Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	IBFS File Nos. SES-LIC-20210323-00557; SES- LIC-20210323-00558; SES-LIC-20210323- 00559; SES-LIC-20210402-00613; SES- LIC-20210402-00614; SES-LIC-20210402- 00609; SES-LIC-20210402-00610; SES-LIC-20210402-00611; SES-LIC-20210416- 00706; SES-LIC-20210416-00707; SES- LIC-20210416-00708; SES-LIC-20210416- 00709; SES-LIC-20210416-00713; SES-LIC-20210416-00715; SES-LIC-20210719- 01082; SES-LIC-20210719-01083; SES- LIC-20210416-00714
Viasat, Inc.	)	
Applications for Earth Station Licenses	)	
	)	Call Signs: E210056; E210057; E210058; E210067; E210068; E210063; E210064; E210065; E210094; E210095; E210096; E210097; E210098; E210100; E210128; E210129; E210099

OPPOSITION OF VIASAT, INC.

Viasat, Inc. ("Viasat") submits this opposition to the petition filed by Verizon regarding the above-referenced applications, in which Viasat seeks authority to operate gateway-type earth stations in frequencies including the 27.5-28.35 GHz band segment (the "Applications"). In its petition, Verizon requests that the Commission defer grant of the Applications until Viasat has submitted additional technical information related to sharing with Upper Microwave Flexible Use Services ("UMFUS").[1] This request is without merit. Verizon fails to establish any deficiency in the technical demonstrations included in the Applications, and Viasat has amply demonstrated that its proposed earth stations satisfy the criteria in Section 25.136(a).

[1] *See* Petition of Verizon, File Nos. SES-LIC-20210323-00557 through 00559; SES-LIC-20210402-00609 through 00611, -00613, -00614; SES-LIC-20210416-00706 through -00709, -00713 through 00715; SES-LIC-20210719-01082, -01083, at 3, 5 (filed Sept. 3, 2021) ("Verizon Petition").

Verizon's petition rests on the demonstrably false claim that Viasat's Applications "do not provide any information regarding the assumptions it used to model clutter loss or compute its earth stations' contours . . . ."[2] Contrary to Verizon's erroneous assertion, each Application includes an exhibit describing the methodology that Viasat used for these purposes ("Explanatory Addendum").[3] More specifically, that exhibit details Viasat's use of the Irregular Terrain Model ("ITM") developed by the National Telecommunications and Information Administration ("NTIA"), and explains how Viasat used the ITM to calculate PFD contours to reflect terrain, clutter and shielding.

The use of the ITM in this fashion is fully consistent with Section 25.136 and related Commission guidance, which does not prescribe the use of any particular propagation model and instead "encourage[s] use of" those that are "widely accepted and publicly available."[4] Viasat has done just that in selecting the ITM, which "is an accepted [FCC] model and was assessed to produce conservative results (low path loss) for propagation paths for the site-specific geometries analyzed."[5] And Viasat has been transparent with respect to how it has used the ITM—*e.g.,* Viasat has discussed at length the use of the ITM in this context with Commission staff in both the International Bureau and Wireless Telecommunications Bureau, as well as with representatives of NTIA. Viasat included the Explanatory Addendum and revised the calculation

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[2] *Id.* at 3.

[3] A copy of the Explanatory Addendum is attached here as reference but can be found in each of the Applications.

[4] *International Bureau Issues Guidance on Siting Methodologies for Earth Stations Seeking to Operate in the 24.75-25.25 GHz, 27.5-28.35 GHz, 37.5-40 GHz, 47.2-48.2 GHz, and 50.4-51.4 GHz Frequency Bands to Demonstrate Compliance with Section 25.136*, Public Notice, 35 FCC Rcd 6347, at 3 (2020) ("*Siting Methodology Guidance*").

[5] *See* Explanatory Statement at 1.

methodology for clutter and shielding in the PFD computation in response to Commission staff requests in those discussions.

Verizon's other claim[6] that the actual contours could exceed Viasat's predictions and potentially infringe on restricted roadways and railway lines is entirely unsupported and is contradicted by Viasat's demonstrations of compliance. To be sure, there may be some variation between predicted and actual contours, but because Viasat has selected a conservative propagation model, the actual contours would, if anything, be smaller than the predicted contours reflected in the Applications. Given the conservative nature of Viasat's analyses, there is no reason to artificially magnify the risks of interference as Verizon suggests.[7]

Further, Verizon fails to recognize that Viasat has provided in each Application the input parameters and calculations to produce the measured gain patterns for the proposed earth stations that serve as the inputs to the propagation model.[8] Viasat thus has provided all information "to allow for independent verification of the results of the propagation models used to generate the PFD contours and protection zones."[9] And Viasat has already "provided updated contours and the assumptions and data upon which its calculations are based."[10]

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[6] *See* Verizon Petition at 4-5.

[7] In any event, Verizon's concerns can be addressed through routine conditions that the Commission has imposed on earth stations in bands shared with UMFUS, requiring licensees "to take corrective action to mitigate interference in the 27.5-28.35 GHz frequency band if the actual PFD, at ten meters above ground level, exceeds -77.6 dBm/m2/MHz anywhere outside the contour specified in the application." *See, e.g.*, SpaceX Services, Inc., File No. SES-LIC-20190816-01062, Call Sign E190648, Condition 90530 (granted July 30, 2021).

[8] *See* Applications, Exhibit A Technical Annex at 1.

[9] *Siting Methodology Guidance* at 3.

[10] Verizon Petition at 5.

Verizon thus has raised no issue warranting deferral of the Commission's grant of the Applications. Viasat respectfully requests that the Commission proceed to process the Applications to a grant without further delay.

Respectfully submitted,

/s/

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September 16, 2021

USE OF IRREGULAR TERRAIN MODEL (ITM) FOR COORDINATING EARTH STATIONS WITHIN 1 KM

Viasat has engaged RKF Engineering Solutions, LLC (RKF) to determine the model to calculate contours around each Satellite Access Node (SAN) earth station which exceeds a power flux density (PFD) of -77.6 dBW/m^2/MHz.

RKF relied upon the National Telecommunications and Information Administration (NTIA)'s Irregular Terrain Model (ITM)[5] to compute the power densities from these transmitting earth stations / SANs for distances greater than 100 m. The ITM model was selected in large part because it is an accepted Federal Communications Commission (FCC) model and was assessed to produce conservative results (low path loss) for propagation paths for the site-specific geometries analyzed, thereby building confidence in the ability to achieve successful spectrum sharing. For elevation and terrain data RKF relied upon the 5-meter NEXTMap[6] Elevation data suite.

In choosing ITM, there were several considerations. First, the Defense Information System's Agency (DISA) Spectrum Sharing Test and Demonstration (SSTD) working group, made up of many Government stakeholders, uses 2D terrain path loss models for predicting clutter in the band 1.755 to 1.780 GHz, for rural and suburban areas. These predictions were shown to be accurate when compared to measurements in the band. In the paper, *"What are the underlying calculations, parameters, and assumptions for the Longley-Rice (ITM) propagation model?*[7], the nominal frequency range for the ITM model is listed as 20 MHz to 40 GHz. While the upper limit was modified to 20 GHz in some later documentation, 28 GHz frequencies, within these topologies, conform to the model.

While the ITM doesn't explicitly account for loss within the first kilometer, the model's formulas were used in association with the NEXTMap data. Specifically, to improve the fidelity of the estimates, NEXTMap terrain and clutter data were calculated from 100 m from the SAN sites. In his doctoral thesis, Kasampalis Stylianos[8] reviews many diffraction models including ITM and observed that the ITM model can be used for distances as low as 200 meters.

The probability of reflections in rural and suburban areas is low at higher frequencies and reflections tend to attenuate quickly at these frequencies if they aren't close to the direct path.

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[5] Model available at https://github.com/NTIA/itm

[6] https://www.intermap.com/nextmap

[7] "What are the underlying calculations, parameters, and assumptions for the Longley-Rice (ITM) propagation model?" September 24, 2013, in RF Engineering Article, (https://www.softwright.com/knowledgebase/faq/underlying-calculations-parameters-assumptions-longley-rice-itm-propagation-model/)

[8] "Modelling and Coverage Improvement of DVB-T Networks," A thesis submitted for the degree of Doctor of Philosophy by Kasampalis Stylianos, March 2018

Furthermore, an accepted 3D model that accurately predicts loss is not available and the 5-meter NEXTMap data does not have enough resolution to predict reflections accurately. Consequently, a 3D model was not employed.

To demonstrate the conservative nature of the ITM model used, simulations were performed with a series of single knife edge terrain path, where the knife edge height was assumed to be 2 m. The table below compares the knife edge diffraction loss to the ITM predicted loss (ITM path loss minus free space loss) for paths equal to or less than 1 km. In all but one case shown, the ITM model significantly underestimates the loss compared to the knife edge prediction.

Frequency	Total Path Distance	Distance to Knife Edge	Knife Edge Loss	ITM Predicted Loss
GHz	meters	meters	dB	dB
28	1000	250	19.02	16.2
18	1000	250	17.28	10
28	800	200	19.94	14
18	800	200	18.15	8.4
28	500	100	22.57	23.6
18	500	100	20.71	15.1
28	200	60	25.33	7.3
18	200	60	23.43	3.5

In summary, the ITM propagation model is well-accepted by regulators and has been used in many instances up to the frequencies associated with the SANs under consideration and down to distances below 1 km, where results were shown to be conservative for pathloss thereby helping to build confidence in successful sharing with these earth station nodes.

CERTIFICATE OF SERVICE

I, Kayla Ernst, hereby certify that on this 16th day of September 2021, I caused to be served a true copy of the foregoing Opposition of Viasat, Inc. via first-class mail upon the following:

Daudeline Meme
Vice President & Associate General Counsel
Federal Regulatory & Legal Affairs
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/s/
Kayla Ernst