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RESPONSE TO TRAI CONSULTATION PAPER ON: ASSIGNMENT OF SPECTRUM FOR SPACE-BASED COMMUNICATION SERVICES

This comprehensive 'Consultation Paper' by TRAI based on DoT's request is indeed laudable since it touches practically all the elements covered by DoT in their request for TRAI recommendations on the 'assignment' of spectrum for space-based communication services.

Introduction:

'RedBooks' is a boutique consultancy that provides technical & regulatory advisory services for ITU (International Telecommunications Union) member countries and satellite operators.

Our team has multiple years of collective experience across a multitude of countries with demonstrated expertise in governmental outreach, complex regulatory regimes, and multi-stakeholder operating environments.

ITU's Radio Regulations have evolved over a period of 117 years and are contained in bound volumes that are red in colour. These *Red Books* are the inspiration for our name.

It may be underlined at the outset that radiocommunication:

- for terrestrial use requires the spectrum resource; and
- for satellite communication requires 'orbit-spectrum' resource.

No satellite system is feasible or complete without the orbit resource – this is not the case for terrestrial mobile network.

Evidently, assignment of radio spectrum for *space-based applications* using either the auction or the administrative route must include 'orbit-spectrum resource' and not just the 'spectrum' resource. ITU-R Study Group 4/Working Party4A (WP4A) appropriately called '*Efficient orbit/spectrum utilization for FSS and BSS*' deliberates on satellite coordination, notification and associated matters for FSS & BSS networks.

Detailed procedures, methodologies for use of the 'orbit-spectrum resource' are contained in the provisions of ITU's Radio Regulations (RR).

It may be also be emphasized that unlike the auction for terrestrial service spectrum e.g. 4G,5G etc., 'orbit-spectrum resource' for space-based services is shared by multiple users by following the coordination & Notification mechanisms (Article 9 & 11 of RR, respectively), Coordination threshold limits (Appendix 5 of RR), GSO-GSO coordination (Appendix 8 of RR), NGSO-GSO coordination (Article 22 of RR), GSO/NGSO/Terrestrial coordination (Article 21 of RR) and coordination trigger PFD values stated in Appendix 5 of RR. The process & methodology of sharing spectrum for space-based services shared by multiple users has been developed over the years, 117 years to be more exact, as a result of 39 World Radiocommunication conferences from 1906 to 2019.

The same frequency band at the same geographical location is extensively used and reused by numerous satellite systems globally taking recourse to the agreed procedures and methodologies detailed in ITU's RR. This has offered satellite use in a competitive manner.

As per the ITU/Radiocommunication Bureau, the current provisions in the RR have resulted in satellite networks to be free from reported harmful interference from other services in 2019 by as much as 99.95%.

For the C, Ku and Ka bands – both up and down links – the spectrum allocated in Article 5 of the RR for space services is shared (without breaking it into chunks or segments – unlike the case of IMT spectrum auction where segments are auctioned for exclusive use by IMT operators) using the procedures outlined in RR and once the favourable finding is obtained for No.11.31 (conformity with the Table of Frequency Allocations) and No.11.32 (Completion of coordination with countries identified by ITU) the frequency assignments are registered in Master Register of ITU/BR for international recognition and protection. It is the objective of every satellite operator to reach this international recognition status (as outlined in Article 8 of RR).

Providing exclusive access of spectrum for space/ satellite applications (often referred as satellite spectrum also) to one operator by way of auctioning it would negate the process developed so painstakingly over the years by the ITU. It goes contrary to the principle of using the same spectrum by multiple users and may seriously hinder and hurt the use of satellites to cover unserved / underserved areas of our country

This clearly indicates that there is no exclusivity (unlike auction & use of spectrum for terrestrial mobile service) for space-based communication services and therefore to `auction` spectrum for satellite services with exclusive allocation and freedom to share it among space and terrestrial use, is not an option.

This path has not been chosen by administrations or members of the ITU in general, and a few who chose to tread this, ended up in failure or have rolled back.

BOX

Contrary to the objective of this `consultation Paper, the concept of spectrum auction for space/ satellite applications, is not supported by the technical and regulatory requirements enunciated in the relevant provisions of ITU's Radio Regulations, primarily for reasons stated below:

- 1. `In-land` terrestrial frequency assignments are mostly NOT notified to the ITU for registration in the MIFR, only those are notified that may cause or receive cross border interference and may require international recognition and protection.*
- 2. Frequency assignments to satellite communication inherently require international, coordination, notification and finally registration in MIFR for international recognition & protection from harmful interference, which is the prime objective of every radio-communication network & system.*
- 3. Administrations cannot unilaterally bypass international obligations or ignore them without taking the risk of ITU cancelling the registration of the frequency assignment(s) from the MIFR under certain provisions of Article 11 or No.13.6 of the Radio Regulations.*
- 4. RR Resolution 2 emphasizes that "All countries have equal rights in the use of both the radio frequencies allocated to various space radiocommunication services and the geostationary-satellite orbit and other satellite orbits for these services".*
- 5. Unlike air space, satellite orbital positions are not within an individual country's territorial jurisdiction.*
- 6. `Resolves 1` of RR Resolution 2 states, "that the registration with the Radiocommunication Bureau of frequency assignments for space radiocommunication services and their use does not provide any permanent priority for any individual country or groups of countries and do not create an obstacle to the establishment of space systems by other countries.*
- 7. Resolves 1 of RR Resolution 4 also implies that- Frequency assignments to space radiocommunication stations located on the geostationary-satellite and other satellite orbits...shall not be considered perpetual.*
- 8. Evidently, Satellite spectrum must be treated by countries differently from the spectrum used for terrestrial services.*
- 9. Countries should not see the ITU as a wholesaler of spectrum rights granted in perpetuity which countries can then market at retail to satellite operators.*

10. Auction methodology is normally adopted when there is scarcity of a particular resource and the item being auctioned is free from any encumbrances. Satellite spectrum (and associated orbit locations) do not qualify for auction.
11. Auctions are inconsistent with the International Nature of Satellite Spectrum & associated Orbit resources, which are essential for space/ satellite Communications.
12. Operation of a satellite network is possible by the coordinated use of the 'orbit-spectrum resource' and auctioning the radio spectrum for space-based services is like treating these services with a 'mindset' applicable to terrestrial-based services.

The task of making recommendations by TRAI along the lines as requested by DoT is like asking TRAI to rewrite provisions incorporated in the Radio Regulations – that have taken so long to develop. This point becomes all the more relevant if reference is made to para 1.4 e), on page 6 of TRAI's Consultation Paper where TRAI has been requested to provide their recommendations for the spectrum auction as per the regulatory/ technical requirements enunciated in the relevant provisions of the latest ITU-R Radio Regulations.

Redbooks Consultancy believes that auction of satellite spectrum in C band, Ku band and Ka band is not supported and strongly advised against. It shall be detrimental to the growth of telecommunication and broadcasting services in India which are so essential for taking broadband and digital connectivity to all nooks & corners of the country for inclusive development of all regions & population, as well as to achieve important national programs.

We also believe that the present satellite-based services in India need all facilitation & encouragement from Govt. (Policy - DoS, DoT & MIB, etc), Regulator (INSPACe & TRAI), as well as other related entities, for their required growth and availability to all needy citizens & entities in an affordable manner, and any review of satellite spectrum charges should be considered only after these services have achieved substantial volumes & affordable tariffs.

Our response to various questions of the TRAI CP is based on the above approach.

Your sincerely,



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Issues for consultation

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:

Following frequency bands are allocated as per Article 5 of Radio Regulations (RR) for satellite links on a shared basis and may be coordinated for use by multiple satellite networks as per the procedures detailed in the RR.

ITU filing procedures and the technical parameters only refer to the direction of transmission with the satellite beams described as transmit beam (Satellite to Earth Station) or receive beam (Earth Station to Satellite):

Non-Plan Bands:

Frequency range	Link direction
1518 - 1559 MHz	space to Earth
1610-1660.5 MHz	Earth to space
1980-2010 MHz	Earth to space
2170-2200 MHz	space to Earth
2483.5-2520 MHz	space to Earth
2670-2690 MHz	Earth to space
3400-4200 MHz	space to Earth
5725-6700 MHz	Earth to space
6700-7075 MHz	Earth to space
7250-7750 MHz	Earth to space
7900-8400 MHz	Earth to space
10.7-12.95 GHz	space to Earth
11.2-11.45 GHz	space to Earth
11.7-12.75 GHz	space to Earth
12.75-13.25 GHz	Earth to space
13.75-14.0 GHz	Earth to space
17.8-18.6 GHz	space to Earth
18.6-18.8 GHz	space to Earth
18.8-19.3 GHz	space to Earth
19.3-19.7 GHz	space to Earth
19.7-20.2 GHz	space to Earth
20.2-21.2 GHz	space to Earth
27.5-28.6 GHz	Earth to space
28.6-29.1 GHz	Earth to space
29.5-30.0 GHz	Earth to space
V-band	Earth to space & space to Earth

Planned bands:

Plan	Frequency bands		Reference to ITU's Radio Regulations
	Uplink	Downlink	
BSS Plan		11.7-12.2 GHz	Appendix 30
BSS feeder links Plan	14.5 - 14.8 GHz 17.3 - 18.1 GHz		Appendix 30A
FSS Plan	12.75 - 13.25 GHz 6.725 - 7.025 GHz	10.7 - 10.95 GHz 11.2 - 11.45 GHz 4.5 – 4.8 GHz	Appendix 30B

Since all the above frequency bands can be shared by many satellite networks, ITU does not provide any limit to the number of satellite networks that can be filed for coordinated use as per Article 9 of RR.

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:

The first column (Type of service) referred to above in Question 2 describes not the service (radiocommunication service) but its applications. Hence, the title should be read as ‘Type of Application’. (There are 41 radiocommunication services defined in Article 1 of RR). Any satellite operator is free to file satellite network(s) for any application depending on the ‘ecosystem’ or the hardware developed for that application

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: As per the ITU there is no limit to the number of satellite networks that can be filed for any frequency band allocated to space service in the Article 5 of the RR.

The question of practical limit posed for NGSOs is being debated in ITU-R Study Group 4 (WP4A) in the light of the large NGSO constellations that have already been filed with the ITU.

Coordination procedures described in Article 22 of RR and the modality for checking and design of the software package for verifying compliance with the efd limits of Article 22, are being debated in ITU-R Working Party 4A.

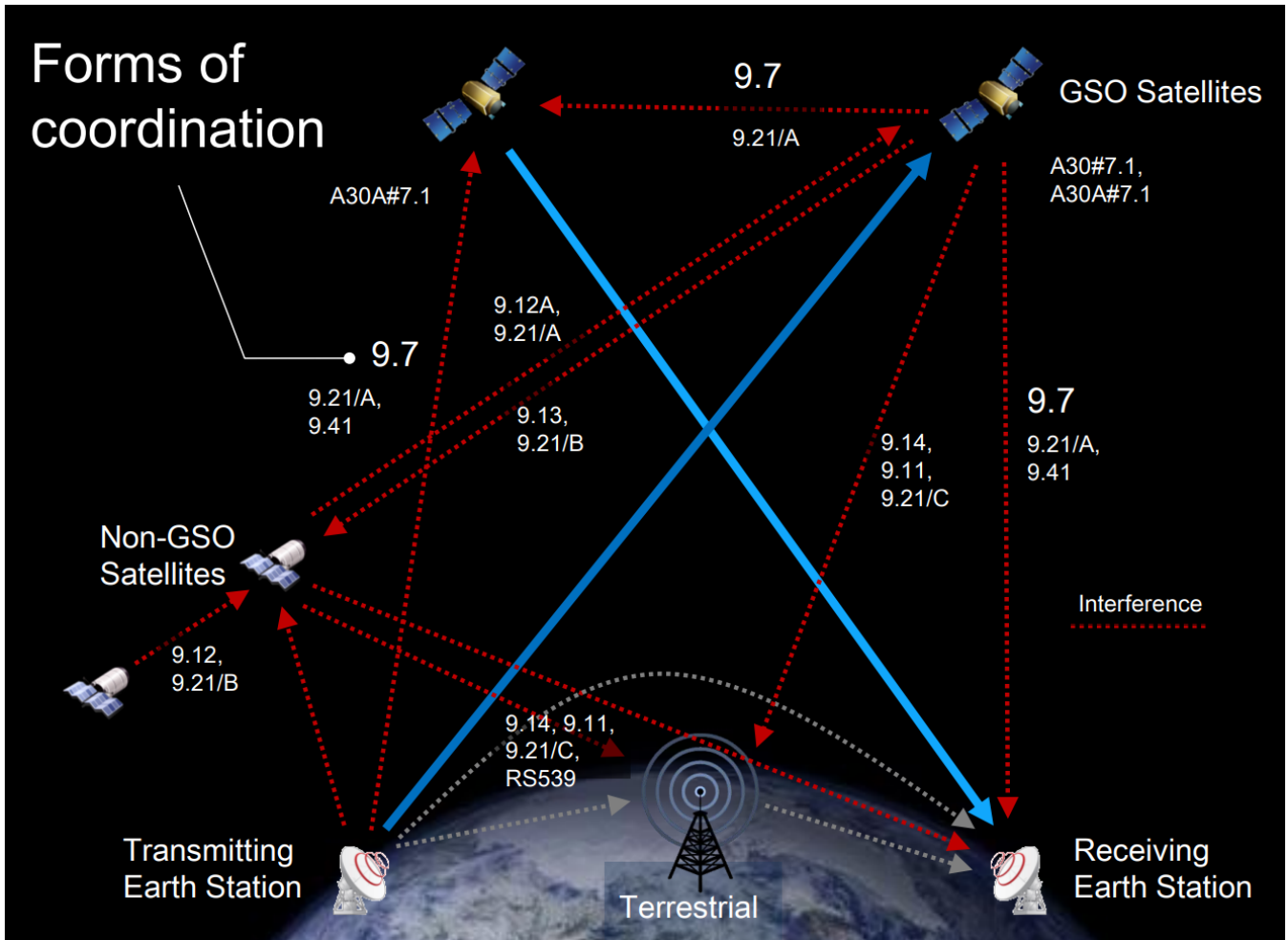
Q4. For space-based communication services, whether frequency spectrum in higher bands such as C band, Ku band and Ka band, should be assigned to licensees on an exclusive basis? Kindly justify your response. Do you foresee any challenges due to exclusive assignment? If yes, in what manner can the challenges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

Response:

Spectrum in C, Ku & Ka bands for space-based communications must NOT be assigned on an exclusive basis (Reference is invited to the Table of Frequency Allocations – ToFA - in Article 5 of ITU's RR). The entire ITU membership has been successfully following the shared use of satellite spectrum with coordination procedures as detailed in the Radio Regulations. Spectrum for space-based services and their applications (DTH, M2M, internet, VSAT, HIBS, IFC et al) is different from the terrestrial spectrum for mobile service and its applications (e.g., IMT, Cellular mobile etc.) and cannot be segmented for exclusive use. Satellite spectrum is shared by multiple users taking recourse to strategies that have been developed over the years and incorporated in the Radio Regulations. Unlike the use of terrestrial radio frequencies that do not spill over beyond the international borders (except those used near such country's borders and therefore internationally coordinated), satellite frequencies (downlink) even when used in spot beams can be steered or go beyond international borders. It is therefore incumbent on its users to carry out the coordination procedures detailed in ITU's Radio Regulations.

The Spectrum for space-based services is always linked with satellites/ spacecrafts in various orbits. As per No. CS.196 of the ITU Constitution, the Orbit-Spectrum are combined natural resources, available to all in an equitable manner at international level.

The pictorial depiction below describes the interference scenario and the multiple coordination requirements necessary for use of spectrum by GSOs-NGSOs and terrestrial applications:



Exclusive allocation of spectrum to space-based services is contrary to the basic philosophy underlying its shared use. The international community has over the years built an eco-system and incorporated it in the RR – and this system is working well (satellite networks have been free from reported harmful interference from other services in 2019 by as much as 99.95%). Any effort to disturb it would disturb the internationally accepted norms and would go grossly against India’s commitment to ITU’s Constitution and Convention.

ITU’s Radio Regulations complement the ITU Constitution (No. 31 of ITU Constitution), and are based on the main principles of `efficient and rational use of the RF spectrum

'and` equitable access' to the spectrum / orbit resources for countries, laid down in No. 196 (Article 44) of the ITU Constitution.

The importance of Radio Regulations to India is such that India is a signatory to this international Treaty. (Incidentally, India is one of the highest contributors to the ITU Budget. It pays 10 Units/year that is equal to about 3.3 million CHF/year - Indian Rs. 27 Crore per annum).

Since the spectrum in C, Ku & Ka bands for space-based communication must NOT be allocated on an exclusive basis, the question of challenges, if any, and the possibility of overcoming them, do not arise.

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,

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.

Whether intra-band sharing of frequency spectrum with other satellite communication service providers holding spectrum up to the prescribed spectrum cap, needs to be mandated?

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.

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:

As mentioned in response to Question 4, the Orbit-Spectrum are interlinked resources shared internationally in an equitable manner. Hence, assignment of radio 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 is against the fundamental principles of the Radio Regulations and would adversely impact the satellite communication ecosystem – in fact it could be a non-starter.

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 the light of the position taken by us and the responses to earlier questions, it is felt that these questions have been framed with a `terrestrial spectrum auction' mindset.

The question is therefore considered as hypothetical.

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:

In the light of the position taken by us and the responses to earlier questions, it is felt that these questions have been framed with a `terrestrial spectrum auction' mindset.

The question is therefore considered as hypothetical.

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:

As indicated in response to questions 1 – 4, the Auction of internationally shared Orbit-Spectrum resources is not feasible. Therefore, the situation described in the above question is considered hypothetical.

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, -

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.

Any other suggestions may kindly be made with detailed justification. Kindly justify your response.

Response:

The frequency spectrum in higher frequency bands such as C band, Ku band and Ka band for space- based communication services should be used strictly as detailed in ITU's Radio Regulations – India is a signatory to this binding treaty.

Framework for sharing of frequency spectrum among satellite communication service providers is elaborately detailed in the RR and there is no need to reinvent the wheel. A few methodologies and procedures for sharing satellite spectrum are:

The coordination & Notification mechanisms (Article 9 & 11 of RR, respectively);

Coordination threshold limits (Appendix 5 of RR);

GSO-GSO coordination (Appendix 8 of RR);

NGSO-GSO coordination (Article 22 of RR);

GSO/NGSO coordination (Article 21 of RR);

Coordination trigger PFD values stated in Appendix 5 of RR

Etc.

All satellite networks that have coordinated with Indian satellites and are registered in ITU's MIFR (Master International Frequency Register) be granted landing rights, on suitable terms and conditions, to offer services in India. Such system is prevalent in many countries.

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:

Before responding to the question of allocating the spectrum 27.5 to 28.5 GHz for space based communication services as well as to IMT applications, it may be emphasized that the Radio Regulations have allocated this band for high-density applications in the fixed-satellite service (along with Fixed & Mobile Services) on co-primary basis. As per the ITU data base, 1540 satellite filings exist in this band.

The band 27.5-30 GHz is also used by the fixed-satellite service (Earth-to-space) for the provision of feeder links for the broadcasting-satellite service.

27.5 to 30.0 GHz is also being deployed by NGSO constellations i.e. for gateway uplinks for OneWeb, Amazon Kuiper, Space-X Starlink and Telesat Lightspeed besides, 27.5 to 29.5 GHz (Earth to space) is also being used for earth stations in motion communicating with geostationary fixed-satellite service space stations.

Therefore, the flexible use of 27.5 to 28.5 GHz for space based communication services as well as to IMT applications, is not supported because it shall be extremely difficult to mitigate the aggregate interference by all transmitting IMT stations within the coverage area of the satellite to an acceptable level. Besides, the deployment of future transmitting Earth stations shall be very challenging in areas where IMT systems are deployed.

For these reasons and also the fact that this band (27.5-28.5 GHz) is used by ISRO/DoS satellite networks, the plan to use this band for IMT application must be dropped and the NFAP be suitably amended.

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:

The idea of flexible use in the frequency range of 27.5 - 28.5 GHz for space-based communication services and IMT services, is not supported (please see detailed answer to Ques. 10).

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:

The frequency range 28.5-29.5 GHz must be allocated and used only for satellite services, as clarified in response to Ques. 10.

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:

Is there a need to deploy and use of the frequency band 28.5 to 29.5 GHz for Captive Non-Public Networks (CNPN)? The challenges would be similar to the flexible sharing of the band 27.5 to 28.5 GHz between IMT and space-based services and therefore CNPN in this band is neither supported or recommended (please see response to Ques. 10).

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:

The concept of space-based communication services and their categorization into different classes of services requiring different treatment for spectrum allocation has been amply dealt with in ITU’s Radio Regulations in Article 5. These allocations are made after prolonged deliberations between the ITU Membership and have been subjected to many years of compatibility studies. For different applications using space/satellite communications, different ‘Guidelines’ for spectrum assignment, can be decided at national level.

There is no need to deviate from ITU’s Radio Regulations – a binding international treaty ratified by India.

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:

The spectrum resource in L-band and S-band is also linked to Orbit resource (please see details in response to Ques. 4). Frequency assignments for user links for space-based communication services in L-band and S-band must also follow the provisions of Article 9 and 11 of Radio Regulations. These procedures are followed the world over by ITU membership.

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:

The spectrum resource in C-band, Ku-band and Ka-band is also linked to Orbit resource (please see details in response to Ques. 4). Spectrum in C, Ku and Ka bands is used and filed by a multitude of ITU member countries. In fact, most filings in ITU database are in these frequency bands. Every effort must be made to ensure that these bands are used and reused by as many satellite networks as possible by using the coordination procedures so painstakingly developed over the years by ITU membership as a result of many WRCs (World Radiocommunication Conferences). The Radio Regulations have ensured very good global compatibility between all the 41 radio services resulting in satellite networks to be free from reported harmful interference from other services in 2019 by as much as 99.95%.

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

Response:

This question appears to have been framed with a `terrestrial' spectrum mindset.

No such differentiation for frequency assignment is needed to be made for satcom. services in the light of the international commitments, if any, that may become necessary for coordination of space services. Uniform licensing conditions covering the entire country may be advantageous. However, in case of 'Narrow Beams', e.g., in High Throughput Satellites (HTS), the licensing can be within the area of earth covered by that Beam.

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:

As stated earlier, and also reiterated, auction of spectrum for space radiocommunication services/applications is not advocated or supported.

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

Auction-based

Administrative

Any other?

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

Response:

Auction of spectrum for space radiocommunication services/applications is not advocated or supported.

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:

Auction of satellite spectrum is strongly opposed (details in responses to Ques. 4 & Ques. 10).

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

What should be the validity period of the auctioned spectrum?

What should be the periodicity of the auction for any unsold/available spectrum?

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:

Auction of satellite spectrum is strongly opposed (details in responses to Ques. 4 & Ques. 10)

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:

While filing a satellite network with the ITU frequency assignments only for satellite transmit and satellite receive beams are identified. Details of gateway links and user links that may be established in the same frequency band are not required to be defined or filed with the ITU. A reference to Appendix 4 and Article 9 of the Radio Regulations clarifies that there is no requirement for assigning different frequency bands for gateway and user links.

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:

Protection or separation distance is not necessary / not required around the satellite earth station gateways when they are using the same frequency band and operating in the same direction of transmission. For the case of use of same frequency band by GSO as well as N-GSO satellite systems, protection/ coordination criteria is defined in Article 22 of ITU Radio Regulations.

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:

The existing Licensing Requirements/ conditions for Operators of different types of services have already been specified as a part of Unified Licence. The frequencies/spectrum are 'assigned' thereafter. Auction of satellite spectrum is not supported (please see response to Ques. 10).

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:

The existing Licensing Requirements/conditions for Operators of different types of services have already been specified as a part of Unified Licence. The frequencies/ spectrum are 'assigned' thereafter.

Administrative, non-exclusive assignment of satellite frequencies to stations – space station or ground station - must be in accordance with the provisions contained in the Radio Regulations. These are the only well established 'terms and conditions' that have worked and continue to work successfully for the realization of satellite systems.

We do not, therefore see any need to specify or establish any additional terms and conditions.

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:

The existing Licensing Requirements/conditions for Operators of different types of services have already been specified as a part of Unified Licence.

There is no need to apply any additional/separate provisions or restrictions on crossholding of equity for satellite-based services.

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:

Based on the provisions and criteria stated in Articles 21, 22, 9, 11 and Appendix 5 (please refer the section 'Introduction' in the beginning of our response), coexistence of terrestrial services and space-based communication services for sharing of same frequency range has always been possible.

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:

Polarization discrimination as a tool for bringing about compatibility between satellite networks has been commonly resorted to by ITU member countries.

ITU 'PREFACE' ([Preface_e \(itu.int\)](#)) in Table-5 (*Symbols used to indicate the polarization*) defines various polarizations deployed by administrations.

Normally, it is quite cumbersome to coordinate usage of different polarizations by different users. Hence, as a general practice, both polarizations of a frequency assignment are assigned to be used by the same user/network.

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)?

Model #1: Exclusive spectrum assignment

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.

Response:

Auction of satellite spectrum in C band, Ku band and Ka band is not supported. It shall be detrimental to the growth of satellite based telecommunication and broadcasting services in India.

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

Response:

The response is the same as in Question 29.

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:

The response is the same as in Question 29.

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:

The response is the same as in Question 29.

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:

The response is the same as in Question 29.

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:

The response is the same as in Question 29.

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

Response:

The response is the same as in Question 29.

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?
Q37. Any other issues/suggestions relevant to the subject, may be submitted with proper explanation and justification. 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 response is the same as in Question 29.

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:

. The satellite-based telecommunication services are quite different from terrestrial based telecommunication services like IMT/ 5G. Hence, valuation of satellite spectrum based on auction determined prices of spectrum bands for IMT/5G services, is not appropriate.

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

Response:

Not Applicable

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.

Response:

The satellite-based telecommunication services are quite different from terrestrial based telecommunication services. Hence, the concept of relative spectral efficiency does not apply in these cases. Anyway, auction of satellite spectrum is not supported.

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:

The response is the same as in Question 29.

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:

The response is the same as in Question 29.

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.

Response:

The response is the same as in Question 29.

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.

Response:

All countries charge administrative licensing fee from operators that use space-based communications. These can be suitably regulated in India based on past experience and international best practices.

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:

All countries charge administrative licensing fee from operators that use space-based communications. These can be suitably regulated in India based on past experience and international best practices.

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.

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

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.

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.

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.

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.

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.

Response:

Response to questions 47 to 53 is `not applicable' based on the responses for similar earlier questions.

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 instalments to recover deferred payments**
- iv. Rate of discount in respect of deferred payment and prepayment**

Please support your answer with detailed justification.

Response:

Auction for Satellite Spectrum is not supported, as detailed in response to many earlier Questions.

For administrative assignment of frequencies for satellite services (along with relevant satellite & orbit details), the payment of annual Licence Fee and Spectrum charges has to be made upfront
