BROADBAND INDIA FORUM
"Think Tank for Digital Transformation"

BIF Response to TRAI CP on Assignment of Spectrum for Space-based Communication Services

PREAMBLE

At the outset we wish to laud the Authority for coming out with a Consultation Paper that takes a balanced view in this very important subject matter. India needs Broadband through Commercial Satellites to reach and connect every nook and corner of the country (including rural & remote areas) in the fastest and most affordable manner. This is required for achieving Hon'ble PM's vision of Digital India, the mission of 'Broadband for All' and hasten the process of reaching a 1Tn USD Digital Economy by 2025.

Satellite Communications is not only required for connecting the unconnected and the under connected, but is required for improving IoT communications in the areas of agriculture, vehicular tracking, disaster management, etc, and for providing community services in areas, where terrestrial communications find it difficult to reach.

Satellite spectrum being a shared resource, cannot be broken down into exclusive blocks or chunks as in the case of terrestrial spectrum for the purpose of auction. By trying to do so, would lead to serious fragmentation and create inefficiencies and would go against the fundamental principles of spectrum management as laid down by ITU- Radio Regulations and our own NFAP.

Hence trying to auction satellite spectrum is likely to lead to seriously harm the interest of the sector and jeopardise the growth of satellite communications, which the country so desperately needs. Also by auctioning of the spectrum, the number of players who can participate would be seriously limited. Auction is likely to lead to spectrum wholesalers and entities with deep pockets buying spectrum. Such entities will then act as 'gatekeepers' and their actions are likely to result in hurting the burgeoning start up sector.

We believe that administrative assignment would be a fair and equitable method of allocation of satellite spectrum to all stakeholders – big and small, indigenous and global, and prevent needless complications that could possibly arise out of the spectrum auctions and ensure the efficient use of satellite spectrum while fostering competition and innovation in the sector. In our opinion, any move to auction satellite spectrum especially in the microwave and millimeter wave bands (which has not been done anywhere else globally) would be detrimental to the potential of the satellite sector to help fulfil India's digital ambitions.

Our comments to the questions in the Consultation Paper are in consonance with the views expressed above.

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.

BIF RESPONSE

The appropriate frequency bands for Gateway and user links are in the following Satellite Spectrum bands viz. S-band, L-band, C-Band, extended C band, Ku-Band and Ka band. Also some applications are there in Q/V bands.

Commercial Satellite Services are present in all these spectrum bands for different types of communication & broadcasting services. GEO & LEO satellite constellations require access to the entire range of Ku and Ka-bands for seamless communication services. Also all satellite based broadcasting services (DTH) which reach at least 70Mn Households in the country use the extended C band (3700-4200Mhz) and the Ku band.

Full access to these spectrum bands should be permitted exclusively for the purposes of satellite based commercial communication & broadcasting services. Partial access could severely impact end-to-end connectivity, network performance and user experience. Hence full spectrum for satellite services should be made available in these bands.

Segregating the satellite frequency based on services segregations and usages is not a practical exercise and will prove to be further challenging.

The allocation of spectrum for satellite services is governed by international treaties and agreements, established by the ITU, so coordination at a global level is critical for the provision of satellite services. Hence the frequency bands for space-based communications services should continue to be governed based on International Telecommunications Union's Radio Regulations ("ITU RR") which also is the basis of National Frequency Allocation Plan ("NFAP").

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)

BIF RESPONSE

Given that the Indian Government has just opened the Space communication segment for private participation, it may be somewhat premature to identify and segregate satellite/space spectrum into various service-based categories. Furthermore, the satellite spectrum has always been a shared resource within which multiple users operate efficiently.

Therefore, segregating the satellite frequency based on service segregations and their usages is not a practical exercise, and prospectively estimating the quantum of spectrum required for each type of service will prove a further challenge. In other words, the quantum of spectrum for various services cannot be prescribed.

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.

BIF RESPONSE

There is no limit on the number of NGSO satellites which can work in a coordinated manner in different orbital locations using shared spectrum in an equitable manner.

While there is no limit on the number of NGSO systems that can operate in a coordinated manner, the exact number would depend on various technical and regulatory factors, such as the frequency bands used, the satellite orbits, the power levels, the antenna beam widths, and the level of coordination among the various NGSO systems.

Spectrum sharing in the L-band and the S-band is also possible. In this regard, we respectfully disagree with TRAI as mentioned in the Consultation Paper. In fact, while sharing spectrum in the L-band and S-band among different applications may present technical challenges, it is possible to explore solutions that can enable efficient use of the limited spectrum resource, for example, by using code separation, interference cancellation techniques, or power control techniques to mitigate interference and allow sharing of the same frequency band among multiple Mobile-Satellite Service (**MSS**) systems.

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.

BIF RESPONSE

For space based communications, spectrum should not be allocated on an exclusive basis, since that would mean fragmentation of spectrum, loss of efficiency and other ill effects which are undesirable.

As mentioned in the Preamble to this Response, spectrum in all the Satellite Spectrum bands should be assigned only in an administrative manner in a shared manner for all operators on a shared basis

If it is divided into portions or chunks and assigned on exclusive basis, it would lead to fragmentation of the spectrum and that would drastically impact the efficiency of the given spectrum, thereby defeating the core principles of spectrum policy and management. Also to be able to exclusively carve out a chunk of the spectrum, would require a complicated set of rules for the coordinated operation of different satellites using the same spectrum band.

The fragmentation of space spectrum results in a loss of satellite capacity that cannot be compensated for. In fact, the sharing of frequencies between satellite operators is what results in large capacities being available over a given geography. This means that the spectrum used for satellite services lacks exclusivity. Any attempt to create exclusivity by dividing the satellite spectrum will render it virtually unusable for the operators. Thus, exclusive assignment would lead to significant loss of value for satellite operators as well as for public interest.

We believe that administrative assignment would be a fair and equitable method of allocation of satellite spectrum to all stakeholders – big and small, indigenous and global, prevent needless complications that could possibly arise out of the spectrum auctions and ensure the efficient use of satellite spectrum while fostering competition and innovation in the sector. In our opinion, any move to auction satellite spectrum (which has not been done anywhere else globally) would be detrimental to the potential of the satellite sector to help fulfil India's digital ambitions.

In view of the challenges that would arise due to auctioning of spectrum or assignment of spectrum in an exclusive manner, it is advised that the same maybe allocated only through administrative manner as reiterated above.

To further amplify the support to the above position, we wish to provide the following arguments (as given below):

Justification of our Response

1. **Satellite spectrum a shared resource: S**atellite spectrum is a shared resource and so, fundamentally, it cannot be auctioned as it cannot be exclusively assigned. The basic prerequisite of a resource that is to be auctioned, is that it should be available for sale as discrete, unique products. Satellite spectrum does not satisfy this elementary criterion. The concerned satellite band of frequencies is shared by all the operators. It is somewhat akin to WiFi spectrum or the common ambient air or a public road or highway.
2. **International nature and ITU involvement:** Satellite spectrum has no national territorial limits and is international in character. It is coordinated and managed by the International Telecommunications Union (ITU) through a global convention which is signed by 194 nations, to which India is also a signatory. Consequently, satellite spectrum management is subject to the radio regulation of the ITU.
3. **Global satellite spectrum allocation:** World over, satellite spectrum is authorized for 'right-to-use' by all administrations and is allocated only by administrative process, at charges that essentially cover the cost of administration. Unlike terrestrial spectrum, satellite spectrum is never exclusively assigned to the operator but coordinated internationally and shared among multiple operators for different orbital slots and all types of satellites. Thus, the terrestrial concept of exclusivity does not apply in case of satellite spectrum and therefore auctioning is not applicable. Moreover, any commodity to be auctioned must be free from encumbrances. Satellite spectrum has international encumbrances.
4. **International Practices:** No Government in the world has auctioned spectrum especially in the micro/ millimetre wave bands for satellites or is considering to do so. Yes, in the past, a couple of countries in the Americas had tried to follow the auction of the satellite orbital slot, but not of the spectrum. However, even the auction of orbital resources along with right to use spectrum proved very problematic and the countries eschewed that approach:
    a) **US**: Discontinued the approach and enacted the Orbit Act in 2000 to prohibit auction (auction of satellite spectrum for the provisions of international or global satellite communication services) is prohibited by US law.
    b) **Brazil**: Discontinued the auction and enacted law to administratively assign spectrum in the year 2019 (Art.172 of Law No. 13789 of October 3 ,2019).
    c) **Mexico**: Auctions failed and discontinued from year 2014.
5. **Satellite service vs terrestrial mobile:** Unlike terrestrial mobile network operators, satellite operators use the same frequencies across multiple satellites without interfering with each other. They also coordinate with each other in sharing the same frequencies across their services. As a result, the satellite spectrum is never exclusively assigned as opposed to the mobile access spectrum
6. **Inefficient spectrum usage:** In a conventional auction for terrestrial spectrum, the capacity is created by slicing the total available spectrum into various block sizes and each block is assigned individually to winners for exclusive use. However, the auction method cannot be followed for satellite spectrum due to the highly inefficient frequency reuse capability, which restricts the use of the spectrum only

to a few operators and significantly reduces its value. Moreover, the sharing of frequencies between operators is what results in large capacities being available over a given geography.

7. **Satellite spectrum and mobile spectrum are different:** Any attempt to equate satellite spectrum with terrestrial mobile spectrum in the matter of spectrum allocation would be completely flawed and incorrect. Satellite services and the terrestrial mobile services are gross 'unequals'. The latter have several unique and precious rights like right to interconnection, right to interference-free spectrum, right to unique numbering resources and right of way. Satellite services have none of these. As per Art. 14 of the Constitution of India, the two have to be treated differently on a mandatory basis because case law has established that unequals are not permitted to be treated as equals.
8. **Grossly different revenue potentials and payment capacity:** Terrestrial mobile operators and satellite VSAT operators are on completely different footings – virtually located in different universes. The current annual revenue of Indian mobile operators is about Rs.2.5 lakh crores i.e. Rs.250000/- whereas that of the Indian satellite VSAT operators is only around Rs. 500/- crores. Satellite services are therefore as miniscule as 1/500th or a mere 0.2% of the mobile operators' revenue. It would be a travesty of justice to equate the two in treatment of mode of allocation of spectrum resource.

   It would therefore be most unfair to put the two groups through the same or similar allocation method.
9. **Public Good and the Cost of services:** Satellite services are almost the only method available for reaching broadband connectivity to the rural and remote regions as also to regions affected by disaster. Hence, auctions which are known to invariably result in high prices, would push up the cost of the service and thus go against public interest or public good and severely impact the wider socio-economic welfare. Satellite services need to be nurtured, protected and fostered in the public interest.
10. **Would harm Inclusive Development:** Satellite broadband is being deployed to serve the unserved and underserved areas of the country. For example, the Government decision to connect far flung islands and border areas of North-East through satellite broadband would be jeopardised if the said spectrum bands for the satellite to deliver satellite broadband were to be auctioned to service providers, who would like to use it for either terrestrial purposes or any other application**. Such a move would be counter-productive to the digital dreams of the country and run contrary to the objectives of inclusivity and 'Sabka Saath, Sabka Vikas' - to which the nation and Government are committed.**
11. **Stifling startups and limiting growth:** The high prices resulting from spectrum auctions would also stifle many budding start-ups who are building and launching new satellites and would need satellite spectrum for launching their own satellite constellations. India presently holds barely 2% of global revenues of the satellite sector. If we aim to meet the stated goal of achieving 10% of global revenues by 2030 or so, and truly emerge as a leading digital economy where satcom is a vital pillar, auctioning would represent a massive setback.
12. **Creation of Gatekeepers:** Deep pocketed players could use auctions to a mass disproportionate amount of spectrum and become gatekeepers and block the entry

of new operators. Thus, a regressive and anti-competitive environment would get created, harming the economy and the nation.

13. **Inadequate Satcom penetration in India:** India has only one-third of its Asian peers' satellite connectivity per capita and only one-twentieth or even lower than that of Europe and the US. This does not reflect well for our digital ambitions, considering that we as a country have vast expanses of territory which are in inhospitable and uninhabited areas and which cannot be possibly served by terrestrial broadband due to techno-economic constraints. Inarguably, satellite spectrum auctions would greatly retard even the existing growth of the industry.
14. **Supreme Court's clarification on Spectrum Auctions:** In many quarters, there is a mistaken understanding that the Supreme Court had mandated spectrum auction in all situations after the 2G spectrum case. However, we wish to respectfully submit that what the Hon'ble Supreme Court held, in its advisory jurisdiction in the Presidential Reference relating to the order in the 2G case that "Auction, as a method of disposal of natural resources, cannot be declared to be a Constitutional mandate under Art. 14 of the Constitution of India." The Supreme Court further stated that "Auction may be the best way of maximising revenue, but revenue maximisation may not always be the best way to serve public good." Hence, because of the various other grounds already outlined above which include public interest and public good, there are ample justifications for continuing to follow administrative allocation of satellite spectrum and this is also completely in line with international practice.
15. **Multiple users of satellite spectrum:** There are multiple users of satellite spectrum, viz., VSAT, DTH, broadcasters and teleport. Any plan to auction spectrum only for satellite communications would create a host of complications in various industry segments affected by this. Apart from satcom, DTH and broadcasting are powerful vehicles for creating public good and the penetration of these could get adversely impacted if satellite spectrum is auctioned.
16. **Investment Risk & Uncertainty*:*** Any enterprise wanting to plan and establish a constellation of satellites for providing broadband services in India cannot predict the cost of advancing these services in India, unless there is prior participation and assignment of spectrum in an auctioning process. Hence, building and launching of satellites can only be done after an auctioning process, where the outcome of the auction may make it unfavourable for the enterprise establishing Indian space assets to invest in a constellation for providing services at all, given the economics of spectrum and NGSO space assets. With this uncertainty, no investment can be sought for establishing space assets to provide broadband services due to the increased risk and uncertainty. The fledgling space sector which has just started picking up growth could get stifled the implications arising from the introduction of spectrum auction.

<u>Pitfalls of assigning the spectrum on an exclusive basis for possibility of auction</u>

1. Consequence of auctioning of spectrum will result in the market leaders using this opportunity to block the entry of new players in the market. **Both DoT and TRAI will find themselves helpless once the spectrum gets auctioned and the terms of sharing are defined and embedded in the NIA**. They can only intervene in the spectrum usage

criteria, once the license expires even while the technology keeps progressing, making the sharing strategies become better and better and unlocking more capacities within the same chunk of the auctioned spectrum for supporting additional players. **Once the "private rights" are established through the process of auction, it will become extremely difficult to change the rules of the game in between the license period.** By doing so, DoT would have 'missed the bus' for effective and efficient spectrum sharing and that would be a huge drain on the public exchequer!

2. **This is the reason why the FCC has been continuously evolving its sharing rules to unlock more capacity with the objective of supporting more players in the market.** FCC's latest effort is embedded here and will likely get formalized by end of this month. FCC is empowered to do so as they have not created "private rights" for satellite spectrum by auctioning it in the manner we are trying to.
3. The issues related to the Satellite spectrum are quite different from those assigned terrestrially. There are virtually no synergies. In the case of the Terrestrial spectrum, the role of the regulator gets significantly limited after assignment, as "**one" operator by itself** is able to **unlock the optimal capacity of the assigned spectrum**. Whereas in the case of the **satellite spectrum**, even **multiple operators can't do so together** — and **without facilitation, from the regulator, the situation will turn worse in no time.**
4. So if you try to auction "Club Goods" for "exclusive" use, then one has to be innovative to figure out a way to do that. Some options are already suggested by the TRAI in its paper. **But, none of this will be without severe pitfalls & shortcomings and will compromise the basic tenets of auction.** For example —
    a) Huge capacities of airwaves lie idle and unused, as we will be artificially limiting the number of players for the auctions to work;
    b) Danger of collusion — leading to the blockage of new players in the market.
    c) Inflexibility on spectrum management and regulatory intervention due to the creation of "Exclusive Rights" on goods which are by character "common" in nature;
    d) Spectrum fragmentation, as the outcome of spectrum auctions — i.e the demand on quantum cannot be predicted in advance
    e) While auctions may be the most optimal method for assignment of spectrum in an exclusive manner, **then using auctions as a tool for making assignments may not be the correct strategy,** that too when and when "sharing" has to be supervised constantly by the regulator for ensuring optimal usage and for the purpose of resolving conflicts between the sharing entities.

This is likely to happen if we follow the DoT request of auctioning spectrum for the satellite service in the manner we have done for terrestrial services.

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.

BIF RESPONSE

In Response to Q4 above, we have said it is not possible to assign spectrum on exclusive basis in any of the satellite spectrum bands.

a) Hence the question of block size, minimum number of blocks, spectrum cap, etc does not arise.
b) Satellite Spectrum Sharing is mutually done by all the satellite operators to ensure maximisation of productivity and efficiency utilisation. No intra-band spectrum sharing rules or guidelines need to be prescribed.
c) As mentioned in b) above, mandatory spectrum sharing guidelines for sharing of satellite spectrum is not required
d) As mentioned in great detail in response to Q4 above, satellite communication ecosystem would be greatly impacted in case it is decided to carve out exclusive blocks/chunks of spectrum for exclusive spectrum assignment. It would lead to fragmentation of spectrum and gross inefficiency, thereby rendering a satellite service unable to deliver round-the-clock, end-to-end service at optimal service levels.

Therefore, spectrum for space based communications should be assigned on non-exclusive, sharable and on administrative basis.

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.

BIF RESPONSE

a) Once satellite spectrum is decided to be auctioned, it would close the doors for a new entrant/entity in the foreseeable future. So, this would be a big setback for the 200+ startups which are registered with ISRO & IN-SPACe as they would neither have deep enough pockets to participate and win spectrum through the auction route nor would they be able to get any spectrum in the foreseeable future for launching their space objects as permitted by the Indian Space Policy 2023. Hence Satellite Spectrum should be administratively assigned and not auctioned.
Period of the assigned spectrum (administratively) should be at least co-terminus with the license period.

b) No spectrum should be assigned through auction. It should be done in an administrative manner. Any satellite spectrum thus assigned, is automatically shared between various satellite players for optimising efficiency of spectrum usage and for maximising satellite throughputs.

c) As mentioned earlier, satellite spectrum should not be put to auction as it will reduce spectrum efficiency and overall throughputs from the satellites.

i) The issues related to the Satellite spectrum are quite different from those assigned terrestrially. There are virtually no synergies.

ii) So if one tries to auction "Club Goods" for "exclusive" use, then one has to be innovative to figure out a way to do that. Some options are already suggested by the TRAI in its paper. **But, none of this will be without severe pitfalls & shortcomings and will compromise the basic tenets of auction.** For example —

a) We should be ready to keep huge capacities of airwaves lie idle and unused, as we will be artificially limiting the number of players for the auctions to work;

b) We should be ready to face the danger of collusion — leading to the blockage of new players in the market.

c) We should be ready to deal with inflexibility on spectrum management and regulatory intervention due to the creation of "Private Rights" on goods which are by character "common" in nature;

d) We should prepare ourselves for possible fragmentation, as the outcome of spectrum auctions — i.e the demand on quantum cannot be predicted in advance;

e) Above all, we should be conscious about the need of continuous supervision from the regulator/licensor for facilitating coordination (between players in case of conflict) to enable optimal sharing so that none of the players involved are disadvantaged on their ability to contribute and add value, though this

contravenes the basic tenet of exclusive allocation of spectrum through auctions.

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.

BIF RESPONSE

Satellite Spectrum should not be auctioned as it would lead to fragmentation & inefficient utilisation of spectrum, thereby leading to loss of capacity. **An administrative and non-exclusive assignment would obviate the need of permitting trade/lease in part or full since an entity can approach the licensor directly and get the desired spectrum, as is the case today.**

Exclusive assignment of spectrum for the provision of satellite services to a single entity will have multiple and specific negative impacts that should - and can - altogether, be avoided. The present set of questions assume that there is a need to artificially create scarcity and use auctions as a methodology, although it also recognizes the need to correct or subvert the main characteristics of such procedures. However, not only the decision to auction spectrum for satellite-based communications is not mandated by court decisions, but it can contravene legal requirements.

As such, we respectfully submit that the methodology that should be used for spectrum assignment for satellite communications is the one that guarantees, *ab initio*, that the spectrum is available to multiple entities, fosters competition, and leads to increased innovation, better quality of services, and more competitive prices. This will ultimately be the only method that benefits consumers and promotes growth in India.

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.

BIF RESPONSE

There is no need for creation of any new provisions for assignment of current spectrum held by satellite service licensees, except that the period of validity of the spectrum assigned should be co-terminus with the validity of the license being held by them.

Assignment of spectrum to service licensees should be done in an administrative manner and not through auction.

A shared, non-exclusive, non-auction-based spectrum assignment i.e. administrative approach will ensure that such disruptions do not occur. Spectrum assignment should be done on the basis of ITU filings, its co-ordination and interference mitigation measures.

Allowing sharing of spectrum among multiple satellite operators and respecting ITU guardrails for ensuring optimal spectrum usage and preventing interference is the only way to make Sat-com services successful in India. The ITU framework and coordination procedure has proven to be successful and has led to 99.95% of spectrum assigned to satellite operators to be free from interference and service disruptions. It has also promoted the efficient and cost-effective use of spectrum which is an important requirement for making Sat-com commercially viable.

The sharing of spectrum among various satellite operator's/service providers is governed by Article 9 of the ITU Radio Regulations (**RR**). The RR provide detailed guidelines on the sharing and coordination of spectrum. We consider the terms for sharing of spectrum among satellite communication operators should be left to frequency coordination, and it should be required for the parties engaged in the coordination to notify the Indian Administration before they can be licensed to operate in the country.

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 spacebased communication services should be assigned on shared (nonexclusive) 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.

BIF RESPONSE

As mentioned in response to Q4, 5 & 6 above, the spectrum should be assigned only in an administrative manner on a shared (non-exclusive) basis. **Sharing of spectrum among service providers should be left to the operators for mutual coordination as it would lead to optimal results for all the players and it would be in their best interest.**

Allowing sharing of spectrum among multiple satellite operators and respecting ITU guardrails for ensuring optimal spectrum usage and preventing interference is the only way to make Sat-com services successful in India. The ITU framework and coordination procedure has proven to be successful and has led to 99.95% of spectrum assigned to satellite operators to be free from interference and service disruptions. It has also promoted the efficient and cost-effective use of spectrum which is an important requirement for making Sat-com commercially viable.

The sharing of spectrum among various satellite operator's/service providers is governed by Article 9 of the ITU Radio Regulations (**RR**). The RR provide detailed guidelines on the sharing and coordination of spectrum. We consider the terms for sharing of spectrum among satellite communication operators should be left to frequency coordination, and it should be

required for the parties engaged in the coordination to notify the Indian Administration before they can be licensed to operate in the country.

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.

BIF RESPONSE

The Spectrum assignee should not be permitted to utilise the said frequency band for flexible /mixed use. The frequency range 27.5-28.5Ghz (lower Ka Band), should be exclusively assigned for commercial satellite usage only.

Justification:

Since 27.5-28.5 Ghz falls under the Ka band and is critical for High Capacity Broadband Communications using Next Generation Satellites, this spectrum must also be earmarked exclusively for Satellite Broadband services –both for user terminals as well as for gateways. Hence we firmly advise that **this band should not be utilised for mixed/flexible use i.e. both terrestrial and satellite. It should only be exclusively preserved for satellite use. Leading global satellite operators are presently using the full 27.5-31.0GHz range for their gateways in India. These ranges need to be kept isolated from use for IMT** or other Mobile Terrestrial services within the vicinity of the gateway locations.

Some additional reasons in support of our position is given below:

1. ITU has not allocated use of 28Ghz band for IMT(5G). Neither did WRC-19 take it up for discussions, nor is it even a work item for upcoming WRC-23. **India is a signatory to ITU and follows the ITU-RR which has not identified 28Ghz for IMT**.

2. DoT's Standing Committee on 5G Policy (which had been set up to identify possible spectrum bands for 5G) chaired by the then Director, IIT , Madras-Dr. Bhaskar Ramamurthi had clearly opined in 2019 that the 28Ghz spectrum band is being used extensively for High Throughput Satellite Services and emission from IMT devices from the ground would adversely affect the Satellite services. It was also mentioned in its report that the Satellite CPEs/terminals could be widely located anywhere in the country and hence, **this band cannot be considered for IMT services**. It was also stated that part of this band is also being identified for ESIM Applications.

3. 28Ghz band is being extensively used by

   i) **ISRO's own satellites**. Besides a number of satellites with Hybrid Uplink/Downlink in the 28Ghz band, one entire satellite in the 28Ghz band is waiting to be launched. Future Broadband Satellites are mostly planned for launch in the 28Ghz band only.

[The 28Ghz (Ka) Band typically uses spectrum in the band 17.7-21.2Ghz (3.5 Ghz) for Satellite Downlink (Space to Earth) and 27.5-30Ghz for Satellite Uplink (Earth-to-Space).]

ii) **Global Satellites (GSO-HTS)** –More than a dozen satellites by leading global satellite service providers are already deployed in this band and all new satellites in future are being planned in this band only

iii) **All NGSO Constellations** –existing and new ones are being planned/deployed in this band.

iv) **ESIM applications**-WRC23 is likely to assign this band for MSS, besides FSS applications also

v) **More than 140+ filings for orbital slots which have interest in Ka band.** Out of this, almost a dozen filings are from India which includes both the Govt operator as well as others. This indicates huge amount of investment that has been made into these Satellites worldwide.

4. The Ka-Band (28Ghz band) between 27.5 to 30.0GHz plays a very important role in the Satellite ecosystem providing a band of 2.5 GHz spectrum, that the modern High throughput Satellites (HTS) and NGSOs can productively use for providing high speed high capacity broadband services with very low latency in a cost effective manner.

5. In a typical GSO based HTS network, the entire 28Ghz band would be used for uplink of signals – both from Gateways as well as from smaller remote terminals. The remote terminals would be many in number and would necessarily be spread in remote and rural areas to provide Broadband connectivity to remote GPs or villages which are primarily inaccessible.

6. The cost of delivering broadband services using satellite has reduced by a magnitude of 10-12 times thanks to the advent of new technologies like High Throughput Satellites (HTS) –both of the GSO & NGSO type and due to the deployment of the 28Ghz spectrum band.

7. **Important Global Developments regarding 28Ghz**

(i) In South Korea, the Government announced the decision of withdrawal of 28Ghz awarded to 5G licensees. This was due to

- lack of investments and interest
- non-optimal utilization of Ka band by IMT/5G Licensees

(ii) Recently in Thailand, the regulator (NBTC) allocated the entire 28 GHz spectrum band for satellite broadband.

(iii) Other countries reviewing/reconsidering the plan of utilising 28 GHz spectrum band for IMT are:

1. Japan (2022): begun studies and undertook industry consultation for ESIM options in 28 GHz

2. Singapore (2022): begun studies and undertook industry consultation for ESIM options in 28 GHz

(iv) The above examples seem to indicate that APT countries, along with other regions, are now refocusing their 5G spectrum requirements on other spectrum bands apart from This is because the economics of terrestrial 5G in mmWave are challenging (eg. South Korea) and because 28 GHz has become the preferred band for ESIM. Many countries have adopted 28 GHz for satellite broadband, and those that have not done so are reviewing their position to bring satellite ESIM in the 28 GHz band (cases of 5G pioneer countries in APT)

In view of the strategic importance of the 28 Ghz band (27.5-31Ghz) and the reasons mentioned above, BIF respectfully requests that the primary rights of the Satellite industry to use this band should be maintained. Govt Spectrum Policy must be suitably aligned accordingly.

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.

BIF RESPONSE

In response to Q10 above, we have clearly mentioned that this frequency range should not be permitted for flexible/mixed use and justification has also been provided accordingly. This is because 27.5-28.5 Ghz falls under the Ka band and is critical for High Capacity Broadband Communications using Next Generation Satellites. **This spectrum must be earmarked exclusively for Satellite Broadband services –for user terminals, ESIMs as well as for gateways. Hence we firmly advise that this band should not be utilised for mixed/flexible use i.e. both terrestrial and satellite. It should only be exclusively preserved for satellite use.**

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.

BIF RESPONSE

No flexible /mixed use should be permitted in this frequency range as 28.5-29.5Ghz Ghz falls under the Ka band and is critical for High Capacity Broadband Communications using Next Generation Satellites, **this spectrum must also be earmarked exclusively for Satellite Broadband services –for user terminals, ESIMs as well as for gateways. Hence we firmly advise that this band should not be utilised for mixed/flexible use i.e. both terrestrial and satellite. It should only be exclusively preserved for satellite use. It is therefore better to find alternative band for CNPN instead of 28.5-29.5 GHz.**

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.

BIF RESPONSE

Spectrum assigned in the said frequency band (28.5-29.5Ghz) must be assigned exclusively for satellite broadband and not for mixed/flexible use including for cellular based CNPNs.

We see inevitable challenges in the allocation of frequency bands for multiple and technologically different services. While it may be possible to address some of these challenges (e.g., use of the 27.5-28.5 GHz band by both IMT and satellite gateway stations), such co-existence would inevitably deteriorate the quality of the communication operations and put undue constraints on either or both services. It is worth pointing out that it would be impossible to coordinate IMT deployments and satellite user terminal deployments in the same frequency band. Thus, we submit that the actual need of these frequency bands for each service is thoroughly assessed, in the face of the current use and demand for spectrum already assigned (for example, in the case of IMT-based services)

We also understand that DOT had setup an internal committee to examine the issue of interference if CNPN networks were to be assigned spectrum in the 28.5-29.5 GHz band and the committee concluded that such an allocation will cause disruption to satellite services operating in this band.

As far as the flexible use of a frequency range for different services by the same operators, spectrum that is assigned either through auction or an administrative mechanism is assigned for a given service. The pricing of the spectrum takes into account the use of the spectrum by a particular service, and does not envisage a flexible use case. So, it will be incorrect to determine the price and then apply the flexible sharing principle. In addition, such a move will create an imbalance where spectrum assigned for IMT (allowing flexible use) could be used for gateway stations, Earth Stations in Motion (**ESIMs**), and user terminal operations, whereas spectrum assigned for satellite use will be permitted only for gateway stations and ESIM use and not for user terminal use. We do not see a need for such flexible use, nor adequate technical solutions given the characteristics of each operation, and would therefore deem it not possible.
On the issue of the allocation of the 28.5-29.5 GHz band to CNPN services, it is most often misunderstood that CNPN services are indoor usage services. On the contrary, the CNPN services are deployed by organizations for private networks that span across campuses, which may be adjacent to satellite deployments. It would be next to impossible to coordinate satellite user terminals with CNPN service use, and this could cause considerable deterioration of one or both of the services.

Additionally, we note that the rollout of terrestrial mobile wireless services in the millimetre wave bands to date have been extremely poor:

- South Korea, which took the lead in allocating the 28 GHz band for IMT services, has publicly admitted failure.[1]
- In Japan, the mobile operators have not been able to exploit the 28 GHz band for IMT services, and are far behind their rollout requirements.[2]
- Thailand did studies on the co-existence of IMT and satellite deployments in the 28 GHz band, and decided to allocate the 28 GHz band only for satellite services.[3]
- In the USA, operators such as T-Mobile and Verizon have not been able to successfully exploit the 28 GHz band.

Since 27.5-31Ghz falls under the Ka band and is critical for High Capacity Broadband Communications using Next Generation Satellites, this spectrum must also be earmarked exclusively for Satellite Broadband services –for user terminals, ESIMs as well as for gateways. Hence our firm suggestion is that this entire Ka band (27.5-31Ghz) should not be utilised for mixed/flexible use i.e. both terrestrial and satellite. It should only be exclusively preserved for satellite use.

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:**
    a. **Type of service: _____**
    b. **Financial Year Revenue (Rs. lakh)**
    c. **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:**
    a. **Type of service: _____**
    b. **Financial Year Revenue (Rs. lakh)**
    c. **Subscriber base CAPEX for the year (Rs. lakh) 2023-24 126 2024-25 2025-26 2026-27 2027-28**

[1] *See*, https://www.rcrwireless.com/20230103/5g/south-korea-officially-cancels-28-ghz-licenses-report.
[2] *See*, https://www.soumu.go.jp/main_content/000860636.pdf.
[3] *See*, https://dpolit.com/2023/01/08/thailand-secures-next-generation-inflight-connectivity-nbtc-allocates-the-full-28-ghz-spectrum-band-for-satellite-broadband/.

BIF RESPONSE

We do not see any reason for space-based communication services to be categorised into different classes of requiring different treatment for spectrum. Since multiple services share the same spectrum band, currently being given on administrative basis, the same approach should be continued.

Further, auction-based allocation will discourage new startups and smaller players from entering the market due to high initial costs hence administrative allocation should continue.

We are of the opinion that all spectrum assignment for satellite bands should be for exclusive use of satellites and should not be for mixed/flexible use and should be assigned uniformly in an administrative manner aligned to global best practices.

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.

BIF RESPONSE

We are of the opinion that all spectrum assignment for all satellite bands including L & S band should be assigned uniformly in an administrative manner aligned to global best practices. This is irrespective of the fact whether spectrum is assigned for user terminals or gateways., auction-based allocation will discourage new startups and smaller players from entering the market due to high initial costs hence administrative allocation should continue. Detailed justification has been provided in Response to earlier questions.

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.

BIF RESPONSE

We are of the opinion that all spectrum assignment for all satellite bands including higher spectrum bands like C-band, Ku-band and Ka-band, should be assigned uniformly in an administrative manner aligned to global best practices. This is irrespective of the fact whether spectrum is assigned for user terminals or gateways. Detailed justification has been provided in Response to earlier questions.

It is clear that administrative allocation is the suitable most approach for assigning fixed satellite spectrum as it is a shared resource wherein the same spectrum can be used by multiple users. Any other approach, e.g., auctioning satellite spectrum, will distort its utility since a satellite constellation (e.g., a typical LEO system) cannot operate with different spectrum in different parts of the world.

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

BIF RESPONSE

The spectrum for user links should be assigned at the national level as the Satellite footprint is expected to be a national one as it offers several advantages that cater to the unique nature of satellite communications:

- Satellite services, both FSS and MSS inherently provide extensive coverage, making them ideal for serving vast geographical areas within a country. Satellite services play a critical role in disaster recovery and emergency response efforts. National-level licensing ensures that satellite user devices can be used consistently and seamlessly across the entire nation and facilitate the rapid deployment of satellite communications during emergencies, ensuring that vital services remain accessible even in remote or affected areas.

- National-level licensing will allow satellite operators to offer services to a broader user base, promoting digital inclusion and ensuring that all citizens have access to essential communications services.

- By assigning user links on a national level, regulators can ensure that users can fully leverage the benefits of transportable satellite services without encountering licensing restrictions or limitations based on regional boundaries.

- National-level licensing will help streamline the administrative process for regulator, licensor and satellite service providers, avoiding the need for managing multiple regional licenses. It will be in line of ease of doing business.

We are therefore of the firm opinion that all spectrum assignment for all satellite bands should be assigned uniformly in an administrative manner aligned to global best practices. This is irrespective of the fact whether spectrum is assigned for user terminals or gateways. Detailed justification has been provided in Response to earlier questions.

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.

BIF RESPONSE

We do not support auction based mechanism for assignment of spectrum for satellite use cases. We are of the opinion that all spectrum assignment for all satellite bands should be assigned uniformly in an administrative manner aligned to global best practices. This is irrespective of the fact whether spectrum is assigned for user terminals or gateways. Detailed justification has been provided in Response to earlier questions.

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.

BIF RESPONSE

We are of the opinion that all spectrum assignment for all satellite bands should be assigned uniformly in an administrative manner aligned to global best practices. This is irrespective of the fact whether spectrum is assigned for user terminals or gateways. Detailed justification has been provided in Response to earlier questions. We do not support auction based mechanism for assignment of spectrum for satellite use cases.

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.

BIF RESPONSE

We do not support auction based mechanism for assignment of spectrum for satellite use cases. We are of the opinion that all spectrum assignment for all satellite bands should be assigned uniformly in an administrative manner aligned to global best practices. This is irrespective of the fact whether spectrum is assigned for user terminals or gateways. Detailed justification has been provided in Response to earlier questions.

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.

BIF RESPONSE

We are of the opinion that all spectrum assignment for all satellite bands should be assigned uniformly in an administrative manner aligned to global best practices. This is irrespective of the fact whether spectrum is assigned for user terminals or gateways. Detailed justification has been provided in Response to previous questions. We do not

support auction based mechanism for assignment of spectrum for satellite use cases. As regards the validity period of spectrum, the validity should continue to be co-terminus with the license period of the licensee.

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.

BIF RESPONSE

We are of the opinion that all spectrum assignment for all satellite bands should be assigned uniformly in an administrative manner aligned to global best practices. This is irrespective of the fact whether spectrum is assigned for user terminals or gateways. Detailed justification has been provided in Response to previous questions. **We do not support auction based mechanism for assignment of spectrum for satellite use cases.**

We do not consider space-based communication services should be categorized into different classes of services that require different treatment for spectrum assignment and, as justified in our comments to previous questions, we wish to submit that the methodology for assignment of any space-based communication services should be administrative only. The assignment of spectrum for space-based communications should be on a national level, and the licensee should be able to choose the specific frequency ranges that are intended to be used for the gateway station links and the user terminal 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?

BIF RESPONSE

Suitable protection distance for Satellite Earth Station Gateways would be required to avoid interference from other in-band and out of band services. This maybe decided based on

existing interference studies carried out in different bands . If not, then the same may be required to be carried out before deciding the matter.

TRAI may recommend rules that determine a coordination distance threshold, requiring new services (mobile or satellite) to seek coordination with existing gateway licensees. The distance needed to ensure an interference-free operation depends on the technical characteristics of the Gateway, this distance being very different depending on these characteristics and terrain. It is therefore advisable that instead of a coordination threshold distance, a power flux-density (PFD) threshold or another technical threshold for such coordination be adopted.

Modern NGSO systems employ frequency sharing techniques that can avoid harmful interference by using techniques such as angular avoidance and satellite selection. It is possible to co-locate both gateway stations and user terminals with other GSO/NGSO systems, by employing appropriate frequency coordination and mitigation mechanisms. No protection distances are warranted, and operators/service providers can be licensed after ensuring that such inter-system coordination has been duly notified and/or such protection mechanisms, as prescribed by Article 22 and Resolution 76, have a favourable finding by the ITU.

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

BIF RESPONSE

Satellite-network operations require bilateral/multilateral coordination and cooperation. Satellite spectrum, which has no national territorial limits, is coordinated and managed by the UN agency, International Telecommunications Union (ITU), and is subject to their Radio Regulations. **Therefore, any eligibility condition should definitely include ITU Filing, proof of Operation as well requisite authorisation under Unified License.** While Eligibility Conditions may be decided viz. Entry Fee and Minimum Net worth, but it must be reasonable and in tune with the size and paying capacity of the industry, considering the existing eligibility criteria of the respective space based communication service licenses. .

However, this may be decided for the sole purpose of assignment of spectrum in an administrative manner and not through auctions. In our response to earlier Qs, we have provided justification for the administrative assignment of spectrum for any space-based communication services. Further to such point, we wish to point out that the eligibility criteria for the various authorisations under the Unified License (**UL**) have already been prescribed, and the same can be applied for the administrative assignment of spectrum for space-based communications

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 nonexclusive (shared) assignment with justification.

BIF RESPONSE

We are of the opinion that all spectrum assignment for all satellite bands should be assigned uniformly in an administrative manner aligned to global best practices. This is irrespective of the fact whether spectrum is assigned for user terminals or gateways. Detailed justification has been provided in Response to earlier questions. We do not support auction based mechanism for assignment of spectrum for satellite use cases.

As regards the rollout of services, there should be a condition that the satellite service provider start commercial service in the country with its satellite constellation within a year of the assignment of spectrum, failing which its spectrum should automatically revert back to the Wireless Planning & Coordination (WPC) Wing. However, as the import of equipment is possible only after the assignment of spectrum, it is impractical to setup a satellite gateway and make it operational within 12 months of the assignment of spectrum. TRAI could possibly recommend a mechanism whereby the service provider/gateway operator could import the equipment at their own risk even prior to the assignment of spectrum.

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.

BIF RESPONSE

Since the industry is at a nascent stage, issues pertaining to crossholding of equity, market dominance, significant market power etc, should not apply at this stage for the satellite industry.

The restriction on crossholding of equity was introduced to discourage monopoly or the hoarding of spectrum for mobile services (which is exclusively assigned LSA wise) in order to ensure adequate competition in the market. On the contrary, for the provision of satellite-based services, this is not a concern since there is no exclusive spectrum assignment and several satellite operators share the entire spectrum range non-exclusively.

Cross-holding restrictions should be kept separate for access spectrum in terrestrial networks and access spectrum in cases of satellite communication. This means, an operator holding access spectrum for terrestrial networks should not be allowed to hold any beneficial interests in another operator holding access spectrum for terrestrial networks. However, there should not be any restriction on cross-holding between an operator holding access spectrum for terrestrial networks and an operator holding spectrum for any kind of satellite communication.

In the event, TRAI decides to frame the cross-holding norms for satellite communication services then, within satellite communication, cross-holding restrictions should apply i.e. one operator providing satellite based communication services should not be allowed to hold equity in another legal entity providing satellite based communication 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.

BIF RESPONSE

The co-existence of terrestrial and space-based communication services cannot be generalised. Interference mitigation strategies have to be developed between concerned operators (both on the terrestrial wireless and space-based communications side), taking into account the frequency overlap, the various protection criteria already stipulated in the ITU RR, and by incorporating necessary protection distances. The licensing conditions should stipulate a mutual frequency coordination between the operators, with an oversight by DOT/WPC.

In case of established co-existence studies between incumbent terrestrial (Fixed Services -FS) and FSS/MSS services and new satellite services, working together maybe permitted after suitable conditions are defined for PFD limits and power emissions. To mitigate interference, ITU prescribes varying measures in ITU-RR which have been duly captured in the TRAI consultation as well.

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.

BIF RESPONSE

Use of multiple polarizations is not only a capacity enhancing measure, but also an interference mitigation technique. The charging mechanism should only take into account the quantum of spectrum, and not consider the use of different polarizations.
In our response to earlier Qs we have provided justification for the administrative assignment of spectrum for any space-based communication services.

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.

BIF RESPONSE

Use of satellite spectrum is dependent on ITU international spectrum coordination, cooperation among satellite operators, and different spectrum management rules. Satellite systems operate within a predefined range of frequencies, which have undergone a lengthy and rigorous process of notification and registration with the ITU, ultimately leading to inclusion in the Master International Frequency Register (MIFR). As a result, satellite operators cannot selectively choose frequencies based on market spectrum assignments.

Model 1: Exclusive Spectrum Assignment through auction of satellite spectrum would result in the fragmentation of the bands that are now shared by all satellite services and may be an inefficient way of utilising the shared limited resource of satellite spectrum.

Model 2: creates an artificial scarcity by limiting the number of licenses available for satellite operators and restricting the full potential of the spectrum from being utilized, which goes against the fundamental principle of efficient spectrum management. This approach will negatively impact not only the satellite operators who do not obtain a license but also the consumers in India. As a result, Indian consumers will have fewer choices compared to other markets.

Both model # 1 and model # 2 – would stifle any aspirations, start-ups may have under the New Space Policy, which professes to encourage private participation in the satellite sector. Model # 2, especially, which envisages an auction but on a non-exclusive basis, would be no auction at all. The phrase 'non-exclusive auction' is itself is conflicting. Limiting the operators in may greatly impede universal connectivity in a large country like India.

We are of the opinion that all spectrum assignment for all satellite bands should be assigned uniformly in an administrative manner aligned to global best practices. This is irrespective of the fact whether spectrum is assigned for user terminals, ESIMs or gateways. Detailed justification has been provided in Response to previous questions. We do not support auction based mechanism and nor the exclusive assignment of spectrum for satellite use cases.

Both the concepts/models (such as spectrum blocks and spectrum caps or exclusivity) are the key characteristics of terrestrial mobile spectrum management and do not apply to satellite communications which make auction of spectrum impractical.

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

BIF RESPONSE

Our detailed response is already submitted in Q29 above. We are of the opinion that all spectrum assignment for all satellite bands should be assigned uniformly in an administrative manner aligned to global best practices. This is irrespective of the fact whether spectrum is

assigned for user terminals or gateways. We do not support auction based mechanism for assignment of spectrum for satellite use cases.

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+ Δ), 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.

BIF RESPONSE

Our detailed response is already submitted in Q29 above. We have clearly stated that **Model 2 creates an artificial scarcity by limiting the number of licenses available for satellite operators and restricting the full potential of the spectrum from being utilized, which goes against the fundamental principle of efficient spectrum management. This approach will negatively impact not only the satellite operators who do not obtain a license but also the consumers in India. Model # 2, especially, which envisages an auction but on a non-exclusive basis, would be no auction at all. The phrase 'non-exclusive auction' is itself is conflicting. Limiting the operators in may greatly impede universal connectivity in a large country like India.**

As for the model presented as a non-exclusive auction, in the case of limited bidders (n in number), the auction starting with the reserve price will end up selling the spectrum in the quoted reserve price, even though it is shared. Thereafter, all participants will have to pay the same price to acquire the same spectrum. There is no exclusivity here nor is the demand-supply dynamic characteristic of auctions present here. Therefore, in conclusion, this is nothing but an indirect equivalent to the administrative allocation.

We are of the opinion that all spectrum assignment for all satellite bands should be assigned uniformly in an administrative manner aligned to global best practices. This is irrespective of the fact whether spectrum is assigned for user terminals or gateways. We do not support auction based mechanism for assignment of spectrum for satellite use cases.

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.

BIF RESPONSE

We do not support auction based mechanism at all for assignment of spectrum for satellite use cases. Had any such model worked efficiently, regulators across the globe would have adopted it. Hence, it must be assigned on a non-exclusive basis through an administrative process. Detailed reasoning in this regard is given in response to previous questions.

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?

BIF RESPONSE

As mentioned and justified in our response to Q17, Satellite Spectrum must be assigned at National level as it cannot be assigned LSA or Area wise. Hence, the above method of area specific assignment will not work.

Referring to the other countries' approach, the method of administrative assignment for gateway is the most implemented one, that demonstrates efficient coordination, assignment and utilisation of spectrum resources for satellite operators. It fosters competition and enables satellite operators to provide essential services that benefit society as a whole.

We are of the opinion that all spectrum assignment for all satellite bands should be assigned uniformly in an administrative manner aligned to global best practices. This is irrespective of the fact whether spectrum is assigned for user terminals, ESIMs or gateways. Detailed justification has been provided in Response to previous questions. Issues that could arise due to exclusive allocation or auction of spectrum has also been provided in response to Q 4 & 6 above. We do not support auction based mechanism for assignment of spectrum for satellite use cases.

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?

BIF RESPONSE

As opposed to terrestrial networks, satellite operators require only a limited number of gateways to serve a large geographical area, such as India. Hence, methodology of administrative assignment is most efficient, and auctions for gateway links is not an appropriate approach.

Moreover, the flexibility of gateway infrastructure allows for the coexistence of multiple satellite systems in the same location. Geostationary satellite operators (GSOs) can share gateway locations without causing interference or affecting the performance of their respective networks. Additionally, these GSO gateways can even be collocated with Non-Geostationary Satellite Orbit (NGSO) antenna farms, further demonstrating the efficient use of available resources.

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

BIF RESPONSE

We are of the opinion that all spectrum assignment for all satellite bands should be assigned uniformly in an administrative manner aligned to global best practices. This is irrespective of the fact whether spectrum is assigned for user terminals or gateways. Detailed justification has been provided in Response to previous questions. Issues that could arise due to exclusive

allocation or auction of spectrum has also been provided in response to Q 4 & 6 above. We do not support auction based mechanism for assignment of spectrum for satellite use cases.

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?

BIF RESPONSE

We do not support any auction based mechanism for assignment of spectrum for satellite use cases.

By employing an administrative assignment approach instead of auctions for gateway links, policymakers can better ensure the efficient use of spectrum resources, reduce potential conflicts among operators and promote the seamless operation of satellite networks. This approach also allows for a more focused consideration of public interest objectives and the unique technical requirements of satellite services, ultimately benefiting both the industry and consumers.

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

BIF RESPONSE

In our response to earlier Qs we have provided justification for the administrative assignment of spectrum for any space-based communication services, and the spectrum resource should be shared between all satellite operators seeking to access it. The assignment of spectrum should be at a national level, and should not be location based for gateway stations. Since the 27.5-29.5 GHz band is co-primary with Fixed Services (**FS**) stations (MWA/MWB), any location-based assignment for FSS stations will make the coordination very difficult, if not impossible.

In addition, for the smooth rollout of satellite services that can effectively address the connectivity needs of unserved and underserved areas in India, the TRAI should take into account the following issues:

1. The provision of internet services to consumers in India can be effectively addressed by satellite services provided under the Internet Services Authorisation (or ISP License) of the UL. However, currently, there is no prescribed charging mechanism for spectrum for the provision of satellite services under the ISP License. We urge the TRAI to address this gap by recommending a charging model for spectrum for providing satellite services under this authorization. A recommendation for a charging model for spectrum for space-based communications could also address this gap.
2. The UL allows the provision of satellite services under service authorisations with varied scope, such as as GMPCS, VSAT CUG and ISP. In order to efficiently use spectrum, it should be feasible to deploy a single network that has access to spectrum and the service provided under different authorisations depending on the scope. In its recommendations on the use of VSAT for cellular backhaul connectivity, the TRAI recommended that the

sharing of active and passive infrastructure owned by a licensee under any of the service authorisation be allowed.[4] However, the sharing of spectrum between service authorisations for the efficient use of spectrum was not addressed, and the same needs to be addressed.

3. WPC carries out frequency assignments through the issuance of Decision Letters. These letters assign frequencies on a carrier-by-carrier basis, which limits the operational flexibility of modern satellite systems that use dynamic frequency usage. There will be a significant administrative overhead resulting in delays of deployment of services if spectrum is to be assigned carrier-by-carrier. Instead, spectrum should be assigned as a block, and the operator should have the flexibility to dynamically use the frequencies assigned across different user terminals, gateway stations, and satellites serving India.

Additional Justification Why Satellite Spectrum cannot be auctioned

1. The assignment strategy chosen for satellite spectrum should prevent the creation of artificial barriers, enable efficient usage, promote competition, and motivate the operators towards the latest and best technologies — all these are in the interest of the consumers and the country at large. The primary reason to auction a resource is to prevent a stalemate (who to give who not to) when the demand is more than the supply. If the reverse is true, then the **process of "auction" really serves no purpose.**
2. In the consultation paper, the TRAI makes the following point: -"...It follows then if satellite systems are designed to operate on a shared spectrum with low or no rivalry in consumption, the spectrum for satellite-based communication acquires characteristic of a **"club good" (**Page 90, Clause 3.119)"
3. **By "club good" the TRAI means that a number of satellite players sharing the same block of the spectrum will not experience a significant loss of capacity.** This is quite in contrast compared to their terrestrial counterpart, whose capacity will decrease linearly proportionate to the number of players sharing (operating) in the same spectrum. Therefore, the **spectrum capacity** for satellite services **can be considered almost limitless**, thereby capable of supporting a large number of players in the same block of spectrum. **Hence, the demand for it can never be more than the supply.** ***That is why sharing of airwaves is a mandatory requirement for satellite players quite unlike their terrestrial counterparts***. Hence, for the auction to be successful for the satellite spectrum, we need to create "artificial scarcity", i.e limit the number of bidders (TRAI, clause 3.120(b), page 90),
4. If multiple satellite players can operate in the same block of airwaves without a significant loss of capacity, then the question arises — limiting the number of bidders artificially (solely with the purpose of enabling a successful auction) will not serve any purpose. On the contrary, it will be harmful. **It will not only limit competition in the market but also prevent the spectrum to be used at its optimal capacity, neither of which** is in the interest of the consumers and the country at large.
5. Consequence of auctioning of spectrum will result in the market leaders using this opportunity to block the entry of new players in the market. **Both DoT and TRAI will**

[4] Clause 3.4 [Para 2.43] of Chapter 3 of the recommendations on "Provision of Cellular Backhaul Connectivity via satellite through VSAT under Commercial CUG Service authorization" dated 28th July 2020.

find themselves helpless once the spectrum gets auctioned and the terms of sharing are defined and embedded in the NIA. They can only intervene in the spectrum usage criteria, once the license expires even while the technology keeps progressing, making the sharing strategies become better and better and unlocking more capacities within the same chunk of the auctioned spectrum for supporting additional players. **Once the "private rights" are established through the process of auction, it will become extremely difficult to change the rules of the game in between the license period.** By doing so, DoT would have 'missed the bus' for effective and efficient spectrum sharing and that would be a huge drain on the public exchequer!

6. **This is the reason why the FCC has been continuously evolving its sharing rules to unlock more capacity with the objective of supporting more players in the market.** FCC's latest effort is embedded here and will likely get formalized by end of this month. FCC is empowered to do so as they have not created "private rights" for satellite spectrum by auctioning it in the manner we are trying to.
7. So if you try to auction "Club Goods" for "exclusive" use, then one has to be innovative to figure out a way to do that. Some options are already suggested by the TRAI in its paper. **But, none of this will be without severe pitfalls & shortcomings and will compromise the basic tenets of auction.** For example —

    a) We should be ready to keep huge capacities of airwaves lie idle and unused, as we will be artificially limiting the number of players for the auctions to work;

    b) We should be ready to face the danger of collusion — leading to the blockage of new players in the market.

    c) We should be ready to deal with inflexibility on spectrum management and regulatory intervention due to the creation of "Private Rights" on goods which are by character "common" in nature;

    d) We should prepare ourselves for possible fragmentation, as the outcome of spectrum auctions — i.e the demand on quantum cannot be predicted in advance. **This is bound to happen if we follow the DoT request of auctioning spectrum for the satellite service in the manner we have done for terrestrial.**

8. While auctions may be the most optimal method for assignment of spectrum in an exclusive manner, **then using auctions as a tool for making assignments may not be the correct strategy,** that too when and when "sharing" has to be supervised constantly by the regulator for ensuring optimal usage and for the purpose of resolving conflicts between the sharing entities.

    Some other points which must be kept in mind which preclude the possibility of auctioning of satellite spectrum. These are

    1. **Satellite spectrum a shared resource: S**atellite spectrum is a shared resource and so, fundamentally, it cannot be auctioned as it cannot be exclusively allocated. The basic prerequisite of a resource that is to be auctioned, is that it should be available for sale as discrete, unique products. Satellite spectrum does not satisfy this elementary criterion. The concerned satellite band of frequencies is shared by all

the operators. It is somewhat akin to WiFi spectrum or the common ambient air or a public road or highway.

2. **International nature and ITU involvement:** Satellite spectrum has no national territorial limits and is international in character. It is coordinated and managed by the International Telecommunications Union (ITU) through a global convention which is signed by 194 nations, to which India is also a signatory. Consequently, satellite spectrum management is subject to the radio regulation of the ITU.
3. **Global satellite spectrum allocation:** World over, satellite spectrum is authorized for 'right-to-use' by all administrations and is allocated only by administrative process, at charges that essentially cover the cost of administration. Unlike terrestrial spectrum, satellite spectrum is never exclusively assigned to the operator but coordinated internationally and shared among multiple operators for different orbital slots and all types of satellites. Thus, the terrestrial concept of exclusivity does not apply in case of satellite spectrum and therefore auctioning is not applicable. Moreover, any commodity to be auctioned must be free from encumbrances. Satellite spectrum has international encumbrances.
4. **International Best Practices:** No Government in the world has auctioned spectrum for satellites or is considering to do so. Yes, in the past, a couple of countries in the Americas had tried to follow the auction of the satellite orbital slot, but not of the spectrum. However, even the auction of orbital resources along with right to use spectrum proved very problematic and the countries eschewed that approach:
    - **(i)** **US**: Discontinued the approach and enacted the Orbit Act in 2000 to prohibit auction (auction of satellite spectrum for the provisions of international or global satellite communication services) is prohibited by US law.
    - **(ii)** **Brazil**: Discontinued the auction and enacted law to administratively assign spectrum in the year 2019 (Art.172 of Law No. 13789 of October 3 ,2019).
    - **(iii)** **Mexico**: Auctions failed and discontinued from year 2014.
5. **Satellite service vs terrestrial mobile:** Unlike terrestrial mobile network operators, satellite operators use the same frequencies across multiple satellites without interfering with each other. They also coordinate with each other in sharing the same frequencies across their services. As a result, the satellite spectrum is never exclusively assigned as opposed to the mobile access spectrum
6. **Inefficient spectrum usage:** In a conventional auction for terrestrial spectrum, the capacity is created by slicing the total available spectrum into various block sizes and each block is assigned individually to winners for exclusive use. However, the auction method cannot be followed for satellite spectrum due to the highly inefficient frequency reuse capability, which restricts the use of the spectrum only to a few operators and significantly reduces its value. Moreover, the sharing of frequencies between operators is what results in large capacities being available over a given geography.
7. If hypothetically, satellite spectrum was to be auctioned, it would have to be divided into portions or chunks, which would lead to fragmentation of the spectrum and that would drastically impact the efficiency of the given spectrum, thereby defeating the core principles of spectrum policy and management. Also to be able to exclusively carve out a chunk of the spectrum (which is essentially

shared), would require a complicated set of rules for the coordinated operation of different satellites using the same spectrum band.

8. **Satellite spectrum and mobile spectrum are different:** Any attempt to equate satellite spectrum with terrestrial mobile spectrum in the matter of spectrum allocation would be completely flawed and incorrect. Satellite services and the terrestrial mobile services are gross 'unequals'. The latter have several unique and precious rights like right to interconnection, right to interference-free spectrum, right to unique numbering resources and right of way. Satellite services have none of these. As per Art. 14 of the Constitution of India, the two have to be treated differently on a mandatory basis because case law has established that unequals are not permitted to be treated as equals.
9. **Grossly different revenue potentials and payment capacity:** Terrestrial mobile operators and satellite VSAT operators are on completely different footings – virtually located in different universes. The current annual revenue of Indian mobile operators is about Rs.2.5 lakh crores i.e. Rs.250000/- whereas that of the Indian satellite VSAT operators is only around Rs. 500/- crores. Satellite services are therefore as minuscule as 1/500th or a mere 0.2% of the mobile operators' revenue. It would be a travesty of justice to equate the two in treatment of mode of allocation of spectrum resource. **Indisputably, the terrestrial mobile industry has a far higher bidding/paying capacity – probably 500 times higher, for spectrum. It would therefore be most unfair to put the two groups through the same or similar allocation method.**
10. **Public Good and the Cost of services:** Satellite services are almost the only method available for reaching broadband connectivity to the rural and remote regions as also to regions affected by disaster. Hence, auctions which are known to invariably result in high prices, would push up the cost of the service and thus go against public interest or public good and severely impact the wider socio-economic welfare. Satellite services are truly akin to social welfare services and need to be nurtured, protected and fostered in the public interest.
11. **Would harm Inclusive Development:** Satellite broadband is being deployed to serve the unserved and underserved areas of the country. For example, the Government decision to connect far flung islands and border areas of North-East through satellite broadband would be jeopardised if the said spectrum bands for the satellite to deliver satellite broadband were to be auctioned to service providers, who would like to use it for either terrestrial purposes or any other application**. Such a move would be counter-productive to the digital dreams of the country and run contrary to the objectives of inclusivity and 'Sabka Saath, Sabka Vikas' - to which the nation and Government are committed.**
12. **Stifling startups and limiting growth:** The high prices resulting from spectrum auctions would also stifle many budding start-ups who are building and launching new satellites and would need satellite spectrum for launching their own satellite constellations. India presently holds barely 2% of global revenues of the satellite sector. If we aim to meet the stated goal of achieving 10% of global revenues by 2030 or so, and truly emerge as a leading digital economy where satcom is a vital pillar, auctioning would represent a massive setback.
13. **Creation of Gatekeepers:** Deep pocketed players could use auctions to a mass disproportionate amount of spectrum and become gatekeepers and block the entry

of new operators. Thus, a regressive and anti-competitive environment would get created, harming the economy and the nation.

14. **Inadequate satcom penetration in India:** India has only one-third of its Asian peers' satellite connectivity per capita and only one-twentieth or even lower than that of Europe and the US. This does not reflect well for our digital ambitions, considering that we as a country have vast expanses of territory which are in inhospitable and uninhabited areas and which cannot be possibly served by terrestrial broadband due to techno-economic constraints. Inarguably, satellite spectrum auctions would greatly retard even the existing growth of the industry.
15. **Supreme Court's clarification on Spectrum Auctions:** In many quarters, there is a mistaken understanding that the Supreme Court had mandated spectrum auction in all situations after the 2G spectrum case. However, we wish to respectfully submit that what the Hon'ble Supreme Court held, in its advisory jurisdiction in the Presidential Reference relating to the order in the 2G case that "Auction, as a method of disposal of natural resources, cannot be declared to be a Constitutional mandate under Art. 14 of the Constitution of India." The Supreme Court further stated that "Auction may be the best way of maximising revenue, but revenue maximisation may not always be the best way to serve public good." Hence, because of the various other grounds already outlined above which include public interest and public good, there are ample justifications for continuing to follow administrative allocation of satellite spectrum and this is also completely in line with international practice.
16. **Multiple users of satellite spectrum:** There are multiple users of satellite spectrum, viz., VSAT, DTH, broadcasters and teleport. Any plan to auction spectrum only for satellite communications would create a host of complications in various industry segments affected by this. Apart from satcom, DTH and broadcasting are powerful vehicles for creating public good and the penetration of these could get adversely impacted if satellite spectrum is auctioned.
17. **Investment Risk & Uncertainty***:* Any enterprise wanting to plan and establish a constellation of satellites for providing broadband services in India cannot predict the cost of advancing these services in India, unless there is prior participation and assignment of spectrum in an auctioning process. Hence, building and launching of satellites can only be done after an auctioning process, where the outcome of the auction may make it unfavourable for the enterprise establishing Indian space assets to invest in a constellation for providing services at all, given the economics of spectrum and NGSO space assets. With this uncertainty, no investment can be sought for establishing space assets to provide broadband services due to the increased risk and uncertainty. The fledgling space sector which has just started picking up growth could get stifled the implications arising from the introduction of spectrum auction.

We believe that administrative allocation would be a fair and equitable method of allocation of satellite spectrum to all stakeholders – big and small, indigenous and global, prevent needless complications that could possibly arise out of the spectrum auctions and ensure the efficient use of satellite spectrum while fostering competition and innovation in the sector. In our opinion, any move to auction satellite spectrum (which has not been

done anywhere else globally) would be detrimental to the potential of the satellite sector to help fulfil India's digital ambitions.

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.

BIF RESPONSE

1. The charging mechanism needs to be unified across all service authorizations under the UL. This will allow for an efficient sharing of spectrum across the different service authorizations under the UL.
2. The charging mechanism should be uniformly applied for the gateway links and the user links. It is common practice for satellite operators/service providers to use spectrum for gateway stations and user terminals interchangeably.
3. In the case of the VSAT-CUG service authorization, in the past, the TRAI recommended a reduction of spectrum usage charges from 4% to 1%, with the rationale that 1% of AGR would adequately cover the administrative expenses incurred for managing the spectrum, thus emphasizing cost-recovery as a basis for charging for spectrum for satellite-based services[5]The TRAI has reiterated the reduction of charges and the model on several occasions. [6]
4. In the case of the GMPCS authorization, the TRAI recommended that the quantity-based charging mechanism should be converted to an AGR-based charging model, and the charges would need to be 1% of AGR. [7]This mechanism, when implemented, will create a uniform charging mechanism across the service authorizations.

In the event that the TRAI recommends a quantity of spectrum-based charging model, then the following issues need to be addressed:

1. Modern satellite networks re-use spectrum across different beams of the satellite, without impacting the sharing of the same set of frequencies with other satellites (both GSO and NGSO systems). In order to encourage such spectrum re-use, the charging mechanism should be designed to encourage re-use, which results in an efficient use of spectrum by all systems.
2. A similar approach needs to be followed for the use of multiple polarizations. Use of multiple polarizations enhances spectrum utilization, increasing its efficient use.
3. As stated in our response to Q37, above, the assignment and charging of spectrum should be as a block, as opposed to assigning and charging for spectrum on a carrier-by-carrier basis. This would give the satellite service provider flexibility to dynamically use the spectrum, and would simplify the calculation of the fees.

[5] *See*, https://www.trai.gov.in/sites/default/files/Recommendations_07032017.pdf.
[6]See, https://www.trai.gov.in/sites/default/files/Recommendations_26082021.pdf
[7] *See*, https://www.trai.gov.in/sites/default/files/Recommendations_26082021.pdf.

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.

BIF RESPONSE

The Auction determined prices of spectrum bands for IMT/5G should not be used for valuation of satellite spectrum.

As clearly mentioned in Response to Q4 above, the terrestrial and satellite spectrum are different in a number of ways. Hence, any method of using auction prices of terrestrial spectrum cannot be applied in case of satellite spectrum due to the following reasons:

i. Distinction between the Mobile and satellite services can be determined by the markets they cater to. Services by mobile operators are more focused towards densely populated urban areas, however satellite services address the connectivity needs of rural and remote populations or niche use cases like maritime, disaster time connectivity.

ii. Satellite operators borne substantial costs in providing its services, including but not limited to satellite manufacturing, launching and operating cost.

iii. Satellite services play a crucial role in bridging the digital divide by providing connectivity in areas where the traditional TSPs business model has failed. High spectrum prices for TSPs often result in prioritizing revenue generation and concentrating network deployment in urban areas. As a consequence, rural and remote areas are left underserved. By adopting a different pricing model for satellite spectrum, regulators can ensure that the connectivity needs of these underserved areas are better addressed.

Clearly, both are entirely different in terms of economic value, market size and exclusivity hence applying the same pricing model as mobile operators could make satellite services unaffordable for the very communities they are meant to serve, further exacerbating the digital divide.

We are of the opinion that all spectrum assignment for all satellite bands including L & S band should be assigned uniformly in an administrative manner aligned to global best practices. This is irrespective of the fact whether spectrum is assigned for user terminals or gateways. Detailed justification has been provided in Response to previous questions. Issues that could arise due to exclusive allocation or auction of spectrum has also been provided in response to

Q 4 & 6 above. We do not support auction based mechanism for assignment of spectrum for satellite use cases.

Auction determined prices of spectrum for IMT/5G services as a basis for the valuation of spectrum for space-based communications would not be appropriate for the following reasons:

1. IMT/5G deployments are envisaged only in a portion of the bands that are used for space-based communications (e.g., the 27.5-28.5 GHz band). Spectrum for space-based communications span across several frequency bands (e.g., L-, S-, C-, Ku-, Ka-, and Q/V bands). It might not be feasible to apply a uniform valuation for spectrum across the bands listed above.
2. The addressable users for IMT/5G services and for satellite-based services would be very different, and a valuation cannot be derived for one service from the other.
3. For IMT/5G services, an exclusive assignment of spectrum is required. Whereas for space-based communications, a shared assignment of spectrum would be the most appropriate approach. Both of these cannot be equated in terms of charging of fees.
4. Around the world, charges for the use of spectrum for the provision of satellite services are based on the cost-recovery principle, and the spectrum for satellite-based services is assigned administratively. Whereas the spectrum for terrestrial mobile wireless services is assigned exclusively through an auction-based process, and a price discovery mechanism is used to determine the price of the spectrum.

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

BIF RESPONSE

Answer to Q39 is NO.

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.

BIF RESPONSE

1. This question is not applicable as we are of the firm opinion that satellite spectrum cannot be auctioned. Hence question of valuation of spectrum does not arise. Spectrum maybe assigned using the present formula based administrative pricing mechanism.
2. We are not aware of any situation in which a regulator has used spectral efficiency as a reference point to determine the value of spectrum for space-based communication.
3. The value of frequency bands for space-based communications should not be derived by comparing the spectral efficiency in relation to other bands, as this would mean many other important factors would be left unconsidered.

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.

BIF RESPONSE

As mentioned in our responses to previous questions, satellite spectrum should not be auctioned as it would lead to fragmentation of spectrum and gross inefficiencies and restrict competition.

This can also be inferred from consultation paper in which TRAI has referred[8] to media reports that *"US, Mexico, and Brazil had attempted to sell frequencies for satellite usage but eventually did not succeed and at last resorted to administrative licensing."*

As clearly mentioned in Response to Q4 , the terrestrial and satellite spectrum are different in many ways. Hence, any method of using auction prices of terrestrial spectrum cannot be applied in case of satellite spectrum. Hence, it would not be feasible to auction using the current method of levying spectrum fees/charges for satellite spectrum bands on formula basis/ AGR basis, serve as a basis for the purpose of valuation of satellite spectrum.

The SUC for Satellite spectrum may kindly be kept as 1% of the AGR as recommended earlier by TRAI.

We are of the opinion that all spectrum assignment for all satellite bands should be assigned uniformly in an administrative manner aligned to global best practices. This is irrespective of the fact whether spectrum is assigned for user terminals, ESIMs or gateways. Detailed justification has been provided in Response to Q4 & 6. Issues that could arise due to exclusive allocation or auction of spectrum has also been provided in response to Q 4 & 6 above. We do not support auction based mechanism for assignment of spectrum for satellite use cases.

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.

BIF RESPONSE

The revenue surplus model used by TRAI is to estimate the maximum amount a service provider would be willing to pay for additional spectrum in a certain frequency band for IMT/5G services in terrestrial networks. This model is based on financial parameters and spectrum holdings and assumes that the NPV of projected revenue surplus over next 20 years represents the maximum amount a service provider would pay. However, this model requires certain financial information about the space industry, such as revenue and operating expenditure (Opex), EBITDA margin, capital cost per subscriber, capacity utilisation, useful life of various network elements/assets, depreciation methodology and RoCE of the space

[8] Para 4.17 of TRAI CP

segment. Unfortunately, this information is currently unavailable since the industry is still at a very nascent stage.

As clearly mentioned in Response to Q4, the terrestrial and satellite spectrum differ in many ways. Hence, any method of using auction prices of terrestrial spectrum cannot be applied in case of satellite spectrum. We are of the opinion that all spectrum assignment for all satellite should be assigned uniformly in an administrative manner aligned to global best practices. This is irrespective of the fact whether spectrum is assigned for user terminals or gateways. Detailed justification has been provided in Response to Q4 & 6. Issues that could arise due to exclusive allocation or auction of spectrum has also been provided in response to Q 4 & 6 above. We do not support auction based mechanism for assignment of spectrum for satellite use cases.

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.

BIF RESPONSE

Around the world, there are no examples of spectrum for satellite services in the microwave and millimetre wave bands being auctioned. There are instances in some countries of orbital slots and the corresponding spectrum resource being auctioned; however, satellite operators who operate satellites in orbital slots filed by other Administrations (other than the local Administration) have not been subject to spectrum auctions to ensure access to the spectrum resource.
The present approach of revenue share for commercial services is appropriate for India for nascent space sector to grow.

As clearly mentioned in Response to Q4 above, the terrestrial and satellite spectrum differ in many ways. Hence, any method of using auction prices of terrestrial spectrum cannot be applied in case of satellite spectrum. We are of the opinion that all spectrum assignment for all satellite bands should be assigned uniformly in an administrative manner aligned to global best practices. This is irrespective of the fact whether spectrum is assigned for user terminals or gateways.

Additional Points to justify our position is given below:

> **International nature and ITU involvement:** Satellite spectrum has no national territorial limits and is international in character. It is coordinated and managed by the International Telecommunications Union (ITU) through a global convention which is signed by 194 nations, to which India is also a signatory. Consequently, satellite spectrum management is subject to the radio regulation of the ITU.
> **Global satellite spectrum allocation:** World over, satellite spectrum is authorized for 'right-to-use' by all administrations and is allocated only by administrative process, at

charges that essentially cover the cost of administration. Unlike terrestrial spectrum, satellite spectrum is never exclusively assigned to the operator but coordinated internationally and shared among multiple operators for different orbital slots and all types of satellites. Thus, the terrestrial concept of exclusivity does not apply in case of satellite spectrum and therefore auctioning is not applicable. Moreover, any commodity to be auctioned must be free from encumbrances. Satellite spectrum has international encumbrances.

International Practices: No Government in the world has auctioned spectrum for satellites or is considering to do so. Yes, in the past, a couple of countries in the Americas had tried to follow the auction of the satellite orbital slot, but not of the spectrum. However, even the auction of orbital resources along with right to use spectrum proved very problematic and the countries eschewed that approach:

a) **US**: Discontinued the approach and enacted the Orbit Act in 2000 to prohibit auction (auction of satellite spectrum for the provisions of international or global satellite communication services) is prohibited by US law.

b) **Brazil**: Discontinued the auction and enacted law to administratively assign spectrum in the year 2019 (Art.172 of Law No. 13789 of October 3 ,2019).

c) **Mexico**: Auctions failed and discontinued from year 2014.

Satellite service vs terrestrial mobile: Unlike terrestrial mobile network operators, satellite operators use the same frequencies across multiple satellites without interfering with each other. They also coordinate with each other in sharing the same frequencies across their services. As a result, the satellite spectrum is never exclusively assigned as opposed to the mobile access spectrum

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.

BIF RESPONSE

We suggest that India establish its own cost benchmarks, and use the cost-recovery principle to charge for spectrum for space-based communications.

Around the world, the charges for the assignment of spectrum for space-based communications through an administrative mechanism has been derived using a cost-recovery principle. The cost benchmarks of those countries and India might vary, and it may not be appropriate to benchmark the charges for an administrative assignment with that of other countries.

Some data on International Best Practices for assignment/allocation & charging methods of Satellite Spectrum is given below for kind reference:

Global satellite spectrum allocation: World over, satellite spectrum is authorized for 'right-to-use' by all administrations and is allocated only by administrative process, at charges that essentially cover the cost of administration. Unlike terrestrial spectrum, satellite spectrum is never exclusively assigned to the operator but coordinated internationally and shared among multiple operators for different orbital slots and all types of satellites. Thus, the terrestrial concept of exclusivity does not apply in case of satellite spectrum and therefore auctioning is not applicable. Moreover, any commodity to be auctioned must be free from encumbrances. Satellite spectrum has international encumbrances.

International Practices: No Government in the world has auctioned spectrum for satellites or is considering to do so. Yes, in the past, a couple of countries in the Americas had tried to follow the auction of the satellite orbital slot, but not of the spectrum. However, even the auction of orbital resources along with right to use spectrum proved very problematic and the countries eschewed that approach:

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Satellite service vs terrestrial mobile: Unlike terrestrial mobile network operators, satellite operators use the same frequencies across multiple satellites without interfering with each other. They also coordinate with each other in sharing the same frequencies across their services. As a result, the satellite spectrum is never exclusively assigned as opposed to the mobile access spectrum

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?

BIF RESPONSE

Our Response to Q45 is NO.

In the event the authority looks at benchmarking international administrative pricing, it will be complex and need to be normalized. To do that, consideration of socio-economic factors, such as income distribution and the digital divide is very crucial to ensure a fair and logical comparison, as these factors have the major influence on the demand for connectivity and spectrum pricing decisions. The unit price should be adjusted by factors such as GDP per capita (GDPPC) or Purchasing Power Parity (PPP). This adjustment will account for differences in economic conditions and purchasing power across the selected markets, providing a more accurate and meaningful benchmark for India's spectrum pricing decisions.

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.

BIF RESPONSE

We are of the opinion that all spectrum assignment for all satellite bands should be assigned uniformly in an administrative manner aligned to global best practices. This is irrespective of the fact whether spectrum is assigned for user terminals or gateways. Detailed justification has been provided in Response to previous questions. Issues that could arise due to exclusive allocation or auction of spectrum has also been provided in response to Q 4 & 6 above. We do not support auction based mechanism for assignment of spectrum for satellite use cases. The present approach of revenue share for commercial services is appropriate for India and shall allow the nascent space sector to grow.

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

BIF RESPONSE

It is possible to re-use spectrum that is used for gateway station links for user station links, as well as across different geographic locations. Any segregation of spectrum for use of gateway station links and user station links should not be carried out. Flexibility needs to be provided to satellite operators to interchangeably use spectrum as the need arises.

We are also of the opinion that all spectrum assignment for all satellite bands should be assigned uniformly in an administrative manner aligned to global best practices. This is irrespective of the fact whether spectrum is assigned for user terminals or gateways. Detailed justification has been provided in Response to previous questions. Issues that could arise due to exclusive allocation or auction of spectrum has also been provided in response to Q 4 & 6 above. We do not support auction based mechanism for assignment of spectrum for satellite use cases. The present approach of revenue share for commercial services is appropriate for India and will allow for the nascent space sector to grow.

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.

BIF RESPONSE

Since it is possible to re-use spectrum that is used for gateway station links for user station links as well, as across different geographic locations, any segregation of spectrum for use of gateway station links and user station links and different charging mechanisms should not be carried out. Flexibility needs to be provided to satellite operators to interchangeably use spectrum as the need arises.

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.

BIF RESPONSE

We advocate a revenue share model and no other method for valuation should be used/prescribed for spectrum valuation.

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.

BIF RESPONSE

The question of valuation of spectrum for auction purposes does not arise, as we do not support auction based pricing mechanism. The present approach of revenue share for commercial services is appropriate for India to allow the nascent space sector to grow.

We are of the opinion that all spectrum assignment for all satellite bands should be assigned uniformly in an administrative manner aligned to global best practices. This is irrespective of the fact whether spectrum is assigned for user terminals, ESIMs or gateways.

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.

BIF RESPONSE

The question of valuation of spectrum for auction purposes does not arise, as we do not support auction based pricing mechanism. The present approach of revenue share for commercial services is appropriate for India to allow the nascent space sector to grow.

We are of the opinion that all spectrum assignment for all satellite bands should be assigned uniformly in an administrative manner aligned to global best practices. This is irrespective of the fact whether spectrum is assigned for user terminals, ESIMs or gateways.

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.

BIF RESPONSE

The question of valuation of spectrum for auction purposes does not arise, as we do not support auction based pricing mechanism. The present approach of revenue share for commercial services is appropriate for India to allow the nascent space sector to grow.

We are of the opinion that all spectrum assignment for all satellite bands should be assigned uniformly in an administrative manner aligned to global best practices. This is irrespective of the fact whether spectrum is assigned for user terminals, ESIMs or gateways.

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.

BIF RESPONSE

Status quo be maintained as regards payment terms is concerned. Only period of validity maybe kindly extended to be co-terminus with the validity of the license.

The question of valuation of spectrum for auction purposes does not arise, as we do not support auction based pricing mechanism. We believe that the present approach of revenue share for commercial services is appropriate for India for nascent space sector to grow. Given the revenue share model, the aforementioned questions would not be applicable.

In response to previous questions, we have provided justification for the administrative assignment of spectrum for any space-based communication services, and the spectrum resource should be shared between all satellite operators seeking to access it.

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