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#### A. PREAMBLE

#### OVERVIEW

1. **The Indian Space Association (ISpA)** is an apex, non-profit industry body exclusively working towards the successful exploration, collaboration, and development of the private and public Space Industry in India.

2. We thank **TRAI** for coming out with the consultation paper (“CP”) on **Assignment of Spectrum for Space-based Communication Services**. This is indeed very timely given that the Department of Space has recently published the **Indian Space Policy 2023**. This long-awaited policy provides impetus to all Space-related commercial activities, especially Space Communications. We appreciate the opportunity to present further aspects to TRAI which will help contribute to achieving a robust decision regarding the most appropriate methodology for the allocation of spectrum for satellite services.

3. **Digital Connectivity** is a key pillar of the Hon'ble PM's Digital India vision. Today, Satellite-based broadband offers universal connectivity solutions to long-standing challenges, some of which would include reaching inaccessible rural as well as topographically-challenged and disaster-prone regions. Given the strategic reach & socio-economic impact, space-based communication technologies need to be strongly supported as well as fully leveraged through a conducive regulatory framework. Also these efforts should focus on protecting the interests of consumers as well as the industry and, ultimately, help in the economic growth of India.

4. **India's National Digital Communications Policy (NDCP)** envisages better connectivity and access to technology for Digital India. Space based communication such as satellite broadband connectivity would contribute significantly for providing satellite connectivity services for national development and public utilization. We therefore request the Government and the Regulatory Authorities to work closely with industry, with a goal of creating a growth-oriented policy framework to propel India's space economy. This approach would be decisive for achieving the announced goals laid down by the **Hon'ble Prime Minister for digital connectivity** through provision of high-speed internet to every village in the country and thus having significant importance in meeting India's obligations to connect 1.5 billion individuals within the next two years through the government-led initiatives of **BharatNet and PM WANI projects**.

### **SATELLITE INDUSTRY TO BRIDGE THE DIGITAL DIVIDE IN INDIA**

5. **We agree that the satellite industry is best positioned to guarantee ubiquitous connectivity to users in India**, who currently lack essential access to fast and reliable high-speed broadband networks. The satellite industry is ready and willing to invest and contribute for bridging the digital divide in the country.

6. **Any step towards auction of the spectrum for satellite services will represent a retrograde step away from fulfilling these objectives**. The features of satellite spectrum make them unsuitable for an auction process.

7. In the consultation paper issued by TRAI, the Department of Telecommunication's directions propose that the allocation of spectrum for space-based communication services be through the method of auction. This **presumption that auction be the method of assignment brings about concerns and bias in the consultation process, as it only wishes to explore and establish a mechanism for assigning satellite spectrum**.

8. Hence, we humbly submit that " ***TRAI, with the authority bestowed on it by the Government of India, needs to have a larger, wider, and comprehensive outlook, keeping in mind global practices of spectrum assignment as well as the technical challenges of auctioning. We are sanguine that TRAI, with a more open-minded study of the multidimensional complexities of spectrum usage in space, will allocate it by administrative methods to help the nascent space industry to grow and be globally competitive.***"

9. It is necessary to flag that the approach of auctioning of spectrum for satellite services has not been adopted by the majority of the countries worldwide (no country has auctioned the spectrum for satellite services in isolation without the corresponding orbital resources it requires, as this approach has not been found to be feasible), and has – in fact – been abandoned by the few countries that have initially considered this approach.

10. Satellite communication apart from playing a crucial role in bridging the digital divide by reaching **underserved and unserved areas** also plays a pivotal role in facilitating disaster response, supporting maritime operations, and meeting the communication needs of defense organizations. Hence, for the assignment of spectrum in space-based communications, it is crucial to align with the vision outlined in the **Indian Space Policy 2023, which places a strong emphasis on encouraging private sector participation, particularly startups.**

11. **Access to low-cost spectrum is a fundamental requirement** for the burgeoning space industry and the overall economy in the long term. It serves as a catalyst for the development of innovative solutions and the delivery of cost-effective services. Recognizing the significance of affordable spectrum resources, all space related associations and Government bodies such as IN-SPACe who are responsible for the growth, promotion and regulation of space sector have consistently advocated for the administrative assignment of spectrum.

12. The call for administrative assignment is driven by the intention to establish an enabling environment that nurtures the growth of the national space industry. Thus, we submit that an **administrative approach** to spectrum assignment would **better serve the industry's needs, foster healthy competition, and ensure a level playing field for all stakeholders involved.**

13. Satellite based communication services share spectrum across many services like satellite-broadband, Direct-to-Home television, captive satellite networks, and Governmental use including defence networks, however, there are several other space applications that need the spectrum including

telemetry, Remote Sensing Data transfer & PNT signals. Additionally, extensive research is currently being conducted on space-based technology and its various applications. As a result, new industrial applications and use-cases are expected to emerge in the future, all of which will require access to spectrum.

14. Satellite networks are often able to serve areas where it does not make economic sense to serve with terrestrial alternatives. This is particularly evident in scenarios where **terrestrial alternatives are economically unfeasible**. Without sufficient access to the spectrum required for their operations, satellite operators would face significant challenges in delivering these essential services. Satellite spectrum would play a crucial role in enabling these diverse applications and services. For e.g., in **tele-health and education**, satellite connectivity allows remote patients to access tele-medicine services and students in underserved areas to participate in virtual classrooms. Start-ups specializing in satellite-based **IoT services rely on satellite networks for innovative solutions like environmental monitoring**. The manufacturing industry depends on satellite communication for efficient supply chain management. Terrestrial mobile operators in remote areas utilize satellite backhaul for mobile coverage. Industries like transportation, energy, and defense heavily rely on satellite communications for real-time tracking, remote infrastructure management, and secure command and control.

15. The world over, administrative allocation is the preferred method for satellite spectrum. Auctions have been attempted in a handful of countries but unsuccessfully. Even in cases where there have been auctions, they have been of orbital slots. The auction of orbital slots done in a few countries should not be confused with the auction of spectrum for satellite services. Countries such as the **United States, Brazil, Mexico, and Thailand** initially attempted to auction satellite orbital slots along with spectrum but ultimately **transitioned to administrative methods due to the shortcomings and limitations of auctions**. The United States even enacted legislation to oppose competitive bidding for spectrum used in satellite systems. These global experiences demonstrate that administrative assignment aligns with international best practices and ensures efficient utilization of spectrum resources.

16. In view of the above, we present the technical, economical and public interest aspects that would help elucidate why auctioning spectrum for satellite services will not be a prudent decision.

## **KEY ARGUMENTS AGAINST AUCTIONING SPECTRUM FOR SATELLITE-BASED COMMUNICATION**

### **A. Non-Exclusivity Of Satellite Spectrum And Geo-Strategic Challenges**

17. Satellite spectrum, being a shared resource, cannot be effectively auctioned due to its non-exclusivity. The nature of satellite spectrum precludes it from being exclusively assigned, which is a fundamental requirement for an auctionable resource. **Auctions are typically suited for discrete and unique products that can be sold individually, whereas satellite spectrum does not meet this criterion.**

18. Assignment of spectrum and orbitals are done in combination isolating one from other would not be possible. To illustrate this concept, one can consider **orbital resources as plots of land and satellite spectrum as the road used to access these plots.** Plots of land can be auctioned along with the right-to-use roads, as they can be treated as discrete entities. However, **roads in isolation cannot be auctioned, as their usage is not exclusive and blocking access would hinder the rights of plot owners and users.**

19. Moreover, auctioning satellite spectrum can have adverse implications for international competitive advantage. Satellite spectrum, along with orbital resources, plays a crucial role in facilitating services beyond national borders. If India were to auction its satellite spectrum, other countries would likely reciprocate by imposing similar measures on Indian service providers. This reciprocal action could have detrimental effects on Indian interests and hinder the ability of Indian service providers to offer seamless coverage in other countries, as outlined in the new space policy.

20. Instead, **administrative assignment of spectrum** should be applied, this effectively manages the shared nature of satellite spectrum and ensure equitable access for all stakeholders. By adopting a comprehensive and inclusive approach, the assignment of satellite spectrum can be optimized to promote international cooperation, preserve competitive advantage, and enable the realization of the goals outlined in the new space policy.

### **B. Exclusive Assignment Of Satellite Spectrum Leads To Fragmentation Of Spectrum & Restricts New Players**

21. The exclusive assignment of satellite spectrum can have negative impacts on its utilization and overall value. By fragmenting the use of the spectrum, exclusive assignments **limit the opportunities for multiple**

**operators** to efficiently utilize the available resources. This **fragmentation reduces** the overall usage and value of the spectrum, hindering its **potential benefits** for various applications and services. Spectrum assignment by auction to satellite services in the C/Ku/Ka band would lead to unnecessary spectrum segmentation and may even promote uncompetitive practices like spectrum hoarding or blocking. This will limit the available service capacity of satellites and will also defeat the business case for Space-based Communications.

22. Furthermore, exclusive assignments can **restrict** the entry of **startups and new players** into the satellite industry. Startups often face challenges in acquiring exclusive spectrum rights due to the high costs and limited availability. This exclusivity barrier prevents startups from fully participating in the industry and limits the potential for innovation and disruptive technologies that they can bring.

23. In addition, exclusive assignments of satellite spectrum can **deprive the country** of the advantages brought by satellite operators. These operators possess extensive experience, advanced technologies, and large capacities, which contribute significantly to the growth and development of the industry. Restricting their access to spectrum through exclusive assignments may **impede the potential for collaboration, knowledge transfer, and innovation within the industry.**

### **C. Absence Of Successful Auction Models For Satellite Spectrum: A Global Practice**

24. Globally, there is **no auction model for satellite spectrum**. The **standard practice** is to **assign** spectrum **administratively** and without exclusivity. An administrative system of assignment promotes principled industry practices and global coordination to ensure maximization of spectrum utility and continuity of service. Internationally, the assignment of satellite spectrum through auctions in the microwave/mmWave bands is not a common practice. Various administrations have recognized the challenges and limitations associated with auctioning satellite spectrum and have adopted alternative approaches.

25. The **United States**, for instance, took a proactive step by enacting the **Orbit Act in 2000**, which specifically prohibits the auctioning of orbital resources along with spectrum. **SEC. 647. SATELLITE AUCTIONS.** ***“Notwithstanding any other provision of law, the Commission shall not have the authority to assign by competitive bidding orbital locations or spectrum used for the provision of international or global satellite communications services. The President shall oppose in the International Telecommunication Union and in other bilateral and***



***multilateral fora any assignment by competitive bidding of orbital locations or spectrum used for the provision of such services.”***

26. This legislative measure highlights the recognition of the unique nature of satellite resources and the need for administrative assignment method that ensures equitable access and utilization.

27. The Telecom Regulatory Authority of India (TRAI) consultation paper also acknowledges the global trends towards administrative assignment. It cites examples such as the United States, Thailand, Mexico, and Brazil, which initially attempted to auction frequencies for satellite usage but ultimately did not succeed. These countries eventually resorted to administrative licensing as a more viable and effective approach. Countries worldwide have recognized the shared nature of microwave/millimeter-wave satellite spectrum and have successfully implemented administrative assignment models.

28. Attempts to create exclusivity by auctioning orbital resources have been met with challenges. Governments soon realized that they can only auction orbital resources that belong to their own country and not those belonging to other countries.

29. By adopting administrative assignment, countries can create a regulatory framework that promotes fair sharing of satellite spectrum, encourages participation from multiple users, and facilitates the growth and development of the satellite sector. This approach aligns with global best practices and provides valuable lessons for countries considering the allocation of microwave/millimeter-wave satellite spectrum.

#### **D. Technical Complexities And Considerations For Satellite Spectrum Assignment**

30. The **technical complexity** of satellite systems poses significant challenges when designing an auction that effectively addresses the needs of all stakeholders. Satellite auctions must consider various technical factors, including **orbital slots, interference management, and spectrum sharing among multiple users**.

31. **Orbital slots are valuable resources** that need to be carefully assigned to ensure efficient satellite operations. For example, **Brazil (Law No. 9,472 of July 16, 1997)** has in the past auctioned satellite orbital resources along with the associated spectrum resources, and decided to **abandon the auction process and switch to an administrative assignment** mechanism. (Art. 172 of Law No. 13,879 of October 3, 2019). Similarly, **Mexico** experimented with auctions of orbital slots and the associated spectrum resource, and

**discontinued this approach** in 2014 after it proved to be unsuccessful. In 2021, the National Broadcasting and Telecommunications Commission (NBTC) of **Thailand** conducted an auction for five orbital slots in the year 2022 and only three slots were taken by two bidders.

32. Different national administrations, including India, file with the ITU for satellite systems, and these filings are accorded a priority based on the ‘first-come-first-served’ principle. The ITU rules and recommendations set forth the terms on which satellite and other operators share spectrum efficiently. Considering the technical complexities associated with satellite systems, an administrative assignment approach provides flexibility and enables tailored solutions that address the unique requirements of satellite operations. By carefully considering the technical intricacies and adopting a balanced approach, policymakers can ensure that the administrative assignment of satellite spectrum promotes diversity, innovation, and the efficient use of resources.

33. Interference management is another critical consideration in satellite communications. Spectrum sharing among multiple users requires sophisticated coordination and technical solutions to mitigate interference and ensure reliable and high-quality services. However, with exclusive assignment this process will become far more complicated.

#### **E. Cost Challenges: A Competitive Disadvantage**

34. Auctioning spectrum for space-based communications can create **challenges for smaller satellite operators** and potentially put them at a **competitive disadvantage** in the market. This disadvantage stems from the fact that larger, more established operators may have greater financial resources and bidding power, making it difficult for smaller players, including startups, to successfully participate and **acquire** the necessary **spectrum**.

35. The participation of smaller satellite operators is crucial for fostering **competition, driving innovation, and promoting the overall growth** of the nascent space industry. These new players often bring fresh ideas, technological advancements, and disruptive business models that can reshape the industry and contribute to its expansion.

36. By adopting an auction-based approach, there is a risk of limiting the entry of smaller operators into the market. This restriction can hinder their ability to acquire the spectrum needed to provide services and compete effectively with larger players. As a result, the growth potential of the nascent space industry, particularly for new players, may be significantly hampered.



37. To create a level playing field and promote the growth of the space industry, it is important to consider alternative approaches that facilitate the participation of smaller operators. By ensuring a fair and accessible assignment of spectrum, policymakers can support the growth and development of the growing space industry in India. This, in turn, will drive innovation, create opportunities for startups, and strengthen the country's position in the global satellite market.

#### **F. Assignment Of Spectrum & Its Socio-Economic Impact**

38. The assignment of satellite spectrum can have implications for socio-economic welfare and the digital divide. Government policies often have specific objectives related to the use of satellite spectrum, such as promoting rural connectivity, bridging the digital divide, and ensuring national security. However, in a **commercial auction scenario, the primary focus is on maximizing revenue generation**, which may not align perfectly with the broader socio-economic objectives. This misalignment can create challenges in balancing the competing interests of commercial objectives and public policy goals.

39. Furthermore, the auction process will **not** necessarily **guarantee** that the spectrum will be allocated in a manner that addresses specific policy objectives, such as **connecting rural or underserved areas**. Auction outcomes are **driven by market forces**, and there is no inherent requirement for operators to prioritize specific social or economic objectives in their service provision. To overcome these challenges, it is essential for governments to carefully consider the potential impacts of spectrum assignment on socio-economic welfare and the digital divide.

#### **G. Auctioning will Distort Utility**

40. Auctioning spectrum for satellite services will impose an **artificial restriction on the effective sharing mechanism** that is the norm in the satellite industry. Satellite technology allows multiple satellite operators to share the same spectrum, and interference among different networks can be resolved effectively through well-tested frequency coordination mechanisms. **Non-exclusive use of spectrum by satellite communications providers promotes spectral efficiency** and the availability of satellite communications for the benefit of users throughout the coverage area. On the contrary, an auction will unequivocally result in a fragmentation of available spectrum and limit the number of operators that can potentially offer much needed connectivity.

41. In addition, auctioning spectrum used for satellite services would grant those entities capable of bidding the highest exclusivity over that spectrum, thereby blocking other potential users and artificially limiting competition to only a few players. Auctions can also result in higher prices for customers, as winning bidders pass through their spectrum acquisition costs. Moreover, **auctioning the spectrum could distort the utility** of satellite spectrum. When a frequency is initially auctioned and later shared, bidders may lack motivation to bid higher since they know they will ultimately have to share it with other players.

42. Additionally, if a foreign player acquires a frequency that is crucial for their services worldwide, it may restrict their ability to provide services within our country. This denial of services occurs because the foreign player who has obtained permission for that frequency in their own country, and acquiring it from them or through an auction may not be feasible. As constellations in lower orbits are international, they need not necessarily originate from India. This raises questions about the method of charging for satellite spectrum, and we believe that **auctions are not the ideal price discovery mechanism**. Auctions do not protect small bidders from monopolies and tend to increase the spectrum's price, which may deter new players from entering the market.

### **ISSUE OF FLEXI USE OF SPECTRUM IN 28 GHZ BAND**

43. The **28 GHz band** is part of the Ka band (27.5-40 GHz) which is used by the satellite industry. This band has been used for satellite communications around the world, specifically **earth to space transmission**, as has been **recognised by the World Radio Congress-2019 (WRC-19)**. In the year, WRC-19 allocated more than 17 GHz of spectrum for 5G services but **28 GHz was not identified for 5G use**.

44. Countries that allocated 28 GHz for 5G services without an ITU resolution did so prior to the WRC 2019. Since then, countries worldwide have made the deliberate decision to prioritize the entirety of the 28 GHz band (27.5 - 29.5 GHz) for the **exclusive use of satellite services**, rather than splitting it with 5G services. This approach is justified because 5G technology already has numerous alternative frequency bands and ample spectrum available. In order **to fully capitalize on the economic advantages** and ensure nationwide coverage of satellite-powered broadband, several regions have taken measures to safeguard the band 27.5 - 29.5 GHz for ongoing use specifically by satellite broadband. These regions include the entire European Union, the majority of countries in the Americas, Africa, the Middle East, China, Australia, and an increasing number of countries in the Association of Southeast Asian Nations (ASEAN).

45. Also, deployments in the 28 GHz have been sub-par and mobile operators in countries where this spectrum has been allocated for 5G services have failed to meet the rollout obligations. Countries such as **South Korea** have **cancelled 28 GHz allocations to 5G**. **Thailand** was actively deliberating the use of 28 GHz for 5G, now has allocated the **entire 28 GHz for satellite use**.

46. To fully support the satellite industry and harness its potential, it is imperative to **grant unrestricted access to the entire 28 GHz frequency range (27.5-30 GHz)**. Attempting to repurpose the 28 GHz frequency band, which the ITU has already designated for satellite use, would **compromise the timing, quality, and affordability of last-mile connectivity, particularly for underserved and unserved populations**.

47. The use of **5G handsets and devices** with **omnidirectional antennas** makes it **difficult to share spectrum with satellite usage**. Satellite use cases, on the other hand, use directional antennas, which allows efficient sharing of spectrum. This is because omnidirectional antennas emit radio waves in all directions, while directional antennas emit radio waves in a specific direction. This difference in antenna design makes it difficult for 5G handsets and devices to share spectrum with satellites, as they may interfere with each other's signals. For example, if a 5G handset is trying to use the 28 GHz spectrum, and a satellite is also trying to use the same spectrum, the two signals may interfere with each other. This interference can cause **dropped calls, slow data speeds, and other problems**.

48. Flexible use of spectrum would place severe constraints on the use of spectrum on either or both of the services, which is undesirable. This is because flexible use of spectrum would require 5G handsets and devices to be able to switch between omnidirectional and directional antennas, which would be costly and difficult to implement. Additionally, flexible use of spectrum would require satellites to be able to share spectrum with 5G handsets and devices, which would also be costly and difficult to implement.

49. The **26 GHz allocation for 5G** by the Department of Telecommunications (DoT) has **not been exploited** by telecommunication service providers (TSPs). This is because the business case for deploying 5G base stations in the 26 GHz spectrum is very fragile. The 26 GHz spectrum is a millimeter wave spectrum, which means that it has a very short wavelength. This makes it difficult to penetrate buildings and other obstacles, which limits the range of 5G signals. Additionally, the 26 GHz spectrum is a very high frequency spectrum, which means that it requires a large number of base stations to be deployed in order to provide adequate coverage. This makes the cost of deploying 5G base stations in the 26 GHz spectrum very high.

50. The Telecom Regulatory Authority of India (TRAI) recommended in the case of 5G auctions that a portion of 28 GHz (27.5-28.5 GHz) be allocated to IMT in addition to 26 GHz (for 5G). However, this recommendation would place severe constraints on satellite usage as it limits the ubiquitous deployment of satellite user terminals in this band, which restricts user terminals from being deployed in remote/rural areas. This is because the 28 GHz spectrum is also a millimeter wave spectrum, which has the same limitations as the 26 GHz spectrum.

### **AUCTION OF SATELLITE SPECTRUM NOT MANDATED BY THE PRESIDENTIAL REFERENCE JUDGEMENT**

51. In the **2G Judgment**, the Supreme Court was asked to consider if specific assignments of spectrum for 2G should have been allocated on a first-come-first-served basis. The Supreme Court determined that these should have instead been auctioned. To avoid any confusion, especially on the issue of distribution methods of these types of resources, the then President of India sought clarity from the Supreme Court on the scope and applicability of the 2G Judgment. ***-In paragraph 78 of the Presidential Reference judgment, the Supreme Court clarified that “[o]ur reading of these paragraphs suggests that the Court was not considering the case of auction in general, but specifically evaluating the validity of those methods adopted in the distribution of spectrum from September 2007 to March 2008.”*** The decision in the Presidential Reference confirms that the findings of the **2G Judgment regarding auctions should not apply to the allocation of satellite spectrum.**

52. The factual context of the 2G Judgment must also be considered. When deciding whether a first-come first-served process was appropriate for the assignment of 2G spectrum, the Supreme Court assumed that terrestrial telecom providers would have exclusive rights to use a particular frequency band. Thus, the Supreme Court found that the first-come-first-served policy unfairly excluded other players from accessing spectrum. The Supreme Court also considered whether auctions would help meet the government’s objective of revenue maximization.

53. These considerations are inapplicable to the question of how to assign spectrum for satellite communications services. First, unlike spectrum for terrestrial services, spectrum for satellite communications can be shared amongst multiple operators, subject to certain conditions. There are no exclusive rights to use the spectrum or resultant exclusion of other operators. Satellite systems operate in frequency bands allocated internationally by the ITU and then reflected in domestic Tables of Frequency Allocations. In Article 9 of the Radio Regulations, the ITU lays out conditions for the sharing of satellite spectrum, which are aimed at managing potentially overlapping uses

to avoid harmful interference among systems. As the TRAI notes, spectrum in C-band, Ku-band, and Ka-band can be assigned to, and be shared among, different satellite communications service providers in the same geographical area. However, unlike satellite communications, terrestrial telecommunications providers require exclusive access to spectrum bands to be able to roll-out their services effectively and recoup their investment.

54. Second, the policy objective for the assignment of spectrum for satellite communications is also different, focusing on connecting underserved areas of the country as opposed to revenue maximization. The business model of satellite communications providers is distinct from that of terrestrial wireless telecommunications companies, including in terms of infrastructure costs and coverage areas. Thus, while satellite communications providers can serve remote and underserved areas without additional outlays of capital that would not be supported by subscription fees or other such revenue, terrestrial wireless operators focus instead on densely populated areas with larger customer bases, lower infrastructure costs per user and, generally, higher ARPUs.

55. These factual differences are critical, and further support our contention that the preference for auctions established in the 2G Judgment should not apply to spectrum allocations for satellite services. In its reference dated 13 September 2021, the DoT equates the usage of spectrum for satellite communications services to that of terrestrial wireless telecommunications services. However, as discussed herein, satellite spectrum is intrinsically different than terrestrial wireless spectrum. Treating them both the same by applying the same allocation methodology would be inequitable, akin to treating unequals equally.

56. Finally, additional precedent confirms that the Government can consider various methods of spectrum allocations, including administrative assignments, and is not limited by the findings in the 2G Judgment. Several Supreme Court judgments direct the Government to conduct periodic evaluations of existing distribution modes so that natural resources are allocated for optimum utilization. At the same time, the Supreme Court has held that the Government cannot make long-lasting rules on resource allocations that restrict utilization to address only current needs. To the extent that the Supreme Court of India has considered spectrum is akin to a natural resource, ISpA submits that this precedent confirms that the Government, having the necessary technical competence, is empowered and mandated to revisit its existing spectrum distribution mechanisms so that maximum utility can be derived from satellite communications. To do that, it can consider different methods of spectrum allocation, including administrative assignments.

## CONCLUSION

57. By adopting an **administrative assignment** framework, the space industry would benefit from the flexibility and adaptability required to meet its diverse requirements, including those of startups. Such an approach provides a level of **certainty, security and predictability** to the developing nascent Indian private space industry which can be highly beneficial for country as a whole.

58. As the symbiosis of communications landscape continues to evolve, it will be important for policymakers to consider a range of approaches to spectrum allocation, with administrative assignment being a **viable and effective option** in many cases would facilitate affordable access to spectrum resources, thus enabling startups to enter the market and drive innovation. This, in turn, would stimulate economic development within the space sector.

59. In essence, the plea for the administrative assignment of spectrum for space-based communications stems from the understanding that it is a vital prerequisite for the growth of the space industry. Moreover, it aligns with the objective of promoting private sector participation and effectively realizes the **goals outlined in the Indian Space Policy 2023**. This perspective underscores the significance of ensuring low-cost spectrum access and acknowledges the pivotal role played by startups in fueling innovation and driving economic advancement within the space sector.

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## B. RESPONSES TO ISSUES FOR CONSULTATION

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

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

The following are some of the most common satellite bands used for satcom:

BAND	APPLICATION	USE-CASES	SATELLITE FOOTPRINT
L Band  (1-2 GHz)	Mobile satellite services	- Remote areas connectivity- Maritime and aeronautical communications	Global coverage
S-Band  (2-4 GHz)	Mobile satellite services	- Land mobile communications- Broadcast services	Regional coverage
C Band  (3-4 GHz)	Fixed and mobile satellite services	- Television broadcasting- Telecommunication services	Regional coverage
C-band Extended  (4-8 GHz)	Fixed satellite services	- Data transmission, Telecommunication services	Regional coverage
Ku-band	Broadband services	- Direct-to-Home (DTH) television, Internet access	Spot beam coverage

(12–18 GHz)			
BSS Band	Broadcasting satellite services	- Direct Broadcast Satellite (DBS) television- Radio services	Spot beam coverage
Ka (26–40 GHz)band	Broadband services	- High-speed internet access- Earth observation	Spot beam coverage

**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.**

**ISpA's Response:** The quantum of spectrum required for gateway links and user links depends on the number of gateway earth stations & the type of services provided along with the number of users, the type of services (remote sensing, earth observation, weather forecasting, navigation, satellite television, broadband internet, and many others. ) provided, and the required bandwidth per user respectively . Typically, gateway links require larger bandwidths than user links due to the aggregation of traffic from multiple users. The demand for spectrum may vary depending on the type of satellite system, such as LEO, MEO, or GEO. Furthermore, the demand for gateway spectrum may vary depending on the type of service provided, such as broadband, broadcast, narrowband or backhaul.

Present LEO satellite constellations require access to the entire range of Ku and Ka-bands for seamless services. Partial access could severely impact end-to-end connectivity, network performance and user experience. Hence full spectrum on sharable basis should be made available. In turn, different frequency bands and services have different characteristics that make them suitable for specific types of applications. For example, higher frequency bands, such as Ku-band, Ka-band and Q/V band frequencies, are ideal for broadband satellite communications because they offer high data rates, while lower frequency bands, such as L-band and S-band frequencies, are better suited for navigation and remote sensing applications because they penetrate through clouds and other objects. Segregating the satellite frequency based on services segregations and usages is not a practical exercise and will prove to be further challenging.

The demand for spectrum will only increase with the growing use of satellite-based services, so the availability of the maximum amount of spectrum possible can help meet this demand and ensure its efficient use while avoiding interference.

**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.**

**ISpA's Response:** This should be governed under ITU Coordination rules under which it is possible to share spectrum among various satellite systems (GSO and NGSO). The exact limit on the number of NGSO systems that can operate on an equitable basis will depend on various factors such as the frequency bands used, the satellite orbits, the power levels, the antenna beam widths, and the degree of frequency coordination among the various systems, among others. We submit that such theoretical limitation is not a determinant for the assessment the TRAI conducts in its Consultation Paper, as the frequency coordination among NGSO systems is typically conducted to avoid interference and to ensure efficient use of limited spectrum resources. ISpA is of the view that compliance with the ITU Radio Regulations provides a well-understood framework for NGSO satellite operators to coordinate their operations along the above lines. However, it is possible to explore solutions that can enable efficient use of the limited spectrum resource, for example, by using code separation, interference cancellation techniques, or power control techniques to mitigate interference and allow sharing of the same frequency band among multiple Mobile-Satellite Service (MSS) systems.

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

**ISpA's Response:** Globally, satellite spectrum is allocated on non-exclusive basis since Satcom systems reuse the same spectrum to serve multiple countries at the same time. Thus, spectrum for space-based communication services in higher bands, such as C band, Ku band and Ka band, should not be assigned to licensees on an exclusive basis.

In case of satellite-based communications, the same spectrum can be used by multiple users and that is how it is assigned globally thereby enhancing its utility, which will be taken away in an auction-based scenario or in case of exclusive assignment. There are no examples where spectrum for satellite services is assigned on non-exclusive basis but through auction, since auction inherently means it comes with exclusivity.

Spectrum usage can vary depending on Type of Link. User Terminals (UTs) require nationwide coverage, while Earth Stations require access for specific locations. It is important that a Sat-com operator has the flexibility to tailor their services based on uplink/downlink requirements.

Satellite spectrum is shared by Fixed Satellite Service (FSS) and Broadcasting Satellite Service (BSS) sectors to deliver various kinds of services without the need to fragment the spectrum and rendering it unusable for all. As a global practice among satellite operators, common ground is reached through sharing of spectrum and close coordination to prevent interference.

In effect, the same spectrum is shared across many services like satellite-broadband, DTH, VSAT (CUG) and governmental users like Defence, maritime, etc. Grant of exclusive rights in such a scenario would affect a wide range of services.

Sharing of spectrum for satellite services is made possible by the directivity that is provided by antennas deployed in the ground as well on the satellite. In addition, technical aspects such as Polarisation, different modulation, coding schemes aid in spectrum sharing mechanisms.

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

Since satellite spectrum is unhindered by national boundaries, ITU plays a central role in harmonizing spectrum use for various kinds of services and operators, linking the global fraternity of satellite professionals, putting in place coordination protocols and implementing strategies for preventing interference and other redundancy measures.

Satellite systems operate based on frequencies defined by ITU and agreed by member states. Global Satellite Operators are required to file their spectrum

requirements with ITU after which they are registered in the Master International Frequency Register (MIFR). This process is vital due to the long-gestation and development period of satellite systems. Therefore, ITUs role in harmonizing spectrum requirements leads to greater avenue for spectrum sharing among operators.

There are other resources such as orbital resource, satellite constellation, that are also required for providing space-based services, and usage of these other resources in turn depends on the assignment of spectrum. This needs to be taken into account when deciding on the mode of spectrum assignment.

In case of auctions, any enterprise willing a plan to establish a constellation of satellites for providing broadband services in India, would be uncertain about its investments, since it could never get assurance whether it could acquire the same spectrum as required by its satellites. With such uncertainty, no investment can be sought for establishing space assets to provide broadband services due to the increased risk and challenges related to exclusive assignment of spectrum may arise in terms of ensuring efficient use of the assigned spectrum and preventing hoarding.

**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.**

**ISpA's Response:** This question seems to stem from understanding that satellite spectrum should be treated in a manner similar to terrestrial. Concepts such as block size, spectrum cap, intra-band share - which originate from terrestrial mobile spectrum management, are not applicable to

satellite spectrum. But, the principles of allocation of spectrum for Sat-com are inherently different from those that apply to terrestrial communications.

It is difficult to conceive an auction model for satellite spectrum given the requirement of sharing and the issue of fragmentation of spectrum in the case of exclusive assignment thereby rendering a satellite service unable to deliver round-the-clock, end-to-end service at optimal service levels. Concepts such as block size, spectrum cap, and intra-band share, which originate from terrestrial mobile spectrum management, are not applicable to satellite spectrum.

Making an already sharable scarce spectrum exclusive, then auction it and then make it sharable through a regulatory intervention will be an exercise in futility, making an efficient process difficult.

Therefore, we would like to state that the entire frequency band must be assigned on a non-exclusive basis. As outlined in the previous response, spectrum sharing is carefully orchestrated at the ITU-level with coordination between multiple operators. Segmenting the frequency band into portions or blocks as done in terrestrial spectrum auctions, would diminish throughput and data speeds. Fundamentally, this does not reconcile with the core principle of efficient spectrum usage. As explained in the response to Q2, some system design requires access to the full band for providing uninterrupted service.

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

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

**i. 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?**

**ii. 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?**



**iii. 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?**

***ISpA's Response:*** Satellite systems are designed to operate on specific frequencies unlike terrestrial networks that run on spectrum capacities spread across various bands. Satellite Operators are required to register their frequency range through ITU filings. Once the satellite system has been designed to operate in a certain frequency range, it is not possible to swap to different frequencies based on territories that the satellites fly over. Therefore, the role of ITU becomes important to harmonize the approach among member states and for individual member states to honour ITU filings and provide the full range of spectrum band to Operators.

Assigning limited spectrum for satellite services will hinder a satellite operator's ability to serve the market and will defeat the global process of satellite spectrum assignment. The template followed for terrestrial assignment under which spectrum is assigned in specific bands cannot be applied to satellite services since fragmented spectrum severely impairs comprehensive satellite connectivity. Consumers will not be able to enjoy round the clock connectivity and optimal service levels, making the business case for Sat-com unviable. It may be noted that the present addressable market for Sat-com services is for segments of customers which are unconnected through terrestrial networks. Therefore, it is recommended that consumer interests are safeguarded by reserving spectrum bands exclusively for Sat-com use and allowing the full use of the frequency bands. Unnecessarily fragmenting spectrum and conflating the approach towards terrestrial and satellite spectrum would deprive consumers from the benefits of a new technology.

The questions on spectrum sharing itself show the complex challenges that are bound to emerge with likely adverse impact on the dynamics of the satellite industry if satellite spectrum is auctioned. To solve such issues, we fear avoidable ex-ante interventions will be forced on the industry.

The period of spectrum assignment should be co-terminus with the period of licenses of an entity. In other words, and importantly, satellite spectrum should be assigned on a shared, non-exclusive, and non-auction basis only.

**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?**

**ISpA's Response:** Please refer to our response in the previous question. Satellite spectrum should be assigned administratively and on non-exclusive basis. An administrative and non-exclusive assignment would obviate the requirement of permitting an entity to trade/lease its partial/full spectrum since the entity will rather approach the licensor directly and get the desired spectrum. The matter of trading or leasing spectrum is strictly excluded from consideration.

**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?**

**ISpA's Response:** Please refer response to previous questions 6 and 7. A shared, non-exclusive, non-auction-based spectrum assignment approach will ensure that such disruptions do not occur. Spectrum assignment should be done on the basis of ITU filings, its co-ordination and interference mitigation measures. We recommend that the administrative assignment methodology for satellite communications ensures, from the outset, the availability of spectrum for multiple entities, encourages competition, fosters innovation, improves the quality of services, and enhances competitiveness.

**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.**

***ISpA's Response:*** Instead of resorting to auctions, the spectrum sharing terms should be established through frequency coordination, with the requirement that all parties involved in the coordination notify the Indian Administration aka 'WPC' before being licensed to operate in the country. The sharing of spectrum among various satellite operators/service providers is governed by Article 9 of the ITU Radio Regulations (RR). The RR provide detailed guidelines on the sharing and coordination of spectrum. This approach not only ensures efficient utilization of spectrum resources. (The ITU framework and coordination procedure has proven to be successful and has led to 99.95% of spectrum assigned to satellite operators to be free from interference and service disruptions. It has also promoted the efficient and cost-effective use of spectrum which is an important requirement for making Sat-com commercially viable) while also promoting transparency and accountability.

The assignment of satellite spectrum should be based on a shared (non-exclusive) arrangement, allowing multiple entities to share the same frequency range. The coordination of space spectrum sharing among satellite operators follows the ITU radio regulations. Service providers utilize the spectrum through a combination of space resources (satellite) and ground segment resources (VSAT Hub). In the case of Geostationary Orbit (GSO), the satellite operator owns the satellites and orbital slots, while the ground station and RF system may be owned by the operator/service provider, and the baseband is typically established by the service provider.

For Non-Geostationary Orbit (NGSO), the satellite system and VSAT Hub/Gateway system are closely interconnected and operate together. The Gateway plays a crucial role in managing network traffic, including dynamic satellite and frequency management across user terminals. The user terminals/VSATs remain under the management and control of the Gateway. In the case of NGSO, it is recommended that satellite spectrum for satcom services be assigned to the Gateway operator due to the close linkage between the Gateway and the satellite constellation.

The sharing of satellite spectrum between GSO & GSO, NGSO & GSO, or NGSO & NGSO should adhere to the ITU Radio regulations. Coexistence between GSO networks is ensured through angular separation on the GSO arc or coordination. Coexistence between NGSO systems and GSO networks is established through compliance with Article 22 limits or coordination, depending on the frequency bands. Coexistence between NGSO systems involves bilateral coordination discussions and analysis by different operators, considering the relevant provisions of the ITU Radio Regulations. It is preferable to leave the coexistence arrangements to the satellite operators as part of the overall system coordination, rather than imposing rigid pre-determined requirements.

A regulatory framework based on applying the ITU Radio Regulations is considered efficient in managing satellite filings, coordinating satellite systems/networks, and resolving interference issues. It provides regulatory certainty for satellite operators, supporting their investments in designing, manufacturing, and deploying satellite systems/networks. Consistency in global regulatory approaches is crucial for satellite services, as deviations from the ITU framework can undermine stability, investments, technological innovations, and ultimately affect citizens and consumers. Allowing sharing of spectrum among multiple satellite operators and respecting ITU guardrails for ensuring optimal spectrum usage and preventing interference is the only way to make Sat-com services successful in India

**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.**

***ISpA's Response:*** The call for flexible use could also result in interference between the two services, which could negatively impact both the IMT and space-based communication services. Leading global satellite operators are presently using the full 27.5-29.1 and 29.5-30.0GHz range for their gateways in India. These ranges need to be kept isolated from use for IMT or other services such as Satellite user terminals within the vicinity of the gateway locations.

Considering the restricted application of IMT deployments in the 28 GHz range, it would not be sensible to pursue an exclusive spectrum assignment for flexible use, allowing it to be used either for IMT or satellite purposes by the assigned entity on a country-wide basis. Such an approach would unnecessarily grant exclusivity to an entity for a spectrum that could easily

be shared among satellite operators. Moreover, the high costs associated with exclusive terrestrial mobile spectrum would likely restrict participation in any auction to terrestrial mobile operators, excluding pure-play satellite operators/service providers from utilizing the spectrum for space-based communication.

Overall, it is clear that compromising satellite investment and services in the 28 GHz band is not in the public interest, especially when terrestrial operators have limited foreseeable requirements for spectrum that can be satisfied by the 26 and 38 GHz bands as well.

It is important to emphasize that spectrum should be utilized for the purpose and service it has been assigned to, without allowing it to be repurposed for other uses or services. Allowing flexible use could artificially limit access to this crucial portion of the spectrum for satellite operators. Therefore, we are not in favor of adopting flexible use of the spectrum.

In the global context, the utilization of 28 GHz spectrum for terrestrial networks in relation to effective utilization for 5G services has yielded disappointing results. It is evident that the use of this spectrum for International Mobile Telecommunications (IMT) is expected to be limited and localized, lacking support for traditional wide-area spectrum licensing.

**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?**

***ISpA's Response:*** It is imperative to reserve the frequency band from 28.5 GHz to 29.5 GHz solely for satellite services, while implementing an administrative allocation approach. This strategic measure is crucial for upholding the reliability and efficiency of satellite communications. Opting for an auction-based allocation method, on the other hand, would introduce complications and constraints that could impede fair competition, restrict the participation of smaller operators, and undermine the optimal utilization of spectrum resources.

The 28 GHz band, also known as the Ka-Band, has been designated for satellite services for a considerable amount of time. The authorization of terrestrial mobile services in this band carries the risk of causing interference, which could compromise the quality of communication operations and pose undue constraints on both services. Notably, this band was not accepted as a potential IMT band at ITU WRC-15 and WRC-19, and instead, ITU Member

States have identified and harmonized 17 GHz of other mm-Wave bands for 5G.

There are various challenges arising out of such flexible use in the frequency range 27.5-28.5 GHz which mainly include the incompatibility and potential for harmful interference between the space-based communication and IMT services. Given that coordinating IMT deployments and satellite user terminals in the same frequency band is impossible, we strongly suggest that the government conduct a thorough study of the need for each service in these frequency bands, taking into account the current use and demand for spectrum already assigned. It is crucial to avoid any co-existence of IMT and Satcom players in the 28 GHz band to ensure uninterrupted operations for both services.

Furthermore, it is worth noting that 26 GHz (24.25 – 27.5 GHz = 3.25 GHz) has already been identified for IMT at the ITU level and is better suited for global harmonization. International evidence suggests that demand for mm-Wave 5G is uncertain and can be adequately met using the 3.25 GHz of spectrum in the n258 band (24.25-27.5 GHz).

The implementation of terrestrial mobile wireless services in the millimeter wave bands has been limited in many countries. South Korea, for example, allocated the 28 GHz band for IMT services but has acknowledged failure in its implementation. In Japan, mobile operators have struggled to use the 28 GHz band for IMT services and have fallen behind their rollout requirements. Thailand conducted studies on the co-existence of IMT and satellite deployments in the 28 GHz band and ultimately allocated the band exclusively for satellite services. Similarly, in the USA, terrestrial operators have not successfully exploited the 28 GHz band.

**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?**

**ISpA's Response:** Frequency band 28.5 GHz to 29.5 GHz should be earmarked only for satellite services. Ka-band is crucial for broadband services and most of upcoming high throughput GSO/NGSO constellation will be using Ka-band satellite services. Any limitation on the availability on the overall Ka-band for Satellite services, will severely impact the satellite based broadband services.

Considering above, there is no requirement for permitting flexible use between CNPN and space-based communication services in the frequency range 28.5-



29.5 GHz. The requirement for CNPN can be easily managed under the guidelines on captive non-public network (CNPN) released by DoT i.e., TSPs. We believe that it is therefore better to find alternative band for CNPN instead of 28.5-29.5 GHz.

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

***ISpA's Response:*** : ISpA sees inevitable challenges in the allocation of frequency bands for multiple and technologically different services. While it may be possible to address some of these challenges (e.g., use of the 27.5-28.5 GHz band by both IMT and satellite gateway stations), such co-existence would inevitably deteriorate the quality of the communication operations and put undue constraints on either or both services. It is worth pointing out that it would be impossible to coordinate IMT deployments and satellite user terminal deployments in the same frequency band. Thus, we submit that the actual need of these frequency bands for each service should be thoroughly assessed, namely, in the face of the current use and demand for spectrum already assigned (for example, in the case of IMT-based services and considering the result of the latest assignments). We do not see a need for such flexible use, nor adequate technical solutions given the characteristics of each operation, and would therefore deem it not possible.

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

- South Korea, which took the lead in allocating the 28 GHz band for IMT services, has publicly admitted that these spectrum assignments have failed.
- South Korean operator, SK Telecom, decided to cease using 28 GHz for 5G. The decision follows the footsteps of peer carriers KT and LG Uplus, leaving no carriers using 28 GHz for 5G.
- In Japan, the mobile operators have not been able to exploit the 28 GHz band for IMT services, and are far behind their rollout requirements.
- Thailand did studies on the co-existence of IMT and satellite deployments in the 28 GHz band, and decided to allocate the 28 GHz band only for satellite services.

- In the USA, operators such as T-Mobile and Verizon have not been able to successfully exploit the 28 GHz band.

On the issue of the allocation of the 28.5-29.5 GHz band to CNPN services, it is often misunderstood that CNPN services are indoor usage services. On the contrary, the CNPN services are deployed by organizations for private networks that span across campuses, which may be adjacent to satellite deployments. It would be next to impossible to coordinate satellite user terminals with CNPN service use, and this could cause considerable deterioration of one or both of the services.

Thus, we urge the TRAI to rethink the allocation of the 28 GHz band to both IMT and CNPN, considering that deployments in this band have not succeeded anywhere in the world. On the contrary, the satellite industry is exploiting this band for the purpose of providing broadband in unserved and underserved areas of the world, for the benefit of users who require these services.

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

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

<b>Type of service:</b>				
<b>Financial Year</b>	<b>Revenue (Rs. lakh)</b>	<b>Subscriber base</b>	<b>CAPEX for the year (Rs. lakh)</b>	<b>Depreciation for the year (Rs. lakh)</b>
<b>2018-19</b>				
<b>2019-20</b>				

<b>2020-21</b>				
<b>2021-22</b>				
<b>2022-23</b>				

**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:**

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

**ISpA's Response:** ISpA does not believe space-based communication services should be categorized into different classes of services that require different treatment for spectrum assignment and, as justified in our general comments, submits that the methodology for assignment of any space-based communication services should be administrative. The assignment of spectrum for space-based communications should be on a national level, and the licensee should be able to choose the specific frequency ranges that are intended to be used for the gateway station links and the user terminal links.

**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?**

**ISpA's Response:** We do not see any reason for space-based communication services to be categorised into different classes of requiring different treatment for spectrum. Since multiple services share the same spectrum band, currently being given on administrative basis, the same approach should be continued. Further, auction-based assignment will discourage new startups and smaller players from entering the market due to high initial costs hence administrative allocation should continue.

**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).**

**ISpA's Response:** From previous responses to questions 4-6 is clear that administrative assignment is the most suitable approach for assigning fixed satellite (FSS) spectrum as it is a shared resource wherein the same spectrum can be used by multiple users. Any other approach, e.g., auctioning satellite spectrum, will distort its utility since a satellite constellation (e.g., a typical LEO system) cannot operate with different spectrum in different parts of the world.

It is also to be noted, that the VSAT services are still very costly and non-affordable by the masses due to regulatory restrictions and higher cost of satellite bandwidth in India. In the recent past, we had seen that the DoT & TRAI had been working on their part to reduce the cost of delivering the services by the service providers by maximizing the usage of the resources & infrastructure of the service providers. Both TRAI & DOT had been advocating & allowing using the same infrastructure for running multiple services like – VSAT CUG infra to be used by IFMC and NLD services etc. If now, we restrict the spectrum usage basis the different types of services (as per table 1.3), then it will drastically load the cost of delivery and make the services unaffordable. The common infrastructure may no longer be used delivering services to multiple types of services and it will be contradictory to what DoT & TRAI had been advocating.

With the above in mind, we suggest that the methodology for spectrum assignment for space-based communication services should be on administrative basis only to the service providers as has been followed assigned currently.

For VSAT communications, the satellite spectrum is anyway shared between multiple users and there is no exclusivity. For spectrum wherein no exclusivity required and is available for all authorized users, there is no rationale for carrying out the auction for satellite spectrum.

In our humble opinion, an auction-based approach to satellite spectrum assignment may lead to anti-competitive and monopolistic market conditions, as well as artificially inflated spectrum prices, ultimately resulting in the exclusion of certain operators and service providers. An administrative approach to spectrum assignment, on the other hand, prioritizes cost recovery rather than revenue generation, thereby promoting affordability and accessibility for consumers, particularly in remote areas where satellite connectivity may be the only viable option. By adopting an administrative assignment approach, regulators can ensure that satellite spectrum is assigned efficiently and effectively, supporting the ongoing growth and

development of the satellite communications industry while safeguarding the essential services that satellite networks provide.

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

***ISpA's Response:*** As satellite spectrum is shared, the co-ordination is done at global level by ITU to ensure interference free operations. Within India, it is well managed by WPC and service providers use same spectrum on different satellites without any interference. Assigning spectrum on regional basis may not be feasible or will result in highly fragmented and inefficient use of spectrum. The spectrum assigned for a specific circle will hinder its using same spectrum on same satellite in any other telecom circle in India. There can be multiple such examples which will suggest that assignment of spectrum on telecom-circle/metro-wise will result in highly inefficient way of spectrum utilization and thus assignment on National basis is the only way for satellite spectrum.

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

- Satellite services, both FSS and MSS inherently provide extensive



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

- National-level licensing will allow satellite operators to offer services to a broader user base, promoting digital inclusion and ensuring that all citizens have access to essential communications services.
- By assigning user links on a national level, regulators can ensure that users can fully leverage the benefits of transportable satellite services without encountering licensing restrictions or limitations based on regional boundaries.
- National-level licensing will help streamline the administrative process for regulator, licensor and satellite service providers, avoiding the need for managing multiple regional licenses. It will be in line of ease of doing business.

**Q 18. 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.**

***ISpA's Response:*** The assignment of spectrum for all types of satellite services through fair and transparent administrative processes, which would include both earth stations and user stations. Additionally, service providers would need to allocate significant resources and time to participate in multiple auctions, which could be a burden for smaller providers.

There is no need to do the auction of satellite spectrum on basis of type of services. Introducing auctions for satellite spectrum based on different types of satellite services would only contribute to more confusion and an unsustainable situation. It would require entities to participate in multiple auctions to acquire the same spectrum, leading to a lack of flexibility in

transitioning between different service provisions. This approach would hinder the ability to adapt and switch between satellite services, ultimately creating an undesirable and inefficient environment.

**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.**

***ISpA's Response:*** Assigning satellite spectrum for gateway operations administratively is the only appropriate approach, given the reasons in response to previous questions.

Gateway frequencies are used at specific locations only, which makes them much more suitable for sharing among different satellite operators than user link spectrum. This localised usage of frequencies allows for greater coordination and sharing of spectrum resources, promoting more efficient utilisation of the available frequencies. By assigning gateway spectrum administratively, regulators can facilitate the sharing of these resources, ensuring that operators are able to establish and maintain their gateway infrastructure at the designated locations. This approach maximises the efficient use of spectrum.

Gateway operations are critical to maintaining the reliability and resilience of satellite networks. By assigning gateway spectrum administratively, regulators can ensure that satellite operators have the necessary resources to establish robust and reliable communications links between satellites and terrestrial networks, ultimately contributing to the overall stability of the satellite communications ecosystem.

Failure to obtain the necessary gateway spectrum through an auction might result in satellite operators being unable to meet their regulatory obligations, leading to an artificial barrier to compliance.

**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.**

**ISpA's Response:** For the reasons mentioned earlier and previous questions, no auction should be conducted for satellite spectrum. Assignment of spectrum for gateway as well user links for space-based communication services should be on a purely administrative basis.

**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?**

**ISpA's Response:** Please refer to the previous responses. No Auction of spectrum should be conducted and it should continue to be allocated on an administrative and non-exclusive basis.

As regards the validity period of spectrum, the validity should continue to be co-terminus with the license period of the licensee.

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

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

**or**

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

***ISpA's Response:*** Gateway and user links spectrum should be assigned administratively, and separately for user and gateway links, as the gateway operator may not necessarily be the same entity as the service provider and the spectrum may not be the same.

Although the assignment of both user links and gateway links is vital for the same system/network, a satellite service provider would be unable to operate effectively only if they have only partial or no gateway link spectrum assigned, even when granted full access to their required user link spectrum. Consequently, a coordinated and bundled approach to assigning spectrum for user links and gateway links is necessary to ensure the seamless operation of satellite services.

However, separate assignments for user and gateway links could be considered. Space-based communication services should not be categorized into different classes of services that require different treatment for spectrum assignment. We submit that the methodology for the assignment of spectrum for any space-based communication services should be administrative. The assignment of spectrum for space-based communications should be on a national level, and the licensee should be able to choose the specific frequency ranges that are intended to be used for the gateway station links and the customer terminal links. The service provider could initially apply for the gateway spectrum, and once it becomes operational, proceed with the application for the user link spectrum. Considering various combination of gateway & user link frequency/spectrum, it is important for satellite service

providers to have the flexibility to obtain authorizations as their needs evolve after obtaining their license.

**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?**

***ISpA's Response:*** In the case of GSO satellites, interference between two GSO satellites is generally not a concern due to the directivity of their antennas. Any potential issues that may arise are resolved through coordination with the Network Operations Control Center (NOCC) in a cooperative manner.

Since GSO satellites are the incumbent users of the frequency band, NGSO satellites are designed and operated in a way that ensures no interference is caused to GSO operations. Therefore, NGSO satellites do not require any specific protection from GSO satellites. It is possible to co-locate both gateway stations and user terminals with other GSO/NGSO systems, by employing appropriate frequency coordination and mitigation mechanisms. Telecommunication Engineering Center (TEC) may issue guidelines to ensure the protection of GSO systems and address any potential interference between NGSO systems. These guidelines should align with the relevant radio regulations established by the International Telecommunication Union (ITU). It is essential to emphasize that the regulations regarding the protection distance and interference management between satellite earth station gateways for GSO/NGSO satellites should be formulated in accordance with the established norms of the International Telecommunication Union (ITU), specifically Article 22 where no protection distances are warranted, and operators/service providers can be licensed after ensuring that such inter-system coordination has been duly notified.

**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**

**ISpA's Response:** Our stance is against utilizing auctions as a means of assigning spectrum for satellite-based services. The question initially enquires about the appropriate eligibility criteria for assigning spectrum, but it later assumes the implementation of an auction process, which we do not endorse. Satellite-network operations require bilateral/multilateral coordination and cooperation. Satellite spectrum, which has no national territorial limits, is coordinated and managed by the UN agency, International Telecommunications Union (ITU), and is subject to their Radio Regulations.

We would like to reiterate the justification for the administrative assignment of spectrum for space-based communication services as stated in previous responses. Leveraging the UL's eligibility criteria for spectrum assignment reduces the need for duplicative requirements and administrative burdens. The UL encompasses a wide range of requirements and guidelines, addressing technical, operational, and financial aspects of service provision.

By utilizing the UL as the basis for assigning spectrum, regulatory authorities can ensure that the assignment process is transparent, consistent, and aligned with existing regulatory frameworks. This approach allows for efficient utilization of spectrum resources while promoting healthy competition among service providers.

**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.**

**ISpA's Response:** Administrative assignment of satellite spectrum should provide stability and confidence for operators to invest and maintain their services. Spectrum should be shared between all satellite operators seeking to access it. A minimum license period of 10-15 years, with possibility of annual renewal, can offer.



As regards the rollout of services, there should be a condition that the satellite service provider start commercial service in the country with its satellite constellation within a year of the assignment of spectrum, failing which its spectrum should automatically revert back to the Wireless Planning & Coordination (WPC) Wing.

**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.**

**ISpA's Response:** The provisions contained in Chapter-VII (Spectrum Allotment and Use) of the Unified License relating to restrictions on crossholding of equity should not be made applicable to satellite-based service licensees.

The restriction on crossholding of equity was introduced to discourage monopoly or the hoarding of spectrum for mobile services (which is exclusively assigned LSA wise) in order to ensure adequate competition in the market.

On the contrary, for the provision of satellite-based services, this is not a concern since there is no exclusive spectrum assignment and several satellite operators share the entire spectrum range non-exclusively.

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

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

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

**ISpA's Response:** To mitigate interference, ITU prescribes varying measures in ITU-RR (Article 21) which have been duly captured in the TRAI consultation as well. Additionally for terrestrial stations and earth stations, operating in frequency bands shared with equal rights between terrestrial radiocommunication and space radiocommunication services, shall be selected having regard to the relevant ITU-R Recommendations with respect to geographical separation between earth stations and terrestrial stations.

Hence in view of the above, there are mechanisms and processes that exist under the ITU framework and global best practices that should be leveraged.

**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.**

**ISpA's Response:** In our previous comments, we explained why we support assigning spectrum for space-based communication services through administrative means. **Polarization is a Technical Parameter:** Utilizing multiple polarizations is not only a way to increase capacity, but also a method to reduce interference. The charging mechanism should only take into account the quantum of spectrum, and not consider the use of different polarizations.

**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.**

***ISpA's Response:***

**I. Model 1**

Exclusive spectrum assignment model **is not suitable for satellite operators.**

Concepts such as spectrum blocks and spectrum caps are the key characteristics of terrestrial mobile spectrum management and do not apply to satellite communications which make auction of spectrum impractical. Use of satellite spectrum is dependent on ITU international spectrum coordination, cooperation among satellite operators, and different spectrum management rules. Satellite systems operate within a predefined range of frequencies, which have undergone a lengthy and rigorous process of notification and registration with the ITU, ultimately leading to inclusion in the Master International Frequency Register (MIFR). As a result, satellite operators cannot selectively choose frequencies based on market spectrum assignments.

Therefore, auctioning of satellite spectrum may be viewed as **slicing up the spectrum into bands and assigning frequency blocks to bidders on an exclusive basis.** This may result in the fragmentation of the bands that are now shared by all satellite services and may be an inefficient way of utilising the shared limited resource of satellite spectrum.

**II. Model 2:**

This model creates an artificial scarcity by limiting the number of licenses available for satellite operators. Unlike terrestrial communications, satellite spectrum is a completely shared resource among different satellite operators. All users share access to the entire band at a global level. This sharing greatly increases the efficiency of satellite spectrum use. By restricting the number of operators in a particular market, the full potential of the spectrum is not

being utilized, which goes against the fundamental principle of efficient spectrum management.

In case it is decided to limit the number of operators in the Indian market for the purpose of increasing government revenue, it will negatively impact not only the satellite operators who do not obtain a license but also the consumers in India. As a result, Indian consumers will have fewer choices compared to other markets.

Auctions in both model # 1 and model # 2 – would stifle any aspirations start-ups may have under the New Space Policy, which professes to encourage private participation in the satellite sector. Model # 2, especially, which envisages an auction on a non-exclusive basis, would be no auction at all. The phrase ‘non-exclusive auction’ is itself an oxymoron.

Moreover, if the Indian authorities decide to limit the number of operators in their market for the purposes of increasing government revenue as envisaged under model # 2, it will negatively impact not only the satellite operators who do not obtain a license but also the consumers in India. As a result, Indian consumers will have fewer choices compared to other markets. Reduced competition often leads to higher consumer prices and lower adoption rates, further exacerbating the digital divide.

By creating an environment with limited competition, it could discourage new entrants and reduce the incentives for existing operators to invest in network improvements, which ultimately diminishes the quality of service provided to the end-users. Limiting the operators may greatly impede universal connectivity in a large country like India

**For the reasons outlined above, ISpA opposes the auctioning of the spectrum for space-based communication services and suggests the administrative assignment of spectrum, which is a standard practice globally.**

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

**ISpA's Response:** Please refer to the previous responses. None. They are both clearly unsuitable for assigning a resource that can be shared and they unnecessarily complicate the spectrum assignment and use between operators. It is necessary to reiterate herein that no auction model is an appropriate spectrum assignment method for Satellite spectrum. Instead, the spectrum for user links in higher bands (such as C band, Ku band and Ka band) must be assigned on a non-exclusive basis through an administrative process.

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

**(a) the value of  $\Delta$ , in case it is decided to conduct a combined**

**auction for all services**

**(b) the values of  $\Delta$ , in case it is decided to conduct separate auction for each type of service**

**Please provide detailed justification.**

**ISpA's Response:** Please refer to the responses to previous questions. The spectrum for user links in higher bands must be assigned on non-exclusive basis through an administrative process.

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

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

**ISpA's Response:** Please refer to the previous responses. It is necessary to reiterate herein that there is no model suitable for auctioning the spectrum for user links (in bands such as C band, Ku band and Ka band).

Had any such model worked efficiently, regulators across the globe would have adopted it. Hence, it must be assigned on a non-exclusive basis through an administrative process.

**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?**

**ISpA's Response:** Referring to the other Countries' approach, the method of Administrative assignment for gateway is the most implemented one, that demonstrates efficient coordination and allocation of spectrum resources for satellite operators. Hence, administrative assignment is the most appropriate approach for managing satellite spectrum as it not only ensures efficient spectrum utilization, fosters competition, but also enables satellite operators to provide essential services that benefit society as a whole.

The option for using auction-determined prices for user links as a basis for charging for spectrum for gateway links is an unfeasible and inappropriate one, to manage satellite spectrum. This option/method may attract negative incidental consequences for the satellite industry and the end-users it serves.

**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?**



**ISpA's Response:** As opposed to terrestrial networks, satellite operators require only a limited number of gateways to serve a large geographical area, such as India hence administrative assignment method is more efficient and auctions for gateway links is not an appropriate approach.

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

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

**ISpA's Response:** Regulators can ensure the efficient use of spectrum resources, shrink in the potential conflicts among operators, and promote the seamless operation of satellite networks when the Administrative assignment approach is opted by them.

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

**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?**

**ISpA's Response:** Please refer to the previous responses. It is necessary to reiterate herein that no auction model is an appropriate spectrum assignment method for fixed Satellite spectrum. Spectrum for gateway should be assigned on an administrative basis.

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

**ISpA's Response:** We refer to our comments section where we provide justification for the administrative assignment of spectrum for any space-based communication services, and the spectrum resource should be shared between all satellite operators seeking to access it. The assignment of spectrum should be at a national level and should not be location based for gateway stations. Since the 27.5-29.5 GHz band is co-primary with Fixed Services (FS) stations (MWA/MWB), any location-based assignment for FSS stations will make the coordination very difficult, if not impossible.

In addition, for the smooth rollout of satellite services that can effectively address the connectivity needs of unserved and underserved areas in India, the TRAI should take into account that the WPC carries out frequency assignments through the issuance of Decision Letters. These letters assign frequencies on a carrier-by-carrier basis, which limits the operational flexibility of modern satellite systems that utilize dynamic frequency usage. If spectrum is to be assigned carrier-by-carrier, there will be a significant administrative overhead resulting in delays in the deployment of services. Instead, spectrum should be assigned as a block, allowing the operator to dynamically use the frequencies assigned across different user terminals, gateway stations, and satellites serving India.

**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.**

**ISpA's Response:** The major factors for consideration in case of spectrum charging mechanism for assignment of spectrum are as follows:

- i. Cost of managing and regulating the spectrum.
- ii. **Reasonable Charging Policy:** High spectrum prices ultimately affect end-users, particularly those in remote areas where satellite connectivity is the only viable option. Hence the reasonable pricing will

boost the satellite service providers to offer competitive pricing, making connectivity more accessible for consumers in underserved regions.

***Currently, the DoT assigns spectrum for satellite services through administrative mechanism, using formula-based charging for some applications and percentage of AGR-based charging for others. It is explained below:***

- ***The Annual Royalty for Captive Users is calculated by using a Standard Annual Royalty Factor of Rs. 35,000 per frequency and the Bandwidth Factor for Satellite Communications.***
- ***For commercial Very Small Aperture Terminal networks, spectrum charges are levied as a percentage of Adjusted Gross Revenue based on data rate ranges. The Telecom Regulatory Authority of India has recommended keeping these charges at 1% of AGR***
- ***The government has accepted TRAI's previous recommendation to levy spectrum charges for BSNL's satellite-based services at 1% of AGR.***

***Hence the current approach should continue, i.e., annual royalty for captive usage and revenue share for commercial usages. High spectrum fees should not be a disincentive to operators to use spectrum efficiently/flexibly and should not become an artificial barrier to entry.***

**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.**

**ISpA's Response:** It is necessary to reiterate herein that no auction model is an appropriate spectrum assignment method for Satellite spectrum. TRAI in its recommendation to DOT had recommended the SUC charges of 1% of AGR. This is a good reflection of the true value of spectrum, as directly and uniquely link to the actual spectrum use in the country. Determining the prices of Satellite spectrum band on the basis of 5G Spectrum prices is not advisable due to the following reasons:

- i. **Different Target Markets:** Distinction between the Mobile and satellite services can be determined by the markets they cater to. Services by mobile operators are more focused towards densely populated urban areas, however satellite services address the connectivity needs of rural and remote populations. Therefore, there is a dire need for differential pricing models for these 2 markets.
- ii. **Different operational and deployment cost structures:** substantial cost is borne by the Satellite operators for providing its services, these include, satellite manufacturing cost, launching cost, and operating cost, whereas, mobile operators have ongoing costs related to infrastructure deployment and maintenance.
- iii. **Role of Satellite services:** Satellite services play a crucial role in bridging the digital divide by providing connectivity in areas where the traditional mobile network operator (MNO) business model has failed. High spectrum prices for MNOs often result in prioritizing revenue generation and concentrating network deployment in urban areas. As a consequence, rural and remote areas are left underserved. By adopting a different pricing model for satellite spectrum, regulators can ensure that the connectivity needs of these underserved areas are better addressed.

*Clearly, both are entirely different in terms of economic value, market size and exclusivity hence applying the same pricing model as mobile operators could*

*make satellite services unaffordable for the very communities they are meant to serve, further exacerbating the digital divide.*

**Therefore, auction-determined prices of spectrum bands for IMT/5G services cannot be used as a basis for valuing space-based communication spectrum bands.**

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

***ISpA's Response: Not applicable in view of above.***

**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.**

***ISpA's Response:*** We are not aware of any situation in which a regulator has used spectral efficiency as a reference point to determine the value of spectrum for space-based communication.

The value of frequency bands for space-based communications should not be derived by comparing the spectral efficiency in relation to other bands, as this would mean many other important factors would be left unconsidered. Factors such as propagation characteristics, atmospheric precipitation, and antenna characteristics can significantly alter spectral efficiency.

The current methodology of charging as revenue share, the Spectrum Usage Charges (SUC) from the Aggregate Gross Revenue of the service provider is the best mechanism that ensures that DoT gets the Spectrum Usage Fees on the basis of the business generated by the service provider.

**Q42. In case of an auction, should the current method of levying spectrum fees/charges for satellite spectrum bands on formula basis/**

**AGR basis as followed by DoT, serve as a basis for the purpose of valuation of satellite spectrum**

**i. For user link**

**ii. For gateway link**

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

**ISpA's Response:** Please refer to the previous responses. It is necessary to reiterate herein that no auction model is an appropriate spectrum assignment method for Satellite spectrum.

This can also be validated by extant consultation paper which captures that “US, Mexico, and Brazil had attempted to sell frequencies for satellite usage but eventually did not succeed and at last resorted to administrative licensing.”

Hence no, it would not be feasible to auction using formula basis/AGR basis.

**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.**

**ISpA's Response:** *No. As suggested previously, the auction-based assignment approach is not appropriate in case of spectrum for satellite services.*

*The revenue surplus model used by Authority is to estimate the maximum amount a service provider would be willing to pay for additional spectrum in a certain frequency band for IMT/5G services in terrestrial networks. This model is based on financial parameters and spectrum holdings and assumes that the NPV of projected revenue surplus over next 20 years represents the maximum amount a service*



*provider would pay. However, this model requires certain financial information about the space industry, such as revenue and operating expenditure (Opex), EBITDA margin, capital cost per subscriber, capacity utilisation, useful life of various network elements/assets, depreciation methodology and RoCE of the space segment. Unfortunately, this information is currently unavailable since the industry is still at a nascent stage.*

**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.**

***ISpA's Response:*** There are no international benchmarks available that could be used for auctions of the satellite spectrum. ***The present approach of revenue share for commercial services is appropriate for India for the nascent space sector to grow.***

**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.**

***ISpA's Response:*** Around the world, the charges for the assignment of spectrum for space-based communications through an administrative

mechanism has been derived using a cost-recovery principle. The cost benchmarks of those countries and India might vary, and it may not be appropriate to benchmark the charges for an administrative assignment with that of other countries. We suggest that India establish its own cost benchmarks, and use the cost-recovery principle to charge for spectrum for space-based communications. As such, the international trend has been clearly in the direction of a general reduction of fees. It is also worth noting that a blanket license approach is typically adopted for the user ubiquitous VSATs and ESIM (i.e., no need for individual terminal-by-terminal licenses).

**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?**

**ISpA's Response:** We believe that the present approach of revenue share for commercial services is appropriate for India for nascent space sector to grow.

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

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

**ISpA's Response:** We believe that the present approach of revenue share for commercial services is appropriate for India for its nascent space sector to grow.

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

**ISpA's Response:** We believe that the present approach of revenue share for commercial services is appropriate for India for its nascent space sector to grow. Any segregation of spectrum for use of gateway station links and user station links should not be carried out. Flexibility needs to be provided to satellite operators to interchangeably use spectrum as the need arises.

**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.**

**ISpA's Response:** We believe that the present approach of revenue share for commercial services is appropriate for India for its nascent space sector to grow.

**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.**

**ISpA's Response:** It is suggested to keep at as reasonable percentage of AGR as this is industry friendly, helps regulator to get share of the growth of the industry and brings in the required transparency. Valuation is just one aspect of spectrum management, and it is important to consider other factors such as competition, innovation, and public interest when determining the appropriate assignment and use of spectrum. Administrative assignment allows for a more holistic and context-specific approach to spectrum management, which can lead to more informed and effective decision-making. Additionally, administrative assignment ensures that the spectrum is allocated in a fair and transparent manner, and can help to prevent anti-competitive situations from arising. Overall, administrative assignment is a more practical and effective approach to spectrum management.

**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.**

**ISpA's Response:** Please, refer previous response.

**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.**

**ISpA's Response:** Not applicable, as it is recommended to do spectrum assignment for space-based communication, on Administration basis.

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

**ISpA's Response:** Not applicable, as it is recommended to do spectrum assignment for space-based communication, on Administration basis.

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

- i. Upfront payment**
- ii. Moratorium period**
- iii. Total number of installments to recover deferred payments**

**iv. Rate of discount in respect of deferred payment and prepayment**

***ISpA's Response:*** Please refer to our previous responses. We believe that the present approach of revenue share for commercial services is appropriate for India for nascent space sector to grow. Given the revenue share model, the aforementioned questions would not be applicable i.e., for assignment of spectrum on administrative basis, it is suggested to keep at as reasonable percentage of AGR as this is industry friendly, helps regulator to get share of the growth of the industry and brings in the required transparency.