
Rivada Space Networks:
Response to TRAI's Consultation Paper on Terms and
Conditions for the Assignment of Spectrum for
Certain Satellite-Based Commercial Communication
Services



1. Introduction

Rivada Space Networks is at the forefront of revolutionising satellite communications through the deployment of its Non-Geostationary Satellite Orbit (NGSO) constellation. This advanced network is designed to deliver high-speed, low-latency, and secure data services on a global scale, with a unique focus on business-to-business and government applications. Unlike traditional satellite operators that rely on gateways and terrestrial infrastructure, Rivada's network architecture uses innovative optical links between satellites, forming a fully meshed optical network in space known as the Rivada Outernet. Rivada's architecture significantly reduces latency and improves data transmission speeds and is ideal for mission-critical applications.

Rivada's system connects user terminals using Ka-band spectrum for service links, enabling high-capacity data transmission that is well-suited for next-generation satellite services. The Ka-band spectrum provides a substantial amount of bandwidth, making it the preferred choice for delivering high data rate services to enterprise customers, government agencies, and other sectors that require secure and dependable connectivity. This frequency range supports the high-throughput capabilities of Rivada's network, ensuring seamless communication across even the most remote and underserved areas.

As a strong advocate for open and competitive markets, Rivada promotes regulatory frameworks that support innovation and reduce barriers to entry for NGSO satellite operators. The company believes that regulatory policies should facilitate spectrum assignment and pricing regimes that incentivises investment and fosters fair competition to ensure that end users benefit from high-quality and cost-effective.

2. Rivada's Response

Q1. Which frequency band(s)/ range(s) should be considered for the assignment to NGSO-based Fixed Satellite Services for providing data communication and Internet service? Please provide a detailed response separately for the user link and feeder link.

Response to Question 1: Rivada agrees that TRAI has correctly identified all the frequency bands to assign to NGSO FSS services.

As was noted in the introduction, Rivada's Outernet uses Ka-band for the user terminals service link, therefore, our responses would focus on the particular merits NGSO-based Fixed Satellite Services, Ka-band spectrum and service link aspects of the consultation.

The Ka-band frequency range (27.5 – 29.5 GHz and 29.5 – 31.0 GHz for uplink and 17.3-17.7 GHz and 17.7 – 20.2 GHz for downlink) provides optimal bandwidth for high-capacity data communication and Internet services. The Ka-band is particularly advantageous for delivering high-throughput satellite (HTS) services due to its capacity for spot beam technology and frequency re-use. The Ka-band frequencies offer significantly larger bandwidths compared to



lower frequency bands, allowing for higher data rates and efficient spectrum usage. The Ka-band frequencies are harmonised globally, making them suitable for international NGSO deployments. The availability of these frequencies for both uplink and downlink ensures seamless global operations.

Regarding international practices, in the United States, the FCC has authorised the use of Ka-band frequencies for several NGSO operators, enabling high-speed data services. Also, the ITU has allocated Ka-band frequencies for FSS globally, promoting their use for high-throughput applications. This harmonisation ensures minimal interference and compatibility across borders.

In conclusion, the Ka-band frequencies (17.7-20.2 GHz and 27.5-29.5 GHz) are recommended for user links in NGSO-based FSS to support high-speed data communication and Internet services due to their capacity, spectral efficiency, and global harmonization.

Q3. What should be the maximum period of assignment of spectrum for:

(a) NGSO-based Fixed Satellite Services for providing data communication and Internet services?

Please provide a detailed response along with international practice in this regard.

Response to Question 3(a): For NGSO-based Fixed Satellite Services providing data communication and Internet services, the maximum period for spectrum assignment should be **20 years**. The rationale is as follows:

- While the operational lifespan of NGSO satellites varies between 5 to 10 years, depending on the orbital altitude and mission requirements, it would not be reasonable to align the period of assignment of spectrum with the satellite lifespan because NGSO operators typically deploy large constellations of satellites over a period of several years, leading to staggered satellite launches and replacements.
- A 20-year assignment period ensures stability and predictability for operators, allowing them to recover the substantial capital investments required for building and launching satellite constellations.
- A 20-year spectrum assignment aligns with the period of validity for service authorisations under existing regulatory frameworks, ensuring that spectrum availability and service licenses are synchronized.
- International practices, like the FCC in the United States grants licenses for NGSO systems for 15 to 20 years, considering the long-term nature of satellite investments and operational planning. Similar practices are followed in Europe and other regions, where long-term spectrum assignments provide operational certainty and encourage investment in satellite infrastructure.

In summary, a 20-year spectrum assignment period is recommended for NGSO-based FSS to ensure alignment with international practices and support sustainable satellite operations.



Q4. For assigning spectrum for NGSO-based communication services, whether every ITU filing should be treated as a separate satellite system? Please provide a detailed response along with international practice in this regard.

Response to Question 4: The spectrum for NGSO-based communication services should **not** be assigned separately for every ITU filing. Instead, the NGSO operator's overall network should be treated as a **single unified network**. NGSO systems typically operate as a cohesive network of satellites (constellations) that share resources and collectively provide continuous coverage. Treating each ITU filing as a separate system disrupts the operational integrity of the network and creates regulatory fragmentation. for the following reasons:

Treating each ITU filing separately results in inefficiencies in spectrum assignment and usage and would lead to increased administrative burdens. Internationally, regulators such as the FCC and UK Ofcom treat NGSO systems as single networks rather than separate filings. This unified approach considers the overall constellation's impact on spectrum usage and interference management.

In conclusion, the NGSO operator's overall network should be treated as a single network, and not separate systems based on individual ITU filings. This approach aligns with international practices and optimises spectrum use, while ensuring effective coordination and interference management.

**Q5. Whether the provisions of ITU-RR are sufficient to resolve interference-related challenges and coordination issues? If not, what additional conditions should be prescribed while assigning frequency spectrum for –
(a) NGSO-based Fixed Satellite Services for providing data communication and Internet services.**

Response to Question 5(a): The provisions of the ITU Radio Regulations (ITU-RR) are sufficient to resolve interference-related challenges and coordination issues for NGSO-based Fixed Satellite Services. Through the comprehensive ITU-RR provisions within Article 21 that deals with the sharing of frequency bands between terrestrial and space services, Article 22 that addresses sharing between GSO and NGSO systems; as well as coordination mechanisms which include a robust coordination framework that requires NGSO operators to coordinate with both existing GSO and other NGSO operators, ensure effective interference management allowing access to spectrum for all satellite systems.

The above approach to interference management is also the standard practice globally, where regulatory bodies rely on ITU-RR provisions to manage interference between NGSO and GSO systems as well as terrestrial systems. This approach has proven effective in allowing multiple NGSO constellations to coexist without significant interference issues.



In conclusion, the ITU-RR framework is comprehensive and provides adequate protection and coordination mechanisms. No additional conditions are required, provided that operators comply with EPFD limits, coordinate in good faith, and adhere to ITU-RR Articles 21 and 22.

Q8. In case the spectrum assigned to the satellite user link is also assigned to terrestrial networks such as Fixed Service, what criterion should be included in the terms and conditions of the assignment of spectrum for satellite user links to avoid any interference to/ from terrestrial networks? Please provide a detailed response along with international practice in this regard.

Response to Question 8: Assigning spectrum to both satellite user links and terrestrial networks could lead to significant interference issues, depending on the nature and direction of the terrestrial transmissions. For example, terrestrial base stations transmitting in the shared spectrum could cause overload interference to the satellite user terminals. Such interference could degrade the quality of the satellite communication link, making it challenging to maintain reliable service. Given the potential for harmful interference, it is proposed that any spectrum allocated for satellite user links should not be shared with terrestrial networks.

However, if it is decided to proceed with sharing spectrum between satellite user links and terrestrial networks, careful consideration should be given to the direction of the terrestrial transmissions to minimise interference. Measures should be in place to ensure that terrestrial transmissions do not exceed interference thresholds that could disrupt satellite user links. This may require modification of the technical parameters of the terrestrial transmissions, such as power levels, to maintain compatibility between the two services.

For protecting terrestrial networks from interference caused by satellite systems, the existing ITU Radio Regulations (ITU-RR) provisions, such as the Power Flux Density (PFD) limits for satellite systems, are effective and sufficient. These regulations ensure that emissions from satellite user links do not cause harmful interference to terrestrial services.

Therefore, while the preferred approach is to avoid assigning spectrum for satellite user links to terrestrial networks, if sharing is pursued, the ITU-RR provisions and careful planning of transmission parameters will be necessary to manage the coexistence of the two systems.



Q10. In addition to the roll-out conditions recommended by TRAI for satellite-based Telecommunication Service Authorisation through its recommendations on the Framework for Service Authorisations to be Granted Under the Telecommunications Act, 2023 dated 18.09.2024, whether there is a need to impose certain additional roll-out obligations for the assignment of frequency spectrum for-

(a) NGSO based Fixed Satellite Services for providing data communication and Internet services? Please provide a detailed response along with international practice in this regard.

Response to Question 10(a): Roll-out obligations are designed for terrestrial networks operators requiring them to have a minimum geographical or population coverage as a condition of their licences to prevent them from prioritise high-revenue areas, and dense population area leaving gaps in less profitable regions. Satellite services, on the other hand, are intended to provide coverage in areas that terrestrial networks cannot serve efficiently. Imposing strict roll-out requirements on satellite operators could hinder their ability to deploy networks effectively.

A more flexible regulatory approach would be better suited, encouraging satellite deployment in underserved regions without imposing unnecessary constraints. This will help address connectivity gaps and ensure satellite services reach the communities that need them most.

Q12. Whether there is a need to prescribe timelines for processing the applications for the assignment of frequency spectrum for-

(a) NGSO based Fixed Satellite Services for providing data communication and Internet services? Please provide a detailed response with justifications.

Response to Question 12(a): Establishing clear timelines for processing spectrum assignment applications is essential to speed up the deployment of NGSO-based Fixed Satellite Services (FSS) for data communication and Internet services. Efficient and prompt application processing is vital for expanding satellite services and boosting accessibility. Quick approvals help operators secure licenses faster, enabling timely service launches and fostering competition.

However, the question does not clarify whether applications can be submitted at any time or only within specific start and end dates. Regardless, we strongly support the flexibility for operators to apply at any time, aligning with their business needs and service launch rather than during a limited window determined by the regulator.

Delays can slow down the rollout of new technologies, especially in underserved regions, and limit digital connectivity.



Q13. Whether there are any other suggestions related to assignment of spectrum for-

(a) NGSO based Fixed Satellite Services for providing data communication and Internet services? Please provide a detailed response with justifications.

Response to Question 13(a): In addition to the specific questions addressed in this consultation, the assignment of spectrum for satellite-based communication services should be based on the existing ITU Regulations and international coordination and promote global harmonisation of frequency allocations. This will facilitate international coordination and minimise cross-border interference.

In summary, the additional considerations will help create a robust and future-proof regulatory framework for satellite-based communication services, promoting sustainable growth and innovation in the sector.

Q14. Should spectrum charges for NGSO-based FSS providing data communication and Internet services, be levied: i. On a per MHz basis, ii. On a percentage of Adjusted Gross Revenue (AGR) basis, or iii. Through some other methodology? Please provide a detailed justification for your answer.

Response to Question 14: Rivada is strongly against levying spectrum charges on a per MHz basis for NGSO-based FSS providing data communication and Internet services. These services typically require large bandwidths on both uplink and downlink directions, and a per MHz charge does not reflect the efficient use of such wide bandwidths. This approach would significantly increase the cost of providing satellite services, ultimately leading to higher costs for end users. Such increased costs could deter the widespread use of satellite services, especially in underserved and unserved regions where terrestrial coverage is absent.

Instead, it is proposed that spectrum charges be based on a percentage of Adjusted Gross Revenue (AGR), with a cap not exceeding 1% of AGR, or even less. Since NGSO-based services are primarily aimed at connecting remote and unconnected areas, a lower or even no spectrum charge aligns with the actual value of the spectrum and its critical role in addressing the digital divide. This approach promotes broader access to satellite services without imposing excessive financial burdens on operators, fostering the growth of satellite connectivity in regions that need it the most.

Q15. In case it is decided that spectrum charges for NGSO-based FSS providing data communication and Internet services should be levied on a per MHz basis, should these charges be calculated based on: i. The Department of Telecommunications (DoT) order dated December 11, 2023, or ii. An alternative approach (please specify)? Please provide a detailed justification to support your answer.

Response to Question 15: Please see response to Question 14.



Q16. If it is decided that spectrum charges for NGSO-based FSS providing data communication and Internet services should be levied on a percentage of AGR basis: i. What should be the appropriate percentage of AGR? ii. Should a minimum spectrum charge be specified to address the issue of inefficient utilization of spectrum? If yes, what methodology may be used to determine the amount of the minimum spectrum charge? iii. Is there an alternative approach that could be followed to address the issue of inefficient spectrum utilization? Please provide detailed justification for your answers.

Response to Question 16: Please see response to Question 14.

Q21. Whether there are any other issues/suggestions relevant to the spectrum charging for:

(i) NGSO/GSO based FSS providing data communication and Internet services. The response may be submitted with proper explanation and justification.

Response to Question 21 (i): For NGSO/GSO-based FSS providing data communication and Internet services, it's important to ensure that the spectrum charging framework remains flexible and affordable. This will encourage the expansion of satellite services, particularly in remote and underserved areas where terrestrial networks are not viable. Excessive spectrum charges could hinder the deployment of new satellite technologies, limiting access to essential communication services.

For NGSO/GSO-based MSS providing voice, text, data, and Internet services, it's crucial to adopt a pricing model that reflects the public benefit of these services. Affordable spectrum fees would support the delivery of critical communication services in areas that lack traditional coverage, helping to bridge the digital divide.

A balanced spectrum charging regime should take into account the unique challenges and wide-reaching benefits of satellite services. It is important that the cost of spectrum is aligned with its actual use, ensuring operators can invest in expanding coverage without being overburdened by disproportionate costs.