Nelco Response to TRAI Consultation paper *on the Terms and Conditions for the Assignment of Spectrum for Certain Satellite-Based Commercial Communication Services*

PREAMBLE

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

Considering new technology development in Satellite communication, which will enable multiple use-cases for its users, it is important to have enabling provisions to the assignment of spectrum for Satellite-based services. The Government of India has already passed `the Telecommunication Act 2023, wherein it is concluded that spectrum for satellite-based communication services will be assigned on administrative basis. The term & conditions, as covered in this consultation paper, for the assignment of spectrum for certain satellite-based services are important to have the clarity to the industry and stakeholders.

Satellite based communication services are important to enable `broadband for all' and helps in government's vision of India achieving $1 Trillion digital economy by 2025-2026. Various telecommunication technologies & their primary use-cases may differ - which need to be considered while formulating any policy guidelines. This has been amply acknowledged & recognised by Government of India as is evident in `the Telecommunication Act 2023, where in spectrum for service entries listed in First Schedule of the Act have been exempted from the auction process. Considering higher cost of Satellite-based communication services, it is not a competition to available fiber or terrestrial based network.

With new satellite technologies like NGSO FSS, MSS services becoming commercially available, it is important to have the relevant clarity on various terms & conditions including spectrum pricing. The GSO FSS service policies should not adversely impacted with policies related to NGSO-FSS and GSO/NGSO-MSS service and there should be no worse off condition in so far existing Commercial VSAT CUG service providers are concerned.

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

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:

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We recommend that the full range of spectrum for space-based communication services, as per ITU provisions, should be made available for NGSO use.

The relevant bands for Satellite Spectrum for NGSO FSS are Ku-Band, Ka band, Q & V bands.

- Ku-band (10-15 GHz)
    - Downlink: 10.7-12.75Ghz
    - Uplink: 13.75-14.5 GHz; 12.75 – 13.25Ghz

- Ka-band (17-31 GHz)
    - Downlink: 17.8 – 18.6Ghz; 18.8 – 19.3Ghz; 19.7 – 20.2Ghz; 20.2-21.2Gh
    - Uplink: 27.5 – 30Ghz; 30-31Ghz

- Q/V band - 33-75 GHz

    - FSS Downlink bands - 37.5 - 42.5 GHz
    - FSS Uplink bands - 47.2-50.2 GHz; 50.4 - 51.4 GHz; 51.4-52.4 GHz

The user links of the NGSO satellite systems are generally in Ku and Ka band, while the feeder links are predominantly in Ka-band currently. Further, the next-generation satellite communication systems have plans for deployment in higher bands such as the lower part of V-band (37.5 to 52.4 GHz) for user links & gateway links

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. Segregating the satellite frequencies based on different services and usages is not a practical exercise and will prove to be a limiting factor in the growth of Satellite Based Communications in the country.

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. Lower frequency bands, such as L-band and S-band frequencies, are better suited for low-bandwidth, bursty application satellite IOT use-cases, navigation and remote sensing applications because they penetrate through clouds and support various form-factors of the antenna. **Therefore, it is important to have access to a diverse set of frequency bands and services that can support these applications.**

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

Q2. Which frequency band(s)/ range(s) should be considered for the assignment to GSO/ NGSO based Mobile Satellite Services for providing voice, text, data, and Internet service. Please provide a detailed response separately for the user link and feeder link.

Response:

L-band & S-band are most suitable to GSO/NGSO MSS services for text/occasional voice/low data-rate application services. To be able to provide interference free services in S-band and L-band, the S-band and L-band should be allocated on exclusive basis.

Other frequency bands like Ku-band, Ka-band and other bands as defined in NFAP-2022 for MSS and as referred in Article 5 of the ITU Radio Regulations (ITU-RR), can also be used providing MSS services.

Q3. What should be the maximum period of assignment of spectrum for - (c) NGSO based Fixed Satellite Services for providing data communication and Internet services, and (d) GSO/ NGSO based Mobile Satellite Services for providing voice, text, data, and Internet services? Please provide a detailed response along with international practice in this regard.

Response:

The period of validity of spectrum assignment for NGSO based FSS and GSO/ NGSO based MSS should be 20 years in line with the period of validity of the service authorisation, so that it provides sufficient certainty to service providers for recovery of their capital investments. Another reason for a longer period of validity would be since Satellite-based broadband services are, at present, in a nascent stage of development, and their business potential would emerge after some years of operations; the policy and regulatory environment should be stable and certain, to give investors sufficient confidence to plan and monetise their investments.

Service provider will need to make substantial Capex investment in building the gateway infrastructure which needs to be recovered over long period. As spectrum availability is key to the satcom services and thus directly related to the investments made by service providers, it is important that the spectrum should be assigned for 20 years.

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 alongwith international practice in this regard.

Response:

NGSO operator may file to ITU as per its product roadmap and requirement like when launching additional satellites etc in the same orbital constellation etc. As the spectrum in case of NGSO will be allocated for respective constellation rather than individual satellite, NGSO operator may add more satellites to increase footprint, more bandwidth per location etc within same constellation.

If the ITU filing done by NGSO operator is for different constellation then it should be considered as separate NGSO-based satellite system with respect to assignment of spectrum.

IN-SPACe authorisation is expected to consider the authorisation for the constellation and thus it may be fair to consider that assignment to NGSO-based communications systems should be done per IN-SPACe authorisation.

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 –

(c) NGSO based Fixed Satellite Services for providing data communication and Internet services; and

(d) GSO/ NGSO based Mobile Satellite Services for providing voice, text, data, and Internet services? Please provide a detailed response alongwith international practice in this regard.

Response:

Article 22 of ITU-RR has required provisions, hard-limits for key parameters and guidelines to address interference and coordination related issues. At the global level, ITU-RR article 22 guidelines are to ensure interference-free radio-frequency spectrum and satellite orbit resources for space-based communication services.

ITU-RR has hard limits with respect to equivalent power flux density (EPFD) to protect GSO Earth station and satellite receivers from the aggregate emissions of NGSO FSS networks, together with reference antenna patterns. Also, EIRP limits (as a function of off-axis angle) are also provided for earth stations operating in GSO-FSS networks in Ku- and Ka-band frequencies. Upholding these hard limits guarantees a stable and level playing field for all the stakeholders as well as help to maintain the delicate balance necessary to have a win-win situation in the satellite industry.

EPFD limits enshrined Article 22 of RR as a basis for the efficient use of the GSO/NGSO shared Ku and Ka band frequencies, wherein the hard-limit and guidelines enable NGSO systems to operate globally without adversely affecting use of the GSO networks.

Furthermore, the algorithm specified by Recommendation ITU-R S.1503-4 (09/2023): Functional description to be used in developing software tools for determining conformity of non-geostationary-satellite orbit fixed-satellite system networks with limits contained in Article 22 of the Radio Regulations. This Recommendation provides a functional description of the software for use by the ITU-BR to conduct examination of NGSO-FSS system notifications for their compliance with the validation limits specified in the Radio Regulations.

Q6. For satellite earth station gateways of different satellite systems operating in the same frequency range, whether there is a need to prescribe a protection distance or any other measures to avoid interference from each other– (c) Between the gateways of GSO and NGSO systems; and (d) Between the gateways of NGSO systems? If yes, please provide a detailed response alongwith international practice in this regard.

Response:

Considering that for NGSO gateway end, there will be multiple antennas, which will be tracking the moving satellites and thus it is important to ensure that it is not causing interference to other NGSO/GSO systems.

For NGSO-GSO systems, coordination procedures under Article 9 of the ITU-RR or EPFD limits under Article 22 of the ITU-RR ensure mutual compatibility between these systems. For NGSO-NGSO systems, the Article 9 coordination procedures provide a sufficient structure to facilitate the necessary dialog between operators so that they can establish the technical conditions, unique to their respective systems, to ensure mutual compatibility between the satellite systems and their associated Gateway earth station. TRAI should rely on the ITU framework and international practice for any interference avoidance measures.

In addition, if it is decided to prescribe the distance between NGSO – NGSO system or between NGSO – GSO system then it may be decided based on existing interference studies carried out in this regard.

Q7. In case the spectrum assigned for satellite gateway links is also assigned to terrestrial networks such as Fixed Service, IMT etc., what protection distance or criterion should be included in the terms and conditions of the assignment of spectrum for satellite gateway links to avoid any interference to/ from terrestrial networks? Please provide a detailed response alongwith international practice in this regard.

Response:

In specific frequency bands, spectrum is shared between satellite-based networks and terrestrial Fixed Service (backhaul) for IMT. For instance, in 13 GHz band (12.75-13.25 GHz) and 18 GHz band (17.7-19.7 GHz), the frequency spectrum is assigned for microwave backhaul access (MWA) service for cellular backhaul. Thus, MWA coexists with FSS in these frequency bands.

Fixed Service (point to point MWA) and Gateways can be coordinated for co-existence.

In the case of the 28 GHz, IMT was not identified in this band. However, similar terrestrial sharing studies was conducted by Task Group 5/1 for WRC-19 on the 26 GHz. The results of the studies1 showed possible separation distance of up to 10km between FSS earth station and IMT station.

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 alongwith international practice in this regard.

[1] Please refer to CPM19-2 report page 172 Section 2/1.13/3.2.1.3

Response:

To the extent feasible, Spectrum assigned to the satellite user link should not be assigned to terrestrial networks to avoid any kind of potential interference between two services as they will come in line of communication & interference between two services may be there. The issue may be quite less when there are limited number of point-point fixed service (MWA) but as the number of satellite user links and FS services will grow, interference issue may be there, and thus is best that spectrum for satellite user link should be kept separate from terrestrial services.

For the case of ESIM, sharing conditions could be adopted from relevant resolutions from the outcomes of previous WRCs such as Res **123 (WRC-23)** and Res **169 (WRC-19)** for protection of terrestrial services in the Ka-band.

Q9. Whether there is a need to prescribe any conditions to mitigate the risk of scarcity of satellite gateway sites? If yes, please provide a detailed response along with international practice in this regard.

Response:

The satellite gateway of NGSO satellite systems consists of an array of tracking antennas, and the decision of the location of the gateway may involve several factors such as no obstructions blocking any views to the satellites, cost of land, power supply, fiber availability etc.

Practice in different countries may be basis the size, availability of various resources etc. In India, there may not be such scarcity related to availability of suitable satellite gateway sites. Considering above, other than consideration of mitigating the interference between NGSO/GSO gateway systems, there should not be any additional conditions required to mitigate any risk of scarcity of satellite gateway links.

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 – (c) NGSO based Fixed Satellite Services for providing data communication and Internet services; (d) GSO/ NGSO based Mobile Satellite Services for providing voice, text, data, and Internet services? Please provide a detailed response alongwith international practice in this regard.

Response:

In its Recommendations on the Framework for Service Authorisations to be Granted Under the Telecommunications Act, 2023 dated 18-09-2024, TRAI has already outlined explicit roll out conditions.

Furthermore, the roll out obligations are to be met within 18 or 24 months from the date of assignment of frequency assignment subject to issuance of relevant Authorization as well. Any delay in issuing administrative authorization should be taken into consideration for levying LD charges.

As such, in our view there is no need to impose additional roll-out obligations for the assignment of frequency spectrum.

Q11. Whether there is a need to introduce a provision for surrender of frequency spectrum prior to the expiry of the period of validity of spectrum assigned for - (c) NGSO based Fixed Satellite Services for providing data communication and Internet services; (d) GSO/ NGSO based Mobile Satellite Services for providing voice, text, data, and Internet services? If yes, what should be the process, and associated terms and conditions such as minimum period of spectrum holding, notice period, surrender fee, etc.? Please provide a detailed response with justifications.

Response:

Yes, there should be provision for surrender of frequency spectrum prior to the period validity of spectrum assigned for NGSO system. This may be based on various conditions such as:

I) The NGSO operator wants to voluntary surrender the spectrum OR
II) Within maximum 18 months of time when the NGSO system is no-longer authorised for providing services in India OR
III) The number of user links are less than pre-defined numbers continuously for last 12 months period OR
IV) The NGSO system is causing major interference to other GSO/NGSO system, which makes the impacted system substantially impacted and both parties are unable to resolve the issue, and such the interference remains unresolved for more than > 12 months.

In the event of spectrum surrender, NGSO operator need to ensure that

a) there are no user terminals operating in the spectrum to be surrendered
b) notice period of defined number of months may be considered
c) there should not be any surrender fee as the spectrum may be re-utilised for other contenders.

Q12. Whether there is a need to prescribe timelines for processing the applications for the assignment of frequency spectrum for- (c) NGSO based Fixed Satellite Services for providing data communication and Internet services; (d) GSO/ NGSO based Mobile Satellite Services for providing voice, text, data, and Internet services? Please provide a detailed response with justifications.

Response:

It is preferable that that spectrum assignment and allocation be made, within 15 days of the application. Delay in the assignment of spectrum may result in non-utilization of precious satellite resources. Therefore, it is important that the frequency spectrum is assigned to the authorised entities within a reasonable timeframe of 15 days. TRAI recommendations on ease of doing business for Satcom issued in May 2023 may be kindly reiterated in this regard.

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; (b) GSO/ NGSO based Mobile Satellite Services for providing voice, text, data, and Internet services? Please provide a detailed response with justifications.

No Comments

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.**

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.

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 a detailed justification for your answers.

Response:

The present approach of revenue share for commercial services is appropriate for India for nascent space sector to grow.

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

Satellite services, both FSS and MSS inherently provide extensive coverage, making them ideal for serving vast geographical areas within a country. Satellite services play a critical role in disaster recovery and emergency response efforts. National-level Service Authorisation as recommended by The Authority shall ensure 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.

Charging Mechanism for the administrative assignment of spectrum for user terminal links and gateway station links should be charged basis percentage of AGR as it ensures that the spectrum charges are linked to the revenue generated by the service provider from such spectrum. Linking it with the amount of spectrum assigned will increase the cost of the satellite bandwidth charges, which anyway is expensive and will expensive as compared to terrestrial technology.

The present approach of revenue share (**Percentage of AGR**) for commercial services is appropriate for India for nascent space sector to grow. Keeping in view that spectrum charges should be sufficient to cover the administrative costs of spectrum which amounts to a fraction of the revenues (0.3-0.4%) for commercial Satcom, we recommend that the percentage be decided accordingly at 1% of the AGR. This would be in consonance with the National priorities of Mainstreaming Satcom and that of Ease of Doing Business as enshrined in the core principles of the Telecommunications Act 2023.

This would be also in consonance with the TRAI Recommendations of June 2021 for implementing 1% SUC for all Commercial VSAT & GMPCS Licenses. This has been the ask of the entire Satcom industry

Therefore, we suggest that the SUC charges should be kept at 1% of AGR, across all satellite service authorizations.

Q17. Considering the Adjusted Gross Revenue (AGR) based charging methodology currently followed for Commercial VSAT and in view of the enhanced scope of the Satellite service authorisation, what should be the spectrum charge, as a percentage of AGR, that should be levied on GSO-based FSS? Or, Should some alternative spectrum charging methodology be used for determining spectrum charges for GSO-based FSS? Please provide a detailed justification for your answer.

Response:

It is suggested that the existing methodology of SUC being percentage of AGR should be continued. The SUC charges should be kept at 1% of AGR, for Commercial VSAT authorisation. As communicated earlier by Nelco in response to consultation paper on `framework of service authorisation' the license for commercial VSAT CUG and GMPCS should be kept separate considering the difference in scope of services. Alternatively, the new proposed Satellite service authorisation, should not result in increase in the AGR based charging methodology for commercial VSAT licensee.

Q18. Should spectrum charges for GSO and NGSO-based MSS that provide voice, text, data, and Internet services be levied: i. On a per MHz basis, ii. On a percentage of AGR basis, or iii. Through some other methodology? Please provide a detailed justification for your answer.

It is suggested that for NGSO-based MSS services, SUC should be charged as percentage of AGR for non-exclusive bands (other than S-band and L-band) and should be kept at 1% of AGR, for GSO and NGSO-based MSS services.

For L-band & S-band, as the spectrum is expected to be assigned on exclusive basis, the pricing may be kept at appropriate higher percentage of AGR.

Q19. If it is determined that spectrum charges for GSO/NGSO-based MSS providing voice, text, data, 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:

Not applicable, as we are in favour of it being decided as a percentage of AGR and not on a per MHz basis.

Q20. If it is decided that spectrum charges for GSO/NGSO-based MSS providing voice, text, data, and Internet services should be levied on a percentage of AGR basis: i. What should be the appropriate percentage? 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? Is there an alternative approach that could be followed to address the issue of inefficient spectrum utilization? Please provide a detailed justification for your answers.

Response:

It is suggested that for NGSO-based MSS services, SUC should be charged as percentage of AGR for non-exclusive bands (other than S-band and L-band) and should be kept at 1% of AGR, for GSO and NGSO-based MSS services.

For L-band & S-band, as the spectrum is expected to be assigned on exclusive basis, the pricing may be kept at higher percentage of AGR.