIA repeatedly argues in its new filing that Boeing's amendment does not address the arguments that CTIA previously made.[4] CTIA fails to acknowledge, however, that Boeing addressed the previous arguments of both CTIA and T-Mobile in the detailed response that Boeing filed with the Commission on December 12, 2016.[5] The fact that neither party addresses (much less acknowledges) Boeing's previous response provides another reason why the most recent filings of CTIA and T-Mobile should be dismissed as irrelevant.

Although Boeing has addressed the arguments of CTIA and T-Mobile in its previous filings, Boeing herein responds briefly to each of these issues and provides references to Boeing's previous submissions where the arguments raised by CTIA and T-Mobile were addressed in more detail.

I. BOEING'S APPLICATION IS CONSISTENT WITH THE COMMISSION'S UNDERLYING PURPOSE OF THE *SPECTRUM FRONTIERS* PROCEEDING

Both CTIA and T-Mobile argue that Boeing's Application is inconsistent with the rules adopted in the *Spectrum Frontiers* proceeding and attempts to pre-judge the outcome of the Commission's *Further Notice*.[6] The underlying purpose of the *Spectrum Frontiers* proceeding, however, has always been to "adopt rules that will allow both satellite and terrestrial networks to continue to expand in a flexible manner."[7] The Commission's intent to facilitate both terrestrial

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[3] *See* Public Notice, *Satellite Policy Branch Information, Boeing Application Accepted for Filing in Part, IBFS File No. SAT-LOA-20160622-00058*, DA 16-1244 (Nov. 1, 2016).

[4] *See CTIA Petition* at 2, 3, 4, 5, and 6.

[5] *See* Opposition and Response of The Boeing Company, IBFS File No. SAT-LOA-20160622-00058 (Dec. 11, 2016) ("*Boeing Response*").

[6] *CTIA Petition* at 2; *T-Mobile Opposition* at 2-8.

[7] *See* Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, *et al.*, 31 FCC Rcd 8014, ¶ 18 (2016) ("*Spectrum Frontiers Order*").

and satellite services is consistent with its statutory public interest mandate to ensure that all Americans have access to the high-speed broadband services that can be made available using mmW spectrum.

Boeing's NGSO FSS system will be able to provide very high data-rate broadband services to all consumers in the United States and throughout the world. In contrast, CTIA has repeatedly acknowledged that terrestrial operators will use mmW spectrum for mobile services only in "areas with the greatest population density,"[8] such as in "more populated, urban environments."[9] Thus, "[w]hile the millimeter wave [("mmW")] bands will help strengthen 5G network capacity, mid- and low-band spectrum will continue to drive network coverage."[10]

CTIA's assessment of the business opportunity for terrestrial mobile systems is consistent with the recent conclusions of the International Telecommunication Union ("ITU") study process leading up to the 2019 World Radiocommunication Conference ("WRC-19"). In a process that was heavily influenced by the U.S. wireless industry, Working Party 5D rejected the possibility of rural deployments, concluding that even in urban areas, terrestrial mmW mobile deployments will exist only in the most densely populated locations, covering no more than 10 percent of the area within each city.[11] Given this fact, it would be highly inappropriate for the Commission to overlook the substantial spectrum sharing opportunities that exist in mmW frequencies between

[8] See Letter from Scott K. Bergmann (CTIA) to Marlene H. Dortch, GN Docket No. 14-177, at 2 (May 20, 2016).

[9] Reply Comments of CTIA, GN Docket No. 14-177, at 9 n.17 (Feb. 26, 2016) (*citing* Comments of Verizon, GN Docket No. 14-177, at 8 (Jan. 28, 2016)).

[10] Comments of CTIA, GN Docket No. 14-177 *et al.*, at 3 (Sept. 30, 2016).

[11] *See* Working Party 5D: Attachment 2 on Spectrum Needs to a Liaison Statement to Task Group 5/1, at 6-7 (Feb. 28, 2017).

broadband satellite systems providing ubiquitous coverage of the United States and terrestrial mobile systems adding increased capacity to dense population centers.

CTIA further argues that Boeing has failed to demonstrate a significant consumer need for very fast broadband services provided by satellites.[12] CTIA's argument, however, is directly contradicted by T-Mobile, which acknowledges the increasing use by consumers of "data-intensive applications, such as video and Internet access."[13] This exploding consumer demand is placing pressure on all forms of broadband delivery infrastructure, including satellites, which are often the only broadband services that are available in rural areas of the country. To satisfy this increasing demand, satellite operators require access to significant additional spectrum resources in mmW frequencies.[14] Fortunately, much of this spectrum is already allocated on a co-primary basis to FSS. Further, as Boeing's has explained in countless filings in the *Spectrum Frontiers* proceeding, satellite systems will be able to share most mmW frequencies with terrestrial mobile networks. Therefore, the Commission can address this consumer demand through the adoption of rules that ensure the shared use of mmW frequencies between satellite and terrestrial services and therefore ensure that less populated areas of the country are not neglected in the *Spectrum Frontiers* proceeding.

Both CTIA and T-Mobile also argue that Boeing's Application seeks to pre-judge the issues under consideration in the *Spectrum Frontiers* proceeding[15] As Boeing explained when it addressed this argument previously, Boeing's NGSO FSS Application repeatedly acknowledges

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[12] *See CTIA Petition* at 2-3.

[13] *T-Mobile Opposition* at 2.

[14] *Contra CTIA* at 3 (claiming that Boeing has failed "to demonstrate any demand projections or requirements for additional satellite spectrum or capabilities").

[15] *See CTIA Petition* at 2; *T-Mobile Opposition* at 1.

the ongoing *Spectrum Frontiers* proceeding and expressly requests that the relevant aspects of its space station license be conditioned on "the eventual outcome of the Commission's deliberations on this issue in the *Spectrum Frontiers* proceeding."[16] Boeing also raised each and every aspect of its NGSO FSS system proposal in the context of the *Spectrum Frontiers* proceeding, including recommending that the Commission incorporate Boeing's related Petition for Rulemaking (seeking additional FSS spectrum in the 51.4-52.4 GHz band) into the *Spectrum Frontiers* docket.[17]

Boeing filed its Application in June 2016 once Boeing had determined that it was feasible and desirable to begin construction of the satellite system. In contrast, 5G proponents have acknowledged that they are far from ready to commercially deploy UMFUS systems. As CTIA has explained, "many questions remain about how the millimeter wave bands will ultimately be put to use."[18] Qualcomm put it more bluntly when it stated that "it is currently unknown how licensees will use their new flexible use rights."[19]

Boeing filed its Application in the months before the Commission adopted its *Further Notice*, which expressly considers the spectrum sharing opportunities that exist between UMFUS and satellite services in the V-band. In doing so, Boeing believes its Application has contributed significantly to the robust record in the *Spectrum Frontiers* proceeding by

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[16] *Boeing NGSO FSS Application* at 54.

[17] Petition of The Boeing Company for Allocation and Authorization of Additional Spectrum for the Fixed-Satellite Service in the 50.4-51.4 GHz and 51.4-52.4 GHz Bands, RM-11773 (Oct. 17, 2016).

[18] *CTIA Further Notice Comments* at 19.

[19] *Qualcomm Comments* at 15.

demonstrating the continued and growing interest of the satellite industry to innovate and provide new broadband services employing mmW spectrum.

Since Boeing filed its V-band NGSO FSS Application, seven other companies have sought Commission authority to operate NGSO FSS systems using V-band frequencies[20] and one existing satellite operator has requested authority to operate a geostationary ("GSO") satellite using V-band frequencies.[21] In apparent recognition of the significant contributions that V-band satellite systems can make to ubiquitous broadband coverage using mmW spectrum, the Commission has already accepted for filing about half of these V-band NGSO FSS applications, placing them on public notice for comment.[22] The substantial reaction by the satellite industry also demonstrates the tremendous industry interest and importance of V-band spectrum to the future of broadband communications services delivered by satellites.

The Commission was therefore correct in considering the potential for spectrum sharing between UMFUS and broadband satellites systems, both in the *Spectrum Frontiers NPRM* and in the *Further Notice*. As Boeing has repeatedly detailed both in this proceeding and in the *Spectrum Frontiers* docket, robust spectrum sharing is achievable in most of the frequency bands that are allocated in the V-band for FSS and terrestrial services.

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[20] *See* Public Notice, *Policy Branch Information: Satellite Space Applications Accepted for Filing*, Report No. SAT-01245 (June 16, 2017) ("*June 16 Public Notice*") (placing four of the additional V-band NGSO FSS systems on public notice for comments).

[21] *See* Application of Hughes Network Systems, LLC for Authority to Launch and Operate a Ka-band and Q/V-band Geostationary Fixed-Satellite Service Satellite at the Nominal 95° W. L. Orbital Location, FCC File No. SAT-LOA-20170621-00092 (June 21, 2017).

[22] *See June 16 Public Notice.*

II. BOEING'S PROPOSAL FOR EACH OF THE SPECTRUM BANDS IDENTIFIED IN ITS NGSO FSS APPLICATION HIGHLIGHTS THE ABILITY TO MAXIMIZE THE USE OF V-BAND FREQUENCIES TO PROVIDE BROADBAND SERVICES TO CONSUMERS

Boeing's NGSO FSS Application included a detailed explanation regarding the potential for spectrum sharing between broadband satellite systems and terrestrial mobile networks in each of the frequency segments that were identified in Boeing's Application. Boeing has also submitted extremely detailed presentations and analysis into the docket for the *Spectrum Frontiers* proceeding demonstrating that robust spectrum sharing can be achieved in most of the mmW frequencies in the V-band. CTIA and T-Mobile, however, seem to disregard these showings, arguing that Boeing has failed to meet its burden of proof that spectrum sharing is possible and consistent with plan for UMFUS use of mmW spectrum. Boeing addressed these arguments repeatedly in its prior submissions in this matter and in the *Spectrum Frontiers* proceedings. Boeing updates and summarizes these arguments below on a band-specific basis.

A. Boeing Has Clearly Demonstrated that Robust Spectrum Sharing is Achievable Between UMFUS and Satellite Systems in the 37/39 GHz band

Boeing has proposed to operate in the 37.5-40.0 ("37/39") GHz band both individually licensed satellite earth station gateways and blanket licensed satellite end user terminals, the latter on an opportunistic basis. These facilities would operate passively in the 37/39 GHz band, receiving, but not transmitting, in this spectrum. Therefore, Boeing's gateways and end user terminals could not result in harmful interference to UMFUS systems in this spectrum.

Boeing is also proposing to operate its satellite network using the PFD limits that are already identified in the Commission's rules for such systems. Specifically, Section 25.208(r) includes two different PFD limits for satellite transmissions in the 37/39 GHz band, a limit of −117 dBW/m^2/MHz for operations in clear sky conditions and a second limit of −105

dBW/m^2/MHz for operations during periods of rain fade.[23] Boeing is not asking the Commission to change these limits. Boeing is instead requesting the Commission to complete the studies that it has already codified as necessary to identify the conditions under which individual satellites are permitted to increase their transmit PFD levels toward the Sections 25.208(r)(2) limits to compensate for rain fade.[24] Boeing has further argued that the Commission should complete this task through the adoption of equivalent power flux density ("EPFD") limits that can be used to restrict satellite downlink transmissions (both individually and in the aggregate) to ensure that the operations of such satellites do not cause harmful interference to UMFUS base stations or end user receivers in the 37/39 GHz band.

In its opposition, T-Mobile incorrectly suggests that the Commission already resolved this issue in its *Spectrum Frontiers Order*.[25] The *Further Notice*, however, clearly indicated that the record in the proceeding remained insufficient to resolve the issue and that further analysis was required.[26] Boeing has undertaken exhaustive further analysis and made extensive submissions into the record in order to demonstrate that spectrum sharing is achievable in the 37/39 GHz band without burdening UMFUS operations in that spectrum.

T-Mobile then challenges Boeing's analysis by quoting at length from an *ex parte* submission made by Straight Path Communications on May 17, 2017.[27] Boeing replied to these

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[23] *See* 47 C.F.R. 25.208(q) and (r) (specifying the above limits for angles of arrival between 25 and 90 degrees above the horizontal plane).

[24] *See* 47 C.F.R. § 25.208, Note to subsections (q) and (r).

[25] *T-Mobile Opposition* at 3.

[26] *Further Notice*, ¶ 499.

[27] *T-Mobile Opposition* at 4-5 (citing Letter from Davidi Jonas, President and CEO and Jerry Pi, Chief Technology Officer, Straight Path Communications Inc., to Marlene H. Dortch, Secretary, Federal Communications Commission, GN Docket No. 14-177 *et al.* (May 17, 2017)).

particular Straight Path's arguments in a subsequent submission that Boeing made on June 19, 2017, citing both the numerous erroneous over-simplifications and omissions in the Straight Path analysis, and further defining the details of the comprehensive and complete multipath interference modeling performed by Boeing that ensure that any V-band interference is correctly modeled and captured by EPFD regulations. The Commission has no need to consider these issues within the application review process for any V-band applicant, and instead should continue to move forward within the *Spectrum Frontiers* proceeding to formulate rules for the 37/39 GHz band that clearly define the manner in which operators of NGSO FSS satellites can operate at the PFD levels indicated in Section 25.208(r)(2) of the Commission's rules during periods of rain fade, and allowing the operation of satellite end user terminals using these same received PFD levels on an opportunistic basis in this spectrum.

B. The Commission has Appropriately Refrained From Considering UMFUS Operations in the 40.0-42.0 GHz Band

T-Mobile and CTIA argue that the Commission should delay considering Boeing's Application to operate its NGSO FSS system in the 40.0-42.0 ("40") GHz band until after the Commission considers the possible use of the band by UMFUS.[28] The Commission, however, has appropriately excluded the 40 GHz band from both the *NPRM* and the *Further Notice* in recognition that this band has long been identified as core growth spectrum for the broadband satellite industry. A significant number of satellite networks have already sought Commission authority to use this spectrum and additional applications seeking authority to operate GSO satellite networks in these frequencies can be anticipated. As Boeing has repeatedly explained, broadband satellite systems will use the 40 GHz band as a critical resource to provide very high

[28] *See T-Mobile Opposition* at 6; *CTIA Petition* at 4.

data-rate services to all Americans. Even if the Commission did decide to consider allowing UMFUS to operate in a secondary and/or opportunistic manner in the 40 GHz band, it would be extremely unlikely that UMFUS systems would be able to satisfy the interference conditions necessary for successful operations of critically important satellite communications services in the 40 GHz band due to the projected need for ubiquitous deployment of UMFUS systems with signal levels that are significantly higher than equivalent satellite signals.

Therefore, the prompt grant of Boeing's NGSO FSS application would not prejudge the outcome of future Commission deliberations regarding this spectrum. Terrestrial services have always been required to protect satellite operations in this spectrum (just as satellite operations are subordinate to terrestrial services in the 37/39 GHz band) and the grant of Boeing's authorization will not disrupt this important balancing of interests.

C. As the Commission has Acknowledged, All or Most of the 47 GHz Band is Needed for Broadband Satellite End User Uplink Operations

T-Mobile and CTIA argue that Boeing's proposal to operate end user uplink terminals in the 47.2-50.2 ("47") GHz band is inconsistent with the Commission's proposal to potentially permit UMFUS operations in all or a portion of this spectrum.[29] The Commission's *Further Notice*, however, acknowledges the need to pair at least two gigahertz of the 47 GHz band with the 40.0-42.0 GHz band because "FSS would have to use some portion of the 47 GHz band to operate user equipment."[30] Further, ITU Radio Regulation No 5.516B identifies two gigahertz of uplink spectrum for high-density FSS operations in the 48.2-50.2 GHz band (Earth-to-space),

[29] *See T-Mobile Opposition* at 7; *CTIA Petition* at 4.

[30] *Further Notice*, ¶ 411; *see also id.*, ¶ 421.

paired with the 40.0-42.0 GHz band (space-to-Earth).[31] Therefore, Boeing's proposal to operate its satellite end user equipment in the 47 GHz band clearly is not in conflict with the Commission's *Further Notice*.[32]

Granted, Boeing has argued in the context of the *Further Notice* that the Commission should designate the entire three gigahertz of the 47 GHz band as primarily for satellite end user uplink operations. Such a designation is necessary to accommodate the tremendous bandwidth requirements of end users, which can be served most efficiently and reliably in rural and remote areas using satellite direct-to-user technology. Boeing, for example, requires primary access to 2.6 gigahertz of uplink spectrum for its end user uplink operations. Boeing anticipates that the full three gigahertz of spectrum in the 47 GHz band will therefore be necessary to accommodate spectrum sharing with other GSO and NGSO satellite systems operating in the V-band.

Boeing and other operators of broadband satellite systems will also need to be able to position two-way satellite end user terminals at the home or office of each of their subscribers. Boeing, for example, will offer its broadband service in all markets, ranging from heavily populated suburban and urban regions to rural communities providing common, ubiquitous two-way Internet access to meet the Commission's broadband goals. Boeing's service cannot succeed in this manner if any significant limits exist on the placement of its two-way end user terminals.

As a result, Boeing's transmitting end user terminals will not be able to share the 47 GHz band with UMFUS systems that are widely-deployed in outdoor locations. Boeing is willing to explore spectrum sharing scenarios that would not encumber the placement of its end user

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[31] ITU Radio Regulation No. 5.516B; *see also* 47 C.F.R. § 2.106 n.5.516B.

[32] *See CTIA Petition* at 8 (acknowledging that the Commission "has proposed mechanisms for potential FSS end-user terminal deployment in the band").

terminals in the 47 GHz band, such as restricting UMFUS systems to indoor locations, or permitting them in any location, but subject to accepting interference from existing or future satellite end user terminals. In any event, Boeing acknowledges that these issues are being explored in the context of the Commission's *Further Notice* and Boeing is actively participating in those deliberations.

D. Boeing's Individually Licensed Gateway Facilities Can Easily Operate in the 50 GHz Band on a Shared Basis with UMFUS

T-Mobile argues that authorizing satellite gateway earth stations in the 50.4-52.4 ("50") GHz band "would severely curtail possibilities for terrestrial mobile operations" and both T-Mobile and CTIA argue that authorizing Boeing's system would therefore prejudge the outcome of the *Spectrum Frontiers* proceeding.[33] As Boeing explained in its *Further Notice* comments and in its response to the previous filings of T-Mobile and CTIA on Boeing's Application, individually licensed satellite gateways can easily share the 50 GHz band with UMFUS systems using minimal exclusion zones.[34] Boeing will locate its gateway facilities only in rural areas, well away from the likely markets for UMFUS systems. Boeing has assessed the likely locations for its satellite gateways and determined that the resulting exclusion zones will affect less than 0.1 percent of the total population of the United States.

As Boeing further explained in its *Further Notice* comments, satellite gateways are similar to UMFUS base stations in that they will transmit very narrow directed beams.[35] Satellite gateways, however, will always transmit upward above a 45 degree elevation angle

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[33] *See T-Mobile Opposition* at 8; *CTIA Petition* at 4.

[34] *See Boeing Further Notice Comments* at 18-21.

[35] *Boeing Further Notice Comments* at 18.

toward satellites.[36] Spectrum sharing with UMFUS therefore only needs to consider the sidelobes for individually licensed earth station transmissions. The resulting exclusion zones are therefore expected to be minimal and can be reduced further in individual circumstances based on interference conditions (such as propagation and line-of-sight) and by employing cooperative and selective siting methods wherein both FSS systems and UMFUS operators disclose their actual locations, antenna sizes, base station sector orientations, and other site specific capabilities.

By employing such approaches, the Commission can facilitate intensive spectrum sharing between UMFUS systems and satellite gateways in the 50 GHz band without appreciably burdening either type of spectrum use. Therefore, no reason exists to delay the grant of Boeing's Application based on its proposed operation of individually licensed satellite gateway facilities in upper portions of the V-band including the 50 GHz band.

III. BOEING'S REQUESTS FOR WAIVER OF CERTAIN COMMISSION RULES DO NOT DETRACT FROM THE PUBLIC INTEREST BENEFITS OF BOEING'S PROPOSED NGSO SYSTEM

In its petition, CTIA repeats its concern about the various waivers of the Commission's rules that Boeing requested in its Application.[37] As Boeing has previously explained, however, applicants for FCC's licensed satellite systems are required by Section 25.112 of the Commission's rules to request a waiver of any Commission rule that is in conflict with their application no manner how minor the conflict and regardless of whether the Commission is already considering (or already adopted) a remedial change to the rule in question.

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[36] *Id*. at 18, 34.

[37] *CTIA Petition* at 5.

For example, Boeing sought a waiver of two rules regarding the construction and operation of satellite systems (Sections 25.164(b) and 25.210(i)(1))[38] even though the Commission adopted an order in December 2015 (six months earlier) making changes to those rules that made Boeing's waiver requests unnecessary.[39] Boeing also requested a waiver of three other rules (Sections 25.143(b)(2)(ii), 25.156(d)(5), and 25.157(e)) addressing the geographic coverage and spectrum sharing requirements of NGSO satellite systems as compared to GSO and other NGSO systems.[40] The Commission has since initiated a rulemaking proceeding to consider modifications (or the elimination) of all or portions of these three rules.[41] To the extent that the new proceeding resolves the issue raised by Boeing, these waiver requests will also be moot.

Boeing also requested a waiver of a sixth rule (Section 25.156(d)(4)) simply because the rule did not envision the possibility of modern, highly efficient NGSO systems that can use the same spectrum for both feeder link and end user operations. Although Boeing believes that grant of this waiver is appropriate, the Commission could grant Boeing's Application without this waiver and Boeing's ability to operate its satellite system would not be impaired.

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[38] Sections 25.164(b) addresses the buildout milestones for satellite systems and 25.210(i)(1) addresses satellite system cross-polarization isolation requirements.

[39] *See* Comprehensive Review of Licensing and Operating Rules for Satellite Services, IB Docket No. 12-267, *Second Report and Order*, FCC 15-167, ¶¶ 59, 264 (2015) ("*Part 25 Second Report and Order*").

[40] Section 25.143(b)(2)(ii) addresses the scope of international geographic coverage requirements for NGSO FSS systems, Section 25.156(d)(5) addresses spectrum sharing between NGSO and GSO systems, and Section 25.157(e) addresses spectrum sharing between different NGSO satellite systems.

[41] *See* Update to Parts 2 and 25 Concerning Non-Geostationary, Fixed-Satellite Service Systems and Related Matters, IB Docket No 16-408, *Notice of Proposed Rulemaking*, FCC 16-170 (Dec. 15, 2016).

The remaining four waivers requested by Boeing each directly relate to the *Spectrum Frontiers* proceeding. Section 25.202(a)(1) contains the existing prohibition on satellite end user terminals in the 37/39 GHz band, a prohibition that the Commission is also reassessing in its *Further Notice*.[42] Sections 25.114(c)(8) and 25.208(r) of the Commission's rules codify the existing PFD limits for satellite systems operating in the 37/39 GHz band.[43] Although Boeing is no longer seeking changes to these PFD limits, Boeing continues to seek Commission action on the Note to Section 25.208(r)(2), which calls for further studies to determine the conditions under which NGSO FSS satellites can operate using the higher power levels that are included in Section 25.208(r)(2) to address rain fade. Fortunately, this issue is already being considered by the Commission in the context of the *Spectrum Frontier's Further Notice*.[44]

The remaining rules identified for waiver (Section 2.106 and other portions of Section 25.202(a)(1)) specify the spectrum allocations that are available for use by FSS systems.[45] As Boeing acknowledged in its Application, the 42.0-42.5 GHz and the 51.4-52.4 GHz bands are not identified in the Commission's rules as available for FSS in the United States. Further, the 50.4-51.4 GHz band is identified for FSS in Section 2.106, but not in Section 25.202(a)(1).

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[42] *See id.*, ¶¶ 500-502.

[43] Section 25.114(c)(8) of the Commission's rules requires applicants for space station licenses to calculate and provide the maximum PFD levels within each coverage area and energy dispersal bandwidths, if any, needed for compliance with Section 25.208 of the Commission's rules. 47 C.F.R. § 25.114(c)(8) (referring to 47 C.F.R. § 25.208). Section 25.208(r) of the Commission's rules includes PFD limits applicable to NGSO satellites operating in the 37.5-40.0 GHz band in clear sky conditions. See 47 C.F.R. § 25.208(r) (specifying a PFD limit of −117 dB(W/m2) in any 1 MHz band for angles of arrival between 25 and 90 degrees above the horizontal plane).

[44] *See Further Notice*, ¶¶ 492-499.

[45] 47 C.F.R. §§ 2.106, 25.202(a)(1).

With respect to the 42.0-42.5 GHz band, the Commission was actively considering the adoption of an FSS allocation in this spectrum when Boeing filed its Application in June 2016. The Commission's July 2016 *Order* declined to create this allocation. Boeing remains hopeful, however, that the Commission will reconsider this decision based on the demonstrated need that exists for additional satellite downlink spectrum adjacent to the 40.0-42.0 GHz band, and because of the ability of broadband satellite systems to share the 42.0-42.5 GHz band on an opportunistic basis with UMFUS licensees.[46]

With respect to the 50.4-52.4 GHz bands, Boeing filed a Petition for Rulemaking seeking changes to the Commission's rules to make this spectrum available for FSS. Boeing believes that its petition complements the *Spectrum Frontiers* docket. For this reason, Boeing expressed support[47] for calls by both 5G proponents and the satellite industry that Boeing's petition be incorporated into the *Spectrum Frontiers* docket.[48]

In summary, Boeing requested a waiver of these rules because such requests are required by the Commission's rules for satellite system applications. Boeing has no anticipation, however, that the Commission (or its International Bureau) would grant a waiver of any of these rules unless such a waiver was consistent with the concurrent (or anticipated) outcomes of the Commission's *Spectrum Frontiers* proceeding and other relevant rulemaking dockets. Therefore, the Commission should disregard calls by T-Mobile and CTIA to dismiss Boeing's

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[46] *See Petition for Reconsideration of The Boeing Company*, GN Docket No. 14-177 *et al.*, at 21-23 (Dec. 14, 2016).

[47] *See* Response of The Boeing Company, RM-11773, at 2 (Nov. 1, 2016).

[48] *See, e.g., Qualcomm Further Notice Comments* at 11; Comments of Inmarsat, Inc., GN Docket No. 14-177, *et al.*, at 19 (Sept. 30, 2016); Comments of ViaSat, Inc., GN Docket No. 14-177, *et al.*, at 14 (Sept. 30, 2016); Reply Comments of the Satellite Industry Association, RM-11773, at 2 (Oct. 17, 2016).

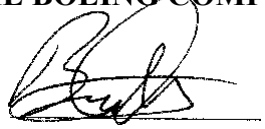
Application and its associated waiver requests as potentially in conflict with (or seeking to "prejudge") the Commission's notice-and-comment rulemaking process.

IV. CONCLUSION

For the reasons stated herein, Boeing urges the Commission to promptly grant Boeing's Application to operate an NGSO FSS system in the V-band conditioned on the outcome of the relevant portions of the *Spectrum Frontiers* and other applicable rulemaking proceedings. The grant of Boeing's Application would serve the public interest by facilitating the launch of a broadband satellite system that could provide very high rate communications services to all Americans regardless of where they are located.

Respectfully submitted,

THE BOEING COMPANY

By: 

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June 29, 2017

CERTIFICATE OF SERVICE

I, Bruce A. Olcott, hereby certify that on June 29, 2017, I caused a copy of the foregoing Opposition and Response of The Boeing Company to be served by U.S. first-class mail, postage paid, upon each of the following:

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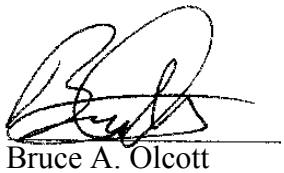

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