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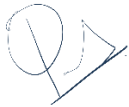
Subject: SpaceX and Starlink India's Response to Consultation Paper on
"Assignment of Spectrum in E&V Bands..."

Dear Sir,

Please find enclosed our response to the ongoing consultation on the crucial issue of assignment of spectrum in E&V bands. It is critical that TRAI and the Government of India ensure and prioritise availability of E-band spectrum for use by FSS gateway earth stations on a non-exclusive basis in any plans for the assignment of this spectrum.

We thank the TRAI for this opportunity to provide comments.

Sincerely,



Parnil Urdhwareshe
Director
Starlink Satellite Communications Private Limited

Visit us at www.starlink.com and www.spacex.com

SpaceX Response to TRAI Consultation on Assignment of Spectrum in E&V Bands, and Spectrum for Microwave Access (MWA) & Microwave Backbone (MWB)

SpaceX and its local subsidiary, Starlink India, thank the TRAI for the opportunity to comment on the crucial issue of assignment of spectrum in E&V bands.

The importance of next-generation satellite networks to universal broadband connectivity has been acknowledged repeatedly by the Government of India. The anticipation of these services has also been demonstrated by the intense industry participation (as well as very high degree of public interest) in TRAI's other consultation on assignment of spectrum for space-based communications services.

It is thus absolutely critical that TRAI and the Government of India ensure and prioritise availability of E-band spectrum for use by FSS gateway earth stations on a non-exclusive basis in any plans for the assignment of this spectrum.

Several of the world's largest satellite operators (including SpaceX) are taking substantial steps in preparation for providing Indian citizens with universal access to broadband of the quality that urban users currently take for granted. Ensuring that next-generation satellite systems have access to spectrum (now and in the future) is the single most important factor towards achieving this shared goal.

SpaceX and Starlink India submit that ensuring non-exclusive and shared access to E-band spectrum for next-generation satellite services -

1. Will lead to substantial improvements to service quality, enable cost-effective and efficient operations, and create parity in quality of connectivity irrespective of infrastructure;
2. Will not preclude simultaneous use by other terrestrial or satellite operators; and
3. Can be achieved through a database-assisted and light licensing framework.

As the TRAI notes, the ability of fixed-satellite services and terrestrial services to exist with ease in these bands has already been well-recognised. Authorizing NGSO satellite operators to augment their traditional Ka-band gateways with ultra-high-capacity E-band spectrum will bring large, near-term benefits for Indian consumers and the broader satellite market through -

- **Improved service quality:** E-band spectrum provides 10 GHz of additional, contiguous spectrum capacity to support robust backhaul links for consumers and businesses. This additional capacity will be essential to meet growing demand for bandwidth-intensive applications, including remote work, education, health care, and government services. It also will be critical to ensure that consumers in rural and remote areas of India can enjoy a similar quality of broadband service as their urban counterparts.
- **Increased choice:** By increasing the number of consumers who can be served and the quality of service for end users, E-band spectrum will allow satellite operators to better provide services at par with other fixed broadband options, including terrestrial broadband. Providing such additional choices for consumers to meet their connectivity needs will in turn drive innovation among operators, as well as enable more affordable prices for consumers.
- **Efficient operations:** The propagation characteristics of E-band links result in extremely efficient "pencil beams" that can use the entire allocated bandwidth while coexisting within close proximity to other users—including terrestrial fixed links and other satellite operators. As such, authorizing satellite operators to use E-band will

provide an efficient option to expand capacity for consumers without impairing or foreclosing future consumer value in the band, including through 5G backhaul and additional satellite operators.

- **Cost-effective deployment:** As an intensively used but spectrally limited band, Ka-band provides a natural limit on the number of consumers that a specific gateway can serve. Augmenting Ka-band capacity with 10 GHz of E-band spectrum will allow satellite operators to connect substantially more consumers with each gateway.

Additionally, higher-capacity gateways — in conjunction with the addition of inter-satellite links — will be crucial to serve maritime and aviation customers in India with the same high-quality service that fixed site users enjoy.

We have provided responses to select questions within this consultation in the following pages. We reiterate however, **the importance of ensuring and prioritizing the availability of E-band spectrum for use by FSS gateway earth stations on a non-exclusive basis in *any plans* for the assignment of this spectrum.**

Responses to Select Questions / Issues

Q23. What quantum of spectrum in E-band (71-76 / 81-86 GHz) and V- band (57-64 GHz) is required to meet the demand of TSPs with Access Service License/ Authorization? Whether spectrum in E-band and V- band is also required by the TSPs other than Access Service License/ Authorizations, and other entities (non-TSP, for non-commercial/ captive/ isolated use)? Information on present demand and likely demand after five years may kindly be provided as per the proforma given below:

(i) Present demand

Band	Quantum of spectrum required (per entity per LSA)		
	TSPs with Access Service License/ Authorization	TSPs with other than Access Service License/ Authorization	Other entities (non-TSP, for non- commercial/ captive/ isolated use)
E-band (71-76/81-86 GHz)			
V-band (57-64 GHz)			

(ii) Likely demand after five years

Band	Quantum of spectrum required (per entity per LSA) -		
	TSPs with Access Service License/ Authorization	TSPs with other than Access Service License/ Authorization	Other entities (non-TSP, for non- commercial/ captive/ isolated use)
E-band (71-76/81-86 GHz)			
V-band (57-64 GHz)			

There is an urgent and essential need for TRAI to ensure and protect shared access to E-band spectrum for next-generation satellite networks.

It has already been well-established during the TRAI consultation on assignment of spectrum for space-based services that satellite spectrum (including within the Ka-band) can be simultaneously used by numerous satellite operators on a shared basis. At the same time, the total capacity that can be unlocked by any one satellite FSS gateway station within the Ka-band is still finite.

As next-generation systems such as Starlink finally enable affordable broadband access for millions of unconnected people around the world, consumer demand from users unserved by terrestrial networks will soon begin to outstrip the carrying capacity achievable within satellite backhaul spectrum such as in the Ka-band.

To keep pace with consumers' growing need for high-speed, low-latency service (as well as adequate capacity for emergencies), **the TRAI must prioritise opening E-band spectrum up to shared use by FSS gateway earth stations as well, and must certainly not preclude next-generation satellite services from being considered in this present assessment for the assignment of E-band immediately.**

There is already immediate and high demand for E-band spectrum in satellite operations around the world. SpaceX's second-generation constellation is currently being deployed and will make use of spectrum in the E-band for gateway earth stations to meet the growing demand of consumers for next-generation satellite service. Satellite industry groups in the United States (such as the *Satellite Industry Association*) and Australia (such as the *Communications Alliance Satellite Services Working Group*) have identified E-band as a *critical* band for next-generation satellite networks that are currently coming to market, which is further evidenced by several ITU satellite filings for access to spectrum in the band.

SpaceX thus supports and strongly recommends including access to the **entire 10 GHz of spectrum for NGS0 gateway earth stations at specific sites**. As further discussed in our responses to Questions 24, 25 and 33, a model of coordinated light licensing would allow satellite backhaul services to exist alongside other terrestrial uses.

(i) Present demand

Band	Quantum of spectrum required (per entity per LSA)		
	TSPs with Access Service License/ Authorization	TSPs with other than Access Service License/ Authorization	Other entities (non-TSP, for non- commercial/ captive/ isolated use)
E-band (71-76/81-86 GHz)		Gateway earth stations for next-generation satellite networks require shared access to the entire quantum of spectrum from 71-76 GHz (space-to-Earth) and 81-86 GHz (Earth-to-space) .	
V-band (57-64 GHz)			

(ii) Likely demand after five years

Band	Quantum of spectrum required (per entity per LSA) -		
	TSPs with Access Service License/ Authorization	TSPs with other than Access Service License/ Authorization	Other entities (non-TSP, for non- commercial/ captive/ isolated use)
E-band (71-76/81-86 GHz)		Gateway earth stations for next-generation satellite networks require shared access to 71-76 GHz (space-to-Earth) and 81-86 GHz (Earth-to-space) .	

V-band (57-64 GHz)			
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Q24. Whether spectrum in E-band and V-band should be assigned exclusively on an LSA-basis, or on P2P link basis? Response may be provided separately for (i) TSPs with Access Service License/ Authorization, (ii) TSPs other than Access Service License/ Authorization, and (iii) other users (non-TSP, for non-commercial/ captive/ isolated use) in the table given below with detailed justification.

No. The TRAI must not provide exclusive licensing for access to the E-band to the elimination of shared use by next-generation satellite networks.

As the TRAI has already and correctly noted in the consultation paper, the high-gain, narrow “pencil beam” properties of links in the 70/80 GHz band make exclusive licensing entirely unnecessary in managing interference. Indeed, exclusive licensing of such readily shareable and reusable spectrum is extremely undesirable and will only hinder the deployment of innovative consumer services that can flourish in India through shared use of these bands.

- **ITU Recommendation ITU-R F.2006** notes that in the 70/80 GHz band, “*high directivity antennas are achievable even with small size antennas, increasing the density of equipment and further reducing risk of interference with same and other services.*”
- Europe’s **ECC Rec. (05)07** supports this conclusion, finding that due to the “*inherent reduced interference occurrence probability*” in the 70/80 GHz band, “[m]ultiple services and applications can be implemented, with simplified coordination mechanisms, ensuring highly efficient re-use of the frequency band.”²
- The United States’ **Federal Communications Commission** adopted a light-licensing framework for the 70/80 GHz band in 2003, noting that links in the band “*may be engineered to operate in close proximity to other systems so that many operations can co-exist in the same vicinity without causing interference to one another.*” It thus strongly supported non-exclusive licensing coupled with a link registration process to protect earlier-in-time links.³

Because “pencil beam” links in the band can readily coexist, the ITU, CEPT, and United States have all recommended flexible channel plans that permit aggregation of channels up to the full 10 GHz of spectrum. Common operator-to-operator coordination techniques can effectively mitigate harmful interference, even where deployed links operate in close proximity (or are co-linear). This provides operators with the maximum flexibility to design their networks to best meet consumer needs.

Exclusive licensing is also out-of-step with international best practices for efficient licensing of 70/80 GHz spectrum –

- **ECC Rec. (05)07** recommends considering light-licensing as a flexible way to manage 70/80 GHz spectrum, and the Belgian telecom regulator (BIPT) has already integrated this into Belgium’s national frequency plan.⁴ In its long-running survey of 70/80 GHz licensing around the world, the European Telecommunications Standards Institute (ETSI) noted that light-

¹ ITU-R Recommendation F.2006: “Radio-frequency channel and block arrangements for fixed wireless systems operating in the 71-76 and 81-86 GHz bands.”

² CEPT/ECC/Recommendation (05)07: “Radio frequency channel arrangements for Fixed Service Systems operating in the bands 71-76 GHz and 81-86 GHz,” 1 (May 2013) (“ECC Rec. (05)07”).

³ See *Allocations and Service Rules for 71-76 GHz, 81-86 GHz and 92-95 GHz Bands*, 18 FCC Rcd 23318, ¶¶ 44-45 (2003).

⁴ *Id.* at 1; Belgian Frequency Plan, available at <https://www.bipt.be/operators/frequency-plan> (last visited February 2022).

licensing represents the predominant means of licensing in the 70/80 GHz band.⁵ In Europe, even where national regulators have not adopted light-licensing, most *have* adopted a simple link-by-link coordinated approach instead of auctioning or granting exclusive spectrum rights.

- In the United States, the database-assisted light-licensing process accommodates *hundreds* of licensees and *tens of thousands* of registered links, including deployments in dense urban environments.⁶ Importantly, the U.S. is actively seeking “*to take advantage of the highly directional signal characteristics of these bands, which may permit the coexistence of multiple types of deployments*” to expand the light-licensing regime in order to accommodate new non-terrestrial services alongside 5G wireless backhaul (rather than consider the shift to an exclusive licensing model).

Auctioning spectrum in the 70/80 GHz E-band spectrum for use by next-generation satellite networks is entirely unnecessary. Drawing from these international experiences, the TRAI can clearly accommodate both India’s mobile telecom operators and other prospective users within the 70/80 GHz band through a flexible light-licensing regime that does not need to resort to exclusive licensing and the resultant harm to a vibrant and multi-service communications market.

Instead, operators can readily self-coordinate, including through the sorts of database-assisted light-licensing regimes that have been so successful in managing coexistence while enabling wide channels in the 70/80 GHz band. Indeed, by shifting to a light-licensing framework, the TRAI would enable mobile operators to leverage *even wider* channels to support 5G backhaul networks than under the current exclusive licensing regime.

Microwave bands	Spectrum should be assigned for the entire LSA on exclusive basis, or on P2P link basis for -		
	TSPs with Access Service License/ Authorization	TSPs with other than Access Service License/ Authorization	other entities (non-TSP, for non-commercial/ captive/ isolated use)
E-band (71-76/81-86 GHz)		Non-exclusive access via P2P link assignment for next-generation satellite services.	
V-band (57-64 GHz)		Non-exclusive access via P2P link assignment for next-generation satellite services.	

⁵ See Mario Giovanni Luigi Frecassetti, “E-Band - Survey on Status of Worldwide Regulation,” ETSI White Paper No. 37, 15-16 (September 2020) (noting that even link-by-link coordination is functionally “closer to a light licensing regime”).

⁶ As of June 2020, there were over 650 licensees and 18,000 registered links in the 70/80 GHz band in the US, and by October 2021 there appeared to be nearly 24,000 registered links in the database. See Modernizing and Expanding Access to the 70/80/90 GHz Bands, WT Docket No. 20-133, Notice of Proposed Rulemaking, 35 FCC Rcd 6039, ¶ 5 (2020) (NPRM) (data as of March 2020).

Q25. Do you agree that the issues relating to the assignment of E-band and V-band for space-based communication services and its coexistence with terrestrial networks may be taken up at a later date? If not, the concerns and measures to overcome such concerns may kindly be suggested with relevant details.

No. The TRAI must absolutely not preclude the assignment of E-band and V-band for space-based communications from the present discussion. SpaceX submits that it is entirely possible, feasible, and extremely desirable to enable shared access to E-band spectrum for next-generation satellite networks while ensuring reasonable co-use by other terrestrial services.

The use of E-band spectrum by next-generation satellite networks is a reality today. SpaceX has begun deploying satellites with E-band capability as part of its second generation (Gen2) satellite system. As such, SpaceX would be able to immediately begin using the E-band to provide Starlink services in India.

With respect to the TRAI's reference of **ITU Resolution 178 (WRC-19)** that calls for '*Studies of technical and operational issues and regulatory provisions for non-geostationary fixed-satellite service satellite system feeder links in the frequency bands 71-76 GHz (space-to-Earth and proposed new Earth-to-space) and 81-86 GHz (Earth-to-space)*', **several countries have already begun making use of or preparing to make use of the E-band for satellite feeder links -**

- **United States.** The United States already authorizes next-generation satellite operators to license E-band for space and earth stations. For example, the US has issued default service rules⁷ that permit operators to license frequency bands for which the FCC has adopted a domestic frequency allocation (including E-band), but *before* any frequency-band-specific service rules have been adopted for that frequency band. The default service rules framework requires operators to coordinate with co-primary terrestrial and government users before obtaining a license, based on generally applicable coordination procedures and protection criteria set forth in the ITU Radio Regulations.

While E-band is already authorized for satellite operators, as a part of its ongoing *70/80/90 GHz Modernization* proceeding, the FCC has been exploring ways to better facilitate coordination between terrestrial and non-terrestrial users in the band. SpaceX, Amazon, the Satellite Industry Association, the Dynamic Spectrum Alliance, and several High Altitude Platform System (HAPS) operators have advocated for the FCC to adopt a common light-licensing framework in the band that incorporates satellite gateways, building on the existing, successful self-coordinated light-licensing framework in the band. Comsearch, one of two third-party E-band database managers in the US, has confirmed that these gateways may be added with only minor, straightforward changes to the existing terrestrial light-licensing system. Importantly however, adopting this efficiency promoting framework is and was not a prerequisite for E-band licensing in the United States.

- **United Kingdom.** In November 2022, Ofcom released its Space Spectrum Strategy⁸, which identified high-level priorities for the agency in the near, medium, and long-term. Among its near-term priorities, Ofcom noted that it would "*consider options for the potential authorisation of E-band satellite gateways (80-86 GHz), alongside existing use of the band (i.e. fixed links).*"

⁷ 47 C.F.R. 25.217 – US Code of Federal Regulations Title 47, Chapter I, Subchapter B, Part 25, Subpart C, Section § 25.217 on "Default service rules".

⁸ OFCOM, "Space Spectrum Strategy", available at <https://www.ofcom.org.uk/consultations-and-statements/category-2/space-spectrum-strategy>

To that end, Ofcom stated that it would potentially consult on proposals for authorisation of E-band earth station gateways, although it recognized that international harmonization work was ongoing.

As the TRAI has already recognized in this consultation paper, SpaceX is not alone in its ability to improve satellite services using E-band (71-76/81-86 GHz) spectrum — other satellite operators are actively developing services that leverage the unique properties of the band.⁹

**Q33. Which methodology should be used for assignment of spectrum in E- band and V-band?
Response may be provided in the table given below:**

User category	Assignment methodology [Auction/ Administrative/ Any other (please specify)]	Justification
(i) TSPs with Access Service License/ authorization		
(ii) TSPs with other than Access Service license/authorization		
(iii) Other entities (non- TSP, for non-commercial/ captive/ isolated use)		

The TRAI must recommend a database-assisted light-licensing framework for all users in order to ensure assignment of and access to these spectrum bands by next-generation satellite services. Exclusive licensing in these bands would harm consumers and competition with no compensatory benefit. Exclusive licensing in the E-band — including through auction — is harmful to consumers and businesses that would otherwise be able to rely on services supported by E-band (71-76/81-86 GHz) backhaul, particularly in rural areas.

User category	Assignment methodology [Auction/ Administrative/ Any other (please specify)]	Justification
(i) TSPs with Access Service License/ authorization		
(ii) TSPs with other than Access Service license/authorization	<i>Database-assisted administrative light-licensing</i>	<i>See below</i>

⁹ See, e.g., Sam Morrar, "Using E-Band for Wideband Satcom: Opportunities and Challenges", *Microwave Journal*, 6, 13 August 2021, available at <https://www.hughes.com/sites/hughes.com/files/2021-08/Microwave-Journal-Aug-2021.pdf>.

<i>(iii) Other entities (non-TSP, for non-commercial/ captive/ isolated use)</i>		
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As the COVID-19 pandemic made clear, access to high-capacity, low-latency broadband at home is critical to participate in essential services such as telehealth, telework, remote education, and access to government services. Fixed wireless and fixed-satellite services that leverage the E-band for backhaul will play an incredibly important role in meeting the needs of these users in India, including in rural and remote areas.

An assignment method that limits all users (except a very small number of operators) to two small shared bands within a 10 GHz band of spectrum will needlessly undermine the primary benefit of the E-band (71-76/81-86 GHz) — massive bandwidth with highly efficient reuse¹⁰ — that the TRAI itself recognizes as the defining characteristic of this spectrum. It would thus deny up to 6 GHz of prime backhaul spectrum that could easily be used to support numerous customers and users of next-generation broadband networks at home and at work. Creating an exclusive licensing framework would harm consumers by limiting innovation, consumer choice, and healthy competition through shared use of the E/V bands (including from next-generation satellite services).

The ITU and CEPT have allocated the 70/80 GHz band on a co-primary basis to the fixed-satellite service, with specific interference protections in the 74-76 GHz band.¹¹ Over the past several years, satellite operators around the world have developed and applied for next-generation satellite networks that will rely on the unique properties of the these band for high-capacity gateway links to meet the growing needs of consumers for bandwidth-intensive applications, including in rural areas.¹² Today there is high demand for E-band (71-76/81-86 GHz) spectrum among fixed-satellite service operators.

Were the TRAI to extend exclusive terrestrial licenses for this band, it would prevent next-generation gateways from being deployed in India, denying consumers the full benefit of those enhanced services at a time when being connected is more important than ever.

The TRAI Should Adopt a Database-Assisted Light-Licensing Framework that Accommodates Next-Generation Fixed-Satellite Services. To best serve the needs of consumers and businesses across India, the TRAI should adopt a database-assisted light-licensing framework for the E-band that enables all co-primary "pencil beam" services, including fixed-satellite service gateways, to register ground equipment on an as-required basis through a common platform. Such a light-licensing framework can have the following characteristics -

- 1. Link Registration Database.** SpaceX recommends that the TRAI adopt policies and software-driven processes for links in the 70/80 GHz band that facilitate

¹⁰ ECC Rec. (05)07 at 1-2 (noting that, unlike lower millimeter wave frequencies, the 70/80 GHz band "is the only viable solution for Fixed links to achieve" wide bandwidths and multiple channel frequency reuse, and that lower fixed service bands "do[] not provide sufficient space for truly wide band links").

¹¹ See ITU-R Radio Regulations, Article 5, Section IV, Footnote 5.561 (stating that in the 74-76 GHz range, "stations in the fixed, mobile and broadcasting services shall not cause harmful interference to stations of the fixed-satellite service"); ERC Report 25, "The European Table of Frequency Allocations and Applications in the Frequency Range 8.3 kHz to 3000 GHz," approved October 2021.

¹² Fixed-satellite service gateways in the 70/80 GHz band can operate using highly directional/high gain "pencil beam" antennas, high minimum elevation angles that largely eliminate the risk of in-line events, and low power toward the horizon that can meet or exceed terrestrial limits in the bands using readily accessible techniques (e.g., site shielding). These technical and operational characteristics will result in small, predictable coordination zones and facilitate high frequency reuse and a low risk of interference to incumbent and future links. Any risk of interference can be efficiently managed using available coexistence techniques and further enhanced through software-driven processes and self-coordinated light licensing.

efficient network planning, coordination, coexistence, and rapid deployment to consumers.

The TRAI must recommend, and the Ministry of Communications must develop and publish, a public database of 70/80 GHz links in India (including links that have been deployed under the existing assignment process). This will enable meaningful analysis and self-coordination between users of this band.¹³ The TRAI can adopt a database-assisted light-licensing framework that permits operators to register new links into the database as required through an automated process.

- 2. Flexible Channelization.** The TRAI must recommend flexible channelization for the 70/80 GHz band - consistent with the ITU and CEPT band plans - that permits operators to aggregate channels up to the full 10 GHz of spectrum in E-band.

Allowing larger channels will maximize the value of the band to consumers of *both* 5G mobile services and other networks by enabling higher capacity backhaul links without meaningfully impacting the interference environment.

- 3. Technology Neutrality.** The TRAI should ensure that its 70/80 GHz framework accommodates emerging co-primary services on a technology neutral basis. To do so, the TRAI should adhere to the National Frequency Allocation Plan's allocation of E-band for fixed-satellite service and include fixed-satellite service gateways in the above-mentioned light-licensing framework.¹⁴

This technology neutral approach would have several important benefits. A multi-service light-licensing approach in the 70/80 GHz band would -

- speed review and approval time by automating basic compliance and coexistence checks;
 - reduce administrative cost and labor associated with manual reviews for all but the most complex interference scenarios;
 - facilitate coordination between different co-primary services through a common platform; and
 - promote rapid deployment of ground equipment for high-speed, low-latency wireless networks, benefitting people and businesses alike.
- 4. Reasonable Spectrum Fees.** Because links in the 70/80 GHz band create small, predictable coordination areas even when they use wide channels, one link almost never excludes another link from operating. Consequently, there is no reason to auction licenses for the spectrum or impose consumption-based fees in the 70/80 GHz band. The TRAI should ensure that its light-licensing framework includes low, flat fees assessed on an administrative cost-recovery basis. Low

¹³ The database should include the latitude, longitude, altitude, and azimuth of the transmitting and receiving antennas and the radiofrequency properties of each link (e.g., center frequency, bandwidth, antenna input power density, antenna maximum gain, antenna gain pattern, receive noise figure, polarization).

¹⁴ In the United States, the 70/80 GHz database manager Comsearch has noted that a light-licensing database can easily accommodate non-terrestrial gateways alongside fixed links with a low risk of interference to terrestrial links. See Comsearch, Aeronet Aviation and Maritime Communications Systems; Compatibility with Incumbent E-band Fixed Services and Link Registration System, at 4, 42 (May 2, 2019), attached to Letter from Samuel L. Feder, Counsel to Aeronet Global Communications Inc. to Marlene H. Dortch, Secretary, FCC, RM-11824 and RM-11825 (filed May 10, 2019); Comsearch, Loon E-Band Backhaul; Analysis of Compatibility with Incumbent Fixed Services, Use of the Link Registration System, and Review Versus Passive Services, attached to Letter from Julie M. Kearney, Loon, to Marlene H. Dortch, FCC, WT Docket No. 20-133, at 38 (Jan. 12, 2021).

fees will allow operators to focus their limited resources on serving customers through network deployment and innovative service offerings.

Together, these features will position India as a leader in spectrum management, especially with respect to the 70/80 GHz band. A unified light-licensing regime will promote the rapid deployment of a range of powerful new co-primary backhaul networks, including 5G mobile backhaul and fixed-satellite service gateways, to serve consumers and businesses throughout India.

Q34. In case you are of the opinion that certain user categories should be assigned spectrum in E-band and V-band for P2P links by any methodology other than auction, should some carriers be earmarked for such users? If yes, how many carriers should be earmarked for such users? Kindly justify your response.

The key benefit of a light licensing model is that the number and (depending on the technical parameters) the types of use are not limited. Exclusive use, for example by a single terrestrial user, would needlessly preclude many current and future users of access to the bands. At the very least, any approach must take these diverse use cases into account and consider access to the entire band for discreet locations for satellite feeder links.

Q37. In case it is decided to assign spectrum in E-band (71-76/ 81-86 GHz) and V-band (57-64 GHz) on an exclusive basis, should the spectrum be assigned on an LSA basis, or pan-India basis or for any other geographic area should be defined? Kindly justify your response.

The TRAI must not provide exclusive licensing for access to the E-band to the exclusion of shared use by next-generation satellite networks.

Q38. What should be the scope of services/ usages for spectrum in E-band (71-76/ 81-86 GHz) and V-band (57-64 GHz) assigned through auction or any other assignment methodology? Kindly justify your response.

The TRAI must recommend a database-assisted light-licensing framework for all users in order to ensure assignment of and protect access to these spectrum bands by next-generation satellite services.

Q49. Should the auction determined prices of spectrum bands for IMT/5G services be used as the basis for valuation of:

- i) E band**
- ii) V band**
- iii) MWA carriers and**
- iv) MWB carriers**

Please justify your responses.

No. The reliability and accuracy of extrapolative models for calculating spectrum prices are *extremely* sensitive to the underlying data and assumptions that feed into these models. As the TRAI already notes in its consultation paper –

*“[t]he E band, V band, MWA, MWB may be contemplated for auction in India for the first time. There is no historical auction data available to conduct comparative analysis involving auction determined prices in India. Hence, **all the valuation methodologies used in IMT***

recommendations cannot be used for valuation of E band, V band, MWA, MWB due to lack of data related to the spectrum bands being put to auction.”

Numerous users in the E and V band can easily co-exist. It is well-established and understood that the high-gain, narrow “pencil beam” properties of links in the 70/80 GHz band make exclusive licensing entirely unnecessary in managing interference. Indeed, exclusive licensing of such readily shareable and reusable spectrum is extremely undesirable and will only hinder the deployment of innovative consumer services that can flourish in India through shared use of these bands.

The TRAI must ensure that it does not forcibly set prices for this spectrum on the basis of entirely inapplicable assumptions and comparisons to prior auctions for spectrum bands of fundamentally different technical and propagation characteristics.

Q50. Whether the value of spectrum in

- i) E band
- ii) V band
- iii) MWA carriers and
- iv) MWB carriers

be derived by relating it to the value of other bands by using spectral efficiency factor? If yes, with which spectrum band, should this band be related and what efficiency factor or formula should be used? Please justify your suggestions.

No. The spectral efficiency factor methodology used by the TRAI for determining the value of terrestrial mobile spectrum is entirely inapplicable to the case of E and V bands. At its core, using mobile spectral efficiency factors to determine the value of certain frequencies relative to others relies on assumptions that plainly do not apply to how both terrestrial and non-terrestrial systems will use E and V band spectrum.

The “pencil beam” characteristics of these higher bands allow systems that are designed to share - making exclusive access not only unnecessary but also undesirable. As the TRAI has previously noted - “*spectral efficiency factor is available only with respect to IMT/5G.*”. It has thus already recognized that the data simply does not exist to apply this concept to valuing spectrum in these higher bands for non-terrestrial systems.

We recommend very strongly against forcing such an incompatible approach for mobile spectrum valuation onto satellite spectrum assignment frameworks. As a general rule, any assignment mechanism should recognize how any practical limit on co-existence is a function of the technical and propagation characteristics of the underlying spectrum, the number of systems in operation, and the nature of their design efficiency and use of such spectrum. More efficient systems with higher tolerances – such as those used in the E and V bands – allow many more systems to co-exist now and in the future. **As a result, we strongly recommend that the TRAI ensure any assignment mechanism be designed to enable shared access to this critical spectrum by next generation satellite systems, as well as reward greater capacity for sharing.**
