



June 01, 2023

**Shri Akhilesh Kumar Trivedi,
Advisor (Networks, Spectrum and Licensing),
Telecom Regulatory Authority of India,
Mahanagar Doorsanchar Bhawan,
Jawahar Lal Nehru Marg,
New Delhi - 110 002.**

Subject: Tata Communications Limited's Response to TRAI Consultation Paper on "Assignment of Spectrum for Space-based Communication Services"

Dear Sir,

This is with reference to the TRAI Consultation Paper No.6/2023 dated 06-04-2023 on Assignment of Spectrum for Space-based Communication Services.

In this regard, please find enclosed herewith Tata Communications Limited's response to the Consultation Paper as Annexure for your kind perusal.

We request you to kindly take on record our response and consider the same while finalizing the recommendations.

Thanking You,
Yours Sincerely,

For Tata Communications Limited,

**Praveen Sharma
(Authorized Signatory)**

Enclosure: As mentioned above

TATA COMMUNICATIONS

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Tata Communications Limited Response to TRAI Consultation Paper on 'Assignment of Spectrum for Space-based Communication Services'

At the outset, we thank TRAI for providing us an opportunity to share our comments/inputs on this important consultation paper which will shape the policy for future spectrum assignments for Space based Communication Services in India.

Our key submissions are as follows:

- Space-based communications play a critical role in a variety of applications, including remote sensing, earth observation, weather forecasting, navigation, satellite television, broadband internet. Therefore, it is important to have access to a diverse set of frequency bands and services that can support these applications. In context of India given the spectrum scenario and availability, amount of spectrum, the higher band spectrum i.e both the Ku and Ka bands are appropriate spectrum bands for use of next generation high throughput Satellites.
- Satellite spectrum should be assigned administratively on a non-exclusive basis to ensure efficient utilization of the spectrum resource. Globally mature satellite markets use satellite spectrum allocation on an administrative basis and follow the sharing of the spectrum between multiple Operators in the lines of guidelines defined by the ITU Radio Regulation.
- There is no reference globally wherein the satellite spectrum is auctioned. A few countries which have tried the spectrum auction in higher bands (C, Ku, Ka) have failed miserably and reverted to administrative allocation. TRAI in its paper has mentioned that only four countries have engaged in some form of competitive allocation in connection to space communications (Brazil, Mexico, United States, and Saudi Arabia) and three of those countries (Brazil, Mexico and United States) decided to discontinue the auction system for satellite communications, as it was not practicable. These administrations rescinded that approach and moved back to administrative assignment on a sharable basis which is the most efficient and optimal use of the spectrum for space-based communication services.
- Given the growing demand for capacity and consumption of CNPN and to satisfy the need to ensure most efficient and optimal use of spectrum, co-existence use of spectrum between Space based Satellite Communications and CNPN services for Enterprises must be permitted in specific bands. In our view, allowing flexible use of frequency spectrum in 27.5-28.5GHz for space-based communication and CNPN (Captive Non-public Network) services for Enterprises will enable optimal utilization of the spectrum across the geography in line with the TRAI earlier recommendations. However, at the same time from a technical perspective and co-existence of these two services in the same band, careful planning, and coordination of the spectrum usage between the CNPN and space-based communication services is required to ensure no interference.
- TRAI should recommend adopting the existing interim measure as spectrum allocation policy for satellite usage to clear the uncertainty amongst the licensees using the satellite bandwidth. The policy should also have a provision or timeline or period of for spectrum allocation, typically 15 years to 20 years and should be bundled with the service license itself instead of case-to-case basis allocation. This is essential for the Operators to make business investments with longer term certainty.

- Satellite spectrum should be assigned administratively on a non-exclusive basis and should be assigned in combination of gateway and user link as both side spectrum will be required in combination, for communication link to work. Thus, assignment of spectrum for both user links and gateway links are both necessary and cannot go one without the other. If a licensee gets spectrum only for one type of link (say user link) but does not get desired spectrum for gateway link, in such cases, the user link spectrum is also waste and will not be useable. Therefore, to ensure efficient utilization of the spectrum resource, Spectrum should be assigned administratively, and in a bundled manner for gateway link and user link and only on non-exclusive basis to all eligible licensees. A satellite service provider cannot operate partially, if only gateway link or user link spectrum is assigned.
- High spectrum fees should not be a disincentive to operators to use spectrum efficiently and should not become an artificial barrier to entry. Therefore, the spectrum charging mechanism should be based on the AGR of the licensee for the administratively assigned spectrum to recover administrative cost of spectrum management. In our view, there should be a single rate of SUC, and it should be only 1% of AGR to cover administrative charges.
- There is no specific need to define the rollout obligation, as the spectrum required for satellite services is shared and can be shared among multiple licensees, thus, there is no hoarding of spectrum, and it continues to be available for other interested licenses.

Tata Communications issue wise comments:

Q1. For space-based communication services, what are the appropriate frequency bands for (a) gateway links and (b) user links, that should be considered under this consultation process for different types of licensed telecommunications and broadcasting services? Kindly justify your response with relevant details.

Response:

Space-based communications play a critical role in a variety of applications, including remote sensing, earth observation, weather forecasting, navigation, satellite television, broadband internet. For each of these applications, there are different and specific frequency bands that are suitable and align with their characteristics. Moreover, customer offerings are based on the criticality of the application, use-cases, satellite footprint, frequency band characteristics etc. For example, higher frequency bands, such as C-band, Extended-C band, Ku-band, Ka-band and Q/V band frequencies, are ideal for broadband satellite communications because they offer high data rates, while lower frequency bands, such as L-band and S-band frequencies, are better suited for navigation and remote sensing applications because they penetrate through clouds and other objects. Therefore, it is important to have access to a diverse set of frequency bands and services that can support these applications.

In context of India given the spectrum scenario and availability, amount of spectrum, the higher band spectrum i.e both the Ku and Ka bands are appropriate spectrum bands for use of next generation High throughput Satellites.

Q2. What quantum of spectrum for (a) gateway links and (b) user links in the appropriate

frequency bands is required to meet the demand of space-based communication services? Information on present demand and likely demand after about five years may kindly be provided in two separate tables as per the proforma given below:

Type of service	Name of the satellite system	Type of satellite (GSO/LEO/MEO)	Frequency range and quantum of spectrum required							
			User Link (Earth to space UL)		User Link (Space to Earth DL)		Gateway Link (Earth to space UL)		Gateway Link (Space to Earth DL)	
			Frequency range	Quantum (in MHz)	Frequency range	Quantum (in MHz)	Frequency range	Quantum (in MHz)	Frequency range	Quantum (in MHz)
Access										
Internet										
NLD										
ILD										
GMPCS										
VSAT CUG (Commercial)										
Captive VSAT CUG										
Machine to Machine (M2M)										
DTH										
Teleport										
DSNG										
HITS										
IFMC										
Any other relevant service (please specify)										

Response:

No Comments

Q3. Whether there is any practical limit on the number of Non-Geo Stationary Orbit (NGSO) satellite systems in Low Earth Orbit (LEO) and Medium Earth Orbit (MEO), which can work in a coordinated manner on an equitable basis using the same frequency range? Kindly justify your response.

Response:

No Comments

Q4. For space-based communication services, whether frequency spectrum in higher bands such as C band, Ku band and Ka band, should be assigned to licensees on an exclusive basis? Kindly justify your response. Do you foresee any challenges due to exclusive assignment? If yes, in what manner can the challenges be overcome? Kindly elaborate the challenges and the ways to overcome them.

Response:

In line with the globally mature Satellite markets like United States (US) and others, we recommend that for space-based communication services, frequency spectrum in higher bands such as C band, Ku band and Ka band should be administratively allocated on shareable basis and not on an exclusive basis as satellite spectrum in higher bands is shared spectrum that is used by multiple service providers. Therefore, it is only with administrative allocation, i.e., sharing of spectrum among multiple satellite operators can be achieved for efficient use of the spectrum:

- Spectrum availability for a greater number of operators would help the service providers to expand services to new geographies, improve cost efficiencies and further improve quality of service for end consumers thereby helping in the socio-economic development of underserved regions by bringing on more competition.
- The spectrum can be used by various types of licensed operators for multiple services and applications.
- It may be noted that by allowing the usage of spectrum in an administratively on a sharable basis, it also helps India create a favorable Ecosystem that can support to quickly reach all possible remote geographies in India for Broadband and other Services penetration. This is in line with the India Government objectives towards Socio Economic growth.
- The policy should also have the provision or timeline or period for spectrum allocation and should be integrated with the service license itself instead of case-to-case basis allocation. This is essential for the Operators to make business investments with longer term certainty.

As spectrum sharing among satellite operators is global phenomenon, with administrative allocation methodology adoption, it will enable satellite operators to comply with the provisions contained in the Radio Regulations (ITU Radio Regulations) as follows:

- Coexistence between GSO networks is based on either a sufficient angular separation on the GSO arc or coordination.
- Coexistence between NGSO systems and GSO networks is ensured, as also well

described in the text of the consultation, either via compliance with Article 22 limits or coordination, depending on the frequency bands.

- Coexistence between NGSO systems is established by bi-lateral coordination discussions in which analysis is carried out by the different operators, taking into account the relevant provisions of the ITU Radio Regulations.

The resource like this (satellite spectrum) which is shared, non-exclusive, there is no rationale for allocating it on exclusive basis. We foresee following major challenges if spectrum assigned on exclusive basis:

- Fragmentation of shared spectrum resources resulting in awfully completely inefficient use of spectrum for satellite services.
- Lead to hoarding of spectrum by exclusive assignee, which may or may not use it.
- Market distortion and lead to monopoly which will be against the principle of fair competition.

Q5. In case it is decided to assign spectrum in higher frequency bands such as C band, Ku band and Ka band for space-based communication services to licensees on an exclusive basis,

- (a) What should be the block size, minimum number of blocks for bidding and spectrum cap per bidder? Response may be provided separately for each spectrum band.**
- (b) Whether intra-band sharing of frequency spectrum with other satellite communication service providers holding spectrum upto the prescribed spectrum cap, needs to be mandated?**
- (c) Whether a framework for mandatory spectrum sharing needs to be prescribed? If yes, kindly suggest a broad framework and the elements to be included in the guidelines.**
- (d) Any other suggestions to ensure that that the satellite communication ecosystem is not adversely impacted due to exclusive spectrum assignment, may kindly be made with detailed justification.**

Kindly justify your response.

Response:

Auction is done for any resource which is exclusive, has high demand but low supply etc. In case of the spectrum available for space-based communication services, does not qualify to be auctioned and should continue to be assigned administratively on a non-exclusive basis. The concepts of block size, spectrum cap and intra-band share, as used in terrestrial mobile spectrum management, are not applicable in case of spectrum to be used for space-based communication services.

Please also refer to answer to Q4, there is no rationale of assigning satellite spectrum on exclusive basis, there will be multiple issues on exclusive assignment of spectrum for space-based communication services. In the present framework, with allocation of spectrum on administrative basis, there is only one block size of full spectrum band available to the service providers on shared use basis without any artificial hinderance/capping or limitation. Moreover, due to the technical characteristics of satellite services and the spectrum sharing mechanisms

already used by most of the administrations worldwide, auctioning spectrum for satellite services is not prevalent and providing exclusive rights to its use will hinder the development of satellite networks in India, as it will decrease its usability and, consequently, decrease its overall value.

Therefore, in our view, assigning spectrum on exclusive basis will be inefficient use of scarce natural resource and will not serve any purpose.

Q6. What provisions should be made applicable on any new entrant or any entity who could not acquire spectrum in the auction process/assignment cycle?

- (a) Whether such entity should take part in the next auction/ assignment cycle after expiry of the validity period of the assigned spectrum? If yes, what should be the validity period of the auctioned/assigned spectrum?**
- (b) Whether spectrum acquired through auction be permitted to be shared with any entity which does not hold spectrum/ or has not been successful in auction in the said band? If yes, what measures should be taken to ensure rationale of spectrum auction and to avoid adverse impact on the dynamics of the spectrum auction?**
- (c) In case an auction based on exclusive assignment is held in a spectrum band, whether the same spectrum may again be put to auction after certain number of years to any new entrant including the entities which could not acquire spectrum in the previous auction? If yes,
 - (i) After how many years the same spectrum band should be put to auction for the potential bidders?**
 - (ii) What should be the validity of spectrum for the first conducted auction in a band? Whether the validity period for the subsequent auctions in that band should be co-terminus with the validity period of the first held auction?****

Kindly justify your response.

Response:

In our view, all eligible licensees incl. ISPs should be allowed to use the spectrum allocated administratively on sharable basis. Globally mature satellite markets use satellite spectrum allocation on an administrative basis and follow the sharing of the spectrum between multiple Operators in the lines of guidelines defined by the ITU Radio Regulation.

It is also important to understand that under the administrative and sharing principles of spectrum assignment, it is simple to allocate spectrum to any new eligible entrants using the above sharable principle defined in the ITU Radio Regulations guidelines.

There is no reference globally wherein the satellite spectrum is auctioned. A few countries which have tried the spectrum auction in higher bands (C, Ku, Ka) have failed miserably and reverted to administrative allocation. TRAI in its paper has mentioned that only four countries have engaged in some form of competitive allocation in connection to space communications (Brazil, Mexico, United States, and Saudi Arabia) and three of those countries (Brazil, Mexico

and United States) decided to discontinue the auction system for satellite communications, as it was not practicable. These administrations rescinded that approach and moved back to administrative assignment on a sharable basis which is the most efficient and optimal use of the spectrum for space-based communication services.

Q7. Whether any entity which acquired the satellite spectrum through auction/assignment should be permitted to trade and/or lease their partial or entire satellite spectrum holding to other eligible service licensees, including the licensees which do not hold any spectrum in the concerned spectrum band? If yes, what measures should be taken to ensure rationale of spectrum auction and to avoid adverse impact on the dynamics of the spectrum auction? Kindly justify your response.

Response:

Satellite Spectrum should be assigned administratively on a sharable basis to all eligible service providers so there is no question of permitting trading of satellite spectrum.

Q8. For the existing service licensees providing space-based communication services, whether there is a need to create enabling provisions for assignment of the currently held spectrum frequency range by them, such that if the service licensee is successful in acquiring required quantum of spectrum through auction/ assignment cycle in the relevant band, its services are not disrupted? If yes, what mechanism should be prescribed? Kindly justify your response.

Response:

It may be noted that Globally mature Satellite markets use Satellite Spectrum allocation in an administrative basis and follow the sharing of the spectrum between multiple Operators in the lines of guidelines defined by the ITU Radio Regulation or Framework.

In our view, such existing practices implemented as per ITU RR can be adopted for administratively allocated sharable spectrum.

Q9. In case you are of the opinion that the frequency spectrum in higher frequency bands such as C band, Ku band and Ka band for space- based communication services should be assigned on shared (non- exclusive) basis, -

- (a) Whether a broad framework for sharing of frequency spectrum among satellite communication service providers needs to be prescribed or it should be left to mutual coordination? In case you are of the opinion that broad framework should be prescribed, kindly suggest the framework and elements to be included in such a framework.**
- (b) Any other suggestions may kindly be made with detailed justification.**

Kindly justify your response.

Response:

We are of the view that the satellite spectrum in C, Ku and Ka band or any other band likely to be assigned in future for satellite-based communication services, should be assigned only

on non-exclusive basis to all eligible licensees to ensure the efficient utilization of the spectrum resource.

Please also refer to the response provided for Q.8 above.

Q10. In the frequency range 27.5-28.5 GHz, whether the spectrum assignee should be permitted to utilize the frequency spectrum for IMT services as well as space-based communication services, in a flexible manner? Do you foresee any challenges arising out of such flexible use? If yes, in what manner can the challenges be overcome? Kindly elaborate the challenges and the ways to overcome them.

Response:

Tata Communications advocate for optimal utilization of scarce spectrum for various upcoming applications and technologies among various licensed operators. In our view, enabling co-existence mode of usage of frequency spectrum in 27.5-28.5GHz band for space-based communication services with CNPN services will ensure optimal utilization of the spectrum. However, at the same time from a technical perspective and co-existence of these two services in the same band, careful planning, and coordination is required to ensure no interference to Space-based communication services.

As 27.5 GHz to 28.5 GHz frequency band will be used for gateway links w.r.t Satellite based communication services and the service area for CNPN services are typically limited to indoors in the given specific geographies based on demand. Hence, it is recommended that 27.5GHz to 28.5GHz band should be assigned directly to Enterprises with the condition of ensuring non-interference to Space-based communication services. This will ensure optimal use of the spectrum.

Q11. In case it is decided to permit flexible use in the frequency range of 27.5 - 28.5 GHz for space-based communication services and IMT services, what should be the associated terms and conditions including eligibility conditions for such assignment of spectrum? Kindly justify your response.

Response:

Given the growing demand for multiple different type of Services and Applications especially within the Industry 4.0 revolution, and also to satisfy the need to ensure most efficient and optimal use of spectrum, co-existence use of spectrum in the frequency range of 27.5 GHz - 28.5 GHz between Space based communication services and CNPN Applications (Use cases) must be enabled with condition that spectrum for CNPN will be assigned directly to enterprises and it will not cause any interference to space-based communication services

Some suggested terms and conditions that could be considered for the assignment of spectrum include:

- **Eligibility conditions:** Spectrum assignees may need to meet certain eligibility criteria, such as technical competence, financial capability, and compliance with relevant regulatory requirements.

- **Technical specifications:** Spectrum assignees may need to comply with certain technical specifications, such as power limits, frequency bands, and distance w.r.t Space-based communication services to ensure efficient use of the spectrum and minimize the risk of harmful interference.
- **Spectrum sharing arrangements:** Spectrum assignees may need to develop spectrum sharing arrangements to ensure that both space-based communication services and CNPN services can co-exist without causing harmful interference. A protection range needs to be defined for each satellite operation area within which no other user, shall be allowed to use that frequency band.
- **Interference management:** Spectrum assignees may need to develop interference management plans to address any interference issues that may arise between space-based communication services and CNPN services. This may involve developing advanced interference mitigation techniques, conducting regular interference monitoring, reporting, and coordinating with other spectrum users to manage interference issues.

Q12. Whether there is a requirement for permitting flexible use between CNPN and space-based communication services in the frequency range 28.5-29.5 GHz? Kindly justify your response.

Response:

Space-based communications play a critical role in a variety of applications, including remote sensing, earth observation, weather forecasting, navigation, satellite television, broadband internet. Therefore, we recommend that the frequency range 28.5 GHz – 29.5 GHz should be reserved for only space-based communication services.

Q13. Do you foresee any challenges in case the spectrum assignee is permitted to utilize the frequency spectrum in the range 28.5-29.5 GHz for cellular based CNPN as well as space-based communication services, in a flexible manner? What could be the measures to mitigate such challenges? Suggestions may kindly be made with justification.

Response:

As reiterated earlier in our response, given the growing demand for multiple different type of Services and Applications especially within the Industry 4.0 revolution, and also to satisfy the need to ensure most efficient and optimal use of spectrum, co-existence use of spectrum between Space Based Communication and CNPN Applications (Use cases) must be permitted in frequency range 27.5 to 28.5 GHz band and 28.5-29.5GHz frequency band should be assigned only for Space based communication services.

As, 27.5 GHz to 28.5 GHz frequency band will be used for gateway links w.r.t Space based communication services and the service area for CNPN services are typically limited to indoors in the given specific geographies based on demand. Hence 27.5 GHz to 28.5 GHz should be administratively assigned directly to Enterprises with the condition of ensuring non-interference to Space-based communication services.

Q14. Whether space-based communication services should be categorized into

different classes of services requiring different treatment for spectrum assignment? If yes, what should be the classification of services and which type of services should fall under each class of service? Kindly justify your response. Please provide the following details:

- a) Service provider-wise details regarding financial and market parameters such as total revenue, total subscriber base, total capital expenditure etc. for each type of service (as mentioned in the Table 1.3 of this consultation paper) for the financial year 2018-19, 2019-20, 2020-21, 2021-22, and 2022-23 in the format given below:

Type of service: _____				
Financial Year	Revenue (Rs. lakh)	Subscriber base	CAPEX for the year (Rs. lakh)	Depreciation for the year (Rs. lakh)
2018-19				
2019-20				
2020-21				
2021-22				
2022-23				

- b) Projections on revenue, subscriber base and capital expenditure for each type of service (as mentioned in the Table 1.3 of this consultation paper) for the whole industry for the next five years starting from financial year 2023-24, in the format given below:

Type of service: _____			
Financial Year	Revenue (Rs. lakh)	Subscriber base	CAPEX for the year (Rs. lakh)
2023-24			
2024-25			
2025-26			
2026-27			
2027-28			

Response:

No Comments.

Q15. What should be the methodology for assignment of spectrum for user links for space-based communication services in L-band and S-band, such as-

- (a) Auction-based
- (b) Administrative
- (c) Any other?

Please provide your response with detailed justification.

Response:

No comments

Q16. What should be the methodology for assignment of spectrum for user links for space-based communication services in higher spectrum bands like C-band, Ku-band and Ka-band, such as

- (a) Auction-based**
- (b) Administrative**
- (c) Any other?**

Please provide your response in respect of different types of services (as mentioned in Table 1.3 of this consultation paper). Please support your response with detailed justification.

Response:

In line with the global practices, we recommend that for space-based communication services, frequency spectrum in higher bands such as C band, Ku band and Ka band should be administratively allocated on shareable basis and not on an exclusive basis as satellite spectrum in higher bands is shared spectrum that is used by multiple service providers. It is a more appropriate approach than auction-based approach for Fixed and Broadcasting Satellite service spectrum. Unlike the mobile services, where each Operator needs a separate dedicated spectrum band, the satellite spectrum is used as a shared resource and the same spectrum is used by a multiple number of satellites under the ITU Radio Regulations framework.

We recommend administrative methodology for assignment of satellite spectrum. This is the only way to:

- Allow for the flexible use of spectrum among operators,
- Ensure an efficient spectrum use,
- Not impose any artificial limit to the number of operators servicing the Indian market, guarantee the best choice and service provision to Indian consumers and avoid anti-competitive and monopolistic situations.

This approach has been adopted by many countries worldwide. Since, globally the satellite spectrum is not auctioned by any regulator considering its purpose and various use-cases that it will potentially address, therefore, by auctioning the spectrum, many of the use cases may become commercially unviable, impacting the digitation of various citizen services.

Administrative allocation is only transparent, unbiased way for shared spectrum assignment. Auction method for satellite spectrum would be biased & will favor large telecom providers. It will be anti-competitive, will limit choice to end customers and may lead to duopoly in the telecom market. Administrative assignment for satellite spectrum will help to be used by multiple service providers, use shared spectrum most efficiently. It will also ensure the satellite technology remains as the viable connectivity option and Indian populace is able to take benefit of the large satellite capacities being made available by HTS/VHTS/MEO/LEO satellites.

Q17. Whether spectrum for user links should be assigned at the national level, or telecom circle/ metro-wise? Kindly justify your response.

Response:

The satellite spectrum should be assigned administratively at national level. As the satellite spectrum is provided using various satellite type –

- Widebeam satellites covering overall India.
- Spot beam satellites covering region specific.
- NGSO (MEO/LEO) satellite constellation covering overall India with moving satellites.

As satellite spectrum is shared, the co-ordination is done at global level by ITU to ensure interference free operations. Within India, it is well managed by WPC and service providers use same spectrum on different satellites without any interference. Assigning spectrum telecom circle/ metro wise may not be feasible or will result in highly fragmented and inefficient use of spectrum. The spectrum assigned for a specific telecom circle/ metro will hinder is using same spectrum on same satellite in any other telecom circle in India.

Satellites by their very nature cross national borders and, as such, are susceptible to international and national regulation. Selection of different licensees for satellite services in different circles would be very complex for the operators to manage and would run the very real risk of harmful interference. Moreover, if a selected licensee is prevented from providing a national satellite service but has to operate in different circles with different radio frequencies, it would be almost technically impossible to achieve with NGSO systems. Given that Satellite services are by their nature at least national if not global in nature, licensing anything less than a national level could lower its return on investment and would be discouraging for potential licensee to take the service.

Q18. In case it is decided to auction user link frequency spectrum for different types of services, should separate auctions be conducted for each type of services? Kindly justify your response with detailed methodology.

Response:

Administrative allocation of satellite spectrum is strongly recommended both for Gateway to Satellite and Satellite to User Communications purposes, in line with the NFAP 2022.

There are various services which utilizes spectrum in two ways:

Broadcast Communication – The broadcast communication uses only one stream, one bandwidth block, which is utilized by all the receivers thereby making the most efficient utilization of the satellite bandwidth. In addition, the same frequency may be used by different satellites, without causing any interference to the communication system. It is used to provide information & entertainment services at affordable cost to the citizens, though the DTH& Teleport industry itself is under stress, operating at the lower end of single digit profitability. If the broadcast spectrum were to be auctioned, it would not only make the DTH & Teleport business unviable but will also result in tariff increase for the consumers.

VSAT Communication – It is two-way communication in general and can be provided under various licenses. All these services use the spectrum on a shared basis or a non-exclusive basis & thus no rationale to do the auction the spectrum for such services.

As spectrum allocation in an administrative way seems to be most optimal way of handling the spectrum, there is no need to do the auction of satellite spectrum basis type of services.

Auction of satellite spectrum, based on type of satellite services would add an additional degree of confusion and unsustainability, as an entity would potentially have to participate in multiple auctions for the same spectrum.

Q19. What should be the methodology for assignment of spectrum for gateway links for space-based communication services, such as

- (a) Auction-based
- (b) Administrative
- (c) Any other?

Please provide your response in respect of different types of services. Please support your response with detailed justification.

Response:

Gateway links are always limited in number and multiple gateways can co-exist within the same geography and share the same spectrum. Therefore, assignment of spectrum for gateway links for space-based communication services should be on a purely administrative basis.

TRAI should recommend adopting the existing interim measure as spectrum allocation policy for satellite usage to clear the uncertainty amongst the licensees using the satellite bandwidth. The policy should also have a provision or timeline or period of for spectrum allocation, typically 15 years to 20 years and should be bundled with the service license itself instead of case-to-case basis allocation. This is essential for the Operators to make business investments with longer term certainty.

Q20. In case it is decided to auction gateway link frequency spectrum for different types of services, should separate auctions be conducted for each type of services? Kindly justify your response with detailed methodology.

Response:

Not Applicable in view of the response given in Q19 above.

Q21. In case it is decided to assign frequency spectrum for space-based communication services through auction,

- (a) What should be the validity period of the auctioned spectrum?
- (b) What should be the periodicity of the auction for any unsold/ available spectrum?
- (c) Whether some mechanism needs to be put in place to permit the service licensee to shift to another satellite system and to change the frequency spectrum within a frequency band (such as Ka- band, Ku-band, etc.) or across frequency bands for

the remaining validity period of the spectrum held by it? If yes, what process should be adopted and whether some fee should be charged for this purpose?

Kindly justify your response.

Response:

Not Applicable in view of the response given in Q19 above.

Q22. Considering that (a) space-based communication services require spectrum in both user link as well as gateway link, (b) use of frequency spectrum for different types of links may be different for different satellite systems, and (c) requirement of frequency spectrum may also vary depending on the services being envisaged to be provided, which of the following would be appropriate:

- (i) to assign spectrum for gateway links and user links separately to give flexibility to the stakeholders? In case your response is in the affirmative, what mechanism should be adopted such that the successful bidder gets spectrum for user links as well as gateway links.

or

- (ii) to assign spectrum for gateway links and user links in a bundled manner, such that the successful bidder gets spectrum for user link as well as gateway link? In case your response is in the affirmative, kindly suggest appropriate assignment methodology, including auction so that the successful bidder gets spectrum for user links as well as gateway links.

Response:

It is reiterated that satellite spectrum should be assigned administratively and should be assigned in combination of gateway and user link as both side spectrum will be required in combination, for communication link to work. Thus, assignment of spectrum for both user links and gateway links are necessary and cannot go one without the other. If a licensee gets spectrum only for one type of link (say user link) but does not get desired spectrum for gateway link, in such cases, the user link spectrum is also waste and will not be useable.

Therefore, to ensure efficient utilization of the spectrum resource, Spectrum should be assigned administratively, and in a bundled manner for gateway link and user link and only on non-exclusive basis to all eligible licensees. A satellite service provider cannot operate partially, if only gateway link or user link spectrum is assigned.

Q23. Whether any protection distance would be required around the satellite earth station gateway to avoid interference from other satellite earth station gateways for GSO/ NGSO satellites using the same frequency band? If yes, what would be the protection distance (radius) for the protection zone for GSO/ NGSO satellites?

Response:

No Comments.

Q24. What should be the eligibility conditions for assignment of spectrum for each type of space-based communication service (as mentioned in the Table 1.3 of this Consultation Paper)? Among other things, please provide your inputs with respect to the following eligibility conditions:

- (a) Minimum Net Worth**
- (b) Requirement of existing agreement with satellite operator(s)**
- (c) Requirement of holding license/ authorization under Unified License prior to taking part in the auction process.**

Kindly justify your response

Response:

As per current practice, spectrum is closely linked with frequency assignment done to the licensee basis latter's requirement & application. Satellite spectrum is quite different from mobile spectrum in several key characteristics – being shared resource as compared to discrete and exclusive chunks, as dependent on ITU frequency coordination, different spectrum management rules and several precious rights. Satellite spectrum is to be shared with multiple satellite operators/service providers using the same frequencies and same is facilitated via coordination with other satellite operators.

In view of the above, since spectrum for space-based communication is a shared resource, thus there is no need for separating spectrum assignment from frequency assignment. As only eligible licensed entity can apply for frequency on specific satellite, there is no need to have additional eligibility conditions for higher frequency bands (for example C-band, Ku-band, Ka-band). For L-band and S-band, there may be additional condition that licensee should be satellite operator or should have agreement with satellite operator having S-band/L-band capacity on their satellites.

Q25. What should be the terms and conditions for assignment of frequency spectrum for both user links as well as gateway links for each type of space-based communication service? Among other things, please provide your detailed inputs with respect to roll-out obligations on space-based communication service providers. Kindly provide response for both scenarios viz. exclusive assignment and non-exclusive (shared) assignment with justification.

Response:

- Spectrum for all types of satellite services should be assigned through fair and transparent administrative processes, for both gateway links and user links.
- Spectrum to the satellite operators should only be assigned on a non-exclusive basis.
- Validity of the spectrum assigned to the satellite operators should be linked with the validity of the license/permission granted by DoT. The duration of the license should be 15-20 years to give sufficient confidence and stability to the operators, especially considering that the deployment of an in-country gateway is also required.

- As the spectrum required for satellite services is shared and can be shared among multiple space-based communication service licensees and CNPN licensees in 27.5 GHz – 28.5 GHz frequency band. Moreover, the 28.5 GHz – 29.5 GHz frequency band will also be shared among various Satellite Service Providers. Thus, there is no hoarding of spectrum, and it continues to be available for other interested licenses. Therefore, there is no specific need to define the rollout obligation.

Q26. Whether the provisions contained in the Chapter-VII (Spectrum Allotment and Use) of Unified License relating to restriction on crossholding of equity should also be made applicable for satellite- based service licensees? If yes, whether these provisions should be made applicable for each type of service separately? Kindly justify your response.

Response:

Provisions in the Unified License relating to restriction on crossholding of equity is not needed to be made applicable for satellite- based service licensees as there is no need to hold any spectrum, given that the spectrum can be shared with multiple licensees on non-exclusive basis.

Q27. Keeping in view the provisions of ITU's Radio Regulations on coexistence of terrestrial services and space-based communication services for sharing of same frequency range, do you foresee any challenges in ensuring interference-free operation of space-based communication network and terrestrial networks (i.e., microwave access (MWA) and microwave backbone (MWB) point to point links) using the same frequency range in the same geographical area? What could be the measures to mitigate such challenges? Suggestions may kindly be made with justification.

Response:

Radio frequency spectrum is a scarce natural resource. Any amount of frequency spectrum, if not in use optimally and efficiently, it is an opportunity loss to allow the benefits of the spectrum to a wider category of users/end customers across all service providers under various licenses/ authorizations, thus also hinders socio-economic development of the country. Considering the growing capacity and thus spectrum, government must explore better methods to tap the full potential of the spectrum.

We can consider the below potential spectrum bands that can be considered for co-existence of Point-to-point Microwave backhaul links along with Satellite-based uplink communication on secondary basis

- 24.65 – 25.25 GHz
- 27 – 28.5 GHz,
- 29.1 – 29.5 GHz

Co-existence of Ka band satellite uplink transmission, P2P microwave links to be made available by way of administratively assigned spectrum through an efficient process of shared spectrum mechanism to ISPs. Microwave backhaul/access to the spectrum should be on secondary, non-interference basis to satellite links, non-protection from satellite link basis.

Following mitigation measures can be adopted to avoid interference between these two types of stations.

1. Using frequency coordination to prevent interference.
2. Selecting microwave sites that are far apart or with suitable terrain features (e.g. hills or mountains) to reduce the likelihood of interference.
3. Using directional antennas with high gain and narrow beam-widths to minimize the amount of energy radiated in unwanted directions.
4. Transmission power of the stations can be adjusted to minimize interference.
5. Using filters to eliminate or reduce the number of unwanted signals or noise that can cause interference
6. Maintaining communication and coordination between the operators of the satellite station and the microwave station to ensure that any interference is identified and addressed promptly.

Q28. In what manner should the practice of assignment of a frequency range in two polarizations should be taken into account in the present exercise for assignment and valuation of spectrum? Kindly justify your response.

Response:

Use of polarization should not be considered, as it's purely a way to configure the satellite system and increase spectrum efficiency and should be considered as technical parameter during assignment of frequencies.

Considering suggestion and rationale of assignment of spectrum on administrative basis and subsequent suggestion of charging spectrum charging as percentage of AGR, then such technical parameters does not impact the charging mechanism.

Q29. What could be the likely issues, that may arise, if the following auction design models (described in para 3.127 to 3.139) are implemented for assignment of spectrum for user links in higher bands (such as C band, Ku band and Ka band)?

- a. **Model #1: Exclusive spectrum assignment**
- b. **Model#2: Auction design model based on non-exclusive spectrum assignment to only a limited number of bidders**

What changes should be made in the above models to mitigate any possible issues, including ways and means to ensure competitive bidding? Response on each model may kindly be made with justification.

and

Q30. In your opinion, which of the two models mentioned in Question 29 above, should be used? Kindly justify your response.

and

Q31. In case it is decided to assign spectrum for user links using model # 2 i.e., non-exclusive spectrum assignment to limited bidders ($n + \Delta$), then what should be

- (a) **the value of Δ , in case it is decided to conduct a combined**

- auction for all services**
- (b) the values of Δ , in case it is decided to conduct separate auction for each type of service**

Please provide detailed justification.

Response to Q29, Q30 and Q31:

It is reiterated that satellite spectrum should be assigned administratively to ensure efficient utilization of the spectrum resource and only on non-exclusive basis to all eligible Space-based communication licensees and CNPN applications (Use cases) must be permitted in 27.5 GHz – 28.5 GHz frequency band for ensuring optimal use of the spectrum.

Auction is not a suitable method but will be artificially forced model and thus will have various challenges.

TRAI in the consultation paper, itself explained the international practices adopted by countries like US, Mexico and Brazil to auction the frequency band, but could not succeed and resorted to administrative licensing. So, therefore, global practices and learnings should also be carefully studied as regards satellite spectrum assignment.

Q32. Kindly suggest any other auction design model(s) for user links including the terms and conditions? Kindly provide a detailed response with justification as to how it will satisfy the requirement of fair auction i.e., market discovery of price.

Response:

We wish to submit that no model of auction may be suitable as the bidders have disparity in terms of their objective, their size, scale, financial power etc. Any auction will only benefit such large size integrated telecom bidders only.

It is reiterated that satellite spectrum should be assigned administratively to ensure efficient utilization of the spectrum resource and only on non-exclusive basis to all eligible licensees.

Q33. What could be the likely issues, that may arise, if Option # 1: (Area specific assignment of gateway spectrum on administrative basis) is implemented for assignment of spectrum for gateway links? What changes could be made in the proposed option to mitigate any possible issues?

Response:

There are no issues linked to administrative assignment of spectrum for gateway links as it is the standard process adopted globally by mature markets in satellite communications. On the other hand, the idea of a possible auction determined price for user links to be used as a basis for charging for spectrum for gateway links does not make sense. Spectrum for the gateway is to be used at a specific location (instead of on a nation-wide basis) by an entity that could be different from the one providing the user links (e.g.a Teleport owner).

It is imperative for India to adopt global practices and learnings from the more mature satellite

markets like such as USA and Brazil, where allocation of satellite spectrum over auctions were previously attempted, which soon failed thus forcing these markets to move back to administrative allocation of satellite spectrum on sharable basis for the most efficient and effective use of the spectrum.

Q34. What could be the likely issues, that may arise, if Option # 2: Assignment of gateway spectrum through auction for identified areas/ regions/ districts is implemented for assignment of spectrum for gateway links? What changes could be made in the proposed option to mitigate any possible issues? In what manner, areas/ regions/ districts should be identified?

Response:

As mentioned earlier in our response, we reiterate that the gateway links are always limited in number and multiple gateways can co-exist within the same geography and share the same spectrum. Therefore, we recommend assignment of spectrum for gateway links for space-based communication services should be on a purely administrative basis.

Q35. In your view, which spectrum assignment option for gateway links should be implemented? Kindly justify your response.

Response:

As mentioned earlier in our response, spectrum assignment for gateway links should be on an administrative basis which is 'Option # 1: Area specific assignment of gateway spectrum on administrative basis'.

Q36. Kindly suggest any other auction design model(s) for gateway links including the terms and conditions? Kindly provide a detailed response with justification as to how it will satisfy the requirement of fair auction i.e., market discovery of price?

Response:

It is reiterated that satellite spectrum should be assigned administratively to ensure efficient utilization of the spectrum resource and only on non-exclusive basis to all eligible licensees.

Q37. Any other issues/suggestions relevant to the subject, may be submitted with proper explanation and justification.

Response:

No Comments.

Q38. In case it is decided for assignment of spectrum on administrative basis, what should be the spectrum charging mechanism for assignment of spectrum for space-based communications services

- i. For user Link
- ii. For gateway Link

Please support your answer with detailed justification.

Response:

The spectrum charging mechanism should be based on the AGR of the licensee for the administratively assigned spectrum. In our view, there should be a single rate of SUC, and it should be only 1% of AGR to cover administrative charges.

High spectrum fees should not be a disincentive to operators to use spectrum efficiently/flexibly and should not become an artificial barrier to entry. Internationally, no doubt on the suitability of administrative assignment for satellite spectrum, the cost of spectrum can vary significantly from country to country. There is however a general tendency towards spectrum fee reduction (e.g. Australia, Canada, Colombia, Saudi Arabia), especially in microwave frequencies, also due to the recognition that modern satellite systems can use large amount of spectrum (e.g. around 4GHz in Ka-band).

Q39. Should the auction determined prices of spectrum bands for IMT /5G services be used as a basis for valuation of space-based communication spectrum bands

- i. For user link**
- ii. For gateway link**

Please support your answer with detailed justification.

Response:

Auction determined prices for IMT/ 5G spectrum bands cannot be used as a basis for valuation of space-based communication spectrum bands due to the following reasons.

- Spectrum usage for space-based communications service is different from terrestrial communication services.
- Instead, satellite spectrum is being used to connect the unconnected places in the country where reach of terrestrial network is not feasible due to various reasons.

We also wish to mention that such a valuation approach would make spectrum unaffordable for the satellite industry and also restrict spectrum usage to terrestrial communication services.

Q40. If response to the above question is yes, please specify the detailed methodology to be used in this regard?

Response:

Not applicable in view of our response given above in Q.39.

Q41. Whether the value of space-based communication spectrum bands

- i. For user link**
- ii For gateway link**

be derived by relating it to the value of other bands by using a spectral efficiency factor? If yes, with which spectrum bands should these bands be related to and what efficiency factor or formula should be used? Please support your response with detailed justification.

and

Q42. In case of an auction, should the current method of levying spectrum fees/charges for satellite spectrum bands on formula basis/ AGR basis as followed by DoT, serve as a basis for the purpose of valuation of satellite spectrum

- i. For user link**
- ii. For gateway link**

If yes, please specify in detail what methodology may be used in this regard.

Response to Q 41 & 42

It is reiterated that satellite spectrum should be assigned administratively to ensure efficient utilization of the spectrum resource and only on non-exclusive basis to all eligible licensees.

We recommend that administrative allocation of spectrum for space-based communication services must be adopted.

Q43. Should revenue surplus model be used for the valuation of space- based spectrum bands

- i. For user link**
- ii. For gateway link**

Please support your answer with detailed justification.

Response

No comments in view of our response given above in Q 41 & 42.

Q44. Whether international benchmarking by comparing the auction determined prices of countries where auctions have been concluded for space-based communication services, if any, be used for arriving at the value of space-based communication spectrum bands:

- i. For user link**
- ii For gateway link**

If yes, what methodology should be followed in this regard? Please give country-wise details of auctions including the spectrum band/quantity put to auction, quantity bid, reserve price, auction determined price etc. Please support your response with detailed justification.

and

Q45. Should the international administrative spectrum charges/fees serve as a basis/technique for the purpose of valuation in the case of satellite spectrum bands

- i. For user link**
- ii. For gateway link**

Please give country-wise details of administrative price being charged for each spectrum band. Please specify in detail terms and conditions in this regard.

and

Q46. If the answer to above question is yes, should the administrative spectrum charges/fees be normalized for cross country differences? If yes, please specify in detail the methodology to be used in this regard?

Response to Q44, Q45 and Q46:

It is reiterated that satellite spectrum should be assigned administratively to ensure efficient utilization of the spectrum resource and only on non-exclusive basis to all eligible licensees.

In our view, all eligible licensees incl. ISPs should be allowed to use the spectrum allocated administratively on sharable basis. Globally mature satellite markets use satellite spectrum allocation on an administrative basis and follow the sharing of the spectrum between multiple operators within the framework given in the ITU Radio Regulations for allocation and management for sharable spectrum bands.

There is no reference globally wherein the satellite spectrum is auctioned. A few countries which have tried the spectrum auction in higher bands (C, Ku, Ka) have failed miserably and reverted to administrative allocation of the spectrum.

Q47. Apart from the approaches highlighted above which other valuation approaches can be adopted for the valuation of space-based communication spectrum bands? Please support your suggestions with detailed methodology, related assumptions and other relevant factors.

Response:

No Comments.

Q48. Should the valuation arrived for spectrum for user link be used for valuation for spectrum for gateway links as well? Please justify.

Response:

No Comments.

Q49. If the answer to the above is no, what should be the basis for distinction as well as the methodology that may be used for arriving at the valuation of satellite spectrum for gateway links? Please provide detailed justification.

Response:

No Comments.

Q50. 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.

and

Q51. 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.

Response:

No Comments on the valuation approach. We would like to reiterate that spectrum should be assigned on an administrative basis and spectrum usage charges should be 1 % of AGR to recover administrative cost of spectrum management.

Q52. Should the reserve price for spectrum for user link and gateway link be taken as 70% of the valuation of spectrum for shared as well as for exclusive assignment? 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 in case of (i) exclusive (ii) shared assignment and why? Please support your answer with detailed justification.

and

Q53. If it is decided to conduct separate auctions for different class of services, should reserve price for the auction of spectrum for each service class be distinct? If yes, on what parameter basis such as revenue, subscriber base etc. this distinction be made? Please support your answer with detailed justification for each class of service.

and

Q54. In case of auction based and/or administrative assignment of spectrum, what should the payment terms and associated conditions for the assignment of spectrum for space-based communication services relating to:

- i. Upfront payment**
- ii. Moratorium period**
- iii. Total number of installments to recover deferred payments**
- iv. Rate of discount in respect of deferred payment and prepayment**

Please support your answer with detailed justification.

Response to Q52, Q53 and Q54 :

Not applicable.

We wish to reiterate that satellite spectrum should be assigned administratively to ensure efficient utilization of the spectrum resource and only on non-exclusive basis to all eligible licensees.