

Astrome's Response on Consultation Paper # 22/2023 on Assignment of Spectrum in E&V Bands, and Spectrum for Microwave Access (MWA) & Microwave

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

(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)	4 x 250MHz	2 x 250MHz	01. 2 x 250MHz for specific usage 02. 4 x 250 MHz for GoI/State Govt entities with well-defined pan India/state wide requirement such as security/public service, broadband networks etc

(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 (71-76/81-86GHz)	8 x 250 MHz	4 x 250 MHz	01. 2 x 250MHz for specific usage 02. 8 x 250 MHz for GoI/State Govt entities with well-defined pan India/state wide requirement such as security/public service, broadband networks etc

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.

	Spectrum should be assigned for the entire LSA on exclusive basis, or on P2P link basis for -
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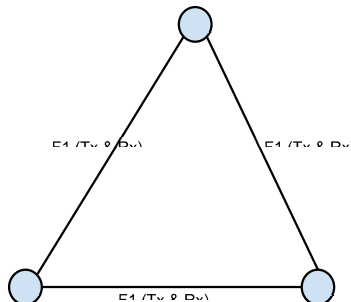
Microwave bands	TSPs with Access Service License / Authorization	TSPs with other than Access Service License/ Authorization	other entities (non-TSP, for non-commercial/ captive/ isolated use)
E-band (71-76/81-86GHz)	Channels defined to be given on an EXCLUSIVE Basis for the LSA	Channels defined to be allocated on P2P link basis	01. Channels defined to be allocated on a P2P/P2MP link basis. 02. For Gov/State Govt entities with well-defined Pan India/ Statewide requirement such as security/public service, Channels to be allocated on an Exclusive Basis

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.

E-band spectrum is becoming more and more popular for use to deliver Very High Throughput data links from LEO and MEO orbits. This was also noted in the Consultation paper where reference was made to WRC-27 regulating on the same. Satellite operators like Starlink have already started experimenting with this spectrum by launching test satellites. It is expected that Indian technology companies will also send demonstration missions to showcase payload and ground terminal technologies in this band for space-based communication. Therefore, it is requested that provision be made for at least 4 x 250MHz channels for space-to-ground and ground-to-space communication for such applications given that the complete bands are not fully utilized by terrestrial applications in the next 5 years. Moreover such allocation will also be critical for planning strategic networks for defense, disaster management and other critical Government applications. If we allocate such a spectrum at a future date, there is a risk of Indian space companies falling behind in technology on a global stage.

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.

We recommend continuing with FDD based configuration but with one change. We request that no strict mandate be made to use a 10GHz separation as technology exists in India (which is already demonstrated) to cater to a smaller separation and operation within the E1 or E2 band both transmit and receive links. Links with 1.25GHz separation have already been demonstrated by Astrome. Secondly, for creation of mesh topology with the point-to-multipoint links, it is needed to use the same spectrum for transmission and reception as the same radio is transmitting and receiving from two different radios. The required isolation is achieved by other means in this case. Technology development for this is already underway in India. Mesh topologies in backhaul networks can result in a significant increase in reliability and redundancy of the network. Please see below diagram for clarity:



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.

- A. We propose that 250MHz can be the standard carrier size for E-Band (71-76/81-86GHz) as a basic unit and multiples can be defined depending upon the use viz
- B. TSPs with Access Service License/Authorization: For Cat A LSA it should be 4 x 250MHz, For Cat B/C LSA 2 x 250MHz. The allocation is suggested based on the already defined classification of respective LSAs
- C. TSPs other than Access Service License/ Authorization and (iii) other users (non-TSP, for non-commercial/ captive/ isolated use): 2 x 250MHz as these would be for entities such as ISPs, NLD, IP2 license holders and others with Point-to-Point and Point-to-Multipoint usage of frequencies
- D. Other users (non-TSP, for non-commercial/ captive/ isolated use)
 - Such users will mostly need it for Point-to-Point usage and hence an allocation of 2 x 250 MHz is suggested.
 - However, for those for GoI/State Govt entities which may have a pan India/state wide requirement for Security of Public Service requirements, suggested allocation can be 4 x 250Hz

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.

Yes, it is preferable to provide contiguous spectrum to a TSP as this will result in better utilization of the spectrum due to improved radio performance as compared to when the spectrum is not contiguous.

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.

Yes, TSP should be given a choice to retain the same frequency carrier to minimize service disruption, though the E-band radios support the complete E-band spectrum and can be used with newer frequency allocations too.

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

We recommend that a maximum number of carriers in E-band for all TSPs with Access Service License/Authorization in total may be prescribed. For example, 10 carriers to be allocated for use by TSPs with Access Service License/Authorization and provided on an auction basis. The remaining 9 carriers will be made available for other TSPs and non-TSPs and space-based communications.

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?

- a. Metro/Cat A Circles: Maximum of 4 x 250MHz at present and a max of 8 x 250MHz in 5 years.

b. Cat B and Cat C Circles: 2 x 250MHz at present a max of 4 x 250MHz in 5 years

(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 holding IMT spectrum

Max of 4 x 250MHz now and 8 x 250MHz in 5 years

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

Max of 2 x 250MHz now and 4 x 250MHz in 5 years

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

For general entities Max of 2 x 250MHz now and 4 x 250MHz in 5 years.

For those for Gol/State Govt entities with a pan India/state wide requirement for Security/Public Service etc: Max of 4 x 250MHz now and 8 x 250MHz in 5 years

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

None

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
TSPs with Access Service License /authorization	No comments	No comments
TSPs with other than Access Service License/authorization	ADMINISTRATIVE	a. This category includes ISPs and other service providers who are operating in limited areas and often expand their network on a need-by-need basis continuously. b. Moreover, this category of user may use the spectrum in discrete locations and would not like to buy spectrum for a whole area. c. Therefore, they will be requiring the spectrum also on a need basis in terms of time and location, Hence our recommendation is to allocate spectrum in administrative mode.

Other entities (non- TSP, for non-commercial/ captive/ isolated use)	ADMINISTRATIVE	<p>a. These entities will be requiring the spectrum on a need basis and administrative mode works the best</p> <p>b. For those Goi/State Govt entities requiring for Pan India / Statewide usage for Security/Public Service, auction is an impractical option</p>
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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.

We have proposed an administrative method of assignment to be used for 'TSPs other than Access Service License/authorization' and 'Other entities (non- TSP, for non- commercial/ captive/ isolated use)'. We propose that at least 4 x 250MHz of paired spectrum should be earmarked for such users and should be increased to 8 x 250MHz in 5 years.

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.

We recommend that no threshold limit in terms of number of links be prescribed as the purpose of administrative assignment is to utilize the same spectrum as densely as possible by multiple TSPs in the same area. Instead, if TRAI wants to put some criteria beyond which auction spectrum needs to be used then such criteria be set on the basis of number of users and/or revenue thresholds.

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.

Yes, TSP should be allowed to further "Auction" or use any other means to sell their spectrum to any entity at all times. For example, a TSP may decide to implement the link coordination mechanism and sell its E-band spectrum to multiple stakeholders on a fixed fee and link-to-link basis as done in most countries.

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.

If the spectrum is assigned on an exclusive basis then:

1. For TSPs with Access Service License / Authorisation should be assigned on LSAs basis only - separately for Metro/Cat circles, Cat -B and aCat -C circles respectively
2. For TSPs with non Access Services - for the licensed area allocated vide their license BUT with restriction for use for their internal Backhaul only

3. For non TSPs Gol/State Govt entities with pan India/ Statewide requirement - on pan India basis for their respective service/needs only and not to be offered for any other requirement/entit
4. For those requiring a very few links for internal use - to be assigned on need basis and reviewed every year

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.

Scope of services/usage for spectrum in E-band:

1. For TSPs with Access Service License / Authorisation should be assigned for use for their own network's access, fronthaul, midhaul and backhaul requirements
2. For TSPs with non Access Services - for use for Backhaul, last mile connectivity and Fixed Wireless services
3. For non TSPs Gol/State Govt entities with pan India/ Statewide requirement - for their respective service/needs
4. For those requiring for a very few links - only for specified private use as an internal connectivity usage and not for any public service

Q41. In case it is decided to assign spectrum in E-band and V-band through any 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.

We have proposed an assignment on an administrative basis. The per link license should be made renewable yearly with a guarantee that they will get the spectrum for a minimum 5 years to recover their investment in radio equipment.

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.

Eligibility condition for assignment of spectrum in E-band

1. For TSPs with Access Service License / Authorisation - for those LSAs for which they have a Valid license to offer services
2. For TSPs with non Access Services - Active and Valid License to offer services in the defined area
3. For non TSPs Gol/State Govt entities with pan India/ Statewide requirement - Must be a Govt of India / State Government entity for security or public services
4. For those requiring for a very few links - any Company registered with Gol as per applicable laws

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.

There cannot be any rollout obligation as the deployment of P2P/P2MP links will be as per need. However, the following limits can be assigned:

1. For TSPs with Access Service License / Authorisation - Carriers assigned to be reviewed every two years and if continued usage of spectrum is less than 50% of the capacity carriers assigned, then extra carriers can be withdrawn

2. For TSPs with non Access Services - Carriers assigned to be reviewed every two years and if continued usage of spectrum is less than 50% of the capacity of carriers assigned, then extra carriers can be withdrawn
3. For non TSPs Gov/State Govt entities with pan India/ Statewide requirement - Carriers assigned to be reviewed every two years and if continued usage of spectrum is less than 50% of the capacity of carriers assigned, then extra carriers can be withdrawn
4. For those requiring for a very few links - To be reviewed at the end of every year for renewal

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.

Rollout based on E-band cannot be a precondition as it is a supporting technology to assist back and front hauling of traffic and as such would depend significantly on the usage of access services by users.

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.

There should be no technical restrictions for use of E-band by those allocated the spectrum in terms of network topologies such as P2P, P2MP, Multiple P2P and in terms of 10GHz channel separation.

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

separately for each of the following three categories: -

a) TSPs with Access Service Authorization

As per the existing methodology of Applicable Percentage (%) of AGR as it is a time tested and well accepted methodology

b) TSPs with other than Access Service Authorization

A fixed fee of INR 5,000 per link per year is reasonable.

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

A fixed fee of INR 2,500 per link per year is reasonable.

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.

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.

We believe that global standards should be used for fixing the price. In any other market, the utilization of E-band will be less dense than India due to our population. Therefore, the Government of India will make revenue greater than in any other country over an area for the spectrum.

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.

Yes, for TSPs with Access Service License/Authorization ONLY as they can use the E-Band frequency for access and backhaul and will have exclusive access to the carriers allocated to them for their respective LSAs.

For other TSPs with Non Access Service License and non-TSPs, the charges specified in answer to Q48 are for covering the administrative costs for managing E-band Frequencies.

Q52. Should the International administrative annual spectrum charges estimated based on specific channel case (250 MHz/Year) of E-Band serve 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 is yes, should the administrative annual spectrum charges be normalized for cross country differences? Please specify in detail the methodology to be used in this regard?

Yes, the pricing can be based on 250MHz/year for E-band.

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

i) E band

ii) V band

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

Yes.

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.

Kindly refer to answers given for Q48

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, related assumptions and other relevant factors, etc.

No other comment