

**Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, DC 20554**

In the Matter of )  
 )  
**AUDACY CORPORATION** )  
 )  
Application for Authority )  
to Launch and Operate a ) File No. SAT-LOA-20161115-00117  
Non-Geostationary Medium )  
Earth Orbit Satellite System )  
in the Fixed- and Inter-Satellite Services )

**OPPOSITION AND RESPONSE OF AUDACY CORPORATION**

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## EXECUTIVE SUMMARY

Audacy Corporation (“Audacy”) welcomes the opportunity to address comments and questions regarding its application for authority to launch and operate a space-based data relay constellation. Given the constructive feedback and interest offered in the record regarding the proposal, Audacy’s ability to promptly address and resolve questions concerning the non-geostationary satellite constellation’s ability to coordinate and protect other spectrum users from interference, and the public interest benefits the constellation provides as discussed herein, Audacy looks forward to working with the Commission to strive towards favorable and prompt action on its application.

Audacy’s proposed satellite network will coordinate with and ensure compatibility with other fixed satellite service (“FSS”) networks. Audacy’s network involves the use of FSS spectrum only for narrowly tailored feeder links between three discrete spacecraft paired with three gateway earth stations, and bears little resemblance to the other satellite networks proposed in the instant processing round. This architecture facilitates coordination with other FSS spectrum users. Specifically:

- Communications between Audacy’s discrete satellites and gateways for feeder link service does not contribute to single-entry or aggregate equivalent-power flux density (“EPFD”) interference events.
- In-line interference events will be addressed by offloading traffic to unaffected Audacy satellites and gateways through robust, inter-satellite links.

The Commission should not impose unnecessary and unduly burdensome conditions on Audacy’s use of K-band frequencies for feeder link service. In particular, the Commission should not impose rules under consideration in IB Docket No. 16-408 on Audacy. Rules in that docket will apply prospectively to service links intended to provide worldwide coverage to end user ground terminals, and would be impractical or impossible for a relay network with narrowly

tailored and minimally intrusive feeder link beams to implement. Nor should the Commission hold Audacy jointly and severally liable for EPFD interference events for which its relay satellites were not involved.

Audacy will protect authorized co-frequency fixed and mobile service users. Certain commenters mistakenly thought that Audacy would be continuously transmitting toward the visible earth, when in fact incidence of Audacy inter-satellite beams intersecting the planet's surface will be infrequent exceptions. As supported by analysis in the instant pleading, given the modest proposed power flux density ("PFD") levels and minimal intersection with the Earth's surface, even in a worst case scenario co-frequency spectrum users will not suffer a meaningful degradation in their clean signal.

To facilitate coordination and resolve certain administrative and ministerial issues, Audacy expects to file a minor amendment to its pending application in the near future. This minor amendment will revise Audacy's Schedule S to reflect use of the 29.5-30.0 GHz frequency range, and eliminate reference to the broader 27.5-30.0 GHz range, for which Audacy is not seeking authority. Audacy will also amend its application to eliminate the 23.18-23.38 GHz band to address concerns raised by Iridium Constellation, LLC.

Finally, Audacy urges the Commission to dismiss the comments of Elefante Group concerning Audacy's use of the 22.55-23.55 GHz band for inter-satellite service. Elefante Group argues that Audacy's use of the band will interfere with a future High Altitude Platform Service (HAPS) in the band. Elefante Group's comments are an attempt to circumvent the rulemaking process. No HAPS allocation or service rules exist for the 22.55-23.55 GHz band. Neither the Federal Communications Commission nor International Telecommunications Union are contemplating HAPs allocations in the 22.55-23.55 GHz band, and Elefante Group candidly

admits it has yet to meet with the Commission to even socialize its proposal. To the extent that Elefante Group submits a petition for rulemaking proposing a HAPS allocation and service rules in the 22.55-23.55 GHz band, Audacy reserves the right to participate in such a proceeding and will provide technical and policy inputs to the Commission on Elefante Group's proposal at that time.

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**OPPOSITION AND RESPONSE OF AUDACY CORPORATION**

Audacy Corporation (“Audacy”), pursuant to Section 25.154(c) of the rules of the Federal Communications Commission (the “FCC” or “Commission”),<sup>1</sup> hereby submits this Opposition and Response to the Petitions to Deny and Comments filed in the above-captioned proceeding.<sup>2</sup> Audacy appreciates the interest generated by our filing and the support for the revolutionary prospect of continuous spacecraft connectivity. The instant pleading resolves questions, comments, and concerns regarding Audacy’s proposal.<sup>3</sup>

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<sup>1</sup> 47 C.F.R. § 25.154(c).

<sup>2</sup> See Comments of Facebook, Inc. (“Facebook”), File No. SAT-LOA-20161115-00117 (filed June 26, 2017) (“Facebook Comments”); Comments of SES S.A. and O3b Limited (“SES/O3b”), File No. SAT-LOA-20161115-00117 (filed June 26, 2017) (“SES/O3b Comments”); Comments of Space Norway AS (“Space Norway”), File No. SAT-LOA-20161115-00117 (filed June 26, 2017) (“Space Norway Comments”); Comments of Elefante Group, Inc. (“Elefante”), File No. SAT-LOA-20161115-00117 (filed June 26, 2017) (“Elefante Comments”); Comments of Hughes Network Systems, LLC (“Hughes”), File No. SAT-LOA-20161115-00117 (filed June 26, 2017) (“Hughes Comments”); Petition to Deny of ViaSat, Inc. (“ViaSat”), File No. SAT-LOA-20161115-00117 (filed June 26, 2017) (“ViaSat Petition”); Petition to Deny of Iridium Constellation LLC (“Iridium”), File No. SAT-LOA-20161115-00117 (filed June 26, 2017) (“Iridium Petition”); and Petition to Deny of Telesat Canada (“Telesat”), File No. SAT-LOA-20161115-00117 (filed June 26, 2017) (“Telesat Petition”).

<sup>3</sup> Audacy herein refers to its proposed aggregate network of space- and Earth-based infrastructure as the “Relay Network;” individual satellites as “Relays” or “Satellite Relays;” complementary ground stations as “Gateways;” and spacecraft using the Network’s communication services as “Users” as further described in the legal narrative accompanying Audacy’s application. See *Audacy Corporation Application for Authority to Launch and*

## I. INTRODUCTION AND SUMMARY

Audacy proposes a space-based data relay constellation that will provide operators with always-on seamless access to their non-geostationary (“NGSO”) spacecraft. End users of the Relay Network will include operators of Earth observation satellites seeking real-time photographic and video data, launch providers needing continuous telemetry from onboard sensors, and operators of large Low Earth Orbit (“LEO”) constellations who require continuous command and control of every satellite, wherever they are in their orbit. Audacy’s Relay Network provides significant public interest benefits, including opening new possibilities for transformative technologies across the value chain by making available commercial access to 24/7 spacecraft communications, and enabling new technologies such as real-time telerobotics and satellite servicing. In addition, Audacy’s Relay Network will dramatically simplify and streamline the process for coordinating communications between satellites and terrestrial gateway facilities, which has become increasingly complex and impossible in certain situations due to conflicts between commercial and scientific missions in already heavily burdened spectrum.

The proposed use of K-band frequencies for feeder link service triggered participation in the instant processing round. Audacy’s use of such frequencies is discrete, and as demonstrated in this pleading, can be successfully coordinated and introduced without affecting alternative existing and planned uses of spectrum. Audacy also resolves below certain other spectrum coordination and electromagnetic compatibility issues.

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*Operate a Non-Geostationary Medium Earth Orbit Satellite System in the Fixed- and Inter-Satellite Services*, Application, IBFS File No. SAT-LOA-20161115-00117 (filed Nov. 16, 2016) (“Audacy Narrative Exhibit”).

## **II. AUDACY WILL TAKE APPROPRIATE STEPS TO ENSURE COMPATIBILITY BETWEEN THE USE OF FSS SPECTRUM FOR ITS DISCRETE FEEDER LINK SERVICE AND EXISTING AND PLANNED SATELLITE SYSTEMS**

Audacy expected incumbent spacecraft operators to view its proposed Relay Network favorably and as compatible with existing and planned systems given the network's characteristics. Specifically, given that Audacy's proposed network involves limited use of FSS spectrum for the purpose of feeder link service which more closely resembles a GSO deployment relative to the large-scale constellations in the instant proceeding designed to provide broadband service to individual and enterprise end users, Audacy anticipated and was pleased with the largely constructive input received from the incumbent commercial satellite community. To the extent relevant to the Relay Network, Audacy will promptly address in-line interference issues raised by GSO operators, which should not delay Commission action on Audacy's pending application.

### **A. Audacy Reaffirms that its Relay Network Uses K-band FSS Spectrum for Narrowly Focused Feeder Link Service**

Certain filers appear to inadvertently overlook or fail to acknowledge the meaningful distinctions between Audacy's Relay Network, which involves the use of FSS spectrum only for narrowly tailored feeder links between three discrete spacecraft paired with three gateway earth stations, and other NGSO systems involved in the instant proceeding which employ FSS spectrum for widespread service links between large fleets of LEO spacecraft and potentially vast numbers of individual and/or enterprise terminals on the ground. For example, Telesat submitted a virtually identical pleading in IBFS for all processing round participants, drawing no distinction between the use of FSS spectrum proposed for feeder links by Audacy and service



links proposed by other participants.<sup>4</sup> Space Norway similarly submitted virtually identical comments in multiple files, including Audacy’s IBFS file, that make reference to potential interference associated with “low altitude NGSO satellites” and new entrants employing “numerous satellites in multiple planes,” both of which more aptly describe the NGSO networks proposed by other applicants.<sup>5</sup> Audacy’s Relay Network does *not* resemble the other NGSO networks in this proceeding, presents *de minimis* interference concerns in FSS bands relative to a widespread service link deployment, and forced “apples-to-oranges” comparisons between Audacy’s Relay Network and the other NGSO applicants in the instant proceeding offer little or no utility to policymakers.

**B. Audacy’s Relay Network Will Not Contribute to a Material Increase in Single-Entry or Aggregate Equivalent Power-Flux Density in K-band Frequencies**

Certain satellite operators request reassurance that the proposed operations of NGSO systems in K-band frequencies will not increase Equivalent Power-Flux Density (“EPFD”) levels and result in noise floor degradation. Specifically, SES, Hughes, and ViaSat either urge the Commission to collect additional EPFD information to ensure adequate interference protection for GSOs, or to impose certain conditions on NGSO licensees to ensure EPFD levels do not affect existing and/or planned GSO systems.<sup>6</sup> Audacy appreciates that with other NGSO systems in the instant proceeding proposing to use FSS spectrum for service links, delivering broadband to theoretically millions of customers from hundreds or thousands of spacecraft blanketing the Earth’s surface with beams intended to serve small, inexpensive and mass-produced ground

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<sup>4</sup> See Telesat Petition.

<sup>5</sup> See Space Norway Comments at 3.

<sup>6</sup> See SES/O3B Comments at 3; Hughes Comments at 3; ViaSat Petition at 5.

stations made available to individual and enterprise end users, that a rise in EPFD levels may concern incumbent systems.<sup>7</sup> However, given that the Audacy Relay Network involves discrete feeder links, and because Audacy's EPFD levels fall significantly below ITU-R recommendations, Audacy will not contribute to any such increase in EPFD levels. Audacy has already responded to one Commission inquiry on its EPFD levels, and provided a showing demonstrating compliance with applicable EPFD limits specified in Article 22 of the ITU Radio Regulations.<sup>8</sup> Audacy would be pleased to answer any additional questions posed by the Commission in this regard.

Audacy's Relay Network will use FSS spectrum for feeder link service only, delivering aggregated traffic using carefully shaped, narrow spot beams to three planned gateway earth stations that will employ large, highly efficient antennas. Accordingly, with the exception of the area in immediate proximity to an Audacy gateway (in this hemisphere Audacy presently plans only a single gateway at a site in California), the Relay Network will not contribute to an increase in single-entry or aggregate EPFD. Moreover, given that the Relay Network will communicate exclusively with large (>6.0 meter), highly efficient/high-gain gateway antennas, even under an Audacy spot beam EPFD falls below that proposed by other NGSO systems in the

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<sup>7</sup> See, e.g., WorldVu Satellites Limited Petition for a Declaratory Ruling Granting Access to the U.S. Market for the OneWeb System, IBFS File No. SAT-LOI-20160428-00041 (proposing constellation of 720 satellites in low-Earth orbit to provide global, broadband internet access and considering expanding to 1,972); Application of Space Exploration Holdings, LLC for Approval for Orbital Deployment and Operating Authority for the SpaceX NGSO Satellite System, IBFS File No. SAT-LOA-20161115-00118 (contemplating a system comprised of 4,425 satellites operating in 83 orbital planes).

<sup>8</sup> See Letter from Jose P. Albuquerque, Federal Communications Commission, to Ralph Ewig, Audacy Corporation, IBFS File No. SAT-LOA-20161115-00117 (March 10, 2017); Letter from James Spicer, Audacy Corporation, to Marlene H. Dortch, FCC, File No. SAT-LOA-20161115-00117 at 1 (April 3, 2017) ("Audacy Response to FCC Request for Additional Information").

instant proceeding.<sup>9</sup> In response to Commission enquiry, Audacy illustrated compliance with all ITU and Commission FSS EPFD limits, including GSO uplink and downlink operations.<sup>10</sup>

### **C. Audacy’s Dynamic Network Architecture Prevents In-Line Interference Events with FSS Spacecraft**

Audacy’s Relay Network will avoid in-line interference events in FSS bands through the implementation of inter-satellite links between Relays, offloading traffic from any Relay affected by a potential in-line interference event to another operational Relay paired with an alternative gateway earth station. Given this proven and reliable capability, in-line interference can be effectively avoided and the Commission need not impose additional conditions related to the mitigation of such interference.

SES/O3b, which operates both GSO and NGSO spacecraft, argues that because Audacy’s Relay Network involves “only three satellites and three gateways, it will not be able to use space or earth station diversity as a sharing mechanism.”<sup>11</sup>

SES/O3b, however, incorrectly describes the capabilities of Audacy’s Relay Network to avoid incidence of in-line interference. Specifically, Audacy’s Relays are interconnected by way of robust inter-satellite links.<sup>12</sup> In the event of an in-line interference event that cannot be coordinated, the affected Relay will preemptively offload its customer traffic to one of the two other operational Relays and the relevant paired gateway earth stations. Hand-off between Relays will be seamless and undetectable by Audacy end users, and provides a reliable

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<sup>9</sup> See ViaSat Petition, Exhibit A. Audacy’s EPFD<sub>up</sub> is the lowest of any of the systems being considered in this instant proceeding, 26 dB(W/(m<sup>2</sup> ·40 kHz)) or 400× lower than the most powerful systems, and 150× lower than the average.

<sup>10</sup> Audacy Response to FCC Request for Additional Information at 1.

<sup>11</sup> SES/O3b Comments at 7.

<sup>12</sup> Audacy Narrative Exhibit at 15.

interference protection mechanism that facilitates full use of the proposed FSS frequencies for Audacy feeder links.<sup>13</sup> The orbital geometry of Audacy Relay satellite orbits and planned earth station locations is designed to preclude the possibility of multiple simultaneous in-line interference events with equatorial NGSO or GSO satellites such as those operated by SES/O3b.

Space Norway, which operates the Arctic Satellite Broadband Mission (“ASBM”) spacecraft in a highly elliptical orbit (“HEO”), expresses concerns that “multiple in-line interference events” may occur between the ASBM spacecraft and Audacy’s Relay Network, and “if no mechanism for avoidance of in-line interference between HEO and LEO/MEO systems were adopted, both Space Norway and [Audacy] would be forced to limit their operations to their respective selected ‘home base’ spectrum.”<sup>14</sup> Space Norway elaborates that “the ASBM, with only one operational satellite (except during a brief handover), cannot implement the commonly proposed techniques to avoid in-line interference, such as satellite diversity and progressive pitch.”<sup>15</sup>

Audacy acknowledges the overlap in the FSS Earth-to-Space and Space-to-Earth spectrum between the Network Relays and ASBM spacecraft; however, Space Norway overlooks the distinction between Audacy’s proposed Network and the other NGSO systems in the instant proceeding.<sup>16</sup> Specifically, the space and ground segments of both Audacy’s and Space Norway’s systems are well-separated geographically, eliminating the possibility of

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<sup>13</sup> Audacy will constantly use state-of-the-art satellite modeling and orbit propagation tools to predict potential interference events with FSS networks well before they occur so that coordination and mitigation techniques can be employed.

<sup>14</sup> Space Norway Comments at 3.

<sup>15</sup> *Id.*

<sup>16</sup> Space Norway filed virtually identically comments for all NGSO systems involved in the instant proceeding. Certain references in Space Norway’s comments concerning Audacy are inconsistent with a high MEO network involving only three satellites. For example, Space Norway incorrectly states that Audacy proposes a low altitude NGSO with multiple orbital planes. *See* Space Norway Comments at 3.

harmful interference between the networks. Audacy's proposed Network involves communications in FSS frequencies between three discrete earth stations and three discrete Relay satellites. All of Audacy's planned earth stations are located well below 55° N latitude and the Relay satellites are in orbits inclined at 25° to the equator, meaning that they never travel above 25° latitude. Given Audacy's understanding that the ASBM system involves two satellites serving a terrestrial service area exclusively above 55° N latitude, there is no possibility of harmful interference between the systems during routine operations. Even if geographic separation did not protect both systems, which it does, Audacy's Relays have been enabled with alternative mechanisms to ensure successful coordination with Space Norway. As discussed above in Section II.B, Audacy's Relay network enjoys satellite and earth station diversity through dedicated inter-satellite links.

**D. The Commission Should Avoid Imposing Unduly Burdensome License Conditions on Audacy's Use of K-band Spectrum for Feeder Link Service**

License conditions imposed on Audacy's use of FSS K-band spectrum should reflect the Relay Network's discrete use of these frequencies for feeder linker services only, and the corresponding low probability that a Relay satellite or gateway earth stations will become a source of harmful interference. The Commission should avoid imposing on Audacy conditions appropriate for a network making more intense use of K-band frequencies for service links to widespread individual and enterprise end users over the entirety of the earth's surface. In particular, certain recommendations made by ViaSat for license conditions intended to enforce aggregate EPFD limits would prove impractical or unduly burdensome for Audacy's Relay Network.

ViaSat expresses concern regarding enforcement of aggregate EPFD limits to protect GSO operations.<sup>17</sup> To address this problem, ViaSat proposes the adoption of two license conditions on all NGSO applicants in the instant processing round. ViaSat first asks the Commission to “condition each Application grant on the outcome of the pending NGSO rulemaking proceeding in IB Docket No. 16-408,” and “require each authorized operator to comply with the rules, policies, and procedures adopted in and through the rulemaking.”<sup>18</sup> ViaSat further argues that “unless and until aggregate EPFD limits are adopted in both the uplink and downlink directions,” along with a means to apportion limits and suitable enforcement mechanisms, all NGSO operators should acknowledge that single-entry EPFD limits may be insufficient to protect the GSO arc, should be prepared to implement further reductions as necessary, and in the event of harmful interference, the Commission should hold each NGSO contributing to the interference jointly and severally responsible.<sup>19</sup>

Such conditions are not appropriate for an NGSO network using K-band spectrum solely for discrete feeder links, and should not be imposed upon Audacy. The ongoing proceeding in IB Docket No. 16-408 addresses the many technical and policy rules needed to implement service links, including broadband Internet to end user terminals, in certain K-band frequencies. Many of these rules do not apply to an in-space relay network, and would effectively prohibit the use of K-band frequencies for feeder service if imposed indiscriminately upon Audacy. For example, IB Docket No. 16-408 contemplates imposing an obligation on all licensees to provide “service worldwide for at least 18 hours every day,” in an effort “intended to foster seamless global

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<sup>17</sup> See ViaSat Petition at 8.

<sup>18</sup> ViaSat Petition at 9.

<sup>19</sup> *Id.*

communication networks.”<sup>20</sup> Such a rule cannot be applied to a relay network delivering aggregated traffic through narrowly tailored spot beams to only a handful of gateway earth stations. Similarly, holding Audacy “jointly and severally responsible” for EPFD-related interference events when its network involves only three Relay satellites and paired gateway earth stations that will be carefully articulated away from the GSO arc is unduly burdensome.

Protections for the GSO arc have been designed into Audacy’s Relay Network from its conception. The orbital period of the Relay satellites is exactly one-third of a sidereal day, which not only results in a repeating ground track for the orbits,<sup>21</sup> but also a repeating sky track as seen from the earth’s surface including from each of Audacy’s earth stations. The orbits’ 25° inclination ensures that each Relay appears to cross the GSO arc no more than twice per day as viewed from any location on the earth’s surface, and crucially will always appear to cross at exactly the same points in the GSO arc. Unlike other applicants in this processing round, whose NGSO satellites will appear from the earth’s surface to cross every point in the visible GSO arc necessitating coordination with all GSO operators, Audacy will only ever transmit towards two discrete points in the GSO arc from each earth station. Given that Audacy is only planning three earth stations, it will be impossible for Audacy’s Network to cause harmful in-line interference with the vast majority of GSO operators. In the event of a susceptible GSO satellite operating at any of the GSO crossing points, Audacy will coordinate with these operators on a case-by-case basis, employing spectrum-sharing methods including the Relay↔Relay inter-satellite links to ensure compatibility.

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<sup>20</sup> *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 at ¶ 35 (2016).

<sup>21</sup> *See* Audacy Narrative Exhibit at 14.

### **III. AUDACITY WILL PROTECT AUTHORIZED CO-FREQUENCY FIXED AND MOBILE SERVICE USERS**

#### **A. Audacity's Network is an Appropriate Use of the Inter-Satellite Service**

The ITU defines the inter-satellite service (“ISS”) as “A radiocommunication service providing links between artificial satellites.”<sup>22</sup> Audacity’s proposed system falls well within this definition of ISS, and the FCC has previously approved numerous applications for Earth-intersecting ISS services. That ITU power flux density (“PFD”) limits exist at all in this band<sup>23</sup> implies that ISS radiation is expected to illuminate the surface of the earth and has the potential to interfere with terrestrial use if not regulated. Further, the PFD limits are set at a certain level by international treaty, implying that emissions up to the specified limits can be tolerated by co-primary services. As shown in the following sections, Audacity’s use of the ISS poses little threat of harmful interference to co-primary terrestrial operators in the Fixed and Mobile services.

The Audacity Network’s Base Service will provide continuous connectivity to low earth orbit satellites at altitudes up to 1,500 km, necessitating forward link emissions towards these User satellites in a volume of space up above the earth’s surface. In a minority of cases, a User satellite will appear from the Relay satellites to be passing across the visible earth disc, so any forward link beam from the Relay to the User at that time would intersect the earth’s surface. The majority of the Relays’ coverage volume does not intersect the earth’s surface, thus earth-intersecting transmit beams are the exception rather than the rule.

Audacity will only transmit on beams that have a User satellite passing through them and when the operator of that User satellite has requested instantaneous command use of Audacity’s network. It is highly unlikely that the Network would have a sufficiently large number of Users,

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<sup>22</sup> ITU Radio Regulations, No. 1.22.

<sup>23</sup> *See* ITU Radio Regulations, Article 21.



all of whom are commanding their satellites simultaneously, to necessitate the concurrent operation of all Relay transmit beams, and such a case would likely be detrimental to the performance and lifetime of the Relays. Several comments on Audacy's application appear to have misunderstood that Audacy will not be continually transmitting towards the entire visible earth disc, instead briefly transmitting to individual User satellites on an as-needed basis.

Given the rapid orbital motion of the low Earth orbit User satellites, and to a lesser extent the Relay satellites, relative to the surface of the earth, any single location on the earth's surface would not be in the direct boresight of the Relay's transmit beam for more than an instant at a time.

In this respect, Audacy's use of the ISS bands differs substantially from the high-density FSS use proposed by many other systems being considered in the instant proceeding. Many proposed NGSO systems, including those planned by OneWeb, SpaceX, and Boeing, *do* plan to transmit towards much of the earth's surface at all times, and must coordinate with existing and planned terrestrial Fixed and Mobile systems to do so. Although Audacy proposes to provide service links in ISS rather than FSS frequency bands and, as explained above, only to a limited number of individual user satellites on an as-needed basis, it will follow similar protocols and employ similar coordination methods to mitigate the possibility of harmful interference with existing and planned terrestrial operators in the Fixed and Mobile services.

**B. Audacy Will Protect Co-Frequency Fixed and Mobile Service Users**

Elefante Group expressed concern about the potential for harmful interference between Audacy's inter-satellite service links and terrestrial Fixed and Mobile service operators in the

22.55-23.55 GHz band (“the 23 GHz band”).<sup>24</sup> Audacy has performed detailed analysis of the potential interference degradation resulting from Relay satellite → Base User satellite emissions into Fixed or Mobile operations for forward links (into a Fixed/Mobile user terminal or handset) and return links (into a Fixed/Mobile base station receiver), the results of which are shown below.

1. Interference into Fixed/Mobile Forward Link (user terminal or handset):

Satellite PFD		Worst-case		Typical	
User terminal Isolation		Worst-case	Typical	Worst-case	Typical
Parameter	Units	Value			
User Terminal Rx Noise Figure	dB	7.0 (Estimated)			
User Terminal Rx Noise Density	dBW/MHz	-139.0 ( $T_0 = 290$ K)			
User Terminal Rx Gain	dBi	13.0 (Estimated)			
User Terminal Rx Isolation	dB	0.0	6.0	0.0	6.0
Relay Satellite PFD at User Terminal	dBW/m <sup>2</sup> /MHz	-115.0		-119.6	
Power Received after User Terminal Antenna Gain	dBW/MHz	-150.7	-156.7	-155.3	-161.3
Interference : Noise, $I_{SAT}/N_{F/M}$	dB %	-13.7 4.25	-19.7 1.07	-18.4 1.46	-24.4 0.37
<b>Interference Degradation</b>	<b>dB</b>	<b>0.18</b>	<b>0.05</b>	<b>0.06</b>	<b>0.02</b>

<sup>24</sup> See Elefante Comments at 7-12.

2. Interference into Fixed/Mobile Return Link (base station):

Satellite PFD		Worst-case		Typical	
Base Station Isolation		Worst-case	Typical	Worst-case	Typical
Parameter	Units	Value			
Base Station Rx Noise Figure	dB	5.0 (Estimated)			
Base Station Rx Noise Density	dBW/MHz	-139.0 ( $T_0 = 290$ K)			
Base Station Rx Gain	dBi	27.0 (Estimated)			
Base Station Rx Isolation	dB	16	20	16	20
Relay Satellite PFD at Base Station	dBW/m <sup>2</sup> /MHz	-115.0		-119.6	
Power Received after Base Station Antenna Gain	dBW/MHz	-152.7	-156.7	-157.3	-161.3
Interference : Noise, $I_{SAT}/N_{F/M}$	dB	-13.7	-17.7	-18.4	-22.4
	%	4.25	1.69	1.46	0.58
<b>Interference Degradation</b>	<b>dB</b>	<b>0.18</b>	<b>0.07</b>	<b>0.06</b>	<b>0.03</b>

These results indicate that terrestrial Fixed and Mobile services and Audacy's ISS relay service can operate on a co-primary basis with less than 0.2 dB worst-case degradation (and typically less than 0.08 dB degradation) into existing and planned terrestrial links. This desirable band-sharing performance is achieved even under the following highly conservative operating conditions:

1. The Relay satellite is transmitting at the ITU's maximum allowed PFD for near-horizontal arrival angles in the worst case, and at the PFD level proposed by Audacy in the typical case. The former case is provided (and the resulting interference calculated) for reference only, as Audacy seeks Commission authority to operate only

at the power levels reflected in the typical case above, consistent with its Schedule S and Narrative exhibit. As described in its Application,<sup>25</sup> Audacy's Network will operate up to 10 dB below ITU and FCC PFD limits for this band, and thus well below the worst-case interference scenario shown above.

2. Atmospheric attenuation has been ignored. Given that Audacy's service links are satellite-to-satellite, power levels for Relay→User emissions are unaffected by earth's changing atmospheric characteristics. Audacy estimates that Relay emissions in the 23 GHz band would be attenuated by up to 7 dB as they pass through the atmosphere, further reducing the possibility of harmful interference into terrestrial receivers.
3. Terrestrial user terminals or handsets provide limited to no isolation from satellite emissions. Typical terrestrial service users would experience 6 to 10 dB isolation from satellite signals arriving at high elevation angles. Nevertheless, Audacy's analysis conservatively assumes no resulting isolation.

Certain commenters also expressed concern about the potential for harmful interference from Audacy's inter-satellite service into receivers operating in High Altitude Platform Stations ("HAPS") services in the 24.45-24.75 GHz band ("the 24 GHz band"), which is one of several bands under consideration for HAPS allocation in ITU Region 2 under WRC-15 Resolution 160.<sup>26</sup> Audacy proposes to use this 300 MHz band for service links between Relay satellites and Advanced User satellites, and notes that it represents less than 6% of the total spectrum being considered for United States HAPS use. As described in Audacy's Application,<sup>27</sup> the Advanced

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<sup>25</sup> See Audacy Narrative Exhibit at 76.

<sup>26</sup> See Elefante Comments at 12-13.; Facebook Comments at 3. See also ITU RESOLUTION 160 (WRC-15): Facilitating access to broadband applications delivered by high-altitude platform stations, The World Radio Communication Conference (Geneva, 2015), available at [https://www.itu.int/dms\\_pub/itu-r/oth/0c/0a/R0C0A00000C0015PDFE.pdf](https://www.itu.int/dms_pub/itu-r/oth/0c/0a/R0C0A00000C0015PDFE.pdf).

<sup>27</sup> See Audacy Narrative Exhibit at 19.

service consists of four narrow independently steerable beams per Relay tracking User satellites across the Relay's field of view. Steering towards a minority of this service volume would result in transmit beams intersecting the surface of the earth.

As described in Audacy's Application, Relay satellites will transmit well below ITU/FCC PFD limits in both 23 GHz and 24 GHz ISS bands, and with roughly 10 dB/m<sup>2</sup>/MHz lower PFD in the latter than in the former.<sup>28</sup> Given that User satellites orbit at speeds of up to 17,500 miles per hour relative to the earth's surface, the small number of Audacy's Advanced beams, and their narrow earth-intersecting footprint, no single point on the earth's surface will be illuminated in the 24 GHz band for more than an instant at a time. Given the highly conservative interference analyses performed above in the 23 GHz band between Audacy's ISS services and Fixed and Mobile receivers which showed minimal interference degradation, Audacy is confident that its proposed system is fully compatible with, and not a cause of harmful interference to, any future HAPS systems that may emerge in the 24 GHz band.

The ITU has tasked Working Group 5C with recommending deployment and technical characteristics of broadband HAPS, and proposing example methodologies to be used for sharing and compatibility studies between HAPS and co-primary services including ISS. Audacy is following the group's progress and output, and will endeavor to comply with any relevant limits, interference mechanisms, and recommendations as they are proposed and ratified by the ITU.

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<sup>28</sup> See Audacy Schedule S.

**C. Elefante Group’s Intended Use of the 22.55-23.55 GHz Band Conflicts with the U.S. Table of Frequency Allocations and Service Rules and Should Not Delay Favorable Action on Audacy’s Application**

Elefante Group’s comments express concern that Audacy inter-satellite communications in the 23 GHz band may affect “its planned stratospheric platforms” in the band.<sup>29</sup> Given that no allocation or service rules exist for High Altitude Platform Stations (“HAPS”)<sup>30</sup> in the 23 GHz band, and that no HAPS allocation or service rules are actively under consideration for the band, Elefante Group’s comments appear to be an effort to circumvent the Administrative Procedure Act<sup>31</sup> and FCC rulemaking process and International Telecommunications (“ITU”) World Radio Conference (“WRC”) protocols and carve out a future home for a speculative technology that may or may not prove viable and compatible with existing spectrum uses.<sup>32</sup> Elefante Group’s proposal falls far outside the narrow scope of the instant proceeding. To the extent that Elefante Group submits a petition for rulemaking seeking to create a new HAPS allocation in the 23 GHz band and complementary service rules, Audacy reserves the right to participate in such a proceeding, should the Commission initiate one. In the interim, the Commission should not delay favorable action on Audacy’s pending application in the instant proceeding, which is materially complete, consistent with U.S. and international allocations, and compatible with approved incumbent spectrum uses.

No HAPS allocation or FCC service rules exist for the 23 GHz band in the U.S., nor is such an allocation being considered before the ITU under Resolution 160 (WRC-15) in any ITU

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<sup>29</sup> Elefante Comments at 11.

<sup>30</sup> The ITU Radio Regulations define HAPS as “a station located on an object at an altitude of 20 to 50 km and at a specified, nominal, fixed point relative to the Earth.” ITU-RR, No. 1.66A.

<sup>31</sup> See 5 U.S.C. § 553 (requiring notice and opportunity for interested persons “to participate in the rulemaking through submission of written data, views or argument”).

<sup>32</sup> Audacy cannot find any evidence of meaningful research and development conducted by Elefante Group.

Region. Accordingly, at present, Elefante Group's proposed use of the 23 GHz band to deploy HAPS is speculative and impermissible under current radiofrequency allocations and service rules in the U.S. and elsewhere, which authorize only inter-satellite service and terrestrial fixed and wireless services in the band.

To ensure that spectrum is efficiently utilized and to minimize interference and other technical issues, the Commission's historic practice has been to initiate a formal rulemaking proceeding to allow adequate notice and comment prior to adopting service rules and authorizing operation in a given spectrum band.<sup>33</sup> The process to create a HAPS allocation and service rules in the U.S. would involve a party filing a petition for rulemaking that provides a substantive technical and policy basis for the expectation that the 23 GHz band can accommodate a HAPS service, and that demonstrates how the public interest will be served by such an allocation. Were the FCC to find such a petition persuasive, it would initiate a rulemaking and seek public comment. A public record would subsequently develop to inform the FCC on the merits of HAPS operation in the 23 GHz band.

In the instant situation, Elefante Group has not taken even the first step towards creating an allocation and service rules for HAPS in the 23 GHz band, openly acknowledging that it plans to meet with Commission staff to discuss its plans for the first time at an unspecified future date.<sup>34</sup> Accordingly, Elefante Group's comments appear to serve as a mechanism to circumvent established FCC rulemaking practices by creating a placeholder or marker for a speculative

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<sup>33</sup> See, e.g., *Serv. Rules for Advanced Wireless Servs. in the 1.7 GHz & 2.1 GHz Bands*, Report & Order, 18 FCC Rcd 25,162, 25,164 (¶1) (2003) (explaining that service rules for AWS will "ensure that this spectrum is efficiently utilized and will foster the development of new and innovative technologies and services, as well as encourage the growth and development of broadband services").

<sup>34</sup> Elefante Group Comments at 3.

HAPS service for which almost no specifics are known at present beyond Elefante Group's cursory description, and for which the merits and public benefits have not been evaluated.

Should Elefante Group proceed with its proposal and petition the Commission to create an allocation and service rules for HAPS in the 23 GHz band, Audacy reserves its right to participate in such a proceeding and looks forward to providing technical and policy inputs at that juncture. Should such a rulemaking result in an eventual allocations and service rules for HAPS, Audacy similarly looks forward to engaging and coordinating with any HAPS systems that may emerge in this band. In the interim, however, the Commission should summarily dismiss Elefante Group's comments as they relate to Audacy's Application. Audacy cannot and should not be expected to undertake a meaningful interference analysis with a service not authorized (or even contemplated) for a band, and for which no allocation, service rules or technical parameters have been proposed.

To the extent that Elefante Group wants to press forward with its HAPS initiative on a more expeditious basis, Audacy respectfully suggests the operation of stratospheric stations in bands already allocated or earmarked for HAPS (In ITU Region 2: 47.2-47.5, 47.9-48.2 GHz already allocated, 21.4-22, 24.25-27.5, 38-39.5 GHz under consideration).

#### **IV. FUTURE MINOR AMENDMENTS TO APPLICATION AND SCHEDULE-S**

In their petition, Iridium noted the challenges associated with coordinating two networks which both provide full global coverage.<sup>35</sup> Audacy has opened discussions with Iridium to resolve the issues and expects to reach a mutually agreeable solution, and expects to file a minor modification that removes the 23.18-23.38 GHz band currently used by Iridium for inter-satellite links from Audacy's pending NGSO application. Audacy will concurrently amend its Schedule S

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<sup>35</sup> See Iridium Petition at 4.



to reflect this change, and anticipates that this amendment will satisfy Iridium's objection to Audacy's proposed network and that they will withdraw their petition.

SES/O3b's comments identify a ministerial oversight in Audacy's Schedule S.<sup>36</sup> Audacy's K<sub>a</sub> band ground-to-space command beams (identified as GRL0 and GRR0) are incorrectly referenced as occupying 27.5-30 GHz in the Schedule S Operating Frequency Band section. The correct uplink band is identified in Audacy's Narrative Exhibit as 29.5-30 GHz.<sup>37</sup> Audacy will amend its Schedule S to correct this inadvertent error.

#### **V. AUDACY'S APPLICATION SATISFIES THE OBLIGATION FOR A COMPREHENSIVE PROPOSAL UNDER FCC RULE SECTION 25.114(a)**

Audacy's Application satisfies the requirement to submit a "comprehensive proposal" as required by Section 25.114(a) of the Commission's Rules and is otherwise materially complete. Future User satellites will not affect Relay satellite emissions as they will conform to existing Relay waveforms and not the other way around. Authority to operate such satellites will be addressed on a case-by-case basis when individual satellite operators seek regulatory approval to become Users of Audacy's Network and communicate with Audacy Relays. Given that the characteristics of Audacy's Relays are known and not affected by future User satellites, it is possible in a "comprehensive" manner to understand and evaluate Audacy's Network.

In this respect Audacy's Network is similar to the many communications networks where the precise characteristics of the end users are variable or unknown at the time of filing and deployment. Beyond government satellite networks such as the Tracking and Data Relay Satellite System (TDRSS), the Deep Space Network (DSN), or Near Earth Network (NEN), all

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<sup>36</sup> See SES/O3b Comments at 4.

<sup>37</sup> See, e.g., Audacy Narrative Exhibit at 2.

of which serve a wide variety of user spacecraft often deployed decades after the network itself, many networks in the Fixed, Mobile, Fixed Satellite, and Mobile Satellite services provide service links to thousands of cellphones, VSAT terminals, satellite phones, handsets, and other mobile and transportable end user terminals of varying designs, the signal characteristics of which are not known or required at coordination of the parent network.

## **VI CONCLUSION**

Audacy's proposed satellite data relay system will bring affordable and much-needed continuous communication services to the commercial satellite market, a capability previously reserved only for governments and their contractors. As demonstrated in Audacy's Application and further supported herein with sound technical and legal rationale, Audacy's Network complies with all Commission rules and is designed for effective compatibility with other GSO, NGSO, and terrestrial systems. Audacy urges the FCC to deny petitions filed by ViaSat and Telesat and proceed with the processing of Audacy's application as expeditiously as possible.

Respectfully submitted,

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July 7, 2017

## ENGINEERING CERTIFICATION

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

1. I am the technically qualified person responsible for the engineering information contained in the foregoing Opposition and Response,
2. I am familiar with Part 25 of the Commission's Rules, and
3. I have prepared and reviewed the engineering information contained in the foregoing Opposition and Response, and it is complete and accurate to the best of my knowledge and belief.

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## CERTIFICATE OF SERVICE

I, Denise Wood, hereby certify that on this 7th day of July, 2017, I served a true copy of the foregoing Opposition and Response of Audacy Corporation via first-class mail upon the following:

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