Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
THE BOEING COMPANY	)	
	)	
Application for Authority	)	
to Launch and Operate a	)	File No.
Non-Geostationary Low	)	
Earth Orbit Satellite System	)	
in the Fixed Satellite Service	)	

AMENDMENT

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AMENDMENT

The Boeing Company ("Boeing"), by its attorneys and pursuant to Sections 308 and 309 of the Communications Act of 1934, as amended, 47 U.S.C. §§ 308 and 309, hereby amends its pending application for authority to launch and operate a non-geostationary satellite orbit ("NGSO") fixed satellite service ("FSS") system operating in low Earth orbit ("LEO") in the 37.5-42.5 GHz (space-to-Earth), and the 47.2-50.2 and 50.4-52.4 GHz (Earth-to-space) bands (collectively, the "V-band"), herein referred to as the "NGSO System."

This Amendment is being filed for the primary purpose of lowering the nominal altitude of the constellation for the NGSO System. This narrative identifies and replaces those portions of the Application that are substantively altered by this Amendment. All portions of the Application that are not addressed below in this Amendment are not substantively altered by this Amendment.

In addition, a new Schedule S is being submitted. Some of the information that is included in the new Schedule S had previously been included in the narrative portion of

the original Application, and sections of the original narrative that are no longer required due to the submittal of an updated Schedule S are so noted in this Amendment. Many of the Schedule S data entries, other than the constellation orbital information, were not altered, but were reentered to use the current Schedule S format. For example, beam IDs had to be renamed due to the change in text length in the new Schedule S format. In addition, transmit beam IDs have been expanded to differentiate between beam operations in the 37.5-40.0 GHz band and the 40.0-42.5 GHz band. This allows the necessary portions of Schedule S and this Application to address the applicable PFD regulations in these downlink bands.

* * *

II. NARRATIVE INFORMATION REQUIRED BY PART 25

* * *

§ 25.114(c)(4)(ii) EIRP Density for Transmitting Beams

This section is deleted since it is now covered by the new Schedule S.

* * *

§ 25.114(c)(4)(v) Minimum Gain-to-Temperature Ratio

Section 25.114(c)(4)(v) of the Commission's rules requires the identification of the minimum gain-to-temperature ratio within the proposed coverage area of each shapeable beam. Schedule S, however, does not appear to have input fields for this data. The values are provided below using the same beam identification numbers ("IDs") that were included in the "Receiving Beams" section of the Schedule S for this Application.

Table II-1. Minimum Gain-to-Temperature Ratio

Beam ID	Min G/T (dB/K)
V2L0	18.1
V2L1	17.9
V2L2	17.7
V2L3	15.0
V3L0	18.1
V3L1	17.9
V3L2	17.7
V3L3	15.0
V2LS	8.0
V3LS	8.0
V2LA	17.7
V3LA	17.7
VTLC	-31.5
V2R0	18.1
V2R1	17.9
V2R2	17.7
V2R3	15.0
V3R0	18.1
V3R1	17.9
V3R2	17.7
V3R3	15.0
V2RS	8.0
V3RS	8.0
V2RA	17.7
V3RA	17.7

* * *

§ 25.114(c)(8) Maximum Power Flux Density Levels

Section 25.114(c)(8) of the Commission's rules requires applicants for FSS space station authorizations to provide the calculated maximum power flux density ("PFD") levels within each coverage area and energy dispersal bandwidths, if any, needed for compliance with Section 25.208. This information is provided in the "Transmitting Beams" section of Schedule S for this Application. As indicated in this section of

Schedule S, the NGSO System would comply with the PFD limits specified in Sections 25.208(s) and 25.208(t) of the Commission's rules for NGSO FSS satellite systems operating in the 40.0-40.5 and the 40.5-42.0 GHz bands, respectively.

The NGSO System also operates within the stricter PFD limits specified in Section 25.208(r) of the Commission's rules for NGSO FSS systems operating in the 37.5-40.0 GHz band. Boeing's NGSO System complies with the specified PFD limits in clear weather conditions as specified in Section 25.208(r)(1). Boeing also seeks authority to operate the NGSO System in the 37.5-40.0 GHz band during rain fade events using PFD levels specified in Section 25.208(r)(2), which allow PFD level of up to -105 dB/m2/MHz during the short times when the FSS system is raising power to compensate for rain fade events.

Boeing seeks authority to operate during rain fade events at up to the Section 25.208(r)(2) limits in the 37.5-40.0 GHz band because Boeing's spectrum sharing analysis for the 37.5-40.0 GHz band, which has been extensively documented in the Commission's *Spectrum Frontiers* proceeding, indicates that operations up to these higher PFD levels during rain fade events would not result in harmful interference to incumbent fixed or terrestrial mobile services (*i.e.*, the Upper Microwave Flexible Use Service ("UMFUS")) in this spectrum.

The outcome of the *Spectrum Frontiers* proceeding may further resolve the operating conditions and extent to which NGSO FSS systems may operate above the Section 25.208(r)(1) levels during rain fades. In acknowledgement of this on-going discussion, out of an abundance of caution and until further rules are enacted that clarify the Note for rain fade operations under Section 25.208(r)(2), Boeing has included in Part

IV of this Application a request for waiver of Section 25.114(c)(8) and this portion of Section 25.208(r) of the Commission's rules. As Boeing's NGSO System fully intends to comply with the outcome of the *Spectrum Frontiers* proceedings, Boeing would also accept the grant of a license conditioned on this outcome.

Finally, Section 25.208 does not include any PFD limits for FSS operations in the 42.0-42.5 GHz band. This Application requests authority to operate the NGSO System in the 42.0-42.5 GHz band using the FCC limits that are maintained for the 40.5-42.0 GHz band under Sections 25.208(s) and 25.208(t).

The combined applicable maximum PFD levels as a function of arrival angle are therefore shown in Figure II-16 for the 37.5-40.0 GHz and the 40.0-42.5 GHz bands. The maximum downlink EIRP density shown in the "Transmitting Beams" section of Schedule S contains the maximum downlink EIRP, EIRP density and PFD values for the transmitting beams illustrating the coverage areas for the NGSO System. Taking into account the free space path loss from the satellite to the Earth's surface, the operation of the NGSO System will not exceed the applicable limits under any operating conditions. For the 37.5-40.0 GHz band only, the clear weather operating values for EIRP and EIRP density will be 12 dB lower than the maximum values shown in Schedule S. The maximum values submitted in Schedule S for the 37.5-40.0 GHz band are attained only when the system raises the beam power to compensate for rain fade.

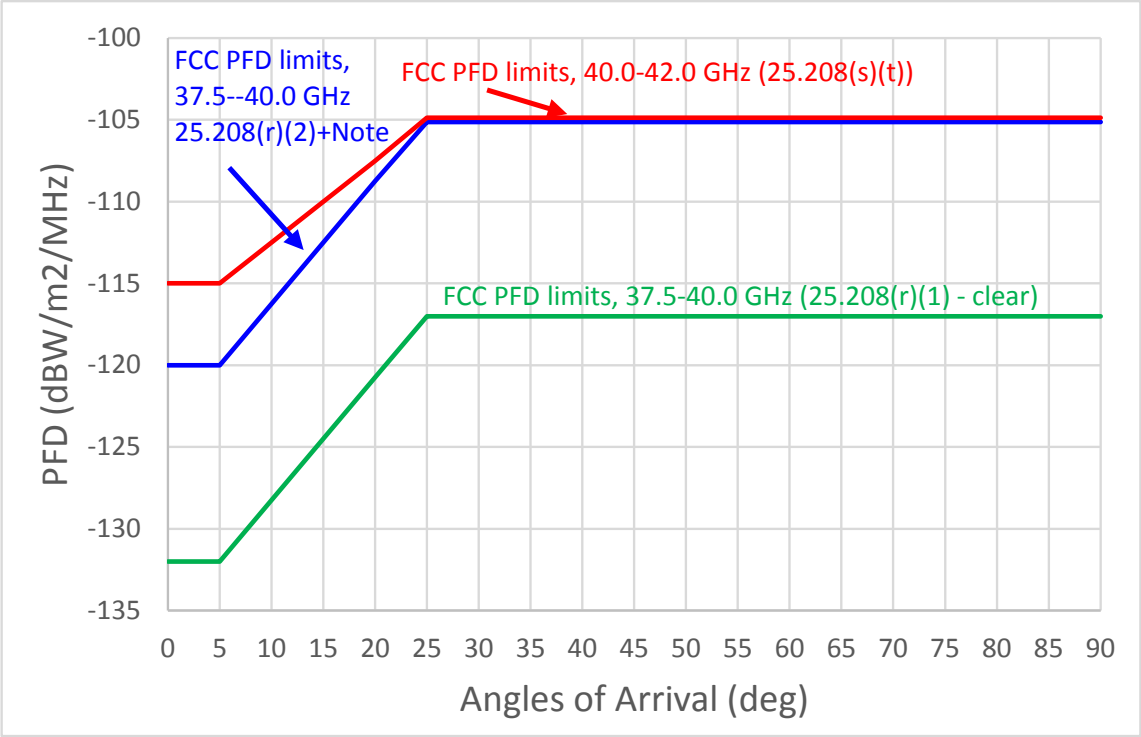

Figure II-16. Maximum PFD Limits for Operating Bands Versus Elevation Angle

* * *

§ 25.114(d)(1) System Facilities, Operations and Services and How Uplink Frequency Bands Connect to Downlink Frequency Bands

A. System Facilities, Operations, and Services

* * *

1. NGSO System Constellation and Coverage

In its Initial Deployment, the Boeing NGSO System would consist of a constellation of 1,396 LEO satellites. The initial constellation would consist of 35 circular-orbit planes operating at a 45 degree inclination at 1,030 kilometers altitude, augmented with 6 additional circular-orbit planes operating at a 55 degree inclination at 1,082 kilometers altitude. A detailed description of the satellite constellation is included

in the "Non-geostationary Satellite Orbital Information" section of Schedule S and geographic coverage is discussed in the narrative covering Section 25.143(b)(2).

The initial configuration would provide satellite visibility at an earth station elevation angle of greater than 45 degrees for all users below 60 degree latitude, and would provide improved satellite visibility and coverage within the highly populated latitude regions. High elevation angles offer a significant advantage for system operation by enabling reduced losses due to link impairments and multiple line-of-sight ("LOS") paths to avoid blockage. These features also provide the system's gateways and user terminals with isolation from other users operating in the V-band spectrum.

The Final Deployment of the NGSO System would increase the number of satellites to 2,956, adding 12 more 55 degree inclination planes operating at an altitude of 1,082 kilometers and adding 21 orbit planes inclined at a near-polar orbit of 88 degrees operating at a lower altitude of 970 kilometers. This Final Deployment could provide additional system capacity and improve coverage for all users worldwide.

The NGSO System payload would use advanced beam-forming and digital processing to generate thousands of narrow spot beams to provide a cellular coverage on the Earth's surface. Figure II-18 shows the illustrative coverage footprints of multiple satellites over the continental United States ("CONUS") with the illustrative cells generated by a single satellite depicted in the highlighted footprint.

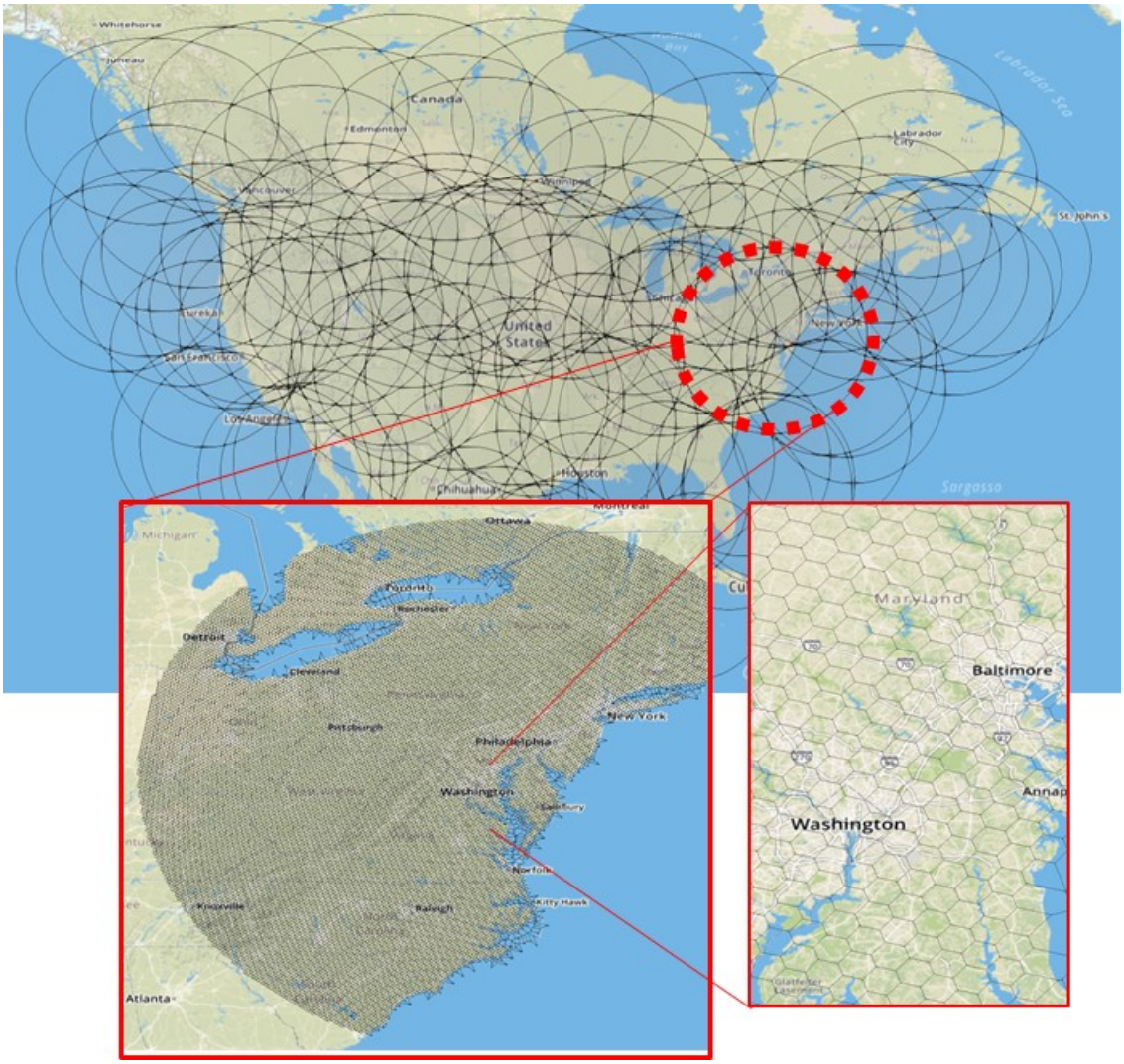

Figure II-18. NGSO System Satellite Coverage Footprints and Cells (Illustrated)

Narrow spot beams with low sidelobes would enable frequency re-use among the thousands of cells within each satellite footprint and unique time-division transmission techniques would enable frequency re-use between user terminals and gateways where both earth station types are present within the same cell. Efficient re-use of the V-band spectrum is described in the narrative covering Sections 25.114(d)(1) and 25.210(f). System gateways would typically be located outside of highly-populated regions in areas of relatively low user demand. Each NGSO System satellite would be able to form beams corresponding to Earth-surface cell diameters ranging from 8 to 11 kilometers

within the overall satellite coverage footprint. Examples of the NGSO System beams are shown in the narrative covering Section 25.114(c)(4)(vi) and are included in Schedule S. User terminals would be mapped into cells, and the payload coverage beams would be directed towards these cells as the NGSO System satellites pass over. The system NOCs would ensure that user terminals and gateways are handed over from cell to cell (and satellite to satellite) at elevation angles greater than 45 degrees, providing seamless user communications service via a make-before-break handover approach.

* * *

B. System Frequency Usage and Frequency Plan

This Section is amended to update the references to particular Tables in the Schedule S software that was filed with this Application in order to correspond to the same sections in the new Schedule S software that is being filed with this Amendment.

The uplink and downlink frequency plans for the NGSO System are contained in the "Operating Frequency Bands" section of Schedule S. The communication channels ("VS" and "VF"), beacon channels ("VTB"), telemetry channels ("VTT"), and command channels ("VTC") associated with these frequency bands are described in the "Receiving Channels" and "Transmitting Channels" section of Schedule S. Figures II-19 through II-21 below replace the figures of similar number in the original Application showing the uplink communications channels, uplink command channels, downlink communications channels, and downlink beacon and telemetry channels, respectively.

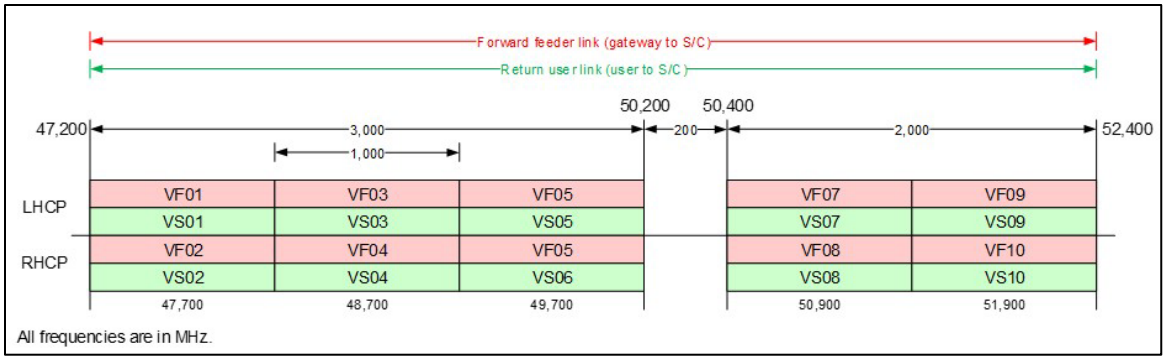

Figure II-19. Communication Channel Uplink Frequency Plan

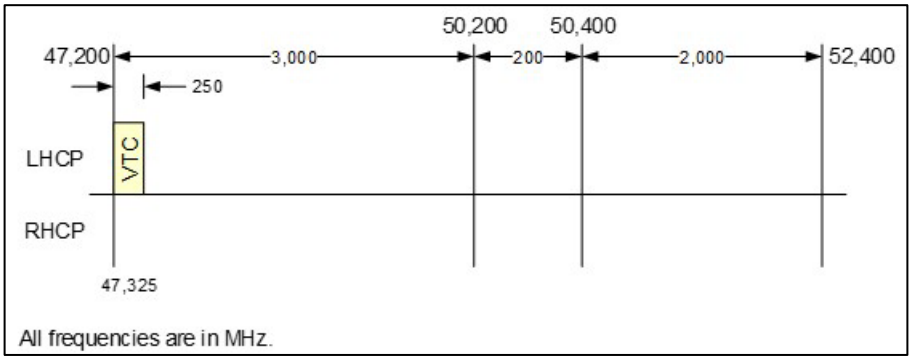

Figure II-20. Command Channel Uplink Frequency Plan

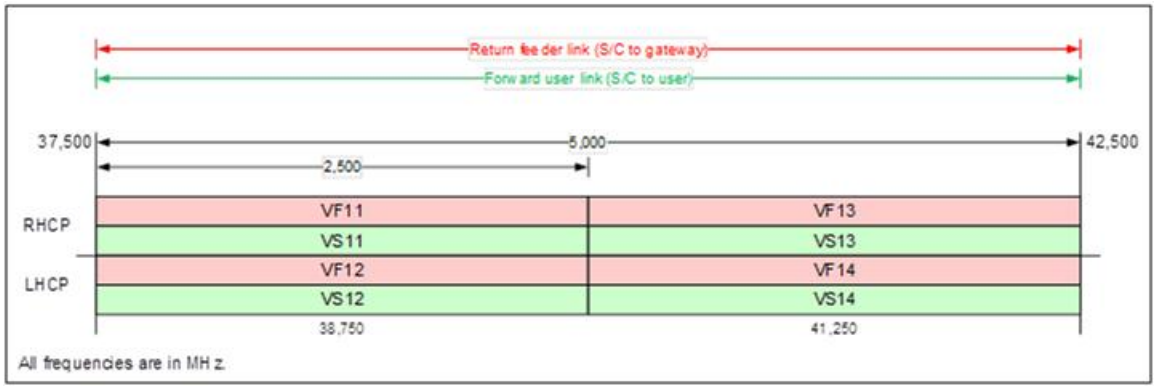

Figure II-21. Communication Channel Downlink Frequency Plan

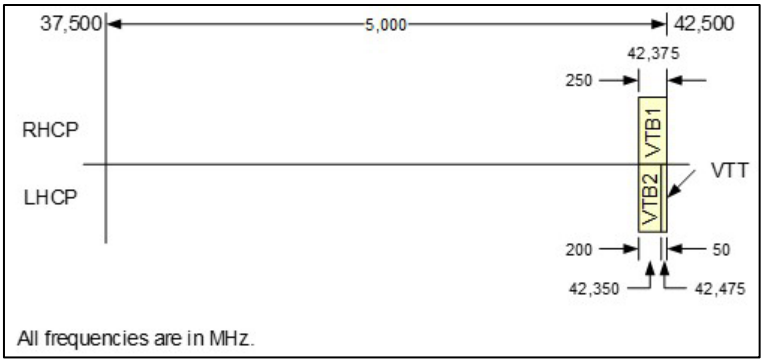

Figure II-22. Telemetry (VTT) and Beacon (VTB1, VTB2) Channels Downlink Frequency Plan

Even though Tables S10 and S11 of Schedule S no longer exist, the payload will still accommodate the same types of carriers with bandwidths ranging from 62.5 MHz to 5000 MHz, and in general will be capable of sub-channelizing any uplink channel in any uplink beam and routing the uplink sub-channels to downlink channel(s) in any downlink beam.