

To,
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“Assignment of Spectrum for Space-based Communication Services”

Technological Developments:

- A. This Consultation paper is a timely policy intervention considering the technological developments taking place in the space communication sector and the plans unveiled by many service providers to enter into this sector. Therefore, in order to set the context, it is importance to describe these technological developments.
- B. Satellite Constellations in Lower Earth Orbit (LEO) and Medium Earth Orbit (MEO) provide superior performance (due to low latency) than the traditional Geostationary (GSO) Satellites. In fact, the latency performance of NGSO satellites is comparable to terrestrial networks. On the other hand, GSO satellites these days employ spot beams, which provide higher capacities due to extensive spectrum reuse. Therefore, **Satellite networks have progressed into the domain of terrestrial networks as these provide the same experience and cater to same use-cases as terrestrial networks.**
- C. On the other hand, new technological developments such as beamforming enable terrestrial networks to utilize higher frequency spectrum (such as above 6 GHz) in the access segment. These frequencies have been until now used for Satellite and backhaul networks but not for access networks due to higher attenuation experienced by these waves. However, with beamforming, directional beams transmit the user data, which overcomes the limitation of high attenuation in higher frequencies. Thus, **terrestrial networks have also progressed into the domain of satellite networks as these can now harness the frequencies that have been until now used predominantly for satellite services.**

Convergence and Competition:

- D. The progression of satellite and terrestrial networks into each other’s domain **has resulted into convergence** between them. The standardization framework also recognizes such convergence; the Release 17 standardization framework of 3GPP includes satellite networks (i.e. Non-terrestrial networks) as a way of delivering services to mobile customers. Several Satellite Operators and Mobile Operators have announced collaborations to provide better coverage to users by providing services to mobile users directly through satellites. Furthermore, the satellite networks can also share the spectrum with terrestrial networks through coordination techniques. In addition, access and backhaul segments within terrestrial networks can also share frequencies.

- E. These technological developments have also **brought Satellite and terrestrial networks into direct competition with each other; as these will compete for the same spectrum bands and be used to serve same use-cases.**

Spectrum Assignment framework for space communication services:

- F. **The legal position in India prescribes the assignment of spectrum only through auctions. Auction is the only transparent and fair method for assignment of scarce resource like Spectrum. Hon'ble Supreme Court in the 2G case has denounced the first come first serve approach it leads to contentions around unfairness and non-transparency. The auction methodology has been successful for assignment of spectrum for mobile access networks since the year 2010.**
- G. Therefore, considering the legal position and growing convergence and competition between the terrestrial and space based communication services, the spectrum for space based communication services should be assigned only through auctions.
- H. However, it is sometimes contended by many that spectrum for space based communication services is a shared resource and can be assigned only by ITU on first come first basis. These contentions are based on misplaced understanding. **Firstly, ITU does not assign spectrum for use in any country and it is a right of a country (or administration) to assign spectrum within its territory. The role of ITU in spectrum management is limited to ensuring no interference between services. Secondly, exclusive assignment of spectrum through auctions is essential for interference free operations; the service providers can coordinate between them to share spectrum exclusively assigned to them based on feasibility and market requirement.**
- I. **Thus, the auction is the only viable assignment method for all commercial purposes (for terrestrial and satellite networks and for any segment access or backhaul) as it ensures transparency (anyone that fulfils eligibility can participate in auctions), encourages competition (new entrants can participate in auctions that are held periodically), and infuses efficiency (provision to share spectrum based on market forces leads to its optimum utilization).**
- J. Apart from above, through auctions, Government also gets fair revenue as per market-determined prices.

Spectrum Auction Methodology for GSO/NGSO user links & Satellite Earth Station Gateway links:

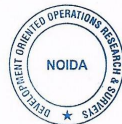
- K. As enunciated in the preface, spectrum for space based communication services needs to be assigned only through auctions. Furthermore, DoT in its reference to TRAI has sought TRAI's recommendations only on auction-based assignment. Therefore, considering the technological developments described in preface, DoT's reference and Judgement given by Hon'ble Supreme Court in the 2G case, spectrum for space based communication services should be assigned only

through auctions. For the purpose of auction, different approaches as described below, need to be adopted for GSO, NGSO and Gateway locations:

- L. GSO: For GSO user links, the spectrum bands need to be segmented into frequency blocks. In GSO satellites, the position of the satellite is fixed in respect to a location on earth and satellites positioned in different orbital positions can reuse the same frequency based on separation. Thus, **spectrum for GSO can be assigned through auction of same frequency blocks for different orbital slot positions.**
- M. NGSO: In NGSO, a constellation consisting of typically thousands of satellites serves the users. Achieving coordination amongst the multiple NGSO constellations, each having thousands of satellites, is practically impossible. Thus, **respective spectrum blocks within a band need to be assigned for exclusive use by respective service providers.**
- N. **Satellite Earth Station Gateway Link:** In each satellite earth gateway location, the **operator must have entire band assigned within the location of gateway due to high bandwidth requirement for gateway operations.** In these gateway location zones, no user links of satellite or terrestrial services will be allowed (operating in the spectrum band assigned to gateway) since the entire spectrum in the band may be used by gateway terminal. These gateway locations should be assigned to service providers on exclusive basis through auction.

Thanking you

Yours truly



Signature

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