AUDACY NON-GEOSTATIONARY SATELLITE SYSTEM (S2982)

EXHIBIT A

Technical Supplement to Schedule S

I. SCOPE & PURPOSE OF APPLICATION

This Technical Supplement provides information supporting a request for modification to the Audacy Non-Geostationary Orbit ("NGSO") satellite system ("Audacy Network") as authorized by IBFS File No. SAT-LOA-20161115-00117 (the "Audacy License"). During the FCC 2016 NGSO processing round, Audacy Corporation, Audacy Spectrum LLC's ("Audacy Spectrum")[1] predecessor, filed for a system of Medium Earth Orbit ("MEO") data relay satellites designed to provide always-on, continuous access to user spacecraft in Low Earth Orbit ("LEO"), other Earth orbits, and in interplanetary space. The Audacy Network consists of three MEO relay spacecraft, geographically distributed gateway earth stations, a network and satellite operations center and client terminals onboard user spacecraft. The relay satellites transfer data between user spacecraft and the network gateways, providing user satellite operators with continuous access to their space assets without the need for ubiquitous earth stations of their own, thereby making efficient use of crowded spectrum and pathways. On 4 June 2018, the FCC authorized the Audacy Network and granted Audacy access to Fixed-Satellite Service (FSS) and Inter-Satellite Service (ISS) spectrum in the K, Ka, Q, and V bands.[2]

Through participation in the current processing round,[3] Audacy seeks authorization to supplement the currently licensed relay network with additional bandwidth in the 20/30 GHz

[1] All references to Audacy herein shall be referred to Audacy Spectrum and the Audacy License as described in the application.

[2] *See Audacy Corporation Application for Authority to Launch and Operate a Non-Geostationary medium Earth Orbit Satellite System in the Fixed- and Inter-Satellite Services*, FCC 18-72, Order and Authorization, IBFS File No. SAT-LOA-20161115-00117 (rel. June 6, 2018) ("*Audacy Grant Order*").

[3] See Cut-Off Established For Additional NGSO FSS Applications or Petitions for Operations in the 10.7-12.7 GHz, 12.75-13.25 GHz, 13.8-14.5 GHz, 17.7-18.6 GHz, 18.8-20.2 GHz, And 27.5-30 GHz

band (17.7-20.2 GHz and 27.5-30.0 GHz) to provide service to fixed or mobile terrestrial user terminals. In addition, Audacy seeks to expand its use of its currently licensed 20/30 GHz band spectrum from off-nominal TT&C to full feeder link communications between the gateways and the relay satellites. Audacy believes that the shared use of these spectrum assets will provide enhanced and value-added services to all end users as well as current and future users of the spectrum by concentrating certain communications into a limited number of gateway paths, thereby opening up other pathways and spectrum for users requiring a point-to-point link.

Audacy requests access to additional spectrum in the Processing Round to enable future customers to make use of the relay service as well as to decrease the time required to build and equip the satellite constellation. These requested modifications also provide additional capacity for growth by increasing the feeder link bandwidth to avoid a system bottleneck. The Audacy system was designed to service LEO spacecraft by shifting the space-to-earth links onto a centralized, wideband data stream that reduces the amount of reserved spectrum needed in the crowded space-to-earth pathways. This same concept can apply to fixed or mobile terrestrial users. Audacy expects its terrestrial users to need a larger 1 m to 2 m aperture to effectively close links with its relatively high MEO relay satellites. Use of these larger terminals keeps the beams narrow, minimizing the possibility of harmful interference with other Geostationary Orbit ("GSO") and NGSO systems.

Expansion of the currently licensed off-nominal TT&C bandwidth to full feeder link status will enable Audacy to equip an initial system with existing Ka-band feeder link hardware, shortening the deployment schedule compared to V/Q-band hardware. The additional bandwidth will also allow the system to grow since feeder link bandwidth is a limiting factor in system capacity. Applying both Ka and V/Q bandwidth to the few, narrow beam feeder links can add an additional 20% to the overall system capacity.

Bands, Satellite Policy Branch Information, Report No. SPB-279, DA 20-325 (rel. March 24, 2020) (the "Processing Round").

The information provided herein conforms to Part 25.117(d) of the FCC rules which governs modifications to existing licenses. As prescribed, Audacy only addresses those items herein which are new compared to its already authorized system. All other portions of the original Audacy application are incorporated by reference herein. We address relevant portions of §25.114 and §25.145 which define the required descriptions of the system and requirements for NGSO use of the 20/30 GHz band. Technical data for this new request are provided in the attached Schedule S. All other data provided in the original Schedule S data is unchanged and incorporated by reference herein.

Audacy also will submit to the International Telecommunications Union ("ITU") a similar request for these same bands and uses. As required by §25.111 of the Commission's rules and per the original Audacy submission to the Commission, Audacy will continue to be responsible for all ITU Cost Recovery fees associated with the modification.

II. DESCRIPTION OF SYSTEM, OPERATIONS & SERVICES (§25.114(d))

The Audacy Network remains a MEO constellation with three spacecraft designed primarily to provide data relay services to LEO spacecraft. The communications with LEO spacecraft use the ISS allocations in the 20/30 GHz band. This instant modification would expand the network to include relay services to terrestrial users using the fixed-satellite system ("FSS") portions of the 20/30 GHz band and expand the previously granted off-nominal use of certain portions of the Ka-band to nominal feeder link usage. To allow for maximum flexibility in avoiding interference with other Ka-band systems, Audacy requests authorization to use the entire 17.7 to 18.6 GHz, 18.8 to 20.2 GHz, and 27.5 to 30.0 GHz bands for communications with terrestrial users. The current Audacy License grants off-nominal use for TT&C in the 19.7 - 20.2 GHz and 29.5 - 30.0 GHz bands. Audacy proposes adding non-interference feeder link capability to these bands. This will enable Audacy to serve more clients and begin service sooner by making use of existing Ka-band hardware. Audacy will make use of this spectrum on a non-interference basis with current and future users of this spectrum as described below. This is enabled by Audacy's use of narrow, highly directive beams on the relay satellites,

network user terminals and network gateways. Table I, below, depicts Audacy's additional proposed frequency use.

Table I. Audacy Modification Application Frequency Pairs

Purpose(s)	Frequency	Application	Allocation
Off-nominal TT&C; Feeder Link	19.70-20.20	Downlink	FSS Space-to-Earth
	29.50-30.00	Uplink	FSS Earth-to-Space
Service Link	17.70-18.60 18.80-20.20	Downlink	FSS Space-to-Earth
	27.50-30.00	Uplink	FSS Earth-to-Space

The beams in the proposed modified system have discrete changes relative to the current Audacy License. New relay-to-user beams in the appropriate portions of the 20/30 GHz FSS bands are added to provide service to terrestrial users. Terrestrial user terminals employ steerable, narrow-beam antennas, minimizing radiated power levels and the possibility of interference with other systems. The planned minimum terrestrial user aperture size is 1 m. Similarly the network feeder link beams will now support the Ka-band as well as the previously licensed V/Q bands. Gateway terminal apertures will not be smaller than 2.5 m. Terrestrial user traffic will pass through the network gateways like all other user traffic.

III. PREDICTED SPACE STATION ANTENNA GAIN CONTOURS (§25.114(c)(4)(vi)(B))

The relay satellite antenna architecture and beams are little changed from the currently licensed Audacy system apart from their full bands of operation. All beams are steerable with a multitude of user beams and at least two feeder link beams per relay spacecraft. The only change is the bandwidth served by these beams and when they are operationally active. The proposed new terrestrial user terminals will track the relay spacecraft, switching between the relay satellites as required. Beam activity will not be scheduled when potential interference

with another system is anticipated due to the geometry of the Audacy user, Audacy relay satellite, and other system spacecraft and users.

The feeder link beams will also be unchanged from the current feeder link beams other than bands of operation and operational constraints to meet interference requirements.

Contour plots of the new beams are provided in Figures III-1 to 4 below. The plots show the nadir-pointed pattern on the global view from the Audacy orbit altitude as well as a more detailed plot of the beam itself. Directivity, EIRP, and G/T performance parameters are provided in Schedule S.

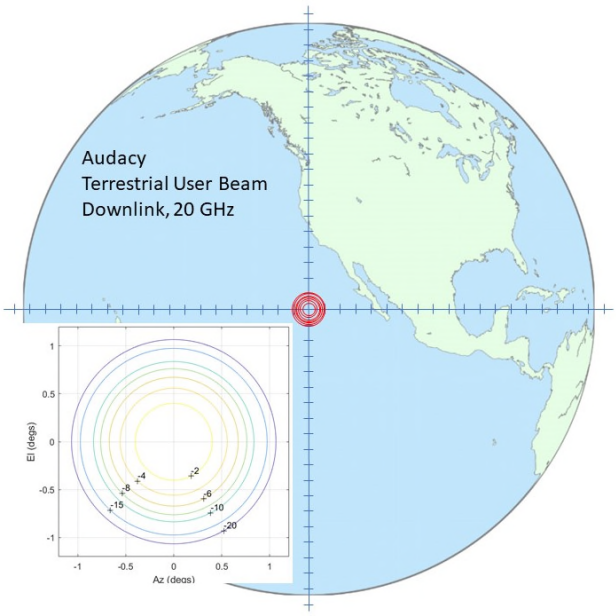

Figure III-1. Audacy Terrestrial User Beam, Downlink

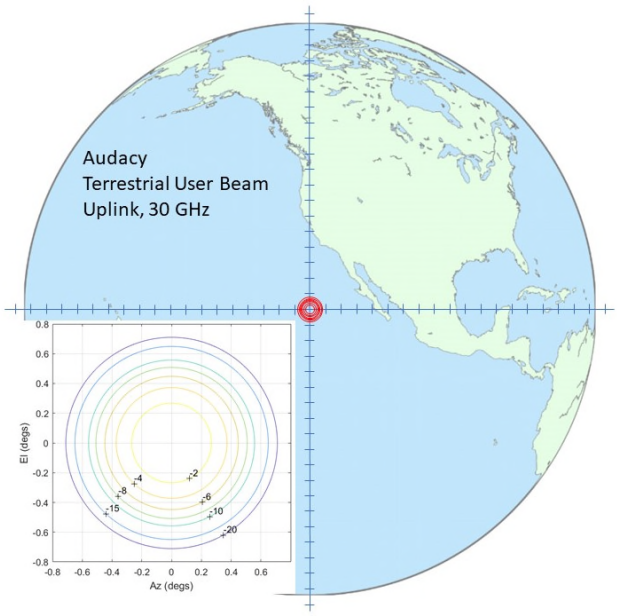

Figure III-2. Audacy Terrestrial User Beam, Uplink

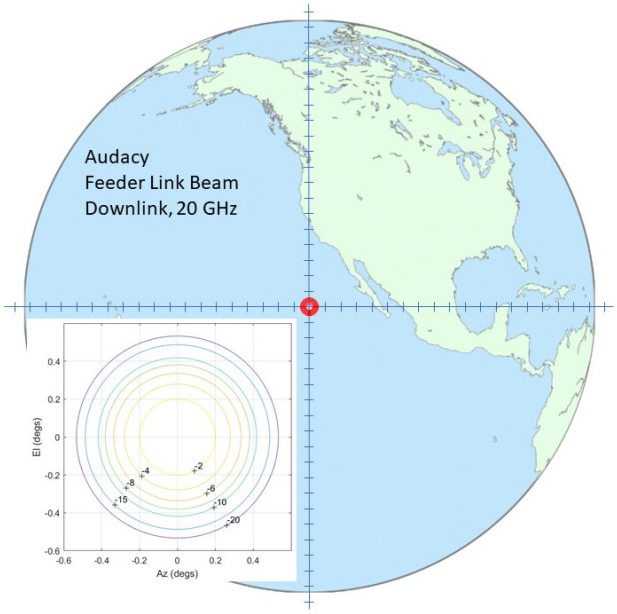

Figure III-3. Audacy Feeder Link Beam, Downlink

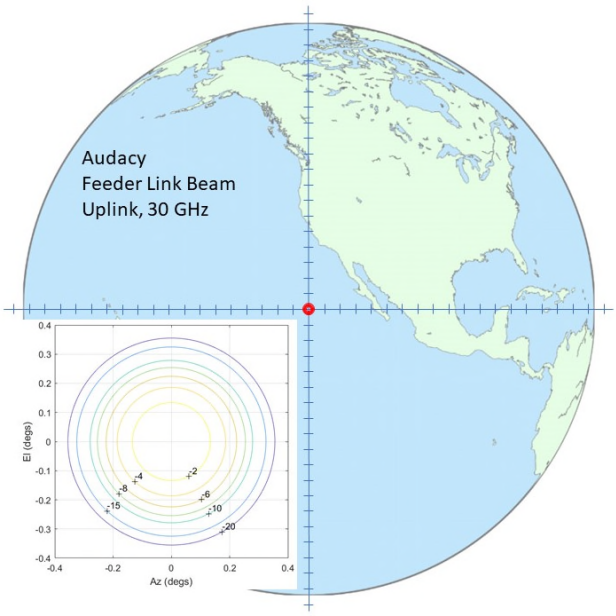

Figure III-4. Audacy Feeder Link Beam, Uplink

IV. POWER FLUX-DENSITY

Maximum downlink Power Flux-Density ("PFD") versus elevation angle is shown for the relay satellite beams from 17.7 to 19.5 GHz, along with the FCC PFD limits as per §25.208 (c) and (e) of the Commission's rules. Note that PFD is only shown down to 5° elevation as Audacy will comply with FCC rule §25.205(a) limiting operation to above 5° elevation.

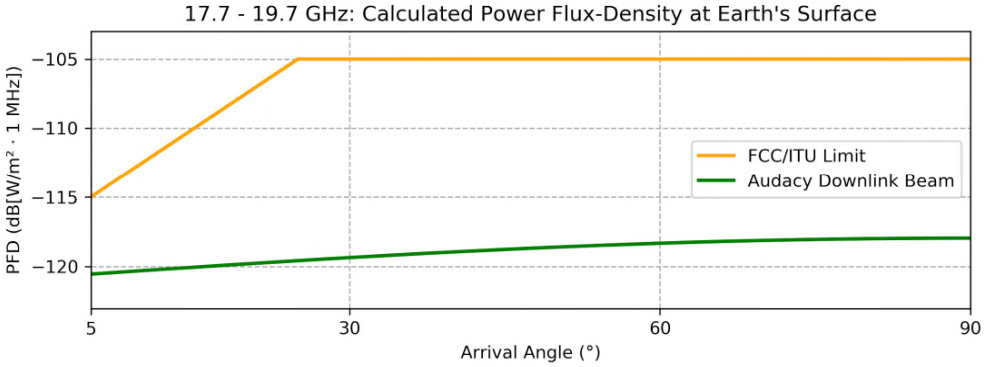

Figure IV-1. Maximum PFD of Terrestrial User Beams

The other new relay satellite downlink beam is the feeder link beam which will be limited to the 19.7 to 20.2 GHz band where the FCC does not prescribe a PFD limit.

V. GEOGRAPHIC COVERAGE (§25.145(c))

Section 25.145(c)(1) of the Commission's rules requires NGSO systems using the 20/30 GHz band to provide coverage up to 70° North Latitude for 75% of the day and section (c)(2) requires continuous coverage of the fifty United States as well as Puerto Rico and the US Virgin Islands. The Audacy Network cannot meet those requirements as described here.

The coverage area for the Audacy terrestrial user system is global. However the global coverage is dynamic and at any time there are regions that are not in view of any of the Audacy space stations. This is due to employing only three relay spacecraft even though they are in relatively high MEO orbits. The coverage holes tend toward the poles, but with the 25° orbital inclination, the pole itself is covered for some portion of each day. An uninclined equatorial 8-hour orbit has permanent coverage holes above 72° latitude. By flying inclined, the poles are covered for significant time at the expense of some short-term, low-latitude coverage outages. Coverage of the poles is significant as US polar research installations at the South Pole in particular struggle to find reliable, high-bandwidth connectivity to the rest of the world. With three spacecraft at 25° inclination and 8-hour periods, the continuous coverage area drops to about 25° latitude or approximately the location of the US Southern border. However these low-latitude outages are very brief: a few minutes per day. At higher latitudes of 60° to 70°, the outage time increases to 25% to 30% of the day. The approximate amount of coverage outage is shown in Figure IV-1 as a percent of the daily coverage.

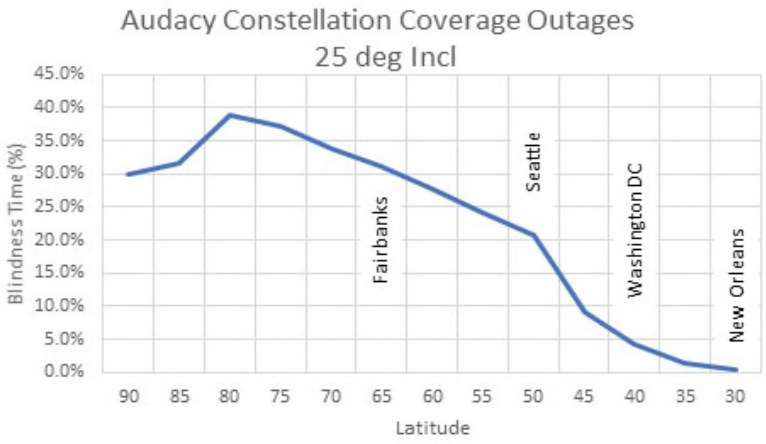

Figure IV-1. User outage time by latitude for the Audacy constellation

As shown in Figure IV-1, the region with 75% temporal daily coverage is limited to about 55° North latitude against the 70° North requirement. Also the 100% daily coverage area lies below about 30° North latitude so most of the United States landmass will not meet the 100% temporal coverage. However, for latitudes up to about 40° North, the outage is less than 5% of the day. These limitations are inherent in the MEO orbits chosen for Audacy which are optimized for LEO spacecraft service.

VI. TT&C FREQUENCIES (§25.202(g))

TT&C frequencies and operations remain very similar to the licensed system. On-station operation will make use of the feeder link signals with a small part of the licensed band used for TT&C signals. Where feeder links are using the 20/30 GHz band, nominal TT&C operations may be in the same band. As currently licensed, off-nominal TT&C operations will be in the 20/30 GHz band.

VII. CESSATION OF EMISSIONS (§25.207)

Procedures and mechanisms for cessation of emissions in the 20/30 GHz occuring pursuant to authority granted under the instant processing round will remain unchanged from the original Audacy filing.

VIII. INTERFERENCE ANALYSIS

A. Compatibility with GSO Co-Channel Systems

In applying to use the FSS Ka-bands, Audacy understands and agrees to comply with international footnote 5.484A of the FCC frequency table that require NGSO systems to not interfere with GSO systems in the 17.8 - 18.6 GHz, 19.7 - 20.2 GHz, 27.5 - 28.6 GHz and 29.5 - 30.0 GHz bands. The Audacy system is based on scheduling of communications with steerable, highly directive beams from both the relay spacecraft and any user or gateway. Therefore, the system always knows the location and beam directions for every node so that it can properly point the antennas. The Audacy communications planning system includes

other systems' GSO Ka-band spacecraft, and will not schedule communications when the relay and user beams are co-aligned with any GSO system spacecraft licensed for co-frequency operation. Due to the inclined MEO orbit of Audacy's relay satellites, blackout time for user communications is short and can be accommodated with scheduling and careful choice of the unused sub-bands for the link.

Additionally, Audacy plans to survey the full uplink spectrum from the relay satellite prior to engaging a communication link to determine which parts of the uplink spectrum within the beam are currently in use to aid in defining the sub-band to be used.

Figures VIII-A-1 to 7 provide the results of the ITU Equivalent Power Flux-Density ("ePFD") terrestrial downlink analysis for both 17.8 GHz and 19.7 GHz bands for the new Audacy beams. The intersatellite ePFD is provided in Figure VIII-A-8. These analyses incorporate the requirements of Article 22 of the ITU Radio Regulations and demonstrate that Audacy's downlink beams do not exceed ITU ePFD limits. Demonstration of Audcay's uplink beam's conforming performance is shown in Figures VIII-A-9 and 10 for 27.5 and 29.5 GHz respectively.

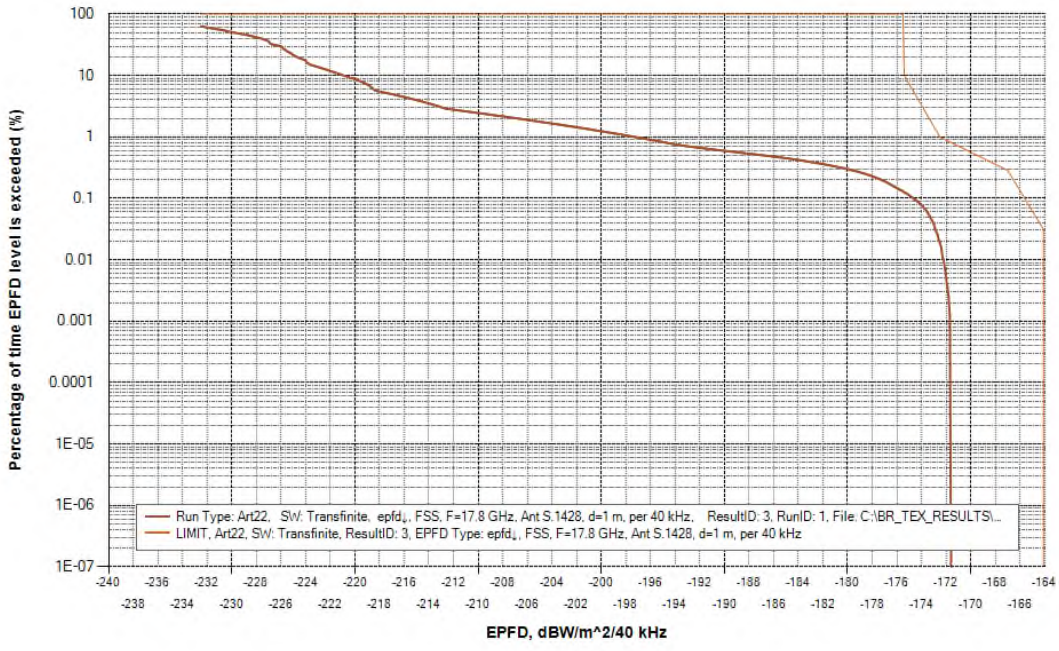

Figure VIII-A-1. Downlink ePFD Perf. and Rqmts., 17.8 GHz, 1 m Terminals

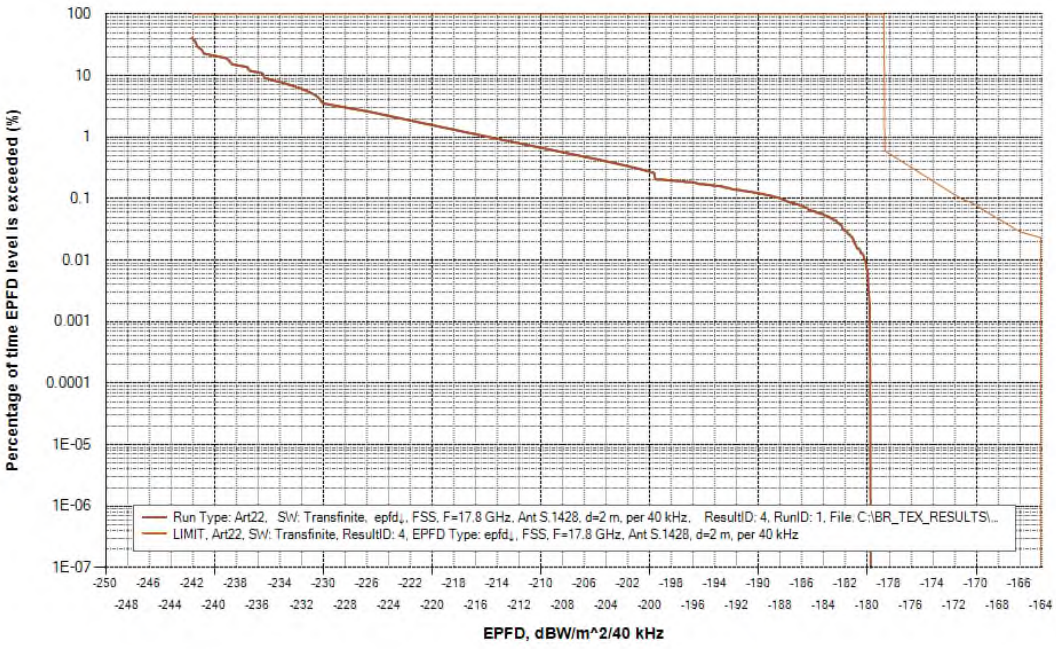

Figure VIII-A-2. Downlink ePFD Perf. and Rqmts., 17.8 GHz, 2 m Terminals

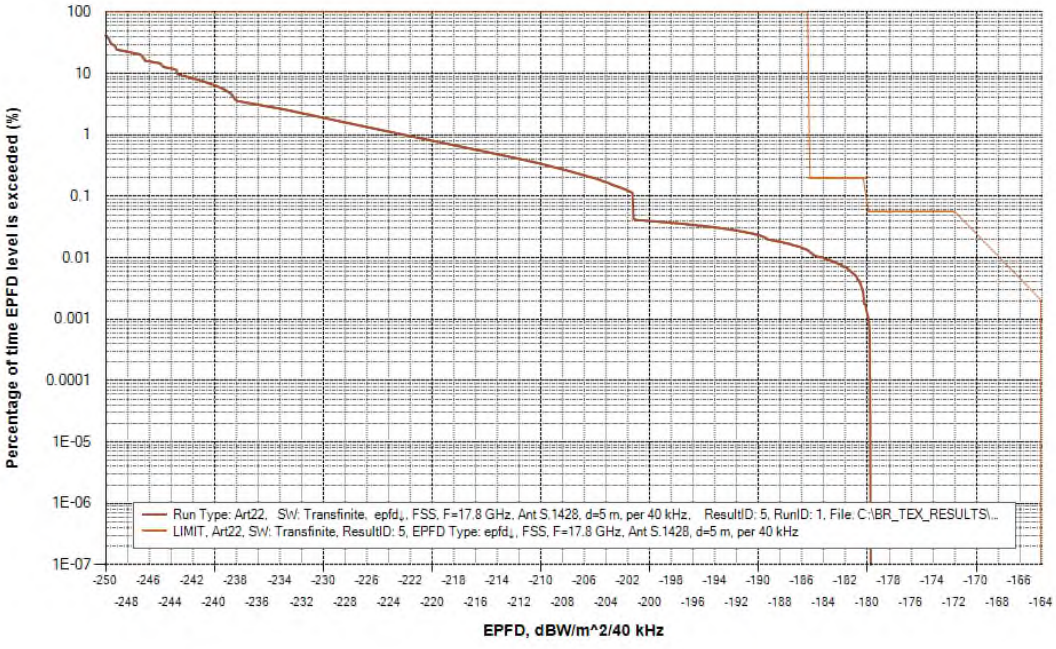

Figure VIII-A-3. Downlink ePFD Perf. and Rqmts., 17.8 GHz, 5 m Terminals

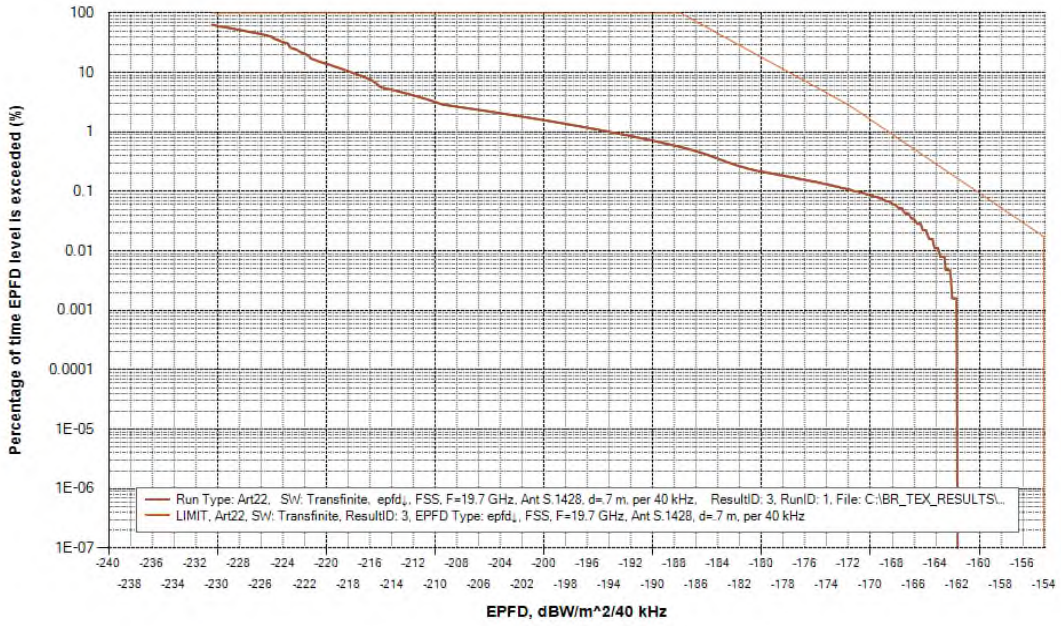

Figure VIII-A-4. Downlink ePFD Perf. and Rqmts., 19.7 GHz, 70 cm Terminals

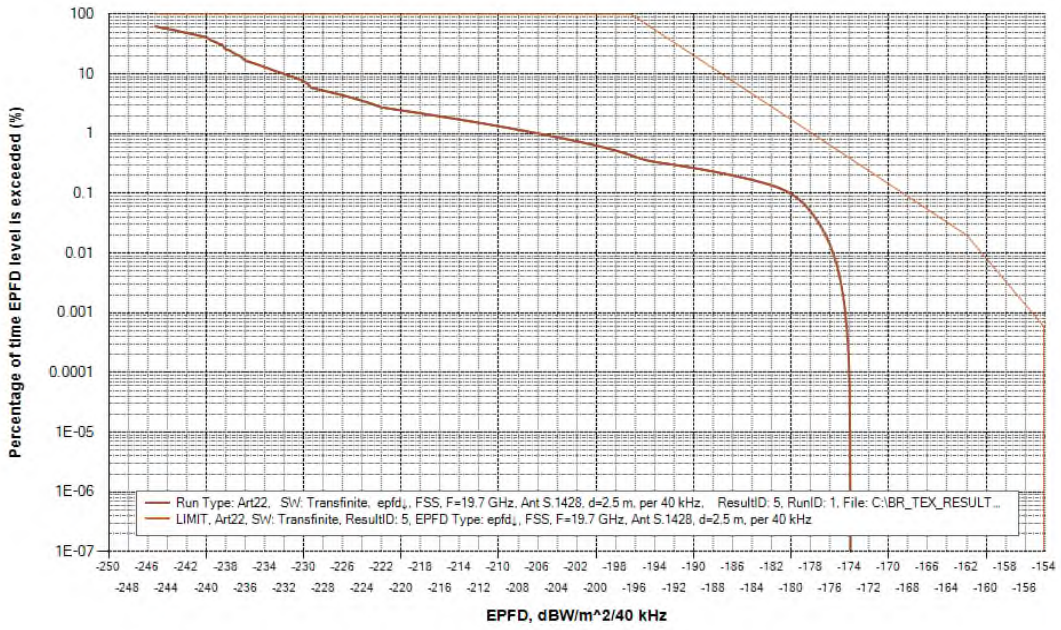

Figure VIII-A-5. Downlink ePFD Perf. and Rqmts., 19.7 GHz, 90 cm Terminals

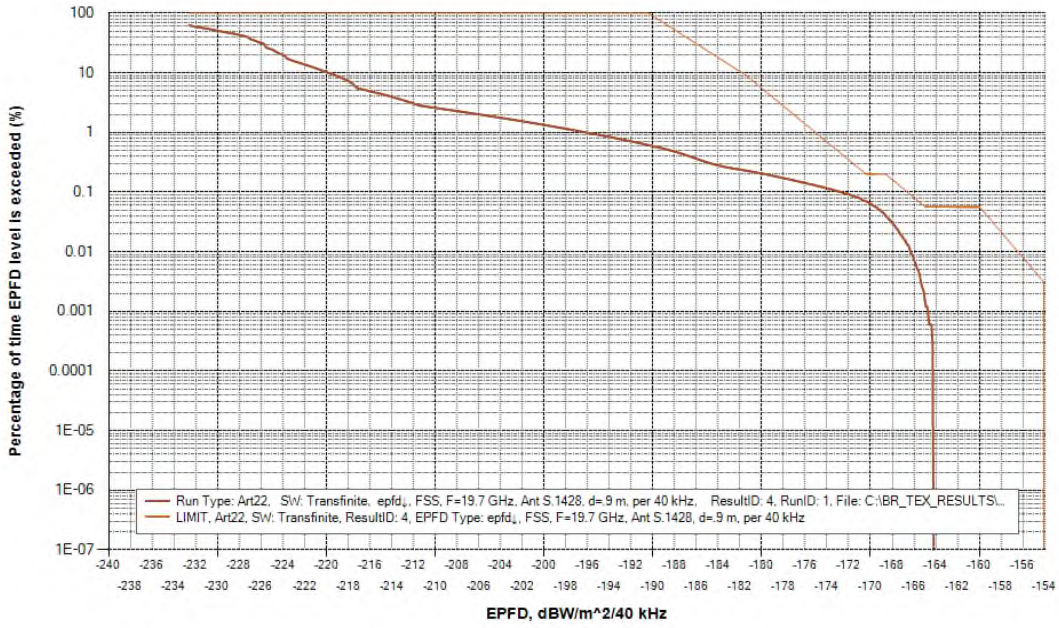

Figure VIII-A-6. Downlink ePFD Perf. and Rqmts., 19.7 GHz, 2.5m Terminals

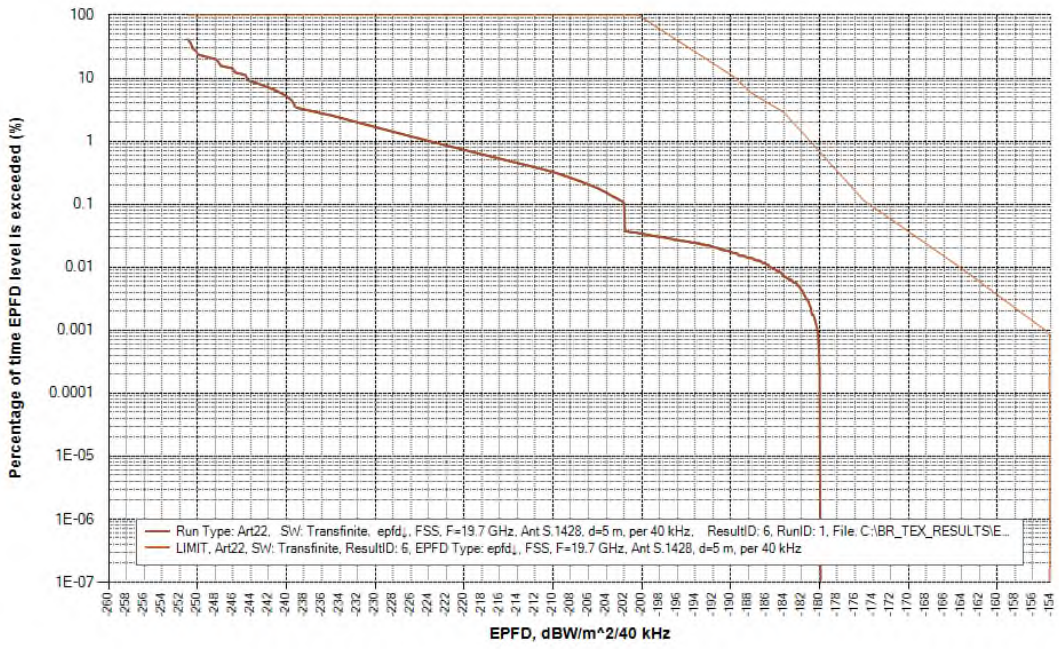

Figure VIII-A-7. Downlink ePFD Perf. and Rqmts., 19.7 GHz, 5m Terminals

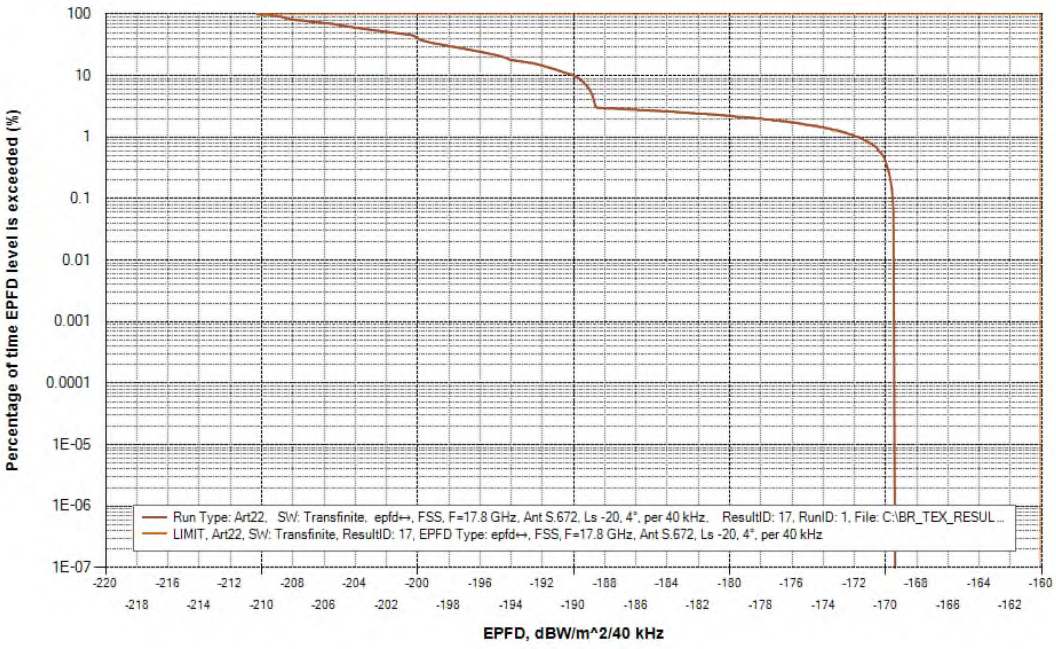

Figure VIII-A-8. Inter-Satellite ePFD Perf. and Rqmts., 17.8 GHz

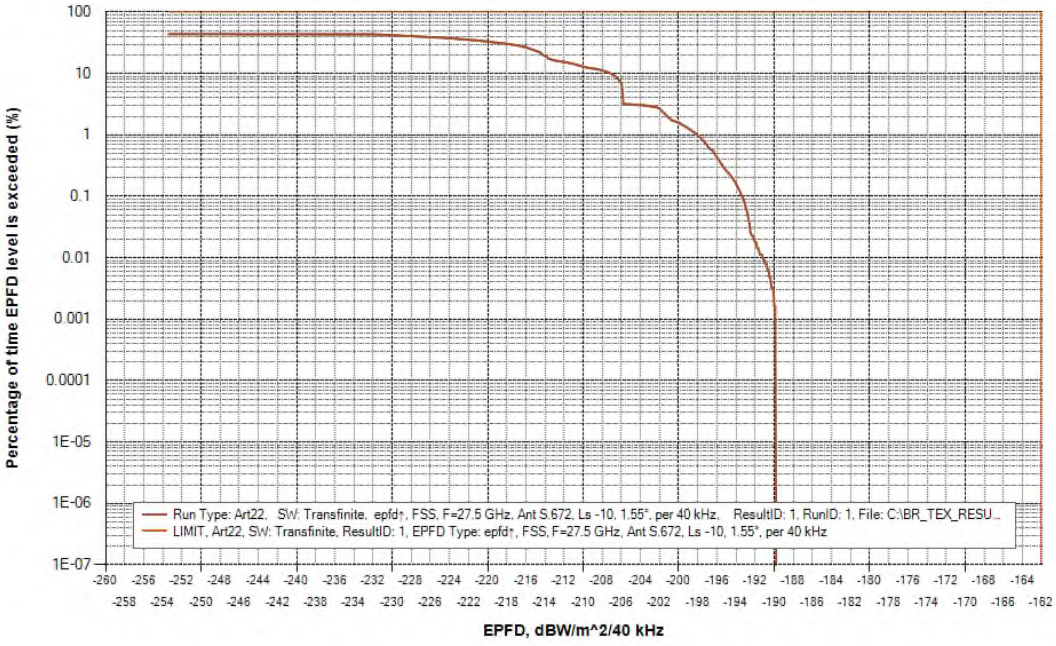

Figure VIII-A-9. Uplink ePFD Perf. and Rqmts., 27.5 GHz

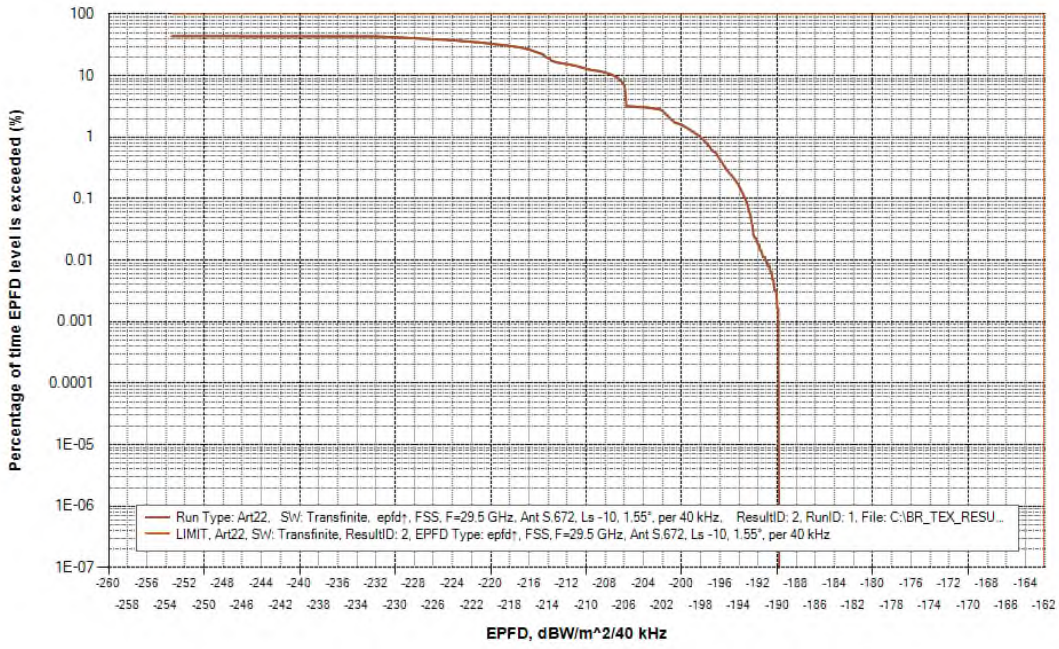

Figure VIII-A-10. Uplink ePFD Perf. and Rqmts., 29.5 GHz

B. Compatibility with NGSO Co-Channel Systems (§ 25.261(c)(1))

Audacy is committed to being a good steward of the licensed band amongst the NGSO family of users. As with the GSO systems, Audacy will maintain knowledge of the ephemerides of the NGSO satellites to the extent possible and minimize the potential for interference by selecting unused sub-bands or rescheduling the communications event to a non-interfering time slot. As required, Audacy will negotiate and coordinate in good faith with other licensed NGSO users to minimize interference and make maximum equitable use of the spectrum between the multiple users.

C. Compatibility with Terrestrial Systems

As defined in §§ 25.202,30.1 and 101.101 of the FCC's rules and the FCC Table of Frequencies,[4] Upper Microwave Flexible Use Service ("UMFUS") operates in the 27.5-28.35 GHz, and fixed microwave systems operate in the 17.7 - 18.3 GHz, 19.3 - 19.7 GHz, 27.5 - 28.35 GHz, and 29.1 - 29.25 GHz bands as incumbent systems.

[4] *See* 4 C.F.R. §2.106.

For Audacy gateway beams, spectrum usage is limited to 19.7 - 20.2 GHz and 29.5 to 30.0 GHz, so there is no frequency overlap, allowing gateways to service relay satellites down to 5° elevation angle as allowed under FCC rules. In addition, and as discussed above in Section VIII-A, Audacy space-to-ground communications in the broader 17.7-20.2 GHz band meet all applicable PFD limits, and thus have sufficiently attenuated at the Earth's surface to avoid adversely affecting terrestrial microwave links.

In areas around terrestrial client terminals in the 27.5-28.35 GHz UMFUS band, Audacy acknowledges that earth station operations must occur on a secondary basis to UMFUS service in the 27.5-28.35 GHz, except for FSS operations associated with earth stations authorized pursuant to 47 CFR § 25.136.[5] Audacy will further ensure interference protection by limiting user uplink operations below 10° elevation where an inline interference may occur. In addition, Audacy will monitor the band and remain frequency agile and capable of dynamically reassigning channels to avoid UMFUS terrestrial use if necessary, and contact the relevant geographic UMFUS licensee to coordinate ground station operations.

IX. COORDINATION WITH US GOVERNMENT SATELLITE SYSTEMS (Footnote US334)

Audacy commits to coordinate with any and all US Government Satellite systems. US Government allocations to the GSO arc in the Ka-band have been included in the preliminary evaluation of potential alignment with GSO systems.

X. ORBITAL DEBRIS MITIGATION (§25.114(d)(14))

Orbital debris mitigation strategies are unchanged from the original Audacy License filings.

[5] 47 C.F.R. §25.136.

XI. ENGINEERING CERTIFICATION

The undersigned hereby certifies to the Federal Communications Commission as follows:

I. I am the technically qualified person responsible for the engineering information contained in the foregoing Modification Application for a Non-Geostationary Medium Earth Orbit Satellite System in the Fixed- and Inter-Satellite Services;

II. I am familiar with Part 25 of the Commission's Rules; and

III. I have prepared and reviewed the engineering information contained in the foregoing Modification Application for a Non-Geostationary Medium Earth Orbit Satellite System in the Fixed- and Inter-Satellite Services, and it is complete and accurate to the best of my knowledge and belief.

Signed: */s/ Karl Clausing*

Karl Clausing

Principal

K spaCe Consulting

Dated: May 26, 2020