RJIL/TRAI/2023-24/70
1st June 2023

To,
Shri Akhilesh Kumar Trivedi,
Advisor (Networks, Spectrum and Licensing)
Telecom Regulatory Authority of India
Mahanagar Doorsanchar Bhawan
Jawaharlal Nehru Marg, New Delhi - 110002

Subject: **RJIL's Comments on TRAI's Consultation Paper dated 06.04.2023 on "Assignment of Spectrum for Space-based Communication Services".**

Dear Sir,

Please find enclosed the comments of Reliance Jio Infocomm Limited on the consultation paper dated 06.04.2023 on "Assignment of Spectrum for Space-based Communication Services".

Thanking you,

Yours Sincerely,
For **Reliance Jio Infocomm Limited**

KAPOOR SINGH GULIANI
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Kapoor Singh Guliani
Authorized Signatory

Enclosure: As above

Reliance Jio Infocomm Limited's comments on TRAI's Consultation Paper on "Assignment of Spectrum for Space-based Communication Services" dated 6th April 2023.

Preface:

1. We express our gratitude to the Authority for releasing this consultation paper to discuss the **auction-based assignment of spectrum for Space-based Communication services.** This Consultation Paper is timely, as technological advancements are fostering convergence between terrestrial and satellite networks, which will serve the same use-cases and operate in the same spectrum bands. Additionally, these technological advancements will promote efficient spectrum utilization through the flexible use of the same frequencies for terrestrial and satellite networks.

2. Thus, we would like to emphasize the technological advancements that are enabling converged networks and minimizing the distinctions between the use of frequencies by satellite and terrestrial networks.

A. The Evolving Technological Landscape

3. Traditionally, specific spectrum bands (i.e. C band and above) were exclusively identified for satellite communications. Such identification was primarily driven by the limited utilization of these frequencies in terrestrial access technologies, while satellite technologies were able to leverage them effectively.

4. The need for higher bandwidth to accommodate various applications, such as high-resolution video and augmented/virtual reality, could be met by utilizing higher frequencies in access networks. The demand for increased data rate, throughput and lower latency has driven the evolution of wireless access technology such as 4G and 5G, allowing these technologies to harness higher frequencies for access networks, and making it increasingly practical to utilize such higher frequencies for both satellite and terrestrial networks in a flexible manner.

5. Some of the technological advancements that have facilitated the utilization of higher frequencies in terrestrial networks, as well as satellite networks, and have contributed to the flexible deployment of these frequencies across C, Ku, Ka, and V bands are highlighted below:-

    a. Technologies such as **Multiple Input, Multiple Output (MIMO)** employ multiple antennas at both the transmitter and receiver, exploiting the multipath propagation

inherent to waves. MIMO bolsters network reliability and throughput by transmitting identical data over multiple paths or different data streams simultaneously.

b. The utilization of antenna arrays and beamforming technologies has enabled service providers to create dynamic capacity. However, it is worth noting that beamforming is only effective in higher frequencies, unlike the sub-2GHz frequencies traditionally employed in mobile networks.

c. **Advancements in Hardware/Software**: Progress in hardware performance and software has endowed networks with significant processing capabilities, enabling them to handle massive traffic loads and control of the MIMO/beams.

d. **Advancements in Satellite technologies**:

i. **GSO High Throughput Satellites (HTS):** Contemporary communication satellite systems employ narrow spot beams to substantially increase satellite network capacity, as multiple beams can reuse the same frequency. This advancement has significantly broadened the satellite system capabilities, allowing them to provide capacity to address use-cases requirements currently met by terrestrial networks. Furthermore, the implementation of narrow beams enables satellite operators to concentrate their resources (Power & Bandwidth) in the smaller areas where they are needed.

ii. **Non-GSO Satellites:** Low Earth Orbit (LEO) and Medium Earth Orbit (MEO) satellites have dramatically reduced latency by positioning satellites closer to the Earth. This development has leveled the playing field between terrestrial and satellite networks in terms of delivering comparable experiences for latency-sensitive applications. Additionally, NGSOs have opened up the possibility of direct satellite communication to users through Direct to Satellite and Mobile Terminals dispersed across different geographic regions. As a result, network planning for such systems must consider the nomadic and mobile nature of user devices, requiring a different approach when compared to traditional GSO satellite networks.

iii. **Advancement in Payload Systems:** Payload systems constitute the core of satellite operations, executing crucial functions such as the allocation of frequency and power to beams serving coverage areas with non-uniform capacity demand. By integrating advancements such as Software-Defined Radio (SDR) into

the payload, these systems can effectively accommodate shifting demands through beam hopping, altering coverage shapes, and strategically targeting areas with high capacity requirements.

e. These advancements represent a pivotal moment in wireless communications, effectively erasing the conventional demarcations between frequencies designated for terrestrial access ("Access Spectrum"), terrestrial backhaul ("MWA/MWB"), satellite access ("Satellite User link") and satellite backhaul ("Satellite Feeder Link"). The rapid evolution and convergence of these technologies, along with flexible utilization of spectrum are poised to significantly optimize spectrum usage, greatly enhance network efficiency, and drive unprecedented progress in global connectivity.

B. New networks standards are dissolving the barriers between terrestrial and satellite communication services:

6. The convergence between terrestrial and satellite networks has led to the development of integrated networks, where both types of networks can utilize common frequency bands. The incorporation of satellite networks as an access technology for terrestrial users by 3GPP in Release 17 further enhanced this convergence, enabling seamless roaming between satellite and terrestrial networks while providing 4G, 5G, and NB-IoT services through space.

7. 3GPP Release 17 enables support for inclusion of satellite in global 5G standard networks. The air interface of 5G NR has been extended for use by satellites with the introduction of specifications for satellite networks: **NR-NTN and IoT NTN** respectively.

   The 3GPP technical report document **"TR 23.737 V17.2.0"** states that a PLMN may have both terrestrial access and satellite access and examines satellite and terrestrial access networks within a PLMN. In this scenario, independent N2 instances handle terrestrial and non-terrestrial access type nodes. However, the coverage of the satellite access network may span over the coverage of the terrestrial access network.

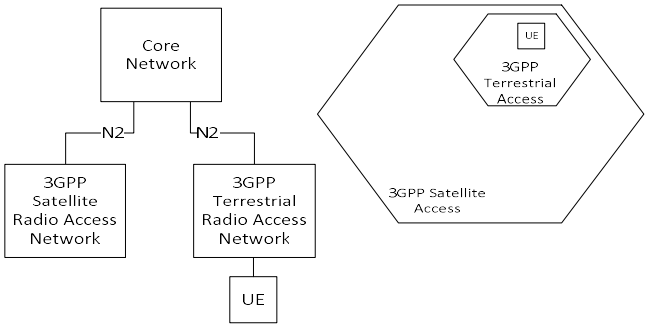

Figure 1: Satellite and terrestrial 3GPP access networks within a PLMN - architecture (left) and coverage (right)
Source: 3GPP TR 23.737 V17.2.0

3GPP supports Non-Terrestrial Networks (NTN) with two common architecture choices for handling data payloads: transparent payload and regenerative payload (3GPP TR 38.821).

The transparent payload architecture in NTN involves the satellite acting as a simple relay, transparently relaying the data payload from the source to the destination without any modifications. In this architecture, the satellite does not process or decode the payload content but operates at the physical layer, focusing on signal amplification, routing, and beamforming.

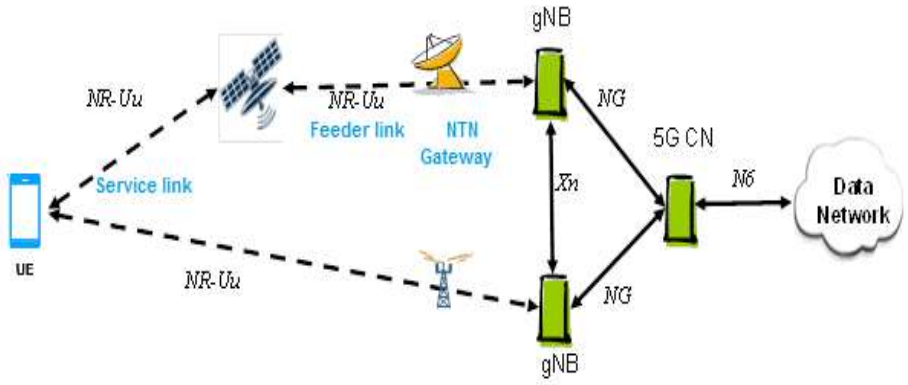

Figure 2: Multi connectivity with transparent NTN-based NG-RAN and cellular based NG-RAN (Supported in 3GPP Rel-17)

The regenerative payload architecture involves the satellite processing and regenerating the payload data. In this architecture, the satellite decodes the received payload, performs necessary processing, and re-encodes the payload before transmitting it to the destination.

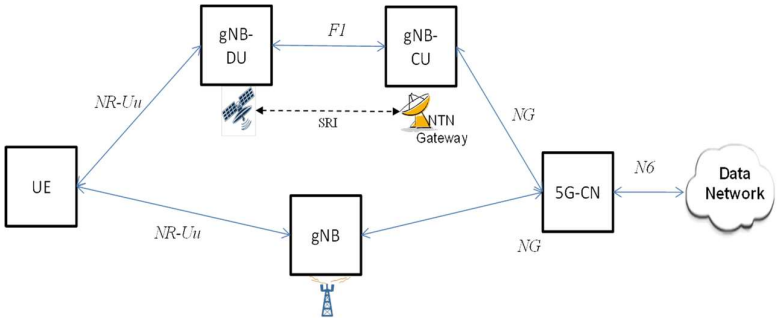

Figure 3: Multi connectivity involving regenerative NTN-based NG-RAN (gNB-DU) and cellular NG-RAN (Rel-18)

In both transparent and regenerative NTN architectures, user equipment (UE) uses the same core network and same radio network interface (NR-Uu) over both terrestrial and non-terrestrial access networks. This enables satellites to serve the same use cases as terrestrial networks and share similar spectrum requirements, resulting in enhanced coverage scenarios.

C. Technology neutral use of spectrum

8. The current approach to spectrum assignment is based on the technology differentiation between Fixed-Satellite Services (FSS), Mobile-Satellite Services (MSS), Terrestrial Access and Terrestrial backhaul networks. However, technological advancements and standards outlined earlier are driving the transition towards technology agnostic and topology agnostic networks. The development and availability of small handheld devices operating in C band, Ku band and Ka band further support this trend. Consequently, any distinction made in the spectrum assignment rules, on the basis of such technology differentiation (FSS, MSS, terrestrial backhaul) would be purely artificial and may lead to inefficient use of spectrum.

9. Currently, spectrum assigned through auctions is permitted to be used in a liberalized and technology neutral manner. As technologies, systems and standards develop further, it will become imperative to extend this liberalized approach to satellite-based communications. Additionally, the distinction between FSS and MSS is becoming less significant, and maintaining it could have negative consequences for the industry in the long run. Therefore, eliminating this distinction is essential to support technological advancements. Flexible use promotes efficient utilization, which is crucial for such a scarce and valuable natural resource.

D. Same Rules for assignment of spectrum due to competing nature of satellite networks with terrestrial networks:

10. The advancements in technology are already being demonstrated in practical tests, trials, and even commercial deployments of satellite networks offering voice and data services that directly compete with terrestrial networks. For instance, **LYNK Mobile**[1] **is working on a direct satellite-to-phone model and has three commercial cell towers in space, including the world's first 5G-enabled payload**. **It has already signed 26 commercial contracts with MNOs to provide coverage in 41 countries**. **In another recent development, Rakuten Mobile and AST Space Mobile completed a space-based voice call on a smartphone**[2].

11. Based on the information provided in their submissions to Government/Regulatory bodies, annual reports, and media coverage of leading NGSO based communication services providers such as SpaceX, OneWeb, Kuiper, Telesat, it can be clearly established that their intent is to create broadband communication services which would compete with terrestrial broadband services. Following are some excerpts from media reports, and their submissions/regulatory filings that corroborate such intent: -

    a. **SpaceX:**

    SpaceX's Starlink project has already placed over 4,000 satellites in orbit, with the first-generation network nearing completion. The broadband internet service, accounting for about one-third of SpaceX's annual revenue, starts at $110 per month. In 2022, **Starlink generated $1 billion in revenue and had over one million users**[3]**.** Plans to take Starlink public as a separate company once it proves financially viable have also been reported.

    SpaceX has also raised $750 million in a new funding round, valuing the firm at $137 billion. Throughout 2022, the company raised over $2 billion, with a valuation of $127

[1] https://lynk.world/statement-of-margo-deckard-lynk-coo-before-the-subcommittee-on-communications-and-technology-u-s-house-of-representatives/
[2] https://telecom.economictimes.indiatimes.com/news/portal-in-portal/satcom/rakuten-mobile-ast-spacemobile-complete-space-based-voice-call-on-smartphone/99779082
[3] https://observer.com/2023/05/spacex-starlink-satellite-ipo/

billion during an equity round in May[4]. The company has informed investors that Starlink is targeting a $1 trillion market, encompassing in-flight internet, maritime services, demand from China and India, and numerous rural customers. Based on our analysis, Starlink could be valued at around $30 billion by 2025, assuming it generates revenues of about $10.4 billion and is appraised using a price-to-sales multiple of approximately 3x[5].

Operation of the Gen2 constellations will improve upon the operations of SpaceX's original Ku/Ka-band system in several ways. First, the ***increase in capacity****, frequency availability, and* ***frequency reuse dramatically*** *increases the number of customers who can be served. Second, the* ***increase in bandwidth available per user improves*** *the quality of service, bringing more high-speed, low-latency broadband to unserved areas and* ***injecting additional competition in areas where terrestrial alternatives are available.*** [6]

b. **OneWeb:**

OneWeb plans to establish global coverage following the launch of the final batch of satellites required for its broadband service. With a total constellation of 634 satellites in Phase-1, OneWeb aims to offer worldwide coverage by the end of the year[7]. OneWeb is set to merge with French satellite company Eutelsat and seek a secondary listing on the London Stock Exchange. The firm targets enterprise clients, while Starlink caters to consumers with its broadband packages. With customers across 15 countries, **OneWeb expects to generate hundreds of millions of dollars in future revenue**[8].

The Phase 2 OneWeb System will significantly enhance its capacity to deliver high-quality, broadband Internet access to small, cost-effective user terminals situated across the World. This expansion will result in a substantial increase in the overall system capacity, allowing for improved connectivity and access to a broader user

[4] https://www.cnbc.com/2023/01/02/spacex-raising-750-million-at-137-billion-valuation-a16z-investing.html
[5] https://www.forbes.com/sites/greatspeculations/2021/04/16/is-spacex-really-worth-74-billion/?sh=44c7ea851271
[6] https://fcc.report/IBFS/SAT-LOA-20200526-00055/2378671
[7] https://oneweb.net/resources/oneweb-confirms-successful-deployment-16-satellites-including-next-generation-joeysat
[8] https://www.cnbc.com/2023/03/27/oneweb-aims-for-global-satellite-internet-coverage-after-key-milestone.html

base. The service provided will be comparable to broadband terrestrial services available in densely populated areas of developed and many developing countries [9]**.**

c. **Kuiper (by Amazon):**

Amazon's Project Kuiper aims to launch 3,236 satellites into low Earth Orbit to provide high-speed, low-latency broadband connectivity to approximately 95% of the global population. The first internet satellites are scheduled for launch in the first half of 2024, with commercial tests to follow. **Amazon intends to invest over $10 billion in the Kuiper network and manufacture millions of terminals required for customer connections**[10]**.**The company plans to open a satellite manufacturing plant in Kirkland, Washington, to achieve its ambitious target of one to three satellites built daily. Amazon is currently assembling its first two prototype satellites, KuiperSat-1 and KuiperSat-2, with completion expected by the end of Q4 2023[11].

*A variety of customer terminal models will be available with varying performance capabilities tailored to different customer segments (e.g., **residential and enterprise customers**). Mobile terminals will be supported for specific mobility applications (e.g., aeronautical, maritime, and **land-mobile**) and will be compliant with earth stations in motion ("ESIM") rules and other requirements adopted by the commission*. [12]

d. **Telesat**[13]**:**

i. *Our business is also **subject to competition from ground-based forms** of communications technology*.

ii. *Satellite operators **compete with terrestrial network operators** (e.g., cable, DSL, fiber optic, cellular/wireless and microwave transmission) in the market for video, data and voice communication services*.

iii. *We* are *a leading global FSS operator in a highly competitive industry, and **we compete against** other global, regional and national satellite operators and with providers of **terrestrial-based communications services***. [14]

[9] https://fcc.report/IBFS/SAT-LOI-20170301-00031/1190495
[10] https://www.business-standard.com/article/international/amazon-targets-2024-launch-of-its-first-kuiper-internet-satellites-123031401279_1.html
[11] https://www.cnbc.com/2022/10/27/amazon-to-open-kuiper-internet-satellite-factory.html
[12] https://fcc.report/IBFS/SAT-LOA-20190704-00057/1773656
[13] https://www.sec.gov/Archives/edgar/data/0001465191/000121390021013340/f20f2020_telesatcanada.htm
[14] https://www.sec.gov/Archives/edgar/data/1465191/000121390020004875/f20f2019_telesatcanada.htm

The statements and reports mentioned above clearly indicate that NGSO satellite operators are strategically planning their networks to compete with terrestrial communication service providers in terms of provisioning of services.Further, their business plans emphasize the allocation of substantial capacity for access services, demonstrating their explicit intention to instigate competition with terrestrial networks.

Hence, it is crucial to ensure that spectrum assignment rules for networks offering competing services are uniform and fair, without granting any stakeholder preferential treatment solely based on network topology or architecture. Auctioning satellite spectrum therefore emerges as the sole viable strategy to guarantee a balanced competitive landscape amongst competing providers.

E. Myths about non-feasibility of spectrum assignment for satellite communication networks:

12. The satellite industry clearly harbors ambitions of attaining comprehensive global coverage, extending to remote areas, while providing access services. Nonetheless, persistent misconceptions concerning the assignment of spectrum through auctions are frequently cited, ostensibly to procure an unfair advantage over terrestrial networks.

13. **Myth #1: Satellite spectrum authorization is assigned by the ITU, and therefore National Regulatory Authorities (NRAs) cannot assign the spectrum through auctions.**

Truth: The assignment of spectrum within a nation's jurisdiction is an inherent sovereign right. Neither the ITU Constitution nor the ITU's Radio Regulations impose any limitations on the methodology used for spectrum assignment. The primary role of the ITU is focused on the allocation of orbital slots and the management of interference. It does not establish rules or guidelines regarding the methodology for spectrum assignment or the pricing decisions made by sovereign states.

14. **Myth #2: Spectrum designated for satellite services should be allocated administratively, as it will only be utilized by a few gateway stations.**

Truth: The deployment and utilization of user terminals across the country, in addition to the gateways, make it imperative to assign spectrum on a pan-India basis through auctions.

15. **Myth #3: Exclusive grant of spectrum through auction will prevent satellite earth station gateways from accessing the complete band.**

    Truth: Due to the widespread installation of user terminals across the country, it is essential to assign different frequencies to each service provider to mitigate interference. Therefore, **exclusive spectrum assignments for user links have to be based on band segmentation.**

    In contrast, satellite earth station gateways, although limited in number, play a crucial role in supporting aggregated traffic. Consequently, they require a wider spectrum bandwidth to accommodate the aggregate traffic. Therefore, frequency-based band segmentation may not be the most optimal approach for gateway spectrum assignments.

    However, it remains essential to allocate spectrum exclusively on a geographical basis for designated exclusion zones. These areas are established to ensure that terrestrial networks do not utilize the frequencies assigned to the satellite earth station gateway. This geographic-based allocation helps prevent interference and maintains the integrity and performance of respective networks.

16. **Myth #4: Acquiring spectrum through auctions is futile without corresponding transponder capacity.**

    Truth: Like terrestrial service provider, any bidder for satellite spectrum will participate in auctions only if it already has the space assets directly or having capacity through valid agreement with satellite operators or has plans for the same.

17. **Myth #5: Satellite broadband will be complementary, primarily improving connectivity in rural and remote areas.**
    Truth:

    A majority of NGSO players have presented business cases and strategic roadmaps that clearly demonstrate the competitive nature of the services both in urban and rural/remote areas. Importantly, neither the policy nor the license impose any restrictions on satellite based service provider from providing services in areas already covered by terrestrial networks. This allows them to operate freely and compete with the terrestrial providers in same regions.

18. **Myth #6: Auctioning satellite spectrum may exacerbate the digital divide and hinder broadband connectivity for millions.**

    Truth: Auctions ensure a fair, transparent allocation process and promote efficient use of a precious resource. Competitive bidding fosters innovative business models and improved services, ultimately benefiting end users.

19. **Myth #7: Satellite spectrum is not auctioned anywhere globally, rendering market allocation mechanisms infeasible.**

    Truth: Several countries have embraced diverse transparent and competitive auction methodologies to assign satellite frequencies in various ways. Successful examples of such practices can be seen in countries like Saudi Arabia[15] and Thailand[16] [17], where spectrum for satellite services has been auctioned. Additionally, India has emerged as a global leader in spectrum auctions for terrestrial services since 2010. The policy framework and auction methodology implemented by India have been widely adopted by numerous countries worldwide, highlighting its effectiveness and influence in shaping international practices. .

20. **Myth #8: Administrative allocation bolsters investment and investor confidence.**

    Truth: The administrative assignment of spectrum refers to an approach where spectrum is allocated on a first-come, first-served basis. However, this methodology has faced criticism and scrutiny, including from the Hon'ble Supreme Court. .

21. **Myth #9: Satellite spectrum is used in a shared mode wherein the same spectrum is re-used by multiple satellite based service providers. Whereas auction will lead to exclusive use by only some service providers and will deprive spectrum access to others.**

    Truth:

    (i) **Gateway Links**: Given that gateways are limited in number and require the entire spectrum band to support aggregated traffic, the assignment can be carried out exclusively for specific geographical areas. These designated areas would serve as exclusion zones for IMT/backhaul. **Consequently, ensuring the exclusivity of spectrum assignment through a transparent auction process becomes crucial.**

    (ii) **User Links**: Due to the widespread geographic distribution of user terminals, it would be infeasible for terminals deployed by different service providers to operate on the

[15] https://www.cst.gov.sa/en/mediacenter/pressreleases/Pages/202212061.aspx
[16] https://www.bangkokpost.com/business/2483104/thaicom-nt-win-satellite-slot-bids-as-auction-raises-b806m
[17] https://satelliteauction.nbtc.go.th/Download/Document/172.aspx

same frequency. Even if some service providers attempt to coordinate and use the same frequencies, it would be exceedingly challenging to co-ordinate millions of user terminals, thousands of satellites, and tens of satellite operators effectively. Exclusive assignment of spectrum is therefore necessary for user links, to ensure that each satellite constellation and user terminal can operate without interference. Further, if a group of service providers want to enhance their spectral efficiency by sharing their spectrum, they can be allowed to do so through private contractual agreements, subject to mutual coordination. This approach would not impose any liability on the Government or create administrative priorities through a "first come, first serve" process.

F. Maintaining the 'Same Service Same Rules' Principle in Licensing, Spectrum Assignment, and Other Regulatory Levies

22. A crucial regulatory element for fostering a diverse economy is facilitating innovation and progressive ideas within a comprehensive, non-intrusive regulatory framework. Economic sector rules should be transparent, rational, understandable, and easily implemented, applied equally without bias to promote inclusive growth. **This principle, known as 'Same Service Same Rule,' originates from the rule of law and enables cohesive economic activity, propelling national progress.**

23. Hence, it is imperative that broadband internet and voice services, regardless of the technology or topology employed in the network (be it terrestrial or satellite), are subject to uniform regulatory standards.

24. The 'Same Service Same Rule' principle fosters fair competition while encouraging innovation and growth. Conversely, its absence results in imbalanced competition, impacting investments and service quality in the long run and fostering monopolistic and anti-consumer practices. 'Same Service Same Rule' eliminates regulatory discrepancies, promoting multi-technology growth, particularly in the rapidly evolving telecom sector. It also ensures that considering the direct competition with terrestrial networks, the investments made by companies in terrestrial networks are not indirectly expropriated due to differentiated treatment. **Therefore, it is crucial to establish 'Same Service Same Rule' as the foundation of the regulatory regime for communication services.**

25. Space-based communication services may complement terrestrial coverage in hard to reach areas, but would also compete for the same subscribers, providing broadband access, including M2M/IoT and Direct-to-Device, throughout the country. Thus, it is vital

to adhere to the 'Same Service Same Rules' principle when determining the spectrum assignment methodology for space-based communication services.

Any proposals that advocate for special treatment would be founded on shaky legal and economic foundations. **It is crucial to uphold the spectrum assignment criteria for communication services without any unreasonable & unwarranted dilution, adhering to the principle of 'Same Service Same Rules' with regard to spectrum assignment policies. This approach guarantees a level playing field, and a fair & equitable environment for space-based and terrestrial service providers, fostering healthy competition and contributing significantly to national growth.**

26. International precedents are irrelevant to the matter of spectrum assignment for communication services provided to Indian customers, as India maintains a stable and predictable legal stance on the subject. The Hon'ble Supreme Court unambiguously declared that the right to use such spectrum can only be transferred through a transparent auction. Only the Apex Court can alter this policy on spectrum assignment.

27. The assignment criteria for any spectrum usable for providing communication services in the country must comply with the Hon'ble Supreme Court Judgement on the assignment of spectrum in the landmark 2G case in CWP 423 of 2010 dated 2nd February 2012. The relevant excerpts are extracted and reproduced below for reference.

> *"69. As natural resources are public goods, the doctrine of equality,* which *emerges from the concepts of justice and fairness, must guide the State in determining the actual mechanism for distribution of natural resources. In this regard, the doctrine of equality has two aspects: first,* ***it regulates the rights and obligations of the State vis-à-vis its people and demands that the people be granted equitable access to natural resources and/or its products and that they are adequately compensated for the transfer of the resource to the private domain; and second, it regulates the rights and obligations of the State vis-à-vis private parties seeking to acquire/use the resource and demands that the procedure adopted for distribution is just, non-arbitrary and transparent and that it does not discriminate between similarly placed private parties.***
>
> *"74. …… Natural resources belong to the people but the State legally owns them on behalf of its people and from that point of view natural resources are considered as national assets, more so because the State benefits immensely from their value. The State is empowered to distribute natural resources.* ***However, as they***

constitute public property/national asset, while distributing natural resources, the State is bound to act in consonance with the principles of equality and public trust and ensure that no action is taken which may be detrimental to public interest. Like any other State action, constitutionalism must be reflected at every stage of the distribution of natural resources. … . .

77. Spectrum has been internationally accepted as a scarce, finite and renewable natural resource which is susceptible to degradation in case of inefficient utilisation. It has a high economic value in the light of the demand for it on account of the tremendous growth in the telecom sector. Although it does not belong to a particular State, right of use has been granted to States as per international norms.
……..

82. In Secretary, Ministry of Information & Broadcasting, Govt. of India v. Cricket Assn. of Bengal, (1995) 2 SCC 161, the Court was dealing with the right of organizers of an event, such as a sport tournament, to its live audio- visual broadcast, universally, through an agency of their choice, national or foreign. In paragraph 78, the Court described the airwaves/frequencies as public property in the following words:

> *"There is no doubt that since the airwaves/frequencies are a public property and are also limited, they have to be used in the best interest of the society and this can be done either by a central authority by establishing its own broadcasting network or regulating the grant of licences to other agencies, including the private agencies."*
> *…….*

85. As natural resources are public goods, the doctrine of equality, which emerges from the concepts of justice and fairness, must guide the State in determining the actual mechanism for distribution of natural resources. In this regard, the doctrine of equality has two aspects: first, it regulates the rights and obligations of the State vis-à-vis its people and demands that the people be granted equitable access to natural resources and/or its products and that they are adequately compensated for the transfer of the resource to the private domain; and second, it regulates the rights and obligations of the State vis-à-vis private parties seeking to acquire/use the resource and demands that the procedure adopted for distribution is just, non-arbitrary and transparent and that it does not discriminate between similarly placed private parties.
…….

89. In conclusion, we hold that the ***State is the legal owner of the natural resources as a trustee of the people and although it is empowered to distribute the same, the process of distribution must be guided by the constitutional principles including the doctrine of equality and larger public good.***

*94****. There is a fundamental flaw in the first-come-first-served policy inasmuch as it involves an element of pure chance or accident. In matters involving award of contracts or grant of licence or permission to use public property, the invocation of first-come-first-served policy has inherently dangerous implications. Any person who has access to the power corridor at the highest or the lowest level may be able to obtain information from the Government files or the files of the agency/instrumentality of the State that a particular public property or asset is likely to be disposed of or a contract is likely to be awarded or a licence or permission is likely to be given, he would immediately make an application and would become entitled to stand first in the queue at the cost of all others who may have a better claim.***

95. …. When it comes to ***alienation of scarce natural resources like spectrum etc., it is the burden of the State to ensure that a non-discriminatory method is adopted for distribution and alienation, which would necessarily result in protection of national/public interest****.*

96. In our view, ***a duly publicised auction conducted fairly and impartially is perhaps the best method for discharging this burden ….****"*

28. The position that auctions are the most suitable method for alienating natural resources like spectrum for commercial pursuits was further reaffirmed by the Hon'ble Supreme Court's opinion dated 27th September 2012, on presidential reference. Relevant excerpts have been extracted and reproduced below for reference.

*149. Regard being had to the aforesaid precepts, we have opined that auction as a mode cannot be conferred the status of a constitutional principle. Alienation of natural resources is a policy decision, and the means adopted for the same are thus, executive prerogatives****. However, when such a policy decision is not backed by a social or welfare purpose, and precious and scarce natural resources are alienated for commercial pursuits of profit maximizing private entrepreneurs, adoption of means other than those that are competitive and maximize revenue may be arbitrary and face the wrath of Article 14 of***

the Constitution. *Hence, rather than prescribing or proscribing a method, we believe, a judicial scrutiny of methods of disposal of natural resources should depend on the facts and circumstances of each case, in consonance with the principles which we have culled out above. Failing which, the Court, in exercise of power of judicial review, shall term the executive action as arbitrary, unfair, unreasonable and capricious due to its antimony with Article 14 of the Constitution.*

29. Consequently, equitable valuation and assignment mechanisms for spectrum utilized in both terrestrial and satellite-based commercial communication services are essential. It is vital to maintain the established policy of auctioning spectrum as the preferred method for obtaining spectrum to provide communication services, irrespective of the service scope**.**

30. Furthermore, spectrum assignment between space-based and terrestrial networks must maximize public good and serve the greatest number of people. There is no better method than free and fair auctions to achieve this goal. Auctioning spectrum is the most transparent method of spectrum assignment and allows service providers to decide on their technology, be it terrestrial, satellite, or any other**.**

31. In addition, **principles and charges for regulatory levies, including but not limited to license fees, should remain consistent for competing services provided under different technologies. The spectrum and licensing policy should not rely on regulatory arbitrage in terms of licensing or resource assignment.**

G. Valuation of spectrum, reserve price & payment methodology

32. Accurate spectrum valuation is essential to ensure sufficient competition in the auction process and guarantee appropriate minimum revenue for the government. The spectrum valuation should aim for optimal utilization and true market price discovery, while also aligning with national objectives, proliferation goals, and the societal and economic impact on all aspects of life.

33. In the absence of past auction prices, the most relevant criteria should include technical efficiency-based approximations derived from other bands. Factors such as the mmWave band and C-Band auction-determined price in the 5G auction, comparative spectral efficiency, existing use cases, anticipated population coverage, and international benchmarking should be used when determining the value of spectrum.

34. A reserve price of 70% of the valuation is too high and may hinder competition. Instead, reducing the reserve price to 50% of the spectrum valuation would be optimum. This approach is likely to facilitate true market price discovery and benefit the industry in the long run by increasing spectrum uptake, minimizing unsold spectrum waste, maximizing overall returns rather than focusing on unit price, and contributing to the achievement of proliferation goals while simultaneously boosting overall license fee proceeds.

35. **Conclusions**

1. **Technological advancements are reshaping the traditional use of specific spectrum bands, blurring the technical boundaries between legacy spectrum uses, and allowing different access technologies to use the same frequencies.**
2. **NGSO satellite based service providers are positioning themselves alongside terrestrial service providers, necessitating the need for the same licensing and spectrum assignment rules for the same services.**
3. **Auctions are the only legally tenable mode of assigning spectrum for all communication services, and space-based communication services are no exception. The DoT reference also envisages an auction method for assignment.**
4. **The spectrum should be auctioned on the following lines:**
   a. **User Spectrum: Exclusive assignment of frequencies on Pan India basis through band segmentation.**
   b. **Gateway Spectrum: Entire spectrum in the band should be assigned for each gateway location (i.e. exclusion zone). Such identified gateway locations should be put to auction.**
5. **The spectrum assignment should be on a flexible basis permitting the bidder to use it for any service based on the scope of their license & NFAP 2022.**
6. **Sharing and leasing of spectrum, through direct sharing/leasing arrangements between service providers, should be incentivized with monetary and non-monetary benefits.**
7. **Technology Neutrality is the hallmark of Indian spectrum auctions and should be maintained.**
8. **The spectrum reserve price should be kept at 50% of the valuation.**

H. Issue wise responses:

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.

RJIL Response:

1. All spectrum bands allocated for satellite services, including FSS and MSS, in various frequency bands such as L, S, C, Ku, and Ka as identified by ITU/ Indian NFAP-2022 be considered as part of this consultation. It is also imperative that spectrum bands identified for satellite services should be made available for both gateway links and user links through auctions.

2. **Furthermore, The Notice Inviting Applications for spectrum auctions should not artificially distinguish between FSS and MSS or terrestrial networks. The Authority should maintain its technology-neutral approach, and all spectrum bands identified for satellite services should be made available for auction and use according to the successful bidder's business plan. Categorizing spectrum into FSS and MSS could restrict future technological advancements and does not align with established policies of spectrum auctions.**

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)										

RJIL Response:

1. We maintain our position on the technology-neutral and topology neutral assignment of spectrum, and therefore, do not support any service-level differentiation in the design of auctions. The successful bidder should be allowed to use the acquired spectrum flexibly for any type of network, be it terrestrial or satellite and any type of service, as per the scope of their UL authorizations and in accordance with the NFAP 2022.

2. Furthermore, it has been the steadfast policy of both the Authority and the Government to conduct auctions for all access spectrum, and it is imperative to maintain this advantageous approach, without deviating on the basis of current/future estimated service requirements. Making accurate estimations in this regard is challenging, as spectrum needs will inevitably evolve with technological advancements. Hence, there is

no necessity to gather data as per the prescribed table, and instead, all available spectrum should be included in the upcoming auction.

3. To ensure fair resource distribution, separate auctions should be conducted for NGSO user link spectrum, GSO user link spectrum and Gateway spectrum.

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.

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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.

RJIL Response:

1. **Managing interference between various satellite systems operating on the same user link frequencies will pose significant challenges due to lakhs' of satellites moving at very high speeds, and the widespread deployment of millions of user terminals across the length and breadth of the country. Achieving effective interference management under such circumstances will be almost impossible.**

2. As multiple NGSO satellite operators plan to provide services using the same set of frequencies for their Gateway Feeder Links (**hereinafter referred as "GFLinks"),** there will be a need for multiple gateways across the country to handle the aggregated traffic. For NGSO Gateways, a separation distance would be appropriate to prevent harmful interference among different satellite networks. Therefore, assignment methodologies for gateways need to ensure sufficient inter-gateway distance. Additionally, the number of gateways and exclusion zones needs to be minimized to ensure minimum coverage gaps for terrestrial networks operating in the same spectrum band.

3. With the increasing deployment of NGSO satellites by multiple satellite operators, the coordination and management of interference due to in-line events will become

increasingly impractical for NGSO user links (**hereinafter referred as "NULinks")**. Therefore, it would be challenging for all NGSO constellations to use the same frequency for their user terminals within same geographical area. Therefore, it is essential to assign separate frequencies to each service provider exclusively through band segmentation in auction.

4. Exclusive spectrum assignment for NULinks would ensure efficient interference management between individual NULinks operated by various NGSO operators, which in turn would guarantee reliable broadband service quality. Additionally, this approach will reduce dependence on government intervention to address interference issues.

5. It is clear from the above, that for **NULinks**, the exclusivity in spectrum assignment should be established through the assignment of separate frequencies to each service provider to eliminate inter-operator interferences. Further, the exclusivity of **GFLinks** should pertain to specific geographical areas where a satellite based service provider has the exclusive right to transmit frequencies within a particular spectrum band. This exclusivity creates an exclusion zone (referred to as the Gateway Exclusion Zone or GEZ) where other service providers (i.e. both terrestrial and satellite based) are prohibited from using the frequencies of the same band**.**

6. Further, when spectrum is assigned exclusively to a service provider, further efficiencies can be achieved by permitting the sharing of such spectrum procured through auction, similar to how it is allowed for terrestrial spectrum. The spectrum sharing guidelines enable service providers to privately contract and coordinate with each other for sharing purposes without requiring government intervention. However, in the event of market failure or national requirements, the Government may retain the right to intervene to facilitate spectrum sharing. Appropriate provisions can be incorporated into the NIA to accommodate such interventions.

7. Certain stakeholders have persistently expressed concerns regarding the auction of spectrum for space-based communication services, asserting that it is a shared resource and should not be granted exclusively to one entity through auction. However, such concerns are baseless and can be easily mitigated by implementing well-defined auction model for various type of links and with spectrum sharing, leasing, and trading policies in place. A policy on spectrum sharing, trading, leasing and surrender can be customized for satellite spectrum. For instance:-

a. Similar to terrestrial networks, space-based networks also undergo a continuous planning process. The service providers optimize the performance of their networks by adjusting parameters, incorporating new nodes, or eliminating existing ones. While there may be technical differences between terrestrial and space communication services, the fundamental principles guiding network optimization remain consistent across both network types. Terrestrial network service providers modify site parameters, while operators of space-based communication systems adjust satellite parameters to ensure optimal network performance.

b. Spectrum sharing between service provider necessitates a coordinated effort, wherein service provider closely collaborate in network planning and operations to maintain harmonious coexistence of their respective networks, thereby preventing interference. This concept is widely accepted and implemented in terrestrial networks. Given the fundamental similarities in planning for terrestrial and space networks, this sharing approach through direct coordination can be adopted for space communication services as well. Consequently, the additional capacities and efficiencies can be achieved in the exclusive assignment of spectrum for space services by sharing the auction assigned spectrum through a private contract between the parties.

c. In an agreement to share the auction assigned spectrum, service providers engage in direct coordination without any involvement of governmental entities. Direct coordination is more efficient, as service providers are better equipped to effectively co-ordinate and share spectrum and to address any interference issues among themselves, rather than seeking government intervention in this dynamic and rapidly evolving sector with ever growing constellations containing lakhs of fast moving satellites.

8. The authority should prioritize optimizing spectrum utilization, which can be best achieved through exclusive spectrum assignment and allowing service providers to share the spectrum through direct spectrum sharing arrangements.

9. **Spectrum assignments should be carried out exclusively through auctions, mirroring the approach used for terrestrial networks. Such exclusivity will have a different meaning for NGSO User links, GSO User links and Gateway Links. However, successful bidders should have the flexibility to share/trade/lease spectrum as per market dynamics and forces.**

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.

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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?

RJIL Response:

The assignment of spectrum for various type of links/uses shall be as follows: -

1. **NGSO user terminal (NULinks)**:-

   Given the significant number of NGSO constellations comprising lakhs of fast moving satellites, and considering the widespread distribution of user terminals across the country, assigning spectrum for each user terminal becomes highly impractical. Coordinating the use of the same frequencies among numerous NGSO operators for their user terminals would be exceedingly challenging due to the growing number of NGSO constellations and the commissioning of additional satellites within existing constellations.

When considering the utilization of the same spectrum for millions of user terminals operated by multiple NGSO satellite service providers, achieving extensive coordination becomes an insurmountable task. This challenge is compounded by the fact that NGSO constellations are owned by satellite operators from different countries, each with their own diverse business plans and strategies. Therefore, the most effective spectrum assignment methodology for NGSO user terminals is the assignment of exclusive frequencies, similar to how it is done for terrestrial networks.

Further, in contrast to feeder links, which handle aggregated traffic, user terminals do not require the full spectrum in a band. The Ka band for instance has in total 2 GHz **(27.5 GHz to 29.5 GHz**) expressly for user link functionality. Not all service providers will find it necessary to utilize the full 2 GHz for their respective user terminals. It is therefore, both feasible and appropriate to assign user link frequency spectrum to multiple service providers exclusively through band segmentation.

Contrarily, one could propose that this band segmentation method could potentially induce inefficiencies, and shared spectrum could potentially lead to more efficient utilization. Drawing a parallel to terrestrial spectrum sharing, it is proposed that NGSO satellite based service providers also be permitted to share their frequencies with other service providers (either fellow satellite NGSO based service providers or with terrestrial IMT service providers) via mutual coordination to ensure optimum efficiency of spectral resources.

This method implies mutual coordination amongst service providers who have been exclusively assigned frequencies, thereby eliminating the necessity for the government's involvement in day-to-day coordination or in interference management between the service providers. This stands in stark contrast to a scenario where the entire spectrum band is assigned to each service provider on a coordination basis, which would require a higher degree of government involvement to ensure effective coordination among service providers.

Since, many of the identified spectrum bands (like n257 band from 27.5 GHz to 28.5 GHz) for NULinks are also required for IMT networks due to global harmonization and to their adoption by 3GPP/ITU, it is important to utilize such spectrum bands in a flexible manner between satellite and terrestrial networks. This will allow for the most efficient utilization of such a valuable and scarce national resources.

Therefore, it is proposed that the NGSO User Links ("NULinks") spectrum, should be assigned exclusively via band segmentation. Further, it should be allowed to be used in a flexible manner between NULinks and IMT.

We propose the following parameters for the auction of NULinks spectrum:

Auction of Spectrum for flexible use between NULinks and IMT	
Parameter	**Proposal**
Assignment	Frequency assignment on band segmentation basis
Geographical area on Ground	Pan-India basis
Block Size	10 MHz
Minimum number of blocks for bidding	1 block
Spectrum Cap	30% of the total blocks available in a band
Technology/ Network Topology	Assigned spectrum to be utilized in a technology & topology neutral manner i.e. assigned spectrum can be utilized for NGSO user terminal, IMT Access & Backhaul subject to interference mitigation requirements under the radio regulations.
Sharing/Trading/Leasing	To be allowed for auction acquired frequencies with other satellite based service providers and terrestrial IMT service providers
Term	20 years
Frequency of auction	Every year
Spectrum for year auction	Unsold spectrum from previous auction, expired spectrum and newly identified bands
Uplink / Downlink frequencies	Separate bidding for Up-link and Down-link as the ratio may be different for each service provider

The assignment of uplink and downlink frequencies in user links should be conducted separately as various service providers may have different demands for uplink and downlink. Any fixed uplink-downlink ratio will lead to inefficient use of spectrum.

2. <u>GSO User Terminal Links ("GULinks"):</u>

Geostationary satellites, due to their fixed position relative to the Earth, can avoid dynamic in-line events typically associated with NGSO satellites. Users on Earth can

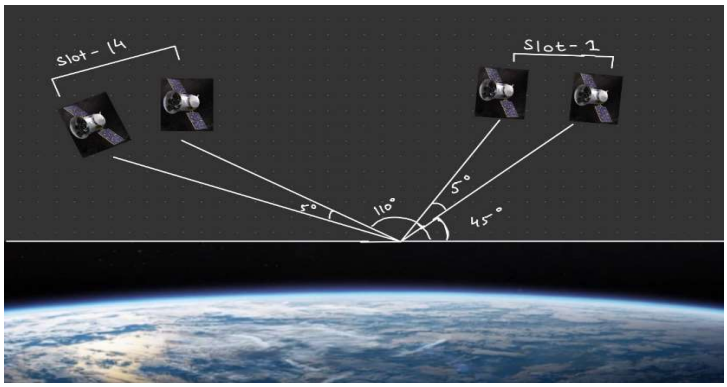
utilize the same frequencies for different satellites based on their look angles. However, this frequency reuse is contingent upon the angular separation between satellites. If satellites are in close proximity, their beams may intersect and disrupt the use of frequencies. Therefore, the available spectrum needs to be divided between such service providers through band segmentation for use within the Angular Sector ("AS") for e.g. around 3 deg. The angular width of such AS will vary depending on the frequency band.

The auction of GULinks spectrum is proposed as follows:-

i. In the GSO satellite communication system, user terminals have a fixed look angle that allows the use of the same frequencies at different look angles towards a fixed orbital segment.

ii. Use of the same frequencies is possible for different look angles, as long as a minimum angular separation requirement for that same frequency band is maintained. However, if the angular distance between two satellites is less than the minimum required, it is not possible for both satellites to utilize the same frequencies without causing interference. In such cases, frequencies must be coordinated or divided between the satellites positioned in a particular Angular Sector. However, the same frequencies can be used in the next angular sector without causing any interference to the neighboring sector. Therefore, for GULinks, the same frequencies can be assigned based on the angular separation of orbital slots.

iii. In the case of India, the suitable orbital slot range is from 45°E to 115°E, covering a total arc of 70^{o}. To facilitate efficient spectrum utilization, this space can be divided into multiple angular sectors for e.g. 14 AS (Angular sectors) of 5^{o} each. These sectors would represent distinct circles in space that enable coverage across the nation, with each AS being capable of reusing the same frequency. A sample of such angular slots is represented in the following diagram: -



iv. Furthermore, it is incumbent on NGSO satellites to protect GSO satellites by implementing appropriate measures as defined in ITU-RR,. Therefore, the full spectrum assigned for the NULinks can be concurrently assigned to GULinks as well. For example, if 27.5 GHz to 29.5 GHz has been assigned for NULinks/IMT flexible use, it can simultaneously be auctioned for GULinks using the methodology explained in the section.

v. Keeping in mind the above, GULinks frequency can be assigned through a transparent auction process. The parameter of such an auction are as follows:-

Auction of Spectrum for GULinks	
Parameter	**Proposal**
Assignment	Frequency assignment on Angular Separation basis
Geo-graphical area	Pan-India for each AS
No of AS	11 for 6^{o} AS and 22 for 3^{o} AS
Block Size	10 MHz
Minimum number of blocks for bidding	1 block
Spectrum Cap	50% of total blocks available in each Angular Sector
Sharing/Trading/Leasing	To be allowed for auction acquired frequencies with other GULinks
Term	20 years
Frequency of auction	Every year
Spectrum for year auction	Unsold spectrum from previous auction, expired spectrum and newly identified bands
Uplink / Downlink frequencies	Separate bidding for Up-link and Down-link as the ratio may be different for each service provider.

3. Gateway terminal ("Feeder Link")

i. The gateway transmits and receives the Feeder Link from the satellite. These feeder links aggregate the traffic of all user terminals served by that specific satellite.

ii. While each satellite may have multiple user beams carrying the traffic to and from a large number of user terminals, it maintains a feeder link connected to the ground station to carry to/from aggregated traffic of all user terminals. Therefore, the spectrum requirement of feeder link's is significantly higher than user link.

iii. Further, since gateways are sparingly installed by the service provider and their locations are pre-determined, these areas can be established in a Geographical Zone, established as exclusion zones (hereinafter referred as Gateway Exclusion Zone, "GEZ").

iv. In GEZs, terrestrial transmissions are prohibited from operating on the same frequency band as of the gateway. Therefore, the gateway equipment installed in such exclusion zones can transmit the complete band unrestricted by band segmentation. GEZ may vary in size from a radius of few meters to Kilometres, depending on the frequency used.

v. These exclusion zones pose a challenge as they create coverage gaps for IMT operating in the same spectrum band. For example, 27.5 GHz - 29.5 GHz band supports IMT as well as NULinks of various satellite constellation. Therefore, the number of gateway locations must be carefully controlled to prevent major disturbances to IMT services provided by terrestrial service providers. Hence it is important that such GEZ are limited in number and are provided through a transparent auction process so that service providers create such exclusion zones with caution and also do not hoard exclusion zones.

vi. Consequently, The Government should create one exclusion zone in each district. The auctioning of these Gateway Exclusion Zones (GEZ) could be executed on a geographic basis for every spectrum band, permitting transmission in the complete spectrum band. As the administrative assignment which is based on first come-first-serve policy could lead to hoarding or deny some service providers suitable locations or cause huge coverage holes in 5G, it is crucial that these GEZs are allocated through a transparent and open auction process.

vii. Hence, we propose the following for the auction for Gateway Exclusion Zones (GEZs):

Auction of Spectrum for Feeder Link	
Parameter	**Proposal**
Assignment	Frequency assignment on geographic location basis
Geographical Area	Gateway Exclusion Zone (GEZ) identified in each district.
Exclusion Zone Radius	The required exclusion zone (radius or in terms of PFD limit) may be defined based on outcome of the coexistence analysis. WPC may workout the required exclusion zone for C, Ku, Ka & other spectrum bands.
Frequency	Complete spectrum in a band be made available in each GEZ as no other service providers can use these frequencies in the exclusion zone.
Block Size	District (Exact location in the GEZ to be identified between the successful bidder and WPC to ensure minimum interference and radius of exclusion zone).
Spectrum Cap/ Location Cap	GEZ district cap. Any service provider can bid for not more than a higher of 10 districts or not more than 10% of the total districts put to auction.

The successful bidder for establishing a gateway in any district will approach WPC/INSPACe, who in turn will carry out the joint survey and suggest the location which causes the least interference from or to:-

- the gateways located in neighboring districts
- Other services like IMT, Backhaul etc.

In situations where suitable space is not available during the joint survey, the WPC/INSPACe may assign the neighboring district where no other service provider has been assigned the spectrum. This assignment should be made without imposing any additional costs on the service provider. This approach would ensure that service providers can still access spectrum, facilitating the deployment of their satellite systems while minimizing any potential disruptions or delays.

Such study and site finalization must be completed within 60 days from the date of auction and the validity period of the spectrum shall start from the date the location is finalized by WPC and communicated to the bidder.

4. **To summarize, NULinks must be auctioned in a flexible manner with IMT, while GULinks should be auctioned for each angular sector separately. Additionally, Feeder Link spectrum should be auctioned on a Geographical basis for each GEZ established in each district.**

5. **Further, to the above, all spectrum for NULinks should be flexible and the successful bidder shall be allowed to use it between NULinks and IMT network.**

6. The structure for spectrum sharing in satellite networks should draw parallels to the framework employed by terrestrial networks. Under such a model, the successful bidder would shoulder the responsibility for managing interference through private contracts. The primary aim of this framework should be to promote the efficient use of the spectrum, operating on a light-touch regulatory approach.

7. Furthermore, the spectrum sharing framework should accommodate intra-operator sharing. Given that many service providers hold both satellite and terrestrial licenses under distinct companies within the same group for strategic reasons, the sharing of spectrum between group companies should be permitted without any additional charges/fee and should not be treated as crossholding of the spectrum. Further, the group companies of the bidder should be allowed to acquire the access spectrum in other companies in other spectrum bands.

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.

RJIL Response:

1. Spectrum acquired through auctions should be allowed to be shared with or leased to any entity that does not currently hold spectrum or was not successful in the auction for the particular band.

2. As per the decision of the Government of India, spectrum auctions should be conducted each year.

3. The auction should have a validity period of 20 years.

4. In the annual auction, the spectrum unsold from the previous auction, expired spectrum and the new spectrum bands made available for the communication services should be included.

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.

The successful bidder should be allowed to trade and/or lease a part or all of their satellite spectrum holding to other eligible service licensees, including those that do not hold any spectrum in the concerned spectrum bands. However, the entity acquiring the spectrum should meet eligibility conditions for holding such spectrum and must hold a valid authorization/license or should obtain the required license before operating services using such spectrum.

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

RJIL Response:

1. Frequency spot assignment within a band should be determined by the final bidder ranking in the auction process. The bidder with the highest rank should be able to secure their preferred frequency slot in the band, followed by the bidder with the second-highest rank, and so on.

2. If a bidder acquires more than one block, the entire spectrum should be assigned in a contiguous form. However, if an existing service licensee is already providing services and could not acquire the spectrum through the auction, they can still obtain the required spectrum through coordination with the successful bidder via spectrum sharing/leasing/trading provisions.

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.

RJIL Response:

1. Due to the reasons explained in our responses to Q5, spectrum in higher frequency bands such as C band, Ku band and Ka band for space- based communication services **cannot be assigned non- exclusively**.

2. Given the finite nature of frequency spectrum, allowing non-exclusive use to all service providers on the basis of mutual coordination would be **tantamount to delicensing**, akin to the use of bands in 2.4 and 5 GHz. This would lead to inefficient resource

utilization, and in our opinion, is the least appropriate assignment mechanism for a growing satellite communications sector.

3. However, if the spectrum is allowed to a limited number of service providers on a non-exclusive basis, the following concerns emerge: -

    a. **How will this limited number of service providers be selected?** Any first come, first serve method would be arbitrary and has already been rejected by the Hon'ble Supreme Court in the 2G judgement.
    b. Any other method of selecting a limited player from a long list on an administrative basis will also be arbitrary and will reflect the bias of the assigning authority.
    c. Further, the inter se requirement of each selected service provider may also vary. In the absence of any transparently discovered priority, Government may not be able to resolve disputes and resolutions would be prone to litigation.

4. **In summary, there are two primary approaches to spectrum allocation: delicensed spectrum and licensed spectrum. In the case of delicensed spectrum, the government does not guarantee protection or exclusivity to any particular service provider. This means that multiple service providers can utilize the spectrum without any specific protections or assurances from the government. On the other hand, the licensed method involves the government providing protection and exclusivity to service providers through licenses.**

5. **Further, the Government cannot provide any protection to a service provider on the basis on an arbitrary determination or on the basis of "First Come, First Serve".**

6. **Assignment of spectrum on a non-exclusive basis even through auctions will have an element of inter se rights of the successful parties who have been assigned spectrum on non-exclusive basis.**

7. **The Government cannot provide any priority to any service provider unless that priority has been determined through open and transparent processes. It is essential that all entities have an equal opportunity to participate in these processes.**

8. **Therefore, spectrum cannot be assigned on a non-exclusive basis by the Government.**

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.

&

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.

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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.

&

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.

RJIL Response:

1. 3GPP is a collaborative organization that brings together several standard development organizations globally to develop technical specifications as well as identify & define various spectrum bands utilized by communication systems.

2. The **3GPP band n257** spans from **26.5-29.5 GHz** & is identified by different countries for IMT applications.

3. The country wise allocations in n257 band for IMT services are mentioned below :-

    a. **USA:** In January 2019, FCC concluded the 28 GHz spectrum auction, with gross bids totaling $702 million. The licenses, assigned on a county-by-county basis, are for two 425 MHz blocks in the 27.5 GHz-28.35 GHz range.

b. **Republic of Korea:** In June 2018, the Ministry of Science and ICT (MSIT) used an auction methodology to allocate three 800 MHz bandwidth blocks in the n257 band (i.e., 26.5 GHz-28.9 GHz) to three entities (Korea Telecom, LG U+, and SK Telecom) to support the rollout of 5G mobile services.

c. **Japan:** In April 2019, MIC assigned 800 MHz of spectrum in the 27.8 GHz-28.2 GHz & 29.1 GHz-29.5 GHz bands to telecom service providers KDDI and Softbank, respectively.

d. **Taiwan:** In January 2020, the National Communications Commission (NCC) assigned the first phase of 5G licenses in the 27.9 GHz – 29.5 GHz spectrum range via an auction to four telecom service provider, namely Chunghwa Telecom (27.9 GHz-28.5 GHz), Far Eastone Telecommunications (28.5 GHz-28.9 GHz), Asia Pacific Telecom Group (28.9 GHz-29.3 GHz), and Taiwan Mobile (29.3 GHz-29.5 GHz).

e. **Norway:** In May 2020, the Norwegian Communications Authority (Nkom) conducted the Combinatorial Ascending Multi-Round Auction (CMRA) for allocating two 56 MHz spectrum blocks in the 28.3325 GHz-28.4445 GHz & 29.3405 GHz-29.4525 GHz ranges.

4. Additionally, it has been observed that many satellite constellations have devised their services in a portion of this n257 band for user links and feeder links, as depicted below:-

S.No	Satellite Operator	User Link (Earth-Space)	Feeder Link (Earth-Space)
1	SpaceX	28.35-29.1 29.5-30.0	27.5-29.1 29.5-30.0
2	O3B	27.5-30	27.5-30
3	Kuiper (Amazon)	28.35-29.1 29.5-30	27.5-30
3	Telesat	27.5-29.1 29.5-30	27.5-29.1 29.5-30
4	OneWeb	-	27.5-29.1 29.5-30.0

5. Many GSO HTS satellites are utilizing a part of the n257 band for their Feeder & User Link.

6. TRAI its recommendation dated 29.08.2014, envisaged 28 GHz band to be earmarked for terrestrial based fixed point-to-point Microwave carriers.

7. To summarize, this band has been envisaged for various types of usage, including backhaul, IMT access, Satellite Gateway & Satellite access for both GSO and NGSO. Reserving this band exclusively for any one type of usage could potentially lead to inefficient utilization and blockage of resources for certain types of networks. Any artificial segmentation of this band, as seems to be proposed in the consultation paper (i.e. 27.5-28.5 GHz & 28.5-29.5 GHz), would also lead to inefficient utilization due to the uncertainty associated with the economic value and utilization (IMT/Satellite/other) of this band.

8. The complete n257 band should be assigned through auction in a flexible manner. The flexible use of spectrum can be defined as a manner in which the utilization of spectrum i.e. technology & topology, is left to the assignee of those frequencies. Such assignees should be free to utilize those frequencies for various technologies/topologies including terrestrial, backhaul & satellite (subject to having valid license authorizations under UL), while ensuring no interference to the assignees of the adjacent or other bands and also providing protection to GSO satellites as envisaged in radio regulations.

9. When a spectrum band is identified by 3GPP, it implies that the entire spectrum would be leveraged once IMT devices are manufactured, ultimately leading to global harmonization usage for the band. Therefore, **instead of fragmenting the full band in two parts i.e. 27.5 GHz-28.5 GHz for IMT and 28.5 Ghz-29.5 GHz for satellite**, it is crucial that the full spectrum within the 3GPP n257 band is used by both terrestrial network and satellite by the way of assigning the complete band for flexible use.

10. The successful bidder should also be allowed to sub-lease part of their assigned spectrum to any other service provider for use in terrestrial or satellite based network, thus ensuring optimal resource utilization. This approach ensures that the government receives the full market value through auctions for terrestrial/mixed use spectrum.

11. Private networks are a subset of the terrestrial IMT network. Therefore, the successful bidder should also be permitted to use the acquired spectrum to provide CNPN services.

12. Any reservation of spectrum in this band, i.e. 27.5 GHz to 29.5 GHz, which is fiercely contested between terrestrial and satellite for direct assignment to fewer location of CNPN will lead to further scarcity in this band. This band is not only among the most ideal mmWave bands for IMT applications but is also sought after for NULinks, GULinks and Feeder Links. Therefore, this band should not be fragmented and wasted by reserving any spectrum for CNPN.

13. In fact, reserving a spectrum band for localized applications such as CNPN will be an unfavorable policy decision. It would be tantamount to sacrificing the entire band, which could otherwise be used for nationwide network deployments, CNPN can be adequately provided by TSPs who have acquired spectrum through auctions. Further, any administrative assignment of spectrum to CNPN, even if on a pro-rated basis of the auction price, would erode the value of the spectrum already acquired through auction or set to be auctioned.

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

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

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

b) Projections on revenue, subscriber base and capital expenditure for each type of service (as mentioned in the Table 1.3 of this consultation paper) for the whole

industry for the next five years starting from financial year 2023-24, in the format given below:

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

RJIL Response:

1. **The auction process should facilitate spectrum assignment without imposing service differentiations. The specific services to be offered should be determined by the successful bidder, in accordance with NFAP 2022 and valid UL authorization.** The successful bidder should have the flexibility to utilize the spectrum efficiently and effectively. Implementing segmented spectrum auctions based on different service classes would result in inefficient spectrum usage and impede market dynamics. Differentiating services based on market, technology, or financial factors is unnecessary.

2. Therefore, the Authority should thoroughly consider all spectrum bands outlined in the DoT Letter dated 16th August 2022, as well as presented in Table 3.1 of the consultation paper, for the purpose of conducting auctions.

3. It is our understanding that space-based communication services can be primarily divided into three categories: Access, Carrier, and Broadcasting, as detailed below:-

    b. **Access Service:** Access Services refer to the provision of telecom/internet access directly to consumers. Similar to terrestrial access services, space-based access services will be employed to deliver telecom services to consumers. Considering the scope of licenses that allows the them to provide services directly to the customer premise/consumer device, GMPCS, ISP, VSAT, NLD, ILD, DSNG services

fall under this category. Some service providers such as NLD, ILD may also provide the carriage services in addition to the Access services such as Leased lines/IPLC etc., which are directly provided to consumers.

c. **Broadcasting Service:** DTH are classified as broadcasting services, as they carry one way transmission of satellite TV channels directly to consumers.

d. **Carrier Services:** These are services provided to other carriers to connect their networks. Unlike Access and Broadcasting services, space-based carrier services such as **IFMC, Teleport and HITS** do not cater to customers directly.

4. Despite the abovementioned service categories, spectrum for all services should be auctioned. Though the design of such auction may be different keeping in mind the properties and demand in that spectrum band.

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.

&

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.

RJIL Response:

1. The assignment of spectrum for user links in all bands (L, S, C, Ku and Ka) should be carried out through the auction method. Furthermore, any spectrum resource utilized

for commercial purposes should be assigned through auction for flexible use by the successful bidder.

2. The auction method offers a transparent approach for allocating spectrum resources and appeals to investors due to the long-term certainty in spectrum assignments.

3. The detailed methodology of auction has been explained in **response to Q5.**

4. **<u>Questions on Administrative assignment of spectrum are beyond DoT's reference:</u>**

   a. **The Authority has previously maintained a position that whenever the Department of Telecommunications (DoT) has sought its recommendations under Clause 11(1)(a) of the TRAI Act 1997, as amended by the TRAI Amendment Act 2000, the Authority has restricted its recommendations only to the extent of the DoT's reference. In cases where DoT has sought recommendations on associated issues as part of its reference, the Authority has not considered said additions as part of the ongoing reference.**

   b. However, the current consultation paper raises issues that are beyond the reference made by DoT and includes a few questions that do not come under the scope of the reference, as illustrated below.

   c. **DoT Reference dated 13.09.2021**

      i. In the above reference DoT has requested TRAI to "*provide recommendations on appropriate frequency bands, band plan, block size, applicable reserve, quantum of spectrum to be auctioned and associated conditions* ***for auction of spectrum for space-based communication services*** *in view of para 6 above*".

      ii. *"6. The Department of Space had invited comments on Draft Spacecom Policy liberalizing space segment for private sector participation to provide commercial communication services in India. This includes the Low Earth Orbit (LEO) and Medium Earth Orbit (MEO) satellite constellations operational over India. In case of satellite communication, the subscriber is accessed from the satellite through "Access Spectrum" similar to "Access Spectrum" in terrestrial network and the demand for such spectrum will potentially increase in the future*

iii. In this reference DoT has also requested TRAI to "*provide any other **recommendations deemed fit for the purpose of spectrum auction** in these frequency bands, including the regulatory/ technical requirements as enunciated in the relevant provisions of the latest ITU-R Radio Regulations*"

d. DoT Letter dated 13.09.2021

i. While responding to additional information requested by TRAI, DoT in para 2.1 has provided that "*details of the **frequency bands and quantum of spectrum available in each band required to be put to auction** and associated information in respect of space-based communication*" as Annexure-I.

ii. In para 2.1 (c) of this DoT letter it is stated that "*While Annexure-1 includes both spectrum band and quantum of spectrum in each band, however the demand of spectrum is not known. Therefore, TRAI, through* consultations*, may assess the demand for space-based communication services and accordingly **provide recommendations on the quantum of spectrum in each band required to be put to auction**"*.

iii. Para 2.2 (a) highlights that "***It is envisaged to auction the Space Spectrum on exclusive basis**. TRAI may explore the feasibility and procedure of sharing auctioned spectrum among multiple* service licensees. *TRAI may* provide *recommendations on **sharing of auctioned frequency bands** between satellite networks and terrestrial networks also, the criteria for sharing and appropriate interference mitigation techniques for sharing and coexistence*".

iv. Para 3 highlights that "*since the service providers may require spectrum both in user links as well as in feeder links, **TRAI may take inputs from the stakeholder and recommend the appropriate auction methodology** so that the successful bidder gets spectrum for user link (shared with IMT in flexible) as well as feeder link".*

v. Para 4 highlights that "*TRAI is requested to provide **any other recommendation as deemed fit for the purpose of spectrum auction in these frequency bands**, including the regulatory/technical requirements as enunciated in the* relevant *provisions of the latest ITU-R Radio Regulations*"

e. Some of the questions in the current consultation paper go beyond the scope of the reference made by DoT and are not in line with the mandate of the DoT reference on this subject.

f. The reference and letter from DoT clearly state that **"auction is the method of assignment"** envisaged by DoT and that TRAI was requested to provide its recommendations only with respect to auction.

g. There was no mention of administrative assignment in the DoT reference. Therefore, it is surprising to see several questions in the consultation paper (numbers 15, 16, 19, 33, and 38) that present administrative means as a method of assignment.

h. Therefore, in our view, these questions based on administrative assignment **go beyond the scope of the DoT reference and should be reconsidered.**

i. Notwithstanding the above, in our responses to earlier questions, we have already justified why auctions are only plausible way to assign satellite spectrum for commercial services and why it cannot and should not be assigned on an administrative basis.

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

RJIL Response:

1. Since space-based communication services cannot be restricted to circle boundaries, it is suggested that the spectrum for user links (NULinks and GULinks) be auctioned on a Pan India basis.

2. Further, the auction of spectrum for Gateway i.e. Feeder Link should be done on the basis of Gateway exclusion Zone (GEA) as explain in previous sections.

3. For spectrum bands which are suitable for use between NGSO user links and IMT, the auction should be done on pan India basis with flexible use.

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.

RJIL Response:

1. **Communication Access Services:** such as GMPCS, VSAT, NLD, ILD, ISP, DSNG etc., the auction should be done on pan India basis.

2. **Broadcasting Services:** Since it is a one way service in a separate designated band (BSS Band), the auction for DTH should be conducted separately.

3. **Carrier Services:** For carrier services like HITS, IFMC, and Teleport, it is recommended to conduct a dedicated auction for backhaul links. The auction design can follow a similar approach to the access spectrum, where backhaul links are treated as user links in terms of spectrum assignment. Alternatively, the backhaul links can be treated as gateway links. In both scenarios, the methodology proposed in response to Q5 can be applied to ensure a fair and efficient allocation of spectrum for backhaul links.

4. Allowing flexible use of spectrum for both terrestrial and satellite networks will aid in determining the true market value of the spectrum in auction.

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.

&

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.

RJIL Response:

1. Gateways in satellite systems serve as feeder links that handle aggregated traffic from user terminals. Consequently, gateways require a far greater amount of spectrum compared to user terminals.

2. We have explained the detailed methodology of auction in response to Q5.

3. It is also clarified on why such spectrum shall not be assigned on an administrative basis, which is nothing but the "first Come First Serve" approach that has been junked by Hon'ble Supreme Court.

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.

RJIL Response:

1. The auction of satellite spectrum should be combined with the auction of terrestrial spectrum and conducted on a yearly basis. This approach offers several advantages. Firstly, a combined auction provides bidders with the flexibility to select spectrum bands that best suit their business requirements, allowing for versatile use across various services. Secondly, it streamlines the auction process by consolidating spectrum offerings and simplifying the bidding process. Lastly, conducting auctions on a regular basis ensures regular opportunities for service providers to acquire spectrum and facilitates the dynamic allocation of spectrum resources in line with evolving market needs and technological advancements.

2. Validity period of spectrum assignment should be 20 years, and the auction periodicity of one year is ideal to ensure consistent spectrum assignment for new entrants.

3. Each spectrum band has its own value, and any change of spectrum to another band could vitiate the auction process. Therefore, if a service provider wishes to utilize a

different band, they should participate in the yearly auction and purchase spectrum in that particular band.

4. This approach ensures that service providers have the flexibility to change their spectrum holdings annually, without compromising the terms and conditions of the NIA.

5. The surrender policy is already in place for terrestrial spectrum as outlined in the DoT letter no. L-14006/01/2022-NTG dated 15.06.2022. To facilitate requests for change in frequencies in space-based services, the implementation of a spectrum surrender policy with a minimum time frame of 5 years from the original assignment of spectrum is recommended. All spectrum dues post effective surrender date should not be levied. Such a policy would enable service providers to plan for participating in upcoming auctions as per their new frequency requirements. Additionally, service providers may be given the option to trade the spectrum with other service providers based on pro-rated auction discovered price with indexation.

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.

RJIL Response:

1. As explained in response to Q5, spectrum assignment for Gateway and User Links (NULinks and GULinks) should be conducted separately.

2. However, all spectrum assignments shall be done through single SMRA based auction process.

3. Auction design should allow bidders to be deemed as provisional winning bidders only under the following circumstances:-
    a. **Userlink downlink spectrum:** only when minimum uplink spectrum and at least 1 GEZ are also allocated.
    b. **Userlink Uplink spectrum:** only when minimum downlink spectrum and at least 1 GEZ are also allocated.
    c. **GEZ spectrum:** Only when atleast 1 GEZ locations and minimum spectrum in Userlink uplink and downlink are available.
    d. The above will ensure that bidders will only be able to procure the spectrum they bid for once they are able to get the minimum quantum prescribed in each three categories.
    e. The same should applicable to userlinks in both NGSO and GSO i.e. for both NULinks as well as GULinks.

4. **Ranking Mechanism:** The DoT should employ a ranking mechanism to assign spectrum to successful bidders. Under this mechanism, the highest bidder would have the option to choose their preferred spectrum, followed by subsequent bidders in order of their ranking. This approach ensures efficient allocation of spectrum while providing bidders with the opportunity to acquire the spectrum that best aligns with their strategic objectives.

5. Conducting separate assignments for user and gateway links through an auction process will ensure that successful bidders can acquire the spectrum they need for both types of links. This process will also encourage and permit standalone service providers to set up the gateway.

6. As previously mentioned, implementing a spectrum sharing/leasing policy will allow service providers who acquire spectrum in user and gateway links through auction to fulfill the requirements of smaller players and startups in the evolving space sector in India.

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

RJIL Response:

1. Bidders should be granted flexible use of the spectrum put to auction. Therefore, the existing Minimum Net Worth threshold for GMPCS or the Access service authorization under the Unified License (UL) should be maintained as an eligibility condition for bidders. The current minimum net worth and minimum equity requirements for various UL authorizations are presented below for reference:

S.No.	Service	Minimum Equity (Rs Cr)	Minimum Net worth (Rs Cr.)
1	UL (All services)	25	25
2	Access Service (Telecom Circle / Metro Area)	2.5	2.5
3	NLD (National Area)	2.5	2.5
4	ILD (National Area)	2.5	2.5
5	VSAT (National Area)	Nil	Nil
6	GMPCS (National Area)	2.5	2.5

2. **The requirement for an existing agreement with satellite operator(s) should be dispensed with.**

3. In addition, any entity that fulfils the eligibility requirements for obtaining the relevant service license issued by the respective ministries (DoT/MIB), upon providing an undertaking to obtain that license, should be allowed to participate in the auction. The service license should enable the provision of services within the scope of the authorization and in accordance with the conditions specified in the NIA..

4. The aforementioned approach aligns with the established practice observed in current auction processes, and it is recommended that a similar approach be adopted for satellite spectrum auctions. Conducting a combined auction using the same NIA and

terms & conditions for both satellite and terrestrial access services seems most appropriate.

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

RJIL Response:

1. The terms and conditions for both user links and gateway links should facilitate flexible utilization without imposing any service level differentiation. Service providers should be granted permission for inter/intra-operator spectrum sharing, leasing, and trading.

2. The implementation of rollout obligations is essential to ensure the effective utilization of spectrum by service providers within a specified timeframe. The following nationwide rollout obligations must be fulfilled by bidders who acquire spectrum through the auction:-

    a. **Gateway Location**:- The operationalization of the gateway should be completed within three years from the date of obtaining all necessary governmental clearances for its establishment. It is worth noting that certain gateway location approvals, such as in rural & forested areas, may be subject to delays on account of environmental and other clearances. In cases where the service provider requests an extension, the government should have the right to grant a one-year extension on the rollout obligations.

    b. **User Links**:- The assignment of user link spectrum should be based on flexible utilization, allowing for IMT /Satellite/any other service permitted under the UL authorization granted to the bidder. In line with this, the following rollout obligations are proposed:-

	Rollout obligations	
Time Period	**mmWave (terrestrial)**	**For satellite services**

Phase-1 **End of 1st Year**	Commercial launch of services anywhere in the country	Commercial launch of services anywhere in the country
Phase-2: **End of 3rd Year**	Cumulative number of sites to be deployed: Metro: 90 Category A LSAs: 240 Category B LSAs: 150 Category C LSAs: 80	Authority may recommend appropriate number of user terminals to be deployed by the service provider
Phase-3: **End of 5th Year**	Cumulative number of sites to be deployed: Metro: 300 Category A LSAs: 660 Category B LSAs: 460 Category C LSAs: 300	Authority may recommend appropriate number of user terminals to be deployed by the service provider
Time Period	**C-band (terrestrial)**	**For satellite services**
Phase-1 **End of 1st Year**	Commercial launch of services anywhere in the country	Commercial launch of services anywhere in the country
Phase-2: **End of 3rd Year**	Cumulative number of sites to be deployed: Metro: 280 Category A LSAs: 700 Category B LSAs: 460 Category C LSAs: 260	Authority may recommend appropriate number of user terminals to be deployed by the service provider
Phase-3: **End of 5th Year**	Cumulative number of sites to be deployed: Metro: 920 Category A LSAs: 2000 Category B LSAs: 1400 Category C LSAs: 940	Authority may recommend appropriate number of user terminals to be deployed by the service provider

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.

RJIL Response:

1. The **Crossholding conditions outlined in the Unified License should be applicable to satellite communication services**. However, **certain exceptions would be necessary in the crossholding clauses** of the Unified License to facilitate the growth of satellite communications services. These are explained below:

    a. Considering the unique nature of the business and infrastructure involved, the majority of service providers in India will establish partnerships with global satellite companies to offer space-based services to Indian customers. As mentioned in the consultation paper, access service providers will need to collaborate with satellite operators to provide space-based services within the country. **In such partnerships or joint ventures, it may be necessary for them to establish a separate legal entity (distinct from the entity providing terrestrial access services) to provide equity to their partnering satellite operators (in the Satellite Services Licensed entity).**

    b. However, the existing conditions in the Unified License impose restrictions on crossholding if a licensee company holds or acquires access spectrum. These crossholding restrictions also extend to promoters who hold 10% or more equity in the licensee company possessing access spectrum.

    c. Access spectrum held by these entities should not be treated as crossholding prescribed in the Unified License.
        i. To align with the principles of crossholding outlined in the license, the spectrum quantity held by these entities should be considered collectively as a unified spectrum holding for the purpose of fulfilling spectrum cap requirements.
        ii. Furthermore, to facilitate flexible utilization of spectrum without any additional charges, sharing of spectrum between these entities of the same group should be permitted, and such sharing should not be regarded as spectrum leasing or subject to any additional conditions.

2. In light of the aforementioned special requirements for enabling satellite communication services, **crossholding restrictions should be applicable with the exceptions mentioned above.**

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.

RJIL Response:

1. As previously stated, spectrum assigned for user links can be utilized in a flexible manner. Consequently, no significant challenges are anticipated with regard to interference mitigation, as the management of interference would primarily involve intra-operator or group companies. This approach ensures that interference management remains within the purview of the service providers, making it more manageable compared to interference management conducted by the government on a day-to-day basis. .

2. Service providers already perform similar interference management within their terrestrial networks, such as when:
    a. Creating heterogeneous networks comprising micro cells, femto cells, small cells etc.
    b. Sharing terrestrial access spectrum with other terrestrial service providers

3. The same principles of interference management employed in terrestrial networks can be applied to the sharing of satellite spectrum as well.

4. Furthermore, the existing provisions of ITU RR and NFAP 2022 already ensure interference-free operations of both space-based and terrestrial networks (MWA/MWB) using the same frequency range in the same geographical area. Any issues regarding interference management should be addressed through mutual coordination among service providers. It is worth noting that spectrum sharing between satellite and terrestrial (MWA/MWB) systems is already implemented successfully without any interference, further validating the flexible assignment of spectrum between satellite and terrestrial networks.

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.

RJIL Response:

1. Satellite networks can utilize either linear or circular polarization, but not both simultaneously. Generally, most satellites in the Ku band are linearly polarized (vertical and horizontal), while satellites in the Ka band are circularly polarized (Left-Hand Circular Polarization and Right-Hand Circular Polarization). However, the choice of polarization is typically left to the satellite operator, who determines it based on frequency plans and design considerations. Therefore, the assignment of polarization should not be specifically included in the auction process and instead be left to the service provider.

2. Moreover, considering the orthogonality feature of polarization, frequency reuse can be evaluated for spectrum utilization in each frequency band. This allows for the potential reuse of frequencies, enhancing the efficiency of spectrum allocation.

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.

&

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

&

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.

&

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.

RJIL Response:

1. We recommend adopting Model #1, which involves the exclusive assignment of spectrum through an auction with a simultaneous multiple round ascending (SMRA) design. As explained in our response to Question 4, under the exclusive spectrum assignment approach, service providers should have the flexibility to enter into spectrum sharing arrangements to utilize the available capacity within the band. Also direct sharing agreements between service providers are more efficient compared to sharing coordinated by the government. .

2. Model #2, an approach similar to a "first come, first served" criteria for resource allocation, raises concerns regarding administrative bias, arbitrariness, and discrimination.

3. Furthermore, in Model #2, only the right to use the shared spectrum is assigned. However, several issues remain unaddressed, such as determining the priority of usage among service providers, which is a crucial consideration in spectrum sharing arrangements. Since all bidders will claim equal priority and equal capacity over the spectrum by paying the same price, conflicts and litigation are likely to arise, undermining the purpose of auctions. Moreover, as the government assigns the spectrum, it may become entangled in such litigations. **Further, equal priority/equal capacity will lead to inefficient utilization of spectrum as network design and business case of each service provider may be different.**

4. In contrast, in Model #1, if service providers share the spectrum based on their exclusive assignment and through private contracts, any disputes will be limited to the service providers themselves, absolving the government from any liability.

5. We would cite a simple example to explain the above situation. Suppose a hall is assigned to five users, each with equal priority over the entire available space. In such a scenario, the occupants need to divide the space among themselves. However, conflicts may arise among the occupants who desire the same portion of the room due to their equal priority over the entire space. **Option 2 creates a similar situation.**

6. A prudent approach in this case would be to first segment the room into five areas with clear demarcations (i.e., walls) and then assign these different areas to occupants based on transparent criteria. After assignment the spectrum may be allowed to be shared, leased through the private contract between the successful bidders. In this case, disputes are avoided as each occupant has exclusive rights over the area assigned to them. Therefore, spectrum assignment should be on an exclusive basis, with the provision of allowing sharing. If the occupants wish to share the assigned spectrum they may enter into private contractual arrangements.

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?

&

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?

&

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

&

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?

RJIL Response:

1. Any allocation of spectrum to commercial gateway links through administrative means would be legally untenable. Our stance on this matter has been clearly stated in the preface and reiterated in our responses to questions 15 and 16, where concerns regarding the administrative assignment of spectrum have been expressed.

2. Instead, the assignment of gateway spectrum be exclusively conducted through the auction process, adopting Option #2. By implementing this approach, successful bidders will have the necessary spectrum resources to operate their gateways without encountering interference issues. Additionally, the establishment of exclusion zones will further safeguard the operations of these gateways. .

   As mentioned in the response to Q23, WPC should identify a remote geographical area within each bidding unit (i.e., at the district level) and declare them as gateway exclusion zones (GEZ).

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

RJIL Response:

Based on the justification provided under Q-3, 4, 34-36, we do not foresee any issue on assigning spectrum on exclusive basis through auction.

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.

RJIL Response:

We do not support for any administrative assignment for both user & gateway links. We reiterate our submissions in our response to question no. 15 and 16.

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.

&

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

&

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.

&

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.

RJIL Response:

1. We reiterate our submission in response to consultation paper on Auction of Spectrum in frequency bands identified for IMT/5G and submit that relevant factors including the spectrum band, technical efficiency, last discovered market price etc.

2. In determining the valuation of spectrum for user links, considering the auction-discovered prices of spectrum with similar propagation characteristics is a crucial factor. Therefore, when conducting valuation exercises for new spectrum bands, it is important to take into account the auction-determined price of mmWave and C-Band in the July 2022 auction, since it serves as a relevant benchmark.

3. Many of the spectrum valuation methodologies used by the Authority in past exercises remain relevant. However, these methodologies need to be updated and that their outcomes should be **rationalized with costs associated with building satellite-based communication networks with higher frequency bands, revenue growth potential, and national proliferation goals, among others.**

4. It is therefore recommended that the spectrum valuation of new bands being put up for auction should not solely rely on past auction prices. Instead, it should consider several factors, including the relative costs of laying a network with new spectrum, the cost for comprehensive coverage, and interference loss in the chosen band plan.

5. **For gateway links, the valuation or reserve price can be based on the present administrative fee paid by service provider who is operating the gateway on link-by-link basis. These figures may kindly be obtained from DoT or calculated from the formulas.**

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.

&

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.

&

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.

RJIL Response:

1. The Authority has extensive experience in valuing different spectrum bands for auction, and it has employed a wide range of methods to derive spectrum valuations. All the models that the Authority has adopted for IMT/5G auctions can also be used for the valuation of space-based communication spectrum bands.

2. The Authority has appropriately employed international benchmarking in the past when there was insufficient data available for new spectrum bands being auctioned. This remains a critical parameter for determining the relative value of spectrum, particularly when the band is being auctioned for the first time, and not much data is available for other methods of spectrum valuation. If the Authority plans to consider the administrative price charged for spectrum bands internationally, such prices should be considered only after keeping in view of Indian market realities.

3. Normalization techniques may not be particularly relevant for new technologies and new spectrum being put up for auction. Parameters such as the average valuation, in the case of multiple international pricing exercises, may be relevant, but the critical factors remain the salability of a band and the price elasticity in the market for optimum valuation through auction.

4. However, it is unnecessary to compulsorily use multiple valuation techniques, and if a single valuation approach for a particular spectrum band can deliver an appropriate value of that band, the Authority should not hesitate to adopt it.

5. The average valuation of multiple valuation methodologies can be too simplistic an approach if the valuations are widely disparate, and if one methodology appears to be the most appropriate from all perspectives, it should be preferred over others.

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.

&

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?

RJIL Response:

1. In comparison to other countries, the telecom market in India possesses distinctive characteristics, including a remarkably high population density of 434 people per square kilometer and a substantial wireless subscriber base of 1,141 million. However, it is noteworthy that India's monthly ARPU stands among the lowest globally at Rs. 137.

2. Consequently, it is inappropriate to consider international administrative spectrum charges/fees as the basis without considering the market realities of Indian telecom sector. Instead, the discovery of market prices through a transparent auction process is most appropriate. This approach ensures a fair and competitive environment where the market can determine the true valuation of spectrum resources.

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

&

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

RJIL Response:

The current administrative charge, which governs the utilization of spectrum by gateways, should serve as the basis for valuing the spectrum pertaining to gateway links.

Q50. Whether the value arrived at by using any single valuation approach for a particular spectrum band should be taken as the appropriate value of that band? If yes, please suggest which single approach/ method should be used. Please support your answer with detailed justification.

&

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

RJIL Response:

The average valuation (simple mean) of valuations obtained through different approaches should be considered for arriving at the valuation of a particular spectrum band, especially when the valuations are relatively clustered together. However, in cases where there is vast disparity in the valuations obtained through each methodology, the Authority can attempt to eliminate any discrepancies and then select the most appropriate valuation approach for determining the optimum valuation of the spectrum band.

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.

RJIL Response:

The reserve price for user link and gateway link should be set at 50% of the spectrum valuation. This approach would allow for the free play of competitive market forces and facilitate the discovery of the real market value of the spectrum.

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.

RJIL Response:

The reserve price for each spectrum band should be determined without any service level differentiation. Since we propose flexible use of assigned spectrum, allowing bidders to utilize it for any service, we advocate for a combined auction that encompasses both satellite and terrestrial use. As previously stated in the response to Q51, considering the simple mean of different valuation approaches to determine the reserve price is recommended.

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.

RJIL Response:

1. The auction payment methodology in the country is well-established for terrestrial auction, and there is no need for any fundamental changes. The Authority should provide a moratorium of approximately 5 years on installment payments at a reasonable interest rate. This will help mitigate the financial burden on successful bidders who would need to make massive efforts to establish the network and monetize the spectrum.

2. The Union Cabinet's liberalizing approach should be reflected in the auction payment methodology for TSPs' dues. The deferred payment scheme ought to be viewed as a financing mechanism for building essential national infrastructure, rather than a monetization option. Given that the spectrum bands being auctioned are being offered for the first time and the current ecosystem status, TSPs may require some time to achieve optimal coverage. A 10% upfront payment requirement to ensure TSP commitment, followed by a 5-year moratorium on payments is recommended. The remaining balance should be distributed over the remaining years of spectrum validity. This approach not only supports TSPs in expediting roll-out but also encourages auction participation. It is further proposed that this deferred payment formula should be uniformly applied to all spectrum bands being auctioned.