

**Nelco Response to TRAI Consultation paper on Assignment of
Spectrum for Space-based Communication Services**

PREAMBLE

Nelco would like to thank TRAI for the opportunity to respond to the Consultation Paper ('CP') on the Assignment of Spectrum for Space-based Communication Services. We especially laud the balanced and holistic approach to the subject and the TRAI's detailed analysis of the issues involved.

TRAI's Consultation Paper reflects a sound approach to DoT's rather limited reference asking it to recommend the appropriate auction methodology to allocate spectrum for space communications. TRAI has rightly broad-based its consultation to seek stakeholder inputs on all appropriate methodologies for allocating this spectrum. Such an approach is especially apt for TRAI, a sector specialist statutory body, as it conducts its first comprehensive consultation on this topical subject.

In the following paragraphs, we discuss the problems with the one-size-fits-all approach to auctioning spectrum for telecom services. We show that auctions are neither appropriate nor the norm for allocating all kinds of spectrum and that they are especially harmful and risky in the case of satellite spectrum.

A. Auction is not the norm for every license/service granted under Section 4 of the Indian Telegraph Act, 1885.

1. The principle that the State-owned resources cannot be alienated except by a process of auction is not a principle applicable universally as clarified by the Constitution Bench of the Hon'ble Supreme Court in Natural Resources Allocation, In Re, Special Reference No. 1 of 2012, cited in (2012) 10 SCC 1.
2. The Constitution Bench of the Hon'ble Supreme Court of India in answering the reference under Article 143 (1) of the Constitution of India, occasioned by the decision of the Hon'ble Supreme Court, rendered by a two-judge bench on 2nd February 2012 in Centre for Public Interest Litigation & Ors. Vs. Union of India & Ors¹ [*famously known as '2G case'*], *inter-alia*, clarified and held that it was not a requirement of Article 14, nor a requirement of administrative law, that natural resources must invariably be distributed through public auction or tender, and that while revenue maximization may be a legitimate goal in some cases, there are myriad other situations where there may be priorities other than revenue maximization, where preferential allocation or allotment of scarce resources may be made without resorting to public auction or tender.
3. The decision in the 2G case by which the Hon'ble Supreme Court found fault with the policy of the Government to grant telecom licenses based on 'first come first serve' and recommended auction for spectrum is to be read and understood in the context of the

¹ Citation; (2012) 3 SCC 1.

facts of the 2G case, which, primarily, concerned with allocation of spectrum for 2G services by the Government in a manner which was non-transparent, not fair and inconsistent with principles of equality enshrined in the Constitution.

4. In our respectful submission, the key considerations for denouncing the First Come First Serve policy were as follows:
 - (i) Scarcity of spectrum (i.e. terrestrial access spectrum) – Unlike satellite spectrum, terrestrial access spectrum i.e. the 2G spectrum is allocated for exclusive use (i.e. *transfer of public resources to private domain/private ownership*) to a service provider who may or may not choose to share its allocated spectrum. Scarcity is due to exclusionary nature of such spectrum [Para 77 & 85 of 2G Judgment].
 - (ii) The policy of allocation was discriminatory and not fair to all eligible persons – The policy of first come first service deprived eligible persons of fair opportunity to compete in getting spectrum by giving unfair advantage to persons who had access to the power corridor at highest or the lowest level. Persons with access to the system could have obtained prior information about allocation. They would immediately make an application and thus become entitled to stand first in the queue at the cost of all other who may have a better claim [Para 94 & 95 of 2G Judgment].
 - (iii) Grabbing of natural resources - That there was a potential of spectrum being misused by unscrupulous people who were only interested in garnering maximum financial benefit. Again, this is so because the terrestrial access spectrum is granted for exclusive use by private players. [Para 96 & 101 of 2G Judgment].
 - (iv) Public interest, public good and efficient utilization of natural resources are important considerations in the allocation of natural resources [Para 75, 80 & 89 of 2G Judgment].
5. Undisputedly, none of the above considerations apply in the case of space spectrum since space spectrum is non-exclusionary by design. Unlike the terrestrial spectrum, satellite spectrum can be used simultaneously by multiple service providers around the world on a non-exclusionary basis. In other words, multiple satellite operators can use the same spectrum without excluding others. Because of its non-exclusive nature, space spectrum is not scarce, with no risk of individual players grabbing it.
6. The concept of scarcity and private ownership, is relevant in case of terrestrial access spectrum, but does not apply to space spectrum. Further, allowing a winning bidder in the auction the exclusive use of spectrum that can be shared easily is an inefficient use of the scarce resource and veritably against public interest.
7. It is due to fundamental differences that exist between terrestrial-based spectrum and space-based spectrum that the two are regulated differently both in India and

Internationally. Treating the two alike will be counterproductive and go against the very public interest that the Government must espouse.

8. The Hon'ble Supreme Court in the Presidential Reference (in the context of 2G case) has also iterated that revenue maximization may not always be the best way to subserve public good. The Hon'ble Supreme Court went on to specifically hold in paragraph 120 that :

“Therefore, in conclusion, the submission that the mandate of Article 14 is that any disposal of a natural resource for commercial use must be for revenue maximization, and thus by auction, is based neither on law nor on logic. There is no constitutional imperative in the matter of economic policies. Article 14 does not pre-define any economic policy as a constitutional mandate. Even the mandate of 39(b) imposes no restrictions on the means adopted to subserve the public good and uses the broad term 'distribution', suggesting that the methodology of distribution is not fixed. Economic logic establishes that alienation/allocation of natural resources to the highest bidder may not necessarily be the only way to subserve the common good, and at times, may run counter to public good. Hence, it needs little emphasis that disposal of all natural resources through auctions is clearly not a constitutional mandate.”

Furthermore, one can't ignore the risk that auctioning satellite spectrum will encourage speculation and hoarding. Terrestrial players have a manifest incentive to do so, to foreclose competition from an alternative technology. They also have the means to do so, as they account for over 99% of the telecom sector's revenue in the country currently. By squeezing out serious stand-alone satellite players from the market, auctions can reduce competition - instead of encouraging it.

B. There is no rationale for auctioning spectrum for space-based communication services.

1. The **spectrum used for space-based communication services is a shared resource** without any exclusive usage right to any one service provider unlike terrestrial mobile access spectrum, which is not sharable, is exclusively assigned and hence auctioned. Auction is suitable for any resource which is exclusive, has high demand but low supply etc. All these rationales suggest that spectrum for space-based communication does not qualify to be auctioned.

Any forced method of spectrum assignment – like auction method, will be counterproductive, will harm the satcom industry, has potential to kill the industry and leave very little choice with end customer w.r.t technology/ service provider etc.

2. There is **hardly any reference globally** wherein the satellite spectrum is auctioned. Few countries which have tried the spectrum auction in higher bands (C, Ku, Ka) have failed miserably and reverted to administrative auction.

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3. Satellite-based services are **vital in providing connectivity to/in remote and rural areas**, where deploying cellular services is not cost-effective. Satellite-based services are a critical link to bridging the digital divide – the gap in overall connectivity in the country. Auctioning satellite spectrum would raise the costs of satellite services and deny access to communication services to the people who need them urgently. End customers in India need the benefits of competition between technologies and service providers to leverage the digital opportunity.
4. Satellite technology has been providing communication services in India for many decades including services to unserved and underserved areas. Despite the extensive rollout of fiber, 4G & 5G services, satellite communication has stayed relevant across the globe. Satcom needs conducive regulation at this stage when **satcom technology is at the cusp of transformation**. New technologies like very High Throughput satellites, MEO & LEO satellite constellations will bring ultra high capacities, fiber-like latencies, and lower unit costs. New satellite technology is also expected to enable **‘Direct to Device’ (D2D)** capabilities, enabling consumer devices to communicate directly with the satellite. India may be the prime beneficiary of satellite D2D services given its vast territory, underserved population, and reliance on mobile phones for Internet access. New 5G standard (3GPP’s 5G New Radio (NR) release 17) specification incorporates standards for NTN for the first time. NTNs offer coverage to vast areas that terrestrial mobile networks cannot still reach. New NGSO systems will offer **5G NTN** services with S-band and L-band play a critical role in enabling them.
5. **Fragmentation of Satellite spectrum:** Space-based communication services need continuous spectrum to work efficiently. A satellite network may serve overall India or a state/region unlike cellular network, which works on a relatively small foot-print area cell-based network. While fragmentation of spectrum may not be an issue in cellular network as different small fragments may be deployed in different cells, for satellite, it is not the case and the fragmentation of spectrum will make the usage very inefficient.
6. Any RF communications require spectrum, be it Wi-Fi, terrestrial point-to-point radio network, Radio broadcast or TV broadcast or Earth sensing satellite or VSAT services or IMT services. **Every technology & use-case has its purpose & value in the overall ecosystem**. The Government has rightly supported the development of diverse communication technologies requiring spectrum. It has not put all spectrum to auction and continues to allocate some administratively.
7. **Satellite spectrum works in combination of Gateway & User spectrum:**
 - Unlike terrestrial services, satellite services require spectrum for gateway links and user links. The gateway spectrum band can be different from user spectrum band. For example, the Gateway spectrum band can be in Ka-band, whereas user spectrum may

be in Ku band. There can be various combinations -e.g., Ku x Ku, Ka x Ku, C x Ku- for Gateway and User spectrum for different satellites.

- As for a service provider, it is important to have both sides of the spectrum. A licensee taking one combination on one satellite might find other satellite working on a different combination. For example, for providing Ku bandwidth services in India on HTS, there are very few satellites in India. Yet, almost all these satellites work in different combinations. For example:
 - GSAT29: Ku x Ku, Ka x Ka
 - GSAT11: Ka x 'planned Ku'
 - IS-33e: C x Ku
- So, a licensee, wishing to offer satellite services, will need to participate in multiple auctions to acquire the different kinds of bands of spectrum such as C, Ku, Planned Ku, Ka, etc. Such an option is impractical and unviable, leaving administrative allocation as the only right one for satellite spectrum.

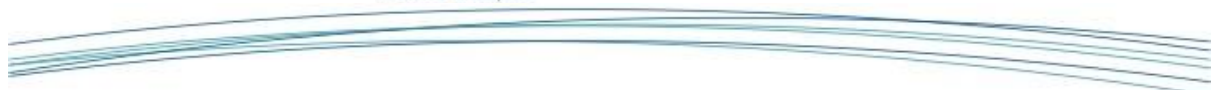
8. Spectrum Hoarding: Auctions can help a few large & deep-pocketed players to corner critical spectrum and conceivably starve satellite services of spectrum and effectively kill competing technology. Such a scenario is especially risky since e.g., terrestrial player have little incentive to develop and expand satellite services and could be tempted to use the satellite spectrum to fuel urban cellular services. Such a move would drastically reduce competition between players and technologies in India's telecom markets, hurting rural and remote populations the most.

9. Any attempt to create exclusivity by dividing the satellite spectrum, in our view, will not only restrict the use of the spectrum only to a few operators and thus **auction will not only create barriers for newer operators** but also significantly reduce the value and efficacy of the scarce resource.

10. Overdependence on terrestrial communication services is not strategically good for India. Unlike some of the developed countries, India does not have a fall-back option of a nationwide terrestrial network, making the country vulnerable in a key part of the economy. **India needs non-terrestrial network/services as an alternative technology option for customers and the economy.** It can only do so by prioritising and incentivising satellite-based services. Auction of satellite spectrum risks depriving India of sustainable satellite-based services.

11. Higher Infrastructure Capex for Licensees: Auctioning satellite spectrum will lead to its fragmentation. A player may end up needing capacities on multiple satellites to deliver its services. Such a player **must put up multiple VSAT Hubs, antennas, RF etc. It will require huge space, capex & opex investment to maintain each satellite-specific network, etc.**

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Apart from being totally impractical, it will raise the cost of satellite bandwidth due to both, the spectrum cost and the huge capex in building these gateways.

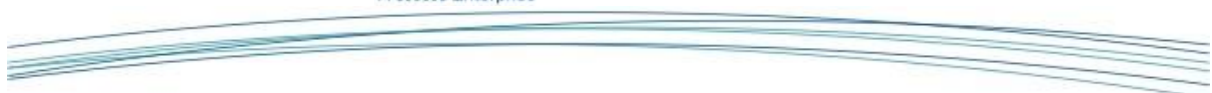
12. Presently, satellite-based services are expensive as compared to terrestrial wireless communications. Auctioning satellite spectrum will only worsen the situation for satellite services & **will make it unviable for space-based communication service providers.**
13. It is important that India ensures that the spectrum ear-marked for specific technology is used as envisaged. **Allowing spectrum use in a “flexible” manner across various technologies and licenses may hurt the services that most need the said spectrum.**
14. In satellite communication, there are two major components which are required to make use of any spectrum - 1) satellite system & 2) Ground segment. These two works together to make spectrum available for communication. Only one component cannot realize the spectrum and for this reason, 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, to which India is also a signatory. Consequently, **satellite spectrum management is subject to the radio regulation of the ITU.**
15. **Adverse impact on the development of Indian Space Industry:** India has very small share, approx. 2%, of the global Space industry revenue. India is one of the very few countries whose excellence, innovation, and competence in space communications is globally recognised. Government has shared its own vision to promote and strengthen India’s Space Industry in the just announced Space Policy 2023. The policy underlines, inter alia, the role of non—government entities (NGE) in the development of satellite gear, and associated services. If steps are taken to nurture it, India’s domestic Satcom market will play a crucial role in developing the overall Space Industry in India.

Auction of satellite spectrum could derail the satellite user industry (satcom and broadcast), and seriously hurt India’s space Industry.

It is our humble request to TRAI to take balance view, as that historic reforms initiated in the space sector does not get derailed.

- There can be no one-size-fits-all formula across all the various RF communication technologies. Rather there is an urgent need to preferentially reduce regulatory burdens on new players and diverse technologies, particularly those which do not have comparable economies of scale, but serve critical needs, like space technology which supports niche services and remote access. Undoubtedly, space market is nascent stage and not comparable to the market for terrestrial communications.

- The sound regulatory approach of boosting weaker markets is not new for India or its telecom sector. For example, TRAI mandated free interconnection between fixed and
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mobile networks several years before interconnection usage charges (IUC) were completely abolished.

- Also, taking a leaf from success of India in solar energy, one would notice that in solar capacity India has grown considerably, thanks to Government policies and regulatory intervention aimed at increasing the uptake of solar energy. The introduction of specific bespoke policies and incentives exclusively for solar energy was critical to ensuring growth of the solar Industry. Had the Government followed 'same service, same rules' and extended same treatment as given to non-renewable energy (eg. thermal etc.), which have economies of scale and well-built ecosystem, solar energy adoption would not have grown in India.

Thus, when making recommendations on the subject, TRAI must take a strategic view that supports Industry and consumers.

The following section provides Nelco's response to specific questions raised in the consultation paper:

Response to the specific questions raised in the Consultation Paper

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

Response:

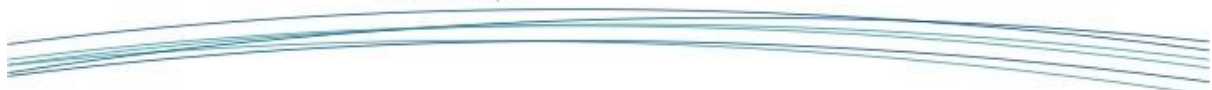
Frequency bands for space-based communications are internationally agreed upon by the ITU, where India is a signatory. A signatory country is required to use frequency bands in conformity with the provisions of the ITU’s Radio Regulations. We recommend that the full range of spectrum for space-based communication services, as per ITU provisions, should be made available for industry use.

Space-based communications are commonly deployed in L Band, S-Band, C Band, `Extended – C’ band, Ku-band, BSS band & Ka band (unplanned & unplanned bands), as described below:

Table 1: Common Satellite bands

Frequency Band	Downlink	Uplink	Remarks
L-band	1525 - 1560Mhz	1610- 1660.5Mhz	
S-band	2170 - 2200Mhz	1980 - 2010Mhz	
C Band	3400 - 4200Mhz	5850 - 6725Mhz	
	4500 - 4800Mhz	6725 - 7025Mhz	Plan band
Ku - FSS	10.95-11.2 GHz 11.45-11.7 GHz 12.2-12.75 GHz	13.75-14.5 GHz	
	10.7-10.95 GHz 11.2-11.45 GHz	12.75-13.25 GHz	Plan band
Ku - BSS	11.7-12.2 GHz	14.5-14.8 GHz 17.3-18.1 GHz	Plan Band
Ka - FSS	17.7 - 21.2Ghz	27.0 - 31.0Ghz	

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:



Response:

Each satellite band can be used interchangeably for satellite gateways and/or user links, subject to compliance with the National Frequency Allocation Plan (“NFAP”). This interchangeability is reflected in the wide variety of frequency plans on satellite systems already in orbit or under construction. The newer satellite systems are software-defined beams wherein the frequency can be used either for user link or gateway link, though in compliance to ITU requirement/ NFAP plan, as per market requirement. (Please refer to Table 1 for frequency bands & associated spectrum.) Higher frequency bands like Q/V are not included in this table as of now.

Satellites can be used for multiple services. The ‘Type of service’ or services deployed depend on the terms & conditions of the respective license and subsequent amendments, if any. We, therefore, focus on overall requirements rather than linking them to the ‘Type of license’ issued to the service provider.

Similarly, ‘Name of satellite system’ may not be relevant given the number of satellites available today, or others that may become available or be launched in future.

The frequency/spectrum requirement for ‘Earth to Space’ and ‘Space to earth’ parts is generally in the same frequency band for user and gateway links and may be mutually inclusive. However, it might be different in cases of cross-band deployment and on specific satellites

In case of satellite communication, the spectrum is shareable allowing multiple satellite, licensee/service provider/ customers to coexist and use the same spectrum. Higher bands (e.g., C, Ku, Ka band), may be in demand in future if these bands are available for satellite services.

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

Response:

With mutual co-ordination between NGSOs, it has not imposed any practical limit to number of NGSOs using same frequency range. NGSOs can coexist using the same frequency provided coordination is done to ensure that multiple user terminals are not on two NGSOs which are coming on same line of directivity (in-lie events). This can be easily achieved by switching user terminal to alternate satellite in visibility of the specific user terminal. It also suggests that the more spectrum is available to each constellation, the easier it will be to avoid in-line events by switching satellites or frequencies. Thus, assigning complete Ka-band, including 27.5Ghz – 28.5Ghz for satellite services is important.

For S-band – in the 1980-2010 MHz paired with 2170-2200 MHz band, the minimum spectrum required to implement the 5G NTN service is 2 x 15 MHz, aligning with the frequency pairings in 3GPP Band n265. To provide 5G NTN, the satellite component contains an advanced beam-forming array that requires a minimum frequency reuse pattern of N=3. The smallest channel configuration identified for 5G NTN operation is 5 MHz. Additional spectrum yields larger channels, the ability to create higher capacity, and the opportunity to serve a larger user base.

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Thus, the optimal block size for interested operators is 2 x 15 MHz block. This sized block is consistent with what has been administratively licensed in Europe. It provides an equal size enabling two operators to coexist and deploy advanced 5G NTN services.

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

Response:

Satellite spectrum in higher bands is shared spectrum that is used by multiple service providers. There is no rationale for allocating this spectrum on exclusive basis.

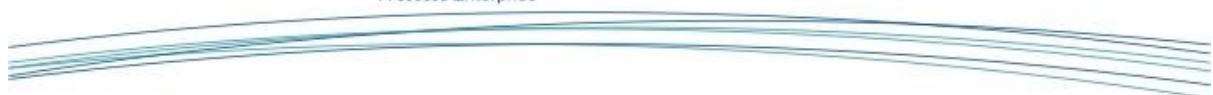
Some challenges posed by allocating the spectrum on an exclusive basis are:

It will result in fragmentation of shared resources with assignees possibly acquiring specific parts, instead of continuous spectrum. Also the spectrum will be highly fragmented if it assigned exclusively to multiple players – making spectrum usage inefficient or even unviable. On the other hand, if only one licensee is assigned the complete spectrum, it could result in:

- a. Inefficient use of a shareable resource.
- b. Monopoly in satellite communication market.
- c. Disruption of existing services if someone other than the existing spectrum user were to win exclusive rights to the spectrum, or if the existing user obtains the spectrum at a higher cost.
- d. Reduction in competitive satellite services in India, if a single party captures spectrum for exclusive use.
- e. Potential abuse of the market by a player with exclusive control over satellite spectrum, deciding the fate of space-based communication industry
- f. Hoarding of Spectrum instead of its use by the exclusive assignee.
- g. Even if the minimum rollout conditions are put, it may be worthless as by the time of milestone of minimum rollout obligation, existing satcom industry/players would be out of business.

As acknowledged by TRAI, only four countries have engaged in some form of competitive allocation in connection to space communications (Brazil, Mexico, United States, and Saudi Arabia) and three of those countries (Brazil, Mexico and United States) discontinued auctions finding them unpracticable. These administrations rescinded auctions and moved back to administrative assignments. Saudi Arabia has assigned a portion of the S-band MSS spectrum on exclusive basis.

In summary, there is no rationale for assigning a shareable resources like higher satellite frequency bands on an exclusive basis.



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 up to 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 the satellite communication ecosystem is not adversely impacted due to exclusive spectrum assignment, may kindly be made with detailed justification.

Kindly justify your response.

Response:

As of today, with allocation of spectrum on administrative basis, there is only one block size of full spectrum band available to the service providers on shared use basis without any artificial hinderance/capping or limitation. The situation is unlike IMT services which require an exclusive spectrum where parameters like `block size`, `number of blocks` etc., are relevant.

Assigning spectrum on exclusive basis and slicing the spectrum into smaller blocks with associated parameters of number of block and capping etc, is too complex, inefficient and will hurt the satcom Industry.

As spectrum used for space-based communication is shareable, the question w.r.t intra-band sharing is not relevant. It is to be noted that the spectrum sharing for space-based communication is due to technical reasons. It is natural and needs no specific policy push for making sharing mandatory. This differs from the IMT case where spectrum is assigned exclusively through auctions.

There is a working model for sharing satellite spectrum assigned administratively. It needs no change.

Q6. What provisions should be made applicable to 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,

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(i) After how many years the same spectrum band should be put to auction for the potential bidders?

(ii) What should be the validity of spectrum for the first conducted auction in a band? Whether the validity period for the subsequent auctions in that band should be co-terminus with the validity period of the first held auction?

Kindly justify your response.

Response:

The above question reflects why it is so unnatural to auction spectrum for exclusive use when satellite spectrum itself is shared. This question would be irrelevant if India follows the global norm of allocating satellite spectrum administratively for sharing amongst all prospective users.

It is counterintuitive to first auction the spectrum for exclusive use and then explore ways of sharing it. Such a move will create new frictions within the industry and encourage market abuse by those who win shareable satellite spectrum for exclusive use and restrict competition in the market

Auction will restrict the entry of a new entity which does not hold spectrum in addition to putting artificial constraint on the existing service providers to the extent of making them unviable.

Administrative way of Assignment poses no barriers to entry of any new players who can access the same spectrum easily. Thus, administrative Assignment benefits existing as well as new entrants besides consumers who get to enjoy the benefits of competition between technologies and service providers.

Our answer to Q4 & preamble above has an elaborate discussion of why the auction of the satellite spectrum will distort existing telecom markets and also hurt consumers.

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.

Trading or leasing spectrum is a legacy of exclusive Assignment of spectrum, such as in the case of IMT spectrum. Fortunately, it is irrelevant in the case of satellite spectrum assigned for shared use worldwide. Breaking from international practices, therefore, comes with these completely avoidable challenges and risks of market abuse by players having exclusive control over any spectrum.

Auction may create an artificial scarcity of a shareable resource (spectrum for space-based services). It would leave the the fate of the space-based Industry in the hands of entity that bids highest, especially if such an entity has high stakes in alternate, more lucrative technology like terrestrial cellular.

Therefore, the trading or leasing of a partial or entire spectrum for space-based communication should not be permitted.

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

Response:

An existing licensee operates in the designated band depending on the satellite frequencies allotted to it based on space availability on transponder). It is important that during the assignment/renewal of spectrum assignment, there are enabling provisions for Assignment so that existing service licensees providing space-based communications can retain the existing frequency range assigned to them. This is the practice with administrative Assignment and should be continued. It is to be noted that the Assignment for satellite spectrum may be in same band (for example Ku x Ku) or it can be cross-band (Ku x Ka). Administrative Assignment is fortunately non-disruptive for service providers as well as consumers.

Auction would be more complicated when service licensee is operating on cross band FSS satellites. While doing this, there will be few challenges wrt exclusive auction methodology:

For example, a service provider entity 'A' may obtain the same quantity of spectrum as it had before but in a different frequency range. An other entity 'B' has now got the spectrum allocation in same frequency range which was allocated to the service provider entity 'A'. In case entity 'B' is not ready to give its frequency range from its acquired spectrum to the existing licensee 'A'. This is one of the reasons that auction is not appropriate for auction-based assignment of spectrum.

This is one of the many risks surrounding auction of satellite spectrum for exclusive use.

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

(a) Whether a broad framework for sharing of frequency spectrum among satellite communication service providers needs to be prescribed or it should be left to mutual coordination? In case you are of the opinion that broad framework should be prescribed, kindly suggest the framework and elements to be included in such a framework.

(b) Any other suggestions may kindly be made with detailed justification.

Kindly justify your response.

Response:

The satellite spectrum assignment needs to be on a shared (non-exclusive) basis. The same frequency-range of satellite spectrum can be shared between multiple entities.

Space spectrum sharing among satellite operators is done through coordination as per ITU radio regulations. Service providers use a combination of Space (Satellite) and ground segment resources (VSAT Hub).

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For GSO, interference observations are rare and are dealt with routinely and successfully by NOCC. For NGSO, the sharing of spectrum is enabled by mutual coordination between the NGSO operators in compliance with relevant ITU RR provisions.

Administrative Assignment poses no difficulties w.r.t. sharing of spectrum between GSOs. A new policy would need to comply with relevant ITU RR provisions.

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

Response:

The frequency range of 27.5GHz to 28.5Ghz should be reserved for Space-based communication. It is part of Ka-band spectrum and is critical for satellite based broadband services in India. Most of high capacity satellites/satellite constellations like HTS systems launched by Inmarsat (e.g. Global Xpress), ISRO/NSIL (e.g. GSAT 11, GSAT 19, GSAT-20, GSAT-29), OneWeb, SES (SES-12, O3b/mPOWER), and Starlink, and upcoming HTS systems such as Amazon Kuiper, Telesat Lightspeed, and ViaSat-3 are using Ka-band spectrum. Any limitation on the ability to use the frequency band, will impair the throughput and capabilities of these satellite systems.

For IMT services, there is sufficient reserved spectrum to support future IMT needs.

Most countries have reserved 27.5GHz to 28.5GHz only for satellite services. For example, Thailand has recently (Jan'23) decided to reserve 27.5GHz to 29.5GHz only for satellite services¹.

Globally there are only a few cases where usage of 28GHz for terrestrial networks have been experimented, but the outcome w.r.t effective utilization for 5G terrestrial services is disappointing.

- a) In South Korea – in Dec'22 regulator canceled two of three 26/28 GHz 5G licenses for failure to meet minimum rollout requirements.² The third Korean licensee, SK Telecom, recently announced that it would stop using the 28 GHz for 5G after building out around 1600 base stations nationwide.³ It reportedly said, “It is practically impossible to utilize 28 GHz for business-to-consumer (B2C) transactions.”
- b) Similarly, in Europe, the 5G Observatory has noted a “lack of demand” for the 26 GHz band and found that “although initially, the mmWave bands proved popular, with the US and Japan leading the world in making them available, their popularity had now waned.”⁴

² The NBTC decision and related analysis can be found at: <https://dpolit.com/2023/01/08/thailand-secures-next-generation-inflight-connectivity-nbtc-allocates-the-full-28-ghz-spectrum-band-for-satellite-broadband/>.

³ SK Telecom to Stop Using 28 GHz Band for 5G: Report, <https://telecomtalk.info/sktelecom-stop-using-28ghz-band-for-5g/701822/>.

⁴ <https://5gobservatory.eu/26-ghz-holds-back-achievement-of-eu-5g-goals/>

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- c) Even in the United States, data from OpenSignal in 2021 (three years after the spectrum auction) showed that U.S. 5G handsets were connected to a millimeter wave network less than 1% of the time.⁵
- d) **In India**, it was decided to reserve mmWave (24.25Ghz to 27.5Ghz) for IMT deployment but the spectrum was sold at substantially lower price of 0.32Cr/Mhz as compared to spectrum in mid-band range, which was at 14.68Cr/Mhz. Thus, mmWave spectrum was valued at just 2.2% of value of mid-band spectrum – reflecting its unsuitability for IMT services.
- e) Further, IMT licensees have recently approached the Government asking for relaxation in rollout norms for mmWave spectrum stating various reasons including the absence of a device ecosystem to support these airwaves. The report refers to IMT industry executive stating “for 26Mhz, no such ecosystem is available and even if they put up radios, there won’t be any utilisation”⁵
- f) Another new telecom entrant – Adani Group, had acquired spectrum in last IMT auction in July’22. A report says that the Adani group is “unable to find suitable use cases to rollout any kind of services in mmWave”⁶

It is also clear that use of this spectrum for IMT is expected to be sparse and highly localized and does not support traditional wide-area spectrum licensing. Overall, it is abundantly clear that it is not in the public interest to jeopardize satellite investment and services in the 28GHz band when terrestrial operators have limited foreseeable requirements for microwave spectrum which can also be satisfied by the 26 GHz and 38 GHz bands.

Considering the limited possibility of IMT deployments in 28GHz, 27.5Ghz to 28.5Ghz should not be allowed for IMT deployments.

We also mention again that the spectrum use must be limited to service for which it has been assigned. So-called ‘Flexible’ use of spectrum as concept itself is quite biased as allowing ‘flexible’ use will only help only the very large integrated telecom service providers and hurt pure-play space-based communication service providers. Terrestrial mobile operators would have an unfair advantage in such auction which would relegate pure-play satellite operators/service providers out of race. Thus, ‘flexible’ use of spectrum should not be permitted.

Co-existence of Satellite & captive non-public networks (CNPN) is feasible between 27.5Ghz to 28.5Ghz since CNPN cover small areas with little chance of interference. Accordingly, co-existence of CNPN & Space base communication services in spectrum between 27.5Ghz to 28.5Ghz may be allowed basis conditions that,

- a) the spectrum be allocated directly to enterprise customers for CNPN
- b) Assignee of CNPN spectrum will ensure that there is no interfere with space-based communications services.

5 <https://www.opensignal.com/2021/10/14/quantifying-the-mmwave-5g-experience-in-the-us-october-update>.

5. <https://economictimes.indiatimes.com/industry/telecom/telecom-news/telcos-to-look-for-relaxation-in-26ghz-rollout-rules-due-to-lack-of-device-ecosystem/articleshow/99931302.cms>

6. <https://telecom.economictimes.indiatimes.com/news/industry/adani-group-unable-to-find-mmwave-use-cases-may-miss-year-one-5g-roll-out-obligations-report/99774952>

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

Response:

As covered in response to Q10, allocation of 27.5GHz to 28.5GHz should not be allowed for IMT services.

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

Response:

As stated in response to Q10, CNPN may be allowed to coexist with space-based communication services in 27.5GHz to 28.5GHz. provided the CNPN is authorized basis condition of non-interference/non-protection and the spectrum is assigned to enterprises directly by DOT

Frequency band 28.5GHz to 29.5GHz should be ear-marked only for satellite services. Ka-band is crucial for broadband services. Most upcoming high throughput GSO/NGSO constellation will be using Ka-band satellite services. Any limitation on the availability of the overall ka-band for Satellite services, will severely impact the satellite based broadband services.

There is no justification for permitting flexible use between CNPN and space-based communication services in the frequency range 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.

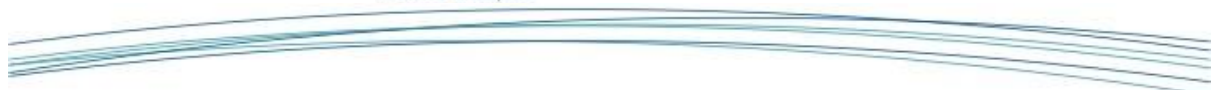
Response:

As responded in Q12, Frequency for 28.5GHz to 29.5GHz should not be allowed on 'flexible' mode as an enterprise seeking this frequency range for CNPN will not be able to use it for satellite services and similarly Satcom service provider may not be able to use it for CNPN purposes. These are two completely different services and allowing 'flexible' use will distort the playing field.

An integrated IMT service provider with a license to provide satcom services, will benefit by using it for either purpose whereas pure play satcom services will be able to use it only for satcom services. Especially if spectrum allocation was not administrative, pure play satcom service providers may not be able to compete with deep-pocketed IMT service providers.

As responded to in Q12, Frequency for 28.5GHz to 29.5GHz should be reserved for satellite services.

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As covered in response to Q10, we are against the use of spectrum in `flexible` mode for any spectrum band related to space-based communication services.

Q14. Whether space-based communication services should be categorized into different classes of services requiring different treatment for spectrum assignment? If yes, what should be the classification of services and which type of services should fall under each class of service? Kindly justify your response.

Response:

Space-based communication may be put under broadly categorized into following:

- FSS (fixed satellite Services)
- BSS (Broadcast satellite services)
- MSS (mobile satellite services)

FSS & BSS services work on shared spectrum and do not require exclusive Assignment, whereas MSS needs exclusive Assignment of spectrum. (Please refer to response to Q15 for more details)

In any case, all spectrum for space-based communication services should be assigned administratively and the spectrum use for gateway links should be treated differently than for user links.

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

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

Please provide your response with detailed justification.

Response:

ITU identifies the spectrum in L and S bands for satellite services. India should accordingly assign is only for satellite services.

While these lower frequency bands do indeed require exclusive use also for satellite service provision, it should be noted that the use-cases for satellite communication based on L-band & S-band are quite strategic in nature. This enables Satellite IOT which will serve to the various enterprise, defense, and government requirement. Few of the potential use – case are:

- i) Use cases related to Cattle tracking, Forest, Irrigation related IOT information.
- ii) Connected Car, Fleet Management
- iii) Pipelines management, warehouse management, building & security management,
- iv) Smart grid management, Infrastructure management like dam/bridges etc

Several factors should be considered when assigning spectrum for user links for space-based communication services in the L and S-band. These include extensive societal advantages satellite services offer, such as connecting the unconnected, disaster forecasting and recovery, logistical tracking, and defence communications. These essential services depend on the availability and efficient utilization of satellite spectrum. In India, MSS in these bands would improve coverage of rural areas in the community, thus bridging the digital divide, strengthening rural economies, and

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contributing to the competitiveness of Indian ICT industries. However, high up-front investment required for the development of mobile satellite system and the associated high technological and financial risks necessitate a predictable administrative framework for licensing, so that MSS can remain economically viable.

Additionally, given the global nature of satellites, L-band and S-band satellite operators seek spectrum assignments in many Administrations around the world. The complexity of multiple licensing regimes is costly and time-consuming, but auctions bring about another level of cost which can impact economies of scale and the ability to deliver services in a cost-effective manner. Where government priority is digital inclusivity, particularly for India's most underserved and citizens, auctioning spectrum would add to the expense of providing service in India, thus risking that services become too expensive for these potential consumers, or worse, unavailable.

Globally the spectrum is not auctioned by any regulator considering its purpose and various use-case that it will potentially address. By auctioning the spectrum, many of the use cases may become commercially unviable, impacting the digitation of various citizen services.

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

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

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

Response:

The methodology for Assignment should be administrative.

Administrative allocation is only transparent, unbiased way for shared spectrum assignment. Auction method for satellite spectrum would be biased & favor large telecom providers. It will be anti-competitive, will limit choice to end customers and risks creating a duopoly in the telecom market. Administrative Assignment of satellite spectrum will allow multiple service providers to share it efficiently. It will also ensure viability of satellite connectivity and help India to exploit large satellite capacities becoming available through HTS/VHTS/MEO/LEO satellites.

Due to regulatory restrictions and higher cost of satellite bandwidth in India, VSAT services are still very expensive and unaffordable for most users. DoT & TRAI have been working on their part to reduce the cost of delivering the services by the service providers by maximizing the usage of the resources & infrastructure of the service providers. Both TRAI & DoT had been advocating & allowing using the same infrastructure for running multiple services like – VSAT CUG infra to be used by IFMC and NLD services etc. Restricting the sharing of spectrum will drastically load the cost of delivery and make the services unaffordable. Such a step would contradict what DoT & TRAI have been advocating so far.

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With the above in mind, Nelco suggests spectrum assignment for space-based communication services in higher bands like C-band, Ku-band and Ka-band should be on administrative basis only as is the practice currently.

The satellites services are used primarily for Broadcast and non-broadcast mode. Broadcasters use satellite to broadcast the TV channels which are in turn received by millions of user across the country. Sharing is the most efficient way of using the spectrum for benefit of society at large. Methods like unicast content download over mobile network are an in-efficient use of spectrum.

For VSAT communications, the satellite spectrum is anyway shared between multiple users and there is no exclusivity. There is no justification for auctions for spectrum, wherein there is no exclusivity required and all authorized users can use it.

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

Response:

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

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

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

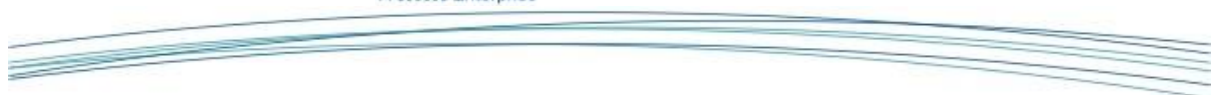
For example:

- i) If spectrum 14.25Ghz to 14.75Ghz (Earth to Space) is assigned for North-East to licensee A on Satellite X.
- ii) Now if same frequency 14.25Ghz to 14.75Ghz (Earth to Space), licensee A or any other license wants to use it in another telecom circle, on same Satellite X, it may not be able to use it.

There can be multiple such examples to show that Assignment of spectrum basis telecom-circle/metro-wise will be highly inefficient and that national Assignment is the only viable option for satellite spectrum.

Satellites by their very nature cross national borders and, as such, are subject to international and national regulation. Selection of different licensees for satellite services in different circles would be very complex for the operators to manage and would risk harmful interference. Moreover, a selected licensee prevented from providing a national satellite service and having to operate in different circles with different radio frequencies, would find it technically impossible to do so with NGSO systems.

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Similarly, in-flight connectivity between source & destination in India will need bandwidth across multiple states.

Considering this, the spectrum for user links should be assigned at national level. Assigning spectrum for user link at circle level would hurt return on investment and discourage potential licensees and investors.

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

Response:

The various services utilize spectrum in two ways:

1) Broadcast communication

When millions of users have to receive the same content, there is better method than broadcast: it uses only one stream, one bandwidth block, that is utilized by all the receivers, making it the most efficient utilization of the satellite bandwidth. In addition, the same frequency may be used by different satellites, without causing any interference to the communication system.

Broadcast communication delivers information & entertainment services at affordable costs though the DTH& Teleport industry. The industry is already under stress, operating at the lower end of single digit profitability. Auctioning broadcast spectrum will raise prices for the consumer, making the DTH & Teleport business unviable.

2) VSAT - two-way communication

The VSAT communication is two-way communication in general and can be provided under various licenses. Technically & commercially, all these services use the spectrum efficiently on a shared basis on non-exclusive basis. There is no justification for auction of spectrum for these services.

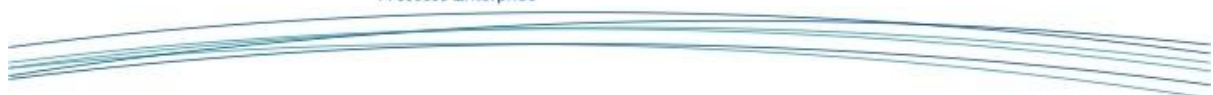
Spectrum allocation on an administrative basis seems to be most optimal way of handling the spectrum. There are no grounds for auctioning satellite spectrum

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

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

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

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Response:

Gateway links are always limited in number and multiple gateways can co-exist within same geography, working on different satellites. Moreover Gateway upstream links are directional in nature making it suitable even more with for sharing of spectrum resources.

For a Satcom based communication link, it is combination of user link & Gateway link. Different satellites might have gateway link is different spectrum band though user links may be in same spectrum band. For example, in three different satellite systems, user links may be in Ku-band for all three satellites whereas gateway link may be in Ku-band for one satellite, C-band / Ka-band in other satellites. For offering Ku-band services to customers (user link), service provider will need to have Gateway in different spectrum band, depending on the satellite to be used.

Thus, even more important that Assignment of spectrum for gateway links for space-based communication services should be done on administrative basis.

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

Response:

As the characteristic basis type of services does not change, there is no rationale for auction of spectrum for gateway or user links.

Please refer to response given wrt Q18 & Q19.

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

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

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

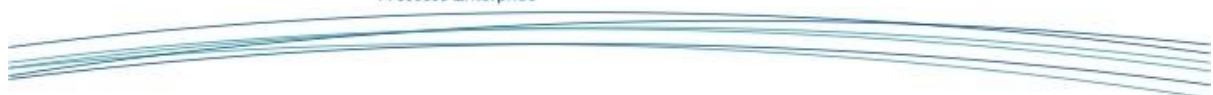
(c) Whether some mechanism needs to be put in place to permit the service licensee to shift to another satellite system and to change the frequency spectrum within a frequency band (such as Ka-band, Ku-band, etc.) or across frequency bands for the remaining validity period of the spectrum held by it? If yes, what process should be adopted and whether some fee should be charged for this purpose?

Kindly justify your response.

Response:

There is no rationale for auction of spectrum for space-based communication, as highlighted in response to Q6 and other questions.

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As stated, auction has inherent challenges wrt validity period, reauctions for unsold auction, exclusive Assignment of a shared resource, complexity of spectrum sharing/leasing, entry of any new licensee etc.

In the case of administrative Assignment on non-exclusive basis, we recommend that

- The duration of the license should be reasonably long, to give sufficient confidence and stability to the operators, especially considering that the deployment of an in-country gateway is also required. Nelco suggests 15-year period for the license, with the possibility of renewal after that.
- In any case, satellite connectivity service provision is a niche market aimed to fill gaps in connectivity, especially in rural and remote areas, and for users on ships/aircraft. The spectrum required for satellite services is shared and can be shared among multiple licensees. Thus, players are not likely to hoard the spectrum or prevent use by other interested licensees. Considering this, rollout obligations are unnecessary in the case of space-based communication.

For S-band and L-band user links assigned exclusively via administrative Assignment, the allotment should be for terms of 15 years. It should be renewable based on meeting performance criteria and license obligations. Rollout obligations are more relevant for the spectrum allocated for exclusive use.

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:

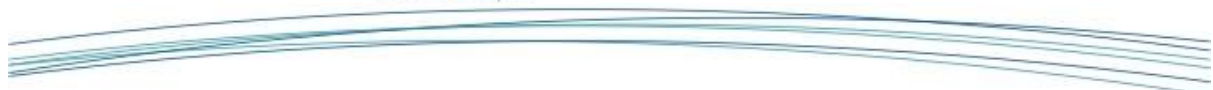
- (i) **to assign spectrum for gateway links and user links separately to give flexibility to the stakeholders? In case your response is in the affirmative, what mechanism should be adopted such that the successful bidder gets spectrum for user links as well as gateway links.**
- (ii) **to assign spectrum for gateway links and user links in a bundled manner, such that the successful bidder gets spectrum for user link as well as gateway link? In case your response is in the affirmative, kindly suggest appropriate assignment methodology, including auction so that the successful bidder gets spectrum for user links as well as gateway links.**

Response:

Spectrum should be assigned administratively. Spectrum will also need to be assigned for gateway and user link as both are necessary for the communication link to function. If a licensee gets spectrum only for one type of link (say user link) but does not get desired spectrum for gateway link, even the user link spectrum would be useable.

The gateway spectrum band may be different from user spectrum band. For example, Gateway spectrum band may be in Ka, whereas user spectrum may be Ku. There can be various combinations of Gateway: User spectrum for different satellites like it may be Ka x Ku / C x Ku / Ku x C (in addition to ExtC x ExtC or Ku x Ku, Ka, x Ka etc). For example, for providing Ku

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bandwidth services in India on HTS, there are very few satellites in India and almost all these satellites having different combinations. For example:

- GSAT29 : Ku x Ku, Ka x Ka
- GSAT11 : Ka x 'planned Ku'
- IS-33e: C x Ku

If the spectrum is auctioned then, to provide Ku band HTS services, a licensee will need to participate and acquire all different kind of band of spectrum: C, Ku, Planned Ku, Ka, etc. **This is impractical, and unviable, highlighting once again the arguments against auctioning satellite spectrum.**

Considering that the

- a) Gateway link spectrum & User link spectrum might be in different bands, there may be various permutations & combination, depending on what satellite someone wants to use. This may not be practical to envisage on day1 since later satellites might use a different combination of gateway link spectrum and user link spectrum.
- b) A licensee may opt for different combination of gateway & user link spectrum for uplink vs downlink. For example, if licensee has sufficient bandwidth available at Gateway level uplink and only require incremental uplink capacity at user link level then the licensee may ask only for User link Uplink and corresponding Gateway link downlink and may not ask for equal capacity for Gateway link uplink (user link downlink).

Considering the above, administrative allocation is the best method of allocating spectrum combinations for user link uplink + Gateway link downlink and/or Gateway link uplink + user link downlink. Flexibility should be maintained so that the licensee may take the bandwidth as per its business needs.

Considering the complexity of user link (uplink/downlink) in frequency band 'X', gateway link (uplink/downlink) in frequency band 'Y' wherein X or Y may be same or different depending on satellite to satellite, administrative assignment is best way to address the market requirements.

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

Response:

For GSO, in view of the directivity of the antenna, there is no specific protection distance is required between different earth stations, operating on different satellites.

Between NGSOs, the interference management can be done through coordination between two NGSO constellation operators as per ITU guidelines.

GSO being incumbent users of frequency band, the required policies in India should mandate NGSO to ensure that no interference is caused due to its operations to GSO in complete frequency band of operation and that NGSO will not claim any protection from GSO satellites in this regard.

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Q24. What should be the eligibility conditions for Assignment of spectrum for each type of space-based communication service (as mentioned in the Table 1.3 of this Consultation Paper)?

Among other things, please provide your inputs with respect to the following eligibility conditions:

(a) Minimum Net Worth

(b) Requirement of existing agreement with satellite operator(s)

(c) Requirement of holding license/ authorization under Unified License prior to taking part in the auction process.

Kindly justify your response

Response:

As of today, there are two conditions for the service licensee asking for frequency assignment on specific satellite:

- i) Entity should be relevant license holder.
- ii) Should have agreement with the Satellite operator for the requested bandwidth capacity.

As only eligible licensed entities can apply for frequency on specific satellite, there is no need to have additional eligibility conditions for service licensee.

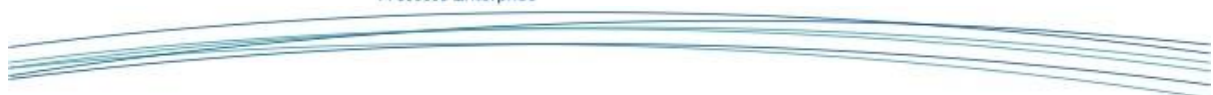
OR only satellite operators should participate in acquiring the spectrum for their specific satellites. In such a case, eligibility criteria may include:

- i) Entity should be registered in India under relevant companies act.
- ii) Entity should be allowed to participate only for the spectrum for which it has got the ITU allocation.
- iii) Entity should not be allowed to transfer its spectrum rights to other satellite operator.

As for NGSO constellation, the overall technology including space segment, ground segment (gateway & user level) is owned by satellite operator, it makes it more relevant for satellite operator to acquire the spectrum for its satellite(s) / satellite constellation. This is relevant for Geostationary satellites as well, wherein Satellite operator may acquire spectrum/bandwidth assignment for its satellites. In such case, service licensee may take the bandwidth (including spectrum charges) directly from the satellite operator.

The new Space Policy 2023, is likely to encourage more participation in Space communication from private entities. More satellite operators are expected to be allowed to provide its satellite bandwidth services to service license. Prior knowledge of expected spectrum charges will help satellite operators to plan their satellite capacities over India.

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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 rollout obligations on space-based communication service providers. Kindly provide response for both scenarios viz. exclusive Assignment and non-exclusive (shared) Assignment with justification.

Response:

The frequency spectrum should be allowed to be used only for the purpose it is assigned for. Flexible use of the spectrum should not be allowed.

The licensee should be required to roll out its services in the frequency band assigned and should utilize significant part of the spectrum assigned within defined months/agreed milestone period of such Assignment, else the spectrum should be taken back from licensee and should be made available for other users.

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

Response:

In satellite-based communications, the spectrum is shared – which means that different licensees may use the same frequency on different satellites. As satellite operators are either ISRO/NSIL or other multi-national organizations – the issue w.r.t. crossholding is not applicable for satellite operators.

The same spectrum can be shared, and new entrant/service licensee can use it easily. We see no potential concerns related to crossholding.

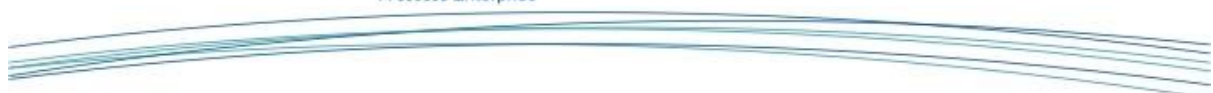
However auctioning of shareable spectrum can lead to many such difficulties. There will be a need for various provisions to ensure that one or two large organizations do not control the space-based communication spectrum and appropriate restriction of cross-holding of equity should be made applicable.

In summary, restrictions on crossholding of equity is not relevant for satellite-based communication service licensees, considering administrative Assignment of the spectrum.

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

Response:

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Ideally the spectrum for space-based communication should be used for space-based communication services only. Allowing sharing specific spectrum with point-to-point terrestrial cellular backhaul services should only be considered:

- For point-to-point terrestrial cellular backhaul services and not for individual end customer connectivity links
- For spectrum used for gateway.
- On Secondary basis on condition that such transmission will not cause any interference to space-based communication system.
- Provided it will not seek protection from space-based communication services and comply with provisions of Radio Regulations Article 21.

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

Response:

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

Use of polarization should be considered to configure the satellite system and increase spectrum efficiency and should be considered as technical parameter during Assignment of frequencies.

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

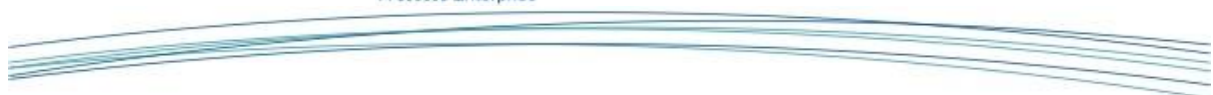
b. Model#2: Auction design model based on non-exclusive spectrum assignment to only a limited number of bidders

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

Response:

As mentioned in response to other queries, the administrative method is most suitable for the spectrum resource which is non-exclusive and is shareable among various users/licensees. Any other method like auction will be forced, unnatural and associated processes like "price discovery process" would be artificial and lead to an inflated price, driven also by terrestrial mobile operators participating to the auction.

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As mentioned, artificial restrictions on the amount of spectrum that satellite operators can use will lead to inefficient use of available resources and possible gaps in the service provision.

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

Response:

None. They are both clearly unsuitable for assigning a resource that can be shared and will unnecessarily complicate the spectrum assignment and use between operators.

Q31. In case it is decided to assign spectrum for user links using model # 2 i.e., non-exclusive spectrum assignment to limited bidders ($n + \Delta$), then what should be
(a) the value of Δ , in case it is decided to conduct a combined auction for all services
(b) the values of Δ , in case it is decided to conduct separate auction for each type of service
Please provide detailed justification.

Response:

As stated earlier, administrative method is the only right option for spectrum assignment for space-based communication. Auction is not suitable method and will be an artificially forced model accompanied by various challenges as described above.

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

Response:

No model of auction is suitable. Bidders differ in their objective, their size, scale, financial power etc. Any auction will benefit large size integrated telecom bidders only and hurt the standalone satcom licensees who are providing satcom services in the country for decades since the inception (of these services).

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

Response:

There are no issues linked to administrative Assignment of spectrum for gateway links. This is the standard process successfully applied all over the world. On the other hand, the idea of a possible auction determined price for user links to be used as a basis for charging for spectrum for gateway links does not make sense.

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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 gateway links? What changes could be made in the proposed option to mitigate any possible issues? In what manner, areas/ regions/ districts should be identified?

Response:

There is no rationale of Assignment of gateway spectrum through auction as multiple gateways can use the same frequency spectrum over various satellite and coexist. There is no need or rationale for auction of gateway spectrum when it can be shared conveniently.

Please see also reply to Q19.

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

Response:

Spectrum assignment for gateway links should be on an administrative basis for the reasons listed in replies to Q33 and Q34.

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?

No response

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

No response

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.

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Response:

For VSAT communication services, the spectrum charges should be considered as percentage of revenue rather than charging fixed price for per unit of spectrum. This will bring transparency & ensuring that Satcom licenses are paying part of the revenue w.r.t spectrum enablement but at the same time are not burdened with huge one-time charges for spectrum. TRAI in its recommendation to DOT had recommended the SUC charges of 1% of AGR. This is a fair reflection of the true value of spectrum, directly and uniquely linked to the actual spectrum use in the country.

Since the suggestion is to charge spectrum as a percentage of AGR, there is no specific spectrum valuation required for gateway and user links. This is quite rational as for satellite communication to work, gateway and user spectrum work together and thus valuation of spectrum for gateway and user links should not be separate.

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

i. For user link

ii. For gateway link

Please support your answer with detailed justification.

Response:

No, such an approach would make spectrum unaffordable for the satellite industry and restrict spectrum usage to terrestrial mobile operators. They, in turn, would most likely insist for flexible use of spectrum, as satellite use alone would not justify the cost, further limiting the possibility of satellite service deployment in India.

As already mentioned in the reply to Q16, the economics of satellite and mobile service provision are completely different (orders of magnitude).

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

Not applicable.

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

i. For user link

ii For gateway link

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

Response:

Nelco would not like to comment on this since it seems to be related to a spectral efficiency factor available only with respect to IMT/5G.

As stated earlier, Nelco doesn't support the spectrum allocation through auction for the space-based communication services. Its value can't be derived by relating it to the value of the other bands. It is important to note that for the space-based services, WPC doesn't provide spectrum separately to Service Providers, and it comes along with the frequency allocation. Moreover, the efficiency of a spectrum band is dependent on various factors of Satellite design, RF power of the satellite, Antenna and RF size of the remote, efficiency of the modems deployed, and all these are not same even for the same Spectrum band. As such there is no value that can be specified for the space-based communication spectrum bands basis the efficiency factor.

DoT has a well formulated mechanism for charging spectrum usage fees to VSAT providers. The current methodology of charging as revenue share, the Spectrum Usage Charges (SUC) from the Aggregate Gross Revenue of the service provider is the best mechanism that ensures that DoT gets the Spectrum Usage Fees basis the business generated by the service provider.

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

i. For user link

ii. For gateway link

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

Response:

Valuation of spectrum has little relevance in case of satellite spectrum. In case of auction, even through regulator may make its assessment w.r.t valuation of satellite spectrum but during auction, the prices will be anyway as per bid value of the participant bidders. case of an auction it will be decided by deep-pocketed telecom service providers, who may hike the price for spectrum to such a level that the satcom service licensees will be completely left out.

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

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Response:

Revenue surplus model implies assumptions, and therefore uncertainty, on the possible revenue over 20 years. While this may make sense for an auction where spectrum is individually and exclusively assigned for 'x' number of years,. In the case of the administrative Assignment d the spectrum usage fee calculated at the rate of 1% of the AGR not only ensures that the licensee pays part of its revenue to government agencies wrt enabling the satellite spectrum for use , but also avoids the need for "guessing" entirely.

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

i. For user link

ii For gateway link

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

Response:

There are no available international benchmarks that can be used for auctions of the satellite 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

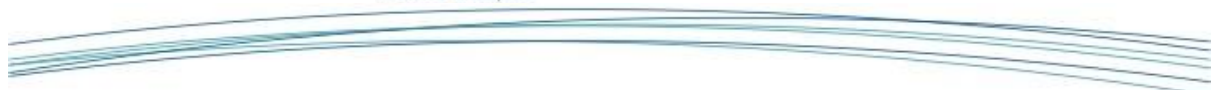
Please give country-wise details of administrative price being charged for each spectrum band. Please specify in detail terms and conditions in this regard.

Response:

Spectrum fees can vary greatly from country to country. Good examples of administrative pricing can be adopted from several countries.

Regulators around the world recognise societal benefits of satellite services using shared spectrum. As such, the international trend has been clearly in the direction of low fees reflective of regulatory costs.

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

Response:

Different countries follow different norms w.r.t administrative spectrum allocation charges. Charges are nominal and related to recovery of administrative charges.

Administrative allocation charges w.r.t spectrum usage, should continue to be in relation to AGR as it helps in multiple ways, like:

- i) It does not load the licensees upfront at the start itself and the administrative fee is expected to be something that Industry can pay.
- ii) It helps growth of the Industry by relating it to payment as % of revenue.
- iii) It is transparent, simple across various spectrum bands basis revenue that it generates using the spectrum.

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

Response:

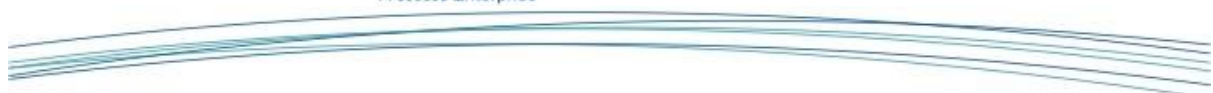
As stated earlier in response to Q38, Nelco doesn't support the spectrum allocation through auction for the space-based communication services. The DoT has a well formulated mechanism for spectrum charging for VSAT providers. The current methodology of charging, as revenue share, the Spectrum Usage Charges (SUC) from the Aggregate Gross Revenue of the service provider is the best mechanism that ensures that DoT gets the Spectrum Usage Fees basis the business generated by the service provider. We suggest that the SUC charges be kept at 1% of the AGR as has been recommended by TRAI earlier.

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

Response:

As suggestion is to charge spectrum as percentage of AGR, there is no specific spectrum valuation required for gateway and user links. This is quite rational as for satellite

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communication to work, gateway and user spectrum work together and thus valuation of spectrum for gateway and user links should not be separate.

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

Response:

Please refer to Q48 above.

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.

Response:

We would like to reiterate that spectrum should be assigned on administrative basis and spectrum charges should be %age of AGR.

Please refer to response to earlier questions.

Q51. In case your response to the above question is negative, will it be appropriate to take the average valuation (simple mean) of the valuations obtained through the different approaches attempted for valuation of a particular spectrum band, or some other approach like taking weighted mean, median etc. should be followed? Please support your answer with detailed justification.

Response:

Please refer to response to Q50.

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.

Response:

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Not applicable, as it is recommended to do spectrum assignment for space-based communication, on administrative basis.

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

Response:

Not applicable, as it is recommended to do spectrum assignment for space-based communication, on Administration basis.

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

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

Please support your answer with detailed justification.

Response:

For Assignment of spectrum on administrative basis, it is suggested to keep it at a reasonable percentage of AGR, as this is Industry friendly, helps regulator to get share of the growth of the Industry and brings in the required transparency.