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RE: Comments on the Consultation Paper on Assignment of Spectrum in E&V Bands, and Spectrum for Microwave Access (MWA) & Microwave Backbone (MWB)

Kuiper Systems LLC (**Kuiper**), a wholly owned subsidiary of Amazon.com Services LLC (together, **Amazon**), welcomes the opportunity to comment on the Consultation Paper on Assignment of Spectrum in E&V Bands, and Spectrum for Microwave Access (MWA) & Microwave Backbone (MWB) (**Consultation Paper**).

As explained herein, the TRAI should ensure that any new spectrum assignment procedures for the MWA service in the 17.7-19.7 GHz band (**18 GHz band**) facilitates continued access by space-based communication systems operating receiving earth stations that include both satellite gateway earth stations and customer terminals in this shared spectrum band. Amazon urges the TRAI to extend the blanket licensing procedures for the licensing of satellite customer terminals to the 18 GHz band, to allow ubiquitous deployment of uncoordinated satellite customer terminals. Finally, we recommend that the TRAI continue its current policies for the E-band as it appears premature to adopt new rules while the spectrum demand landscape in this band remains uncertain.

Background

Amazon has successfully launched into orbit and tested its initial two (2) satellites, which is the start of the deployment of Project Kuiper, a non-geostationary satellite orbit (**NGSO**) constellation consisting of over 3,000 satellites in low Earth orbit (**LEO**). Project Kuiper will provide ubiquitous, high-capacity, high-speed, low latency broadband services to residential customers, schools, businesses, and institutions around the world, including those in the remote parts of India. Project Kuiper will also provide communications to terrestrial mobile network operators, global enterprise, and government users, among others. Through Project Kuiper, Amazon will enable connectivity where it is lacking, thereby helping to close the Digital Divide and ensure reliable access to communications.

Summary of Amazon's Submission

The demand on the 18 GHz band by space-based communication services is growing. These services support systems like Project Kuiper, which will transform connectivity infrastructure both for backhaul and broadband services provided directly to customers. To anticipate these demands and enable their benefits, Amazon urges the TRAI to adopt policies for terrestrial services, like MWA, that recognize the shared nature of the 18 GHz band between satellite and terrestrial systems. Accordingly, the TRAI should ensure the continued and increased access by receiving earth stations, including satellite gateway earth stations and customer terminals, in this shared spectrum band.

Enabling nationwide, ubiquitous satellite customer terminal deployment in the 18 GHz band is key to enabling the benefits of space-based communication systems in India. Accordingly, the TRAI should extend the blanket licensing procedures for satellite customer terminals to this band. In addition, the TRAI must recognize that space-based communication services should be assigned spectrum on an administrative basis, with the understanding that auctions for spectrum that is shared among different systems are inefficient mechanisms for spectrum assignments and also are economically untenable. Finally, Amazon believes it is premature for the TRAI to adopt new procedures for the E-band frequencies, and encourages the TRAI to postpone developing new rules for this band to a later date. Until such time, the TRAI can continue to rely on its interim policies to spectrum assignment and licensing in these frequencies, which facilitate innovation without prejudice of future uses of this spectrum.

A. General comments

a. Space-based communication services are important for bridging the digital divide.

Amazon encourages the TRAI to recognize the role of space-based communication services and their spectrum requirements. NGSO fixed-satellite service (FSS) systems like Project Kuiper bring about an exponential change to telecommunications services by delivering satellite-based broadband connectivity to customers in unserved and underserved areas, as well as providing important backhaul medium for the rollout of terrestrial mobile services throughout India. These space-based communication services offer rapid deployment of connectivity across remote areas where terrestrial broadband or backhaul solutions are impractical.[1] To do this effectively, satellite systems like Project Kuiper require access to large, contiguous blocks of spectrum that are globally harmonized.

There is spectrum overlap in the 18 GHz band frequencies among space-based communication systems and MWA and MWB systems, as discussed in the Consultation Paper. Project Kuiper plans to use frequencies in the 18 GHz band for space-to-Earth (downlink) transmissions for communications between its satellites and its gateway earth stations and customer terminals—including those used for broadband and backhaul services. Internationally, the frequencies in the 18 GHz band are allocated to the FSS and to terrestrial services, and both services have successfully coexisted in the 18 GHz band for decades. Amazon urges the TRAI to adopt a balanced approach, and specify the technical conditions that ensure access and compatible operations between the FSS, and MWA and MWB systems. Such an approach will ensure connectivity diversity that will benefit Indian businesses and citizens throughout.

b. The TRAI should ensure continued regulatory certainty for gateway earth stations in the 18 GHz band.

Project Kuiper has plans to deploy several gateway earth stations in India, which will operate multiple antennas that will connect Kuiper satellites and their corresponding customers to the Internet. In the process of considering new terrestrial uses by MWA systems, the TRAI must also ensure gateway earth stations for space-based communication systems can continue to be assigned spectrum across the entire 18 GHz band and be licensed throughout the Indian territory. As these gateway earth stations will be limited (compared to the number of customer terminals), it is feasible to coordinate their operations with that of MWA systems. The process of frequency coordination could follow the methods and parameters described in Appendix 7 of the ITU Radio Regulations (**RR**) —or something comparable developed by the TRAI with industry input. Such an approach would ensure the broadband communications to these gateway earth stations are able to obtain protection against interference from MWA systems.

c. The TRAI should adopt procedures for uncoordinated customer terminals in the 18 GHz band.

[1] *See* Consultation Paper at Table 2.1. Noting the information was sourced by the GSMA, it is possible that the capabilities of advanced NGSO FSS systems like Project Kuiper were not considered when assembling this table, which could underestimate the potential of space-based communication services for backhaul. For example, an enterprise network can be deployed in days and include customer terminals in cities, towns, and rural areas.

Another important consideration for spectrum assignments in the 18 GHz band is the operation of uncoordinated earth stations (customer terminals) with space-based communication systems. This concept allows receiving earth stations to be deployed anywhere without constraining the operations and future development of point-to-point (**P2P**) terrestrial systems. The Consultation Paper reports that the 18 GHz band is largely unutilized by terrestrial Access Service Providers.[2] This is evidence that the deployment of uncoordinated earth stations associated with space-based communication systems in the 18 GHz band will not (1) experience a high likelihood of interference from MWA systems, and (2) constrain future deployment of Access Service Providers in the 22 Licensed Service Areas (**LSA**) identified in the Consultation Paper. Accordingly, the TRAI should ensure any new procedures for MWA systems will facilitate coexistence with uncoordinated earth stations operating with space-based communication systems, by adopting a non-interference, non-protected mechanism for the ubiquitous deployment of satellite customer terminals in the 18 GHz band where both stations in the fixed service (FS) and the FSS have co-primary allocation status. Such an approach would extend the existing blanket licensing procedures to the 18 GHz band, allowing the quick and ubiquitous deployment of satellite customer terminals throughout India's national territory without imposing constraints on MWA systems.

d. It is premature to define new policies in the E-band.

Based on the data provided in the Consultation Paper, the utilization remains low for both the "traditional backhaul" bands at 6-42 GHz and V- and E-bands.[3] While the Department of Telecommunications (**DOT**) notes the expectation of growing backhaul demands to support 5G and even 6G technologies, by the reported usage data, it appears the MWA and MWB demand has not yet materialized. Consequently, the TRAI may wish to report a decision to hold its current course and revisit it in 5 years (or a comparable timeframe) when more empirical data on 5G and perhaps 6G backhaul requirements is available. The interim policies can be maintained until that time, with appropriate proviso that authorizations do not vest rights to licensees that isolate them from future decisions by the TRAI. Should the TRAI decide to establish policies and technical conditions for MWA and MWB systems in the E-band at the present moment, Amazon urges the TRAI to ensure space-based communication systems can obtain nationwide licenses through administrative assignment of spectrum, with equitable access alongside terrestrial systems.

B. Specific comments on the issues for consultation

Q1. What quantum of spectrum in different MWA and MWB frequency bands is required to meet the demand of TSPs with Access Service License/ Authorization? Whether MWA/ MWB spectrum is also required by TSPs having authorizations other than Access Service License/ authorization, 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 with detailed justification:

[2] *See* Consultation Paper at 2.26.

[3] *See* Consultation Paper at Table 2.4 for the utilization of traditional backhaul frequencies, and at 3.18 and 3.35 for V- and E-band use.

Q2. Whether spectrum for MWA and MWB should be assigned for the entire LSA on an exclusive basis, or on Point-to-Point (P2P) link basis? Response may be provided separately for (i) TSPs with Access Service License/ Authorization, (ii) TSPs having authorizations other than Access Service License/ authorization, and (iii) Other entities (non-TSP, for non-commercial/ captive/ isolated use) in the table given below with detailed justification:

As noted by the TRAI, many of these frequency bands are shared with space-based communication systems like the FSS.[4] Project Kuiper relies on the 18 GHz band for space-to-Earth communications to its gateway earth stations and customer terminals. Amazon urges the TRAI to ensure that the assignment and licensing procedures for MWA permit the continued coexistence with space-based communication systems like Project Kuiper. Furthermore, the TRAI can rely on well-established international provisions and recommendations that enable operational certainty for both terrestrial and space systems that have shared the 18 GHz band for decades. Appendix 7 of the ITU RR describes methods for determining the coordination area around earth stations which can be used as a baseline. The channel modelling of the terrestrial path between an earth station and a fixed station can be further refined using Recommendation ITU-R P.452.

Should the TRAI decide to assign spectrum by auction for MWA systems, Amazon urges the TRAI to ensure earth stations operating with space-based communication systems can continue to be sited within an LSA. These procedures could rely on international frequency coordination provisions (viz, those in Article 9 of the RR) to allow earth stations, such as gateway earth stations, to obtain interference protection within the LSA while not unduly constraining the Access Service Provider.[5] Uncoordinated satellite customer terminals should be permitted on a non-interference, non-protected basis with respect to the Access Service Provider. In other words, the operator of the uncoordinated earth station would be solely responsible for mitigating the interference from MWA systems.

Moreover, we invite the TRAI to recognize that assignment of spectrum on an exclusive basis should only be done for terrestrial systems, and not for space-based communications systems. Amazon disagrees with the assumption that the Supreme Court's 2G Judgment binds the Indian government to assign spectrum only through auctions. When viewed in the broader context of a subsequent 2012 five-judge Presidential Reference ruling[6] and several other Supreme Court judgments,[7] it is clear that the 2G judgment does not lay down any general principle relating to auctions of spectrum. In a prior submission to the TRAI regarding the Consultation Paper on assignment of spectrum for space-based communication systems,

[4] *See* Consultation Paper at 2.31.

[5] The international procedures rely on coordination areas around the earth station, which are determined by using the methods defined in Appendix 7 of the RR, to trigger coordination between earth stations and terrestrial stations. Table 8d in Appendix 7 of the RR specifies the parameters for determining the coordination distance for receiving earth stations operating with NGSO systems. The ITU offers free software -- called GIBC (Graphical Interface for Batch Calculations) -- that can produce coordination contours. While the thresholds in Appendix 7 of the RR may be considered conservative coordination triggers, the methodology can be applied by the TRAI.

[6] Judgment dated 27 September 2012 in Re: Special Reference 1 of 2012 ("**Presidential Reference**").

[7] Kasturi Lai Lakshmi Reddy v. State of Jammu and Kashmir, AIR 1980 SC 1992; Tinsukhia Electric Supply Co. Ltd v. State Of Assam, AIR 1990 SC 123; Reliance Natural Resources Ltd. v. Reliance Industries Ltd. etc., (2010) 7 SCC 1.

Amazon described the negative consequences of spectrum auctions for satellite systems like Project Kuiper.[8]

Q3. Keeping in view the provisions of ITU's Radio Regulations on coexistence of terrestrial services and space-based communication services for sharing of the same frequency range, do you foresee any challenges in ensuring interference-free operation of terrestrial networks (i.e., MWA/ MWB point to point links in 6 GHz, 7 GHz, 13 GHz, and 18 GHz bands) and space-based communication networks using the same frequency range in the same geographical area? If so, what could be the measures to mitigate such challenges? Suggestions may kindly be made with justification.

Coexistence between terrestrial networks like MWA systems and space-based communication systems cannot be generalized. However, coexistence between these systems can be managed both with appropriate spectrum assignment mechanisms and technical conditions for the operations of these systems.

Specifically, the TRAI should adopt technical conditions applicable to MWA systems that follow ITU-R Recommendations for FS applications in the 18 GHz band. For example, Recommendation ITU-R F.699 contains antenna patterns for stations in the FS. Such antenna patterns facilitate compatibility with space-based communication systems by managing off-axis emissions. Recommendation ITU-R F.595 contains channel arrangements which enhance operational transparency. Applying these Recommendations and the frequency coordination provisions in the ITU RR are sufficient for space-based communication systems like Project Kuiper to anticipate the magnitude and behaviour of potential interference from terrestrial systems. With predictable and transparent spectrum assignment procedures for MWA systems and technical conditions following international standards, the interference magnitude and likelihood from MWA systems can be calculated, which is important for sharing spectrum with space-based communication systems — particularly for gateway earth stations. Finally, the power flux-density (**PFD**) limits contained in Article 21 of the ITU RR protect MWA systems against interference from space-based communication systems.

Amazon urges the TRAI to extend the practice of blanket licensing for satellite customer terminals to the 18 GHz band, to permit the ubiquitous deployments of uncoordinated earth stations (customer terminals). In ECC Report 232, the European Conference of Postal and Telecommunications Administrations (**CEPT**) Electronic Communications Committee (**ECC**) studied the compatibility between stations in the FS and the FSS.[9] This report concludes that compatibility among stations in these systems can be ensured in the long-term in less populated areas. In urban areas, FSS earth stations could use more than 65% of the 18 GHz band. The study showed that if interference occurred, there were alternative frequencies available to which the FSS earth station could move its traffic. Amazon agrees with these conclusions, which support actions by the TRAI to adopt spectrum assignment methodologies for uncoordinated earth stations in the 18 GHz band. Those uncoordinated earth stations (customer terminals) operating with space-based communication systems should follow a national-level administrative assignment methodology for spectrum and operate on a non-interference, non-protected basis with respect to MWA stations. This ensures that future

[8] *See* Kuiper's Comments on the Consultation Paper on Assignment of Spectrum for Space-based Communication Services, dated June 1, 2023, at 3.
[9] *See* ECC Report 232 (https://docdb.cept.org/document/338).

operations of MWA stations are not incumbered with regulatory uncertainty by a potentially large deployment of earth stations (customer terminals) receiving signals in the 18 GHz band. The TRAI can refer to the CEPT ECC Decision (00)07, adopted in October 2000 and amended in March 2016, for more information regarding possible procedural considerations for the deployment of uncoordinated earth stations.[10]

Q4. What should be the carrier size for MWA and MWB carriers in each band viz. 6/7/13/15/18/21 GHz bands? Whether there is a need to prescribe a different carrier size based on different LSA categories or different user categories viz. (i) TSPs with Access Service License/ Authorization, (ii) TSPs with other than Access Service License/ Authorization and (iii) other users (non-TSP, for non-commercial/ captive/ isolated use)? If yes, suggestions may be made in the table given below with detailed justification.

Q5. Whether there is a need to assign MWA and MWB carriers in such a way that if a TSP acquires more than one carrier in a band, all assigned carriers are contiguous, and assigned frequency range(s) can be catered through a single equipment? If yes, kindly provide details of the frequency range(s) supported by the available equipment in each band. Any other suggestion(s) may kindly be made with detailed justification?

Q6. For the existing service licensees holding MWA/ MWB carriers, whether there is a need to create some specific provisions (as discussed in para 2.38 of this CP) such that if the licensee is successful in acquiring the required number of carriers through auction/ assignment cycle, its services are not disrupted? If yes, kindly provide a detailed response with justification.

Q7. Whether there is a need to review the existing ceiling on number of MWA carriers that can be held by a licensee? In case it is decided to review the ceiling on the number of MWA carriers that a licensee can hold,

(a) Whether a separate ceiling for each band (13 GHz/ 15 GHz/ 18 GHz/ 21 GHz) should be prescribed or an overall ceiling for MWA carriers taking all bands together?

(b) Whether different ceilings based on the service area category i.e., Metro/ Category 'A' Circles/ Category 'B' Circles/ Category 'C' Circles, needs to be prescribed?

(c) What should be the ceiling in terms of the number of carriers of 28 MHz per licensee in each case i.e., band-wise ceiling and overall ceiling for each service area category for–

(i) TSPs with Access Service License/ Authorization , and

(ii) TSPs with other than Access Service License/ Authorization?

(d) Any other relevant suggestion may be made with justification.

Q8. In case it is decided to assign MWB carriers exclusively on LSA basis to the TSPs, whether there is a need to prescribe any ceiling on the maximum number of MWB carriers that can be held by a TSP? Kindly justify your response.

Q9. In case it is decided to prescribe a ceiling on the number of MWBcarriers that a TSP can hold,

[10] *See* ERC Decision (00)07 (https://docdb.cept.org/document/685).

(a) **Whether separate ceiling for each band (6 GHz, 7 GHz (7.125-7.425 GHz) and 7 GHz (7.425-7.725 GHz)) should be prescribed or an overall ceiling for MWB carriers should be prescribed?**

(b) **Whether different ceiling based on the service area category i.e., Metro/ Category 'A' Circles/ Category 'B' Circles/ Category'C' Circles, needs to be provided?**

(c) **What should be the ceiling in terms of number of carriers of 28MHz per licensee in each case i.e., band-wise ceiling and overallceiling for each service area category for –**

(i) **TSPs with Access Service License/ Authorization, and**

(ii) **TSPs with other than Access Service License/ Authorization?**

(d) **Any other relevant suggestion may be made with justification.**

Q10. Which methodology should be used for assignment of MWA carriers? Response may be provided in the table given below

Q11. In case you are of the opinion that certain user categories should be assigned MWA carrier P2P links by any methodology other thanauction, should some MWA carriers be earmarked for such users? If yes, how many carriers should be earmarked for each of such user category? Kindly justify your response.

Q12. Which methodology should be used for assignment of MWB carriers? The response may be provided in the table given below:

Q13. In case you are of the opinion that certain user categories should be assigned MWB carrier by any methodology other than auction, shouldsome MWB carriers be earmarked for such users? If yes, how many carriers should be earmarked for such users? Kindly justify your response.

Q14. In case it is decided to assign MWA/MWB carriers to the TSPs with Access Service License/ Authorization through auction and to continue the existing P2P assignment of MWA/MWB carriers for TSPsother than Access Service License/ Authorization, who may be requiring to establish only a few links, what threshold limit in terms of number of links, may be prescribed, beyond which, the TSPs with other than Access Service License/ Authorization should also berequired to acquire MWA/ MWB carriers through auction? Kindly justify your response.

Q15. In case it is decided to assign MWA/ MWB carriers to all types of licensed TSPs through auction, should such TSPs be permitted to lease their spectrum acquired through auction, on P2P link basis, to other TSPs and other entities (non-TSP, for non-commercial/ captive/ isolated use) who may be requiring establishing only a few links? If yes,

(a) **suggest a mechanism and regulatory framework for such leasingarrangement.**

(b) **Do you foresee any regulatory issues and potential misuse of sucha regime? If yes, what measures could be put in place to mitigate theconcerns?**

Kindly justify your response.

Q16. In case MWA/MWB carriers are decided to be assigned through auction,

(a) Should the auction be conducted based on Simultaneous Multiple Rounds Ascending Auction (SMRA) method as adopted for IMT spectrum auction? Any other auction method may be suggested with detailed justification.

(b) what quantum of spectrum in each band (6/7/13/15/18/21 GHz) should be put to auction? Kindly justify your response.

Q17. In case it is decided to assign MWA and MWB carriers through auction,

(a) What should be the validity period of the assigned spectrum?

(b) Whether there is a need to create a provision for surrender of MWA / MWB carriers? If yes, what should be the lock-in period and other associated terms and conditions?

Response may be given for each user category viz. (i) TSPs with Access Service License/ Authorization, (ii) TSPs with other than Access Service License/ Authorization, and (iii) Other entities (non-TSP, for non-commercial/ captive/ isolated use) with detailed justification.

Q18. In case it is decided to continue with the existing methodology of assignment of MWA/ MWB carriers, whether any change in the validity period, or process for augmentation/ surrender of carriers isrequired to be made? If yes, suggestions may be made with detailed justification.

Q19. What should be the eligibility conditions and associated conditions for assignment of spectrum in 6/ 7/ 13/ 15/ 18/ 21 GHz bands? Response may kindly be given for each user category viz. (i) TSPs with Access Service License/ Authorization, (ii) TSPs with other than Access Service License/ Authorization, and (iii) Other entities (non- TSP, for non-commercial/ captive/ isolated use) with detailed justification.

Q20. Whether there is a need to prescribe any roll out obligations for MWA/ MWB carrier assignment? Should the roll out obligations be linked to the number of carriers assigned to a TSP? Kindly justify your response.

Q21. In case it is decided to prescribe roll out conditions, what should be the roll-out obligations associated with the assignment of spectrum in 6/ 7/ 13/ 15/ 18/ 21 GHz bands? What provisions should be prescribed for non-fulfilment of the prescribed roll-out obligations? Response may kindly be given for each user category viz. (i) TSPs with Access Service License/ Authorization, (ii) TSPs with other than Access Service License/ Authorization, and (iii) Other entities (non- TSP, for non-commercial/ captive/ isolated use) with detailed justification.

Q22. Any other suggestions relevant to assignment of spectrum for MWA and MWB in 6/ 7/ 13/ 15/ 18/ 21 GHz frequency bands, may kindly be made with detailed justification.

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 AccessService 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:

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.

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

Amazon plans to use spectrum in the E-band on future generations of Project Kuiper satellites and associated earth stations. This spectrum offers 5 GHz of contiguous spectrum at high frequencies that represents a step change for space-based communication systems. The change could come in the form of smaller, lower-cost, customer terminals and gateway earth stations, and smaller and less costly satellites. Finally, this large spectrum block allows greater flexibility for many terrestrial and satellite systems to coordinate and share the same spectrum resource.

Amazon agrees that the ITU RR do not yet contain technical and procedural conditions for the coexistence of space-based communication systems and terrestrial networks in the E-band. While the 2019 World Radiocommunication Conference (**WRC-19**) discussed multiple proposals to develop technical and regulatory procedures for these frequencies, the proposals were tentatively included in the Preliminary Agenda for the 2027 World Radiocommunication Conference (**WRC-27**). These proposals included (1) developing PFD limits in Article 21 of the RR to protect terrestrial services, and (2) a technical provision in Article 22 of the RR for NGSO FSS systems to protect GSO networks.[11] WRC-23 is meeting at present to decide on the Agenda Items for WRC-27, which may or may not include the two Resolutions mentioned above.[12] Amazon notes that the decisions at WRC-23 will be to study these issues, and the regulatory and procedural changes would not be adopted until WRC-27.

Given the international timeline, the TRAI should continue its 'light touch regulation' approach to spectrum management in E-band frequencies where applicants, terrestrial and space-based alike, are responsible for demonstrating compatibility with other primary service allocations.[13] This will facilitate the efficient use of the spectrum resource by those operators that plan service in these frequencies while international studies are advanced in parallel. Furthermore, the TRAI will benefit from additional time to understand and evaluate how spectrum requirements for 5G and 6G backhaul systems materialize.

[11] *See* Resolution 775 (WRC-19) and Resolution 178 (WRC-19), respectively.

[12] For example, the CEPT adopted a European Common Proposal proposing modifications to Resolution 775 (WRC-19) and to complete these studies in time for WRC-27.

[13] *See* Consultation Paper at 3.10.

Amazon notes that the mechanism to ensure compatibility with satellite downlinks and terrestrial networks is described in ITU-R Recommendations.[14] The ITU-R also contains protection criteria for space-based and terrestrial systems.[15] As such, a licensee has internationally recognized thresholds and procedures to make an informed compatibility demonstration.

Q26. Whether it will be appropriate to continue with the Frequency Division Duplexing (FDD) based configuration as adopted for the provisional assignment of E-band carriers or Time Division Duplexing (TDD) based configuration should be adopted? Kindly justify your response.

Q27. Whether Frequency Division Duplexing (FDD) or Time Division Duplexing (TDD) based configuration should be adopted for V-band carriers? In case you are of the opinion that FDD based configuration should be adopted, detailed submissions may be made with band plan, ecosystem availability, and international scenario.

Q28. What should be the carrier size for assignment of spectrum in E-band (71-76/81-86 GHz) and V-band (57-64 GHz)? Whether there is a need to prescribe a different carrier size based on different LSA categories or different user categories viz. (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)? If yes, suggestions may be made with detailed justification.

Q29. Whether there is a need to assign spectrum in E-band and V-band in such a way that if a TSP acquires more than one carrier, all the assigned carriers to a TSP are contiguous? Kindly justify your response.

Q30. Since E-band carriers will be reassigned as per the assignment methodology that will be finalized, to avoid any disruption of services to the consumers of the existing TSPs holding E-band carriers, whether there is a need to create a provision such that the TSP is given a choice to retain the same frequency carrier as long as such TSP is able to acquire the carriers in the new regime? Kindly justify your response.

Q31. Whether there is a need to prescribe the maximum number of carriersthat can be held by a TSP in E-band and V-band? Kindly justify your response.

Q32. In case it is decided to prescribe a ceiling on the number of carriers that a licensee can hold in E-band and V-band,

(a) Whether different ceilings based on the service area category i.e., Metro/ Category 'A' Circles/ Category 'B' Circles/ Category'C' Circles, need to be prescribed?

(b) Considering a carrier of 250 MHz (paired) spectrum for E-band, and 50 MHz (unpaired) spectrum for V-band, what should be the ceiling in terms of the number of carriers per licensee for each service area category for

(i) TSPs with access service License/ authorization holdingIMT spectrum,

[14] For example, Recommendation ITU-R SF.1483 describes a methodology for the 17.7-19.3 GHz band which could be applied to other frequency ranges like the E-band.

[15] For example, Recommendation ITU-R F.1108 describes a methodology to determine criteria to protect terrestrial systems from NGSO systems.

(ii) TSPs with access service License/ authorization not holding IMT spectrum, and

(iii) TSPs with other than Access Service License/Authorization?

(c) Any other relevant suggestion may be made with justification.

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:

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.

Q35. In case it is decided to assign spectrum in E & V bands to the TSPs with Access Service License/ Authorization through auction and adopt P2P links assignment for TSPs other than Access Service License/ Authorization, who may be requiring to establish only a few links, what threshold limit in terms of number of links, may be prescribed, beyond which, the TSPs with other than Access Service License/ Authorization should be required to acquire spectrum in E- band and V-band bands through auction? Kindly justify your response.

Q36. In case it is decided to assign spectrum in E & V bands to all the TSPs through auction, should such TSPs be permitted to lease their spectrum acquired through auction, on P2P link basis, to the TSPs and other entities for non-commercial/ captive/ isolated use, who may be requiring to establish only a few links? What could be the regulatory issues and potential misuse of such a regime? What measures could be put in place to mitigate the concerns? Kindly justify your response.

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.

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.

Q39. In case spectrum in E-band and V-band is decided to be assigned through auction,

(a) Should the auction be conducted based on Simultaneous Multiple Rounds Ascending Auction (SMRA) method as adopted for IMT spectrum auction? Any other auction method may be suggested with detailed justification.

(b) What quantum of spectrum in each band should be put to auction? Kindly justify your response.

Q40. In case it is decided to assign spectrum in E & V bands through auction,

(a) What should be the validity period?

(b) Whether there is a need to create a provision for surrender of E& V band? If yes, what should be the lock-in period and other terms and conditions?

Response may be given for each user category viz. (i) TSPs with Access Service License/ authorization, (ii) TSPs with other than Access Service License/ authorization, and (iii) Other entities (non- TSP, for non-commercial/ captive/ isolated use) with detailed justification.

Q41. In case it is decided to assign spectrum in E-band and V-band throughany methodology other than auction, what should be the validity period, process for augmentation/ surrender of carriers, and other terms and conditions? Suggestions may be made with detailed justification.

Q42. What should be the eligibility conditions and associated conditions for assignment of spectrum in E-band (71-76/81-86 GHz) and V-band (57-64 GHz)? Response may be given for each user category viz. (i) TSPs with Access Service License/ authorization, (ii) TSPs with other than Access Service License/ authorization, and (iii) Other entities (non-TSP, for non-commercial/ captive/ isolated use) with detailed justification.

Q43. Whether there is a need to prescribe any roll out obligations for spectrum in E-band and V-band? Should the roll out obligations be linked to the number of carriers assigned to a TSP? Kindly justify your response.

Q44. In case it is decided to prescribe roll out conditions, what should be the roll-out obligations associated with the assignment of spectrum in E-band and V-band? What provisions should be prescribed for non- fulfilment of the prescribed roll-out obligations? Response may kindly be given for each user category viz. (i) TSPs with Access Service License/ Authorization, (ii) TSPs with other than Access Service License/ Authorization, and (iii) Other entities (non-TSP, for non- commercial/ captive/ isolated use) with detailed justification.

Q45. Whether it is feasible to allow low powered indoor consumer device- to-consumer device usages on license-exempt basis in V-band (57-64 GHz), in parallel to use of the auction acquired spectrum by telecom service providers for establishment of terrestrial and/ or satellite- based telecom networks? If yes, whether it should be permitted? Kindly justify your response.

Q46. In case it is decided to allow low powered indoor consumer device- to-consumer device usages on license-exempt basis in V-band (57-64 GHz),

(a) Whether it should be permitted in entire band or part of the band? Kindly provide detailed response including the frequency carriers, which should be considered for license exemption with justification.

(b) Whether there is a need to define such indoor use? If yes, what should be the definition for such indoor use?

(c) What technical parameters should be prescribed including EIRP limits? Suggestions may kindly be made with supporting justification and international scenario.

Q47. Any other suggestions relevant to assignment of spectrum in E-band (71-76/81-86 GHz) and V-band (57-64 GHz) may kindly be made with detailed justification.

Q48. In case it is decided for assignment of spectrum on administrative basis, what should be the spectrum charging mechanism for assignment of spectrum for

(i) E band

(ii) V band

(iii) MWA carriers and

(iv) MWB carriers

separately for each of the following three categories:

(a) TSPs with Access Service License/ Authorization

(b) TSPs with other than Access Service License/ Authorization

(c) Other entities (non-TSP, for non-commercial/ captive/ isolated use)

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.

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 spectralefficiency factor? If yes, with which spectrum band, should this bandbe related and what efficiency factor or formula should be used? Please justify your suggestions.

Q51. Should the current method of levying spectrum fees/charges for E band, MWA carriers and MWB carriers on AGR basis as followed by DoT, serve as a basis for the purpose of valuation of

(i) E band

(ii) V band

(iii) MWA carriers and

(iv) MWB carriers

If yes, please specify in detail what methodology is to be used in this regard?

Q52. Should the International administrative annual spectrum charges estimated based on specific channel case (250 MHZ/Year) of E-Bandserve as a basis for the purpose of valuation of

(i) E band

(ii) V bands

Please provide detailed justification. If the answer to the question isyes, should the administrative annual spectrum charges be normalized for cross country differences? Please specify in detail themethodology to be used in this regard.

Q53. Should international benchmarking by comparing the auction determined price in countries where auctions have been concluded inE and V bands, if any, be used for arriving at the value of

(i) E band

(ii) V bands

If yes, then what methodology can be followed in this regard? Pleaseprovide detailed information.

Q54. Whether any fixed administrative annual spectrum charges/ auction determined prices are available for other jurisdictions in case of MWAand MWB links? If yes, whether these charges/ prices can serve as abasis for the purpose of valuation of

(i) MWA carriers

(ii) MWB carriers

Please provide with detailed justification

Q55. Should the methodology, as adopted by the Authority in 2014 Recommendations for calculating spectrum charges for MWB links, beused as one of the valuation approach for MWB links? If yes, please provide detailed methodology for arriving at the valuation along withjustification.

Q56. Whether the valuation for spectrum in E-band (71-76/ 81-86 GHz) and V-band (57-64 GHz), MWA (13 GHz/ 15 GHz/ 18 GHz/ 21 GHz), MWB (6 GHz/ 7 GHz) be done separately for each LSA, or pan-India basis, or any other geographic area/ link basis? Kindly justify your response.

Q57. Apart from the approaches highlighted above which other valuation approaches should be adopted for the valuation of

(i) E band

(ii) V band

(iii) MWA carriers and

(iv) MWB carriers

Please support your suggestions with detailed methodology, relatedassumptions and other relevant factors, etc.

Q58. Whether the value arrived at by using any single valuation approach for a particular spectrum band should be taken as the appropriate value of that band? If yes, please suggest which single approach/ method should be used. Please support your answer with detailed justification.

Q59. In case your response to the above question is negative, will it be appropriate to take the average valuation (simple mean) of the valuations obtained through the different approaches attempted for valuation of a particular spectrum band, or some other approach like taking weighted mean, median etc. should be followed? Please support your answer with detailed justification.

Q60. Should the reserve price be taken as 70% of the valuation of spectrum? If not, then what ratio should be adopted between the reserve price for the auction and the valuation of the spectrum in different spectrum bands and why? Please support your answer with detailed justification.

Q61. In case of auction-based assignment of

(i) E band

(ii) V band

(iii) MWA carriers and

(iv) MWB carriers

what should the payment terms and associated conditions relating to:

i. Upfront payment

ii. Moratorium period

iii. Total number of installments to recover deferred payments

iv. Rate of interest in respect of deferred payment and prepayment

Please support your answer with detailed justification.