Recommendations on Telecom Regulatory Authority of India Consultation Paper on Assignment of Spectrum for Space-based Communication Services

Reference on TRAI's Consultation paper dated on 06/04/2023

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Chapter 1

Introduction ITU-APT Foundation of India (IAFI)

We, the ITU-APT Foundation of India (IAFI), are a registered non-profit and non-political industry association registered under the Cooperative Societies Act of India. IAFI has been recognized by the International Telecommunication Union (ITU), the UN Organization for ICT issues, as an international/ regional Telecommunications organization and has been granted the sector Membership of the ITU Radio Communications Bureau (ITU-R), ITU Development Bureau (ITU-D) and ITU Telecommunication Standardization Bureau (ITU-T). IAFI is also an affiliate member of the APT. IAFI has been working for the last 20 years to encourage the involvement of professionals, corporate, public/private sector industries, R&D organizations, academic institutions, and other agencies in the activities of the ITU and APT. For more details regarding IAFI, please visit https://www.itu-apt.org/

Chapter 2

Executive Summary of views of IAFI

The use of satellite communication services has been rapidly increasing over the years, and with the ever-growing demand for high-speed internet and wireless services, the allocation of satellite spectrum has become a crucial issue. In the case of satellite spectrum, the decision on how to allocate the spectrum has been a topic of debate. The Telecom Regulatory Authority of India (TRAI) has solicited views on the methodology for the assignment of spectrum for space-based communication services in including auction-based and administrative approaches.
Satellite communications have a special global status as a part of the ITU constitution, a legal treaty signed by the administration of India. Provision 196 of the ITU Constitution stipulates as below.

> ***"196 (PP-98)***
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> ***In using frequency bands for radio services, Member States shall bear in mind that radio frequencies and any associated orbits, including the geostationary-satellite orbit, are limited natural resources and that they must be used rationally, efficiently and economically, in conformity with the provisions of the Radio Regulations, so that countries or groups of countries may have equitable access to those orbits and frequencies, taking into account the special needs of the developing countries and the geographical situation of particular countries."***

IAFI is of the firm view that administrative assignment is a more appropriate approach than auction-based approach for satellite spectrum, due to the following reasons:

a. Unlike the mobile services, where each operators needs a separate dedicated spectrum band, the satellite spectrum is used as a shared resource and the same spectrum is used by a multiple number of satellites and there are ITU rules for such sharing.
b. the administrative assignment of satellite spectrum enables efficient spectrum allocation.
c. The administrative assignment of satellite spectrum is consistent with international best practices. This approach has been adopted by all countries worldwide.
d. The assignment of spectrum for satellite services and the associated orbital resources is governed by international treaties and agreements, established by the International Telecommunication Union (ITU), so coordination at a global level has to be followed

as per the Radio Regulations (RRs) issued by ITU. Spectrum to the satellite operators in C band, Ku band and Ka band, should only be assigned on non-exclusive basis. Allocating spectrum on a non-exclusive basis allows for more efficient use of the limited spectrum resources available. This is particularly important for satellite services, which require large portions of the spectrum to operate effectively. Any spectrum serving an area on Earth can be used by multiple satellites.

e. Non-exclusive spectrum assignment enables multiple satellite operators to share the same spectrum, which can result in lower costs and better service for consumers. Sharing can also increase the flexibility of spectrum use, as operators can adjust their operations to fit changing demand.

f. Contrary to the exclusive spectrum rights that are enjoyed by terrestrial cellular operators for decades, space-based communications reuse the same spectrum repeatedly to service multiple countries from the same satellites from both the GEO and non-GSO systems, as also by multiple satellites serving the same area on Earth.

g. As acknowledged by TRAI, only four countries have engaged in some form of competitive allocation in connection to space communications (Brazil, Mexico, United States, and Saudi Arabia) and three of those countries (Brazil, Mexico and United States) decided to discontinue the auction system for satellite communications, as it was not practicable. These administrations rescinded that approach and moved back to administrative assignment. The United States passed legislation that is still in effect today (the ORBIT Act[1]) that prohibits the FCC from auctioning satellite spectrum and requires the President to advocate against international satellite spectrum auctions.In the case of Saudi Arabia, portions of MSS "S band" were auctioned only once in Saudi Arabia's history, and no other country has replicated that practice. iIt is noted that half of the S band spectrum auctioned in Saudi Arabia was sold specifically for terrestrial use (i.e., 3GPP carriers), and the other half was sold as MSS. However, these MSS blocks were sold with a path to convert their usage to terrestrial[2]. Therefore, it is arguable whether, in reality, the Saudi Arabia auction of S band spectrum was targeted

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[1] ORBIT Act: Open-Market Reorganization for the Betterment of International Telecommunications Act, Pub. L. No. 106-180, 114 Stat. 48 (2000), as amended, Pub. L. No. 107-233, 116 Stat. 1480 (2002), as amended, Pub. L. No. 108-228, 118 Stat. 644 (2004), as amended, Pub. L. No. 108-371, 118 Stat. 1752 (2004) (2004 ORBIT Act Amendments), as amended, Pub. L. No. 109-34, 119 Stat. 377 (2005) (2005 ORBIT Act Amendment), codified at 47 U.S.C. § 701 *et seq*., https://www.congress.gov/106/plaws/publ180/PLAW-106publ180.pdf.

[2] Excerpt from CITC public consultation document (section 3.4, page 10): "the winner of Block A2 may subsequently apply for an upgrade of its license to authorise the use of terrestrial technologies".

for space-based communications for the long term.

h. Non-exclusive assignment of spectrum can reduce the interference, as satellite services cover large geographic areas for instance, increasing the flexibility in frequency reuse. Non-exclusive spectrum assignment allows for coordination and cooperation between countries, reducing the risk of interference and ensuring that satellite services can operate without disruption.

i. The assignment of spectrum is governed by international treaties and agreements, established by the International Telecommunication Union (ITU) as well as bilateral coordination among different countries, so coordination at a global level has to be followed as per the ITU Radio Regulations (RRs). In case of satellite services, the ITU and national regulatory agencies aim to promote the efficient use of spectrum by allowing multiple users to share the same frequency bands through various coordination and interference mitigation techniques.

j. Satellite systems have a predefined range of frequencies, filed with the ITU and follow long and rigorous process of notification and registration into MIFR, so cannot be subsequently pick and choose depending on the outcome of the spectrum assignment of a market.

k. An auction of satellite spectrum will create anti-competitive and monopolistic conditions and augment the price of satellite spectrum by artificially making it a scarce resource and it will exclude some operators/service providers from the market entirely. Additionally, auction of spectrum for satellite services invariably results in a fragmentation of the available spectrum into small pieces, making it difficult for multiple satellite operators to share this limited resource.

l. Auction will also result in reduced quality of service since satellite operators will not have enough spectrum to meet the demand for services, this will in turn impact consumers in remote and underserved areas who rely on satellite communication services for internet connectivity, television programming, or emergency communications, among other offerings. Lack of spectrum can result in higher subscription fees or equipment costs, which can result in higher costs for consumers and, consequently, make services less accessible to consumers, particularly those in remote or underserved areas.

m. The unavailability of the necessary quantity of spectrum limits innovation in the satellite communication industry, as satellite operators may not have enough incentive to invest in new technologies or services when the spectrum required for such offerings

is lacking.

n. Connected and allied industries that rely on satellite communication services for critical operations will be impacted by the restricted availability and affordability of satellite communication services due to restrictions in access to required spectrum, rendering these industries unable to use satellite technology for critical operations, with an evident impact on the productivity and profitability of these industries.

Comparison of Shared, Administrative and-Auction Spectrum

Terrestrial Mobile spectrum (2G/3G/4G/5G) Auction Only	**Captive users Spectrum (Police/Defence/Aviation /Industrial/Government Administrative only**	**Satellite Spectrum (GSO/NGSO) Administrative Only**
Exclusive spectrum	Exclusive spectrum	Non-Exclusive and shared spectrum
Operators do not share spectrum. Each operator takes an exclusive portion of the Frequency band	Users do not share spectrum. Each user takes an exclusive portion of the band	Same portion of the frequency band is shared by multiple operators
Closed national market	Closed national users only	National/ Global or regional market
Network designed and operated for one country	Network designed and operated for users of one country	Network designed and operated for Global or regional footprint
No need of coordination with other countries through ITU for national use	No need for coordination with other countries through ITU for national use	Must coordinate with other countries through ITU
Operators do not share spectrum. Each operator takes an exclusive portion of the band	Users do not share spectrum. Each user takes an exclusive portion of the band	Same band is shared by multiple operators
Used for Commercial purpose for profit	Used for captive and noncommercial purposes only	Used for commercial and noncommercial purposes
Few Operators on exclusive basis required regular monitoring and competition review	Few Operators on exclusive basis required regular monitoring and competition review	Unlimited number of Operators and hence greater competition
A bankable property right	No property right	No property rights – shared by multiple operators

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Chapter 3

Response to Consultation Paper Questions

Q-1. 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.

IAFI response:

The assignment of spectrum for satellite services is governed by international treaties and agreements, established by the International Telecommunication Union (ITU), so coordination at a global level has to be followed as per the Radio Regulations (RRs) issued by ITU.

In India, WPC wing of DoT assigns the uplink/downlink frequency bands to all the satellite operator/end users willing to start satellite telecommunication/broadcasting services, depending up on the availability and coordination with ITU.

WPC wing of DoT has released the National Frequency Allocation Plan (NFAP-2022) based on the ITU Radio Regulation -2020, to bring transparency and ease of doing business. NFAP-2022 includes the frequency bands those can be assigned by Indian administration for various types of satellite communications services viz for Fixed (FSS), Mobile (MSS) and Broadcasting (BSS). Frequency bands can be used for up-linking or down-linking of telecom and broadcasting services, as clearly mentioned in the NFAP-2022.

There are 130 Frequency Bands allocated for various satellite communication services. A list of these bands is attached as Annexure-I. All these bands need to be considered for assignment for relevant satellite services in accordance with relevant provisions of the ITU Radio Regulations. Space-based communications play a critical role in a variety of applications, including remote sensing, earth observation, weather forecasting, navigation, satellite television, broadband internet. For each of these applications, there are different and specific frequency bands that are suitable and align with their characteristics. 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. Therefore, it is important to have access to a diverse set of frequency bands and services that can support these applications.

Further, provision 196 of the ITU Constitution stipulates as below.

> ***"196 (PP-98)***
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> ***In using frequency bands for radio services, Member States shall bear in mind that radio frequencies and any associated orbits, including the geostationary-satellite orbit, are limited natural resources and that they must be used rationally, efficiently and economically, in conformity with the provisions of the Radio Regulations, so that countries or groups of countries may have equitable access to those orbits and frequencies, taking into account the special needs of the developing countries and the geographical situation of particular countries."***

Hence, satellite communications have a special global status a a part of the ITU constitution which is a legal treaty signed by the administration of India.

Q-2. What quantum of spectrum for (a) gateway links and (b) user links in the appropriate frequency bands is required to meet the demand of space-based communication services? Information on present demand and likely demand after about five years may kindly be provided in two separate tables as per the proforma given below: (Table from Q2 is not reproduced)

IAFI response:

i. The quantum of spectrum required to deliver a particular service through satellite depends on factors such as the bandwidth to be transported, the modulation scheme used, and the number of channels being transmitted. Broadband internet services may require tens or even hundreds of MHz depending upon the of bandwidth to be transmitted.

ii. In general, the amount of spectrum required for satellite communications is assigned by national regulatory body, as the WPC wing of DoT in India. The Regulatory body

in India (WPC) works to ensure that the required spectrum will be used efficiently, and other services can coexist without interfering with each other.

iii. Satellite communication faces significant limitations in spectrum availability, with fewer bands allocated for this purpose compared to IMT bands. Moreover, some of the already limited bands have been repurposed for IMT, creating further constraints. Despite these challenges, the demand for satellite communication is on the rise. To address this, the IAFI recommends that TRAI fully harmonize India's spectrum use with global practices and secure exclusive use of all bands for satellite communication.

iv. The WRC process has evaluated demand for spectrum, leading to international spectrum allocations. India should consider these allocations and participate in the WRC process to address emerging demands for satellite communication.

v. 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.

Q-3. 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.

IAFI response:

The number of NGSO systems that can operate at a time without interfering with GSO systems and other NGSO systems depends on several factors, due to the unique system characteristics of each NGSO system and various technical and regulatory factors, such as the frequency bands used, the satellite orbits, the power levels, the antenna beam widths, and the level of coordination among the various NGSO systems. Necessary frequency coordination among NGSO systems is typically conducted to avoid interference and to ensure efficient use of limited spectrum resources. This is how satellite operators ensure that NGSO systems are deployed in a way that eliminates the potential for interference, while still allowing for efficient use of the available frequency bands. As long as the interference can be managed, there is no limit on the number of NGSO systems.

Article-22 of the Radio Regulation deals with the control of interference to geostationary-satellite systems:

As per Clause Article 22.2, non-geostationary-satellite systems shall not cause unacceptable interference to GSO and unless otherwise specified in these Regulations, shall not claim protection from geostationary satellite networks in the fixed-satellite service and the broadcasting-satellite service.

Table 22-2 of Article-22 of the Radio Regulation contains the EPFD limits of NGSO systems in detail. Further, the NGSO systems need to coordinate among themselves also.

Q-4. 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.

IAFI response:

i. IAFI does not support the exclusive assignment of satellite spectrum. If competitive, exclusive assignments are considered as the spectrum assignment mechanism, significant uncertainties will impact investment in space communications in India. For example, operators and countries will have to continue to coordinate their spectrum-orbit resource use through the globally established and shared spectrum regime under the ITU treaty obligations. But then they will also have to find a way to coordinate with a newly created regime of private-exclusive users that is only adopted by India.

ii. The consultation paper cites some examples of auctions in other jurisdictions. We note that those examples validate the industry view that auctions are not feasible for satellite spectrum, for the following reasons:

- As acknowledged by TRAI, only four countries have engaged in some form of competitive allocation in connection to space communications (Brazil, Mexico, United States, and Saudi Arabia) and three of those countries (Brazil, Mexico and United States) decided to discontinue the auction system for satellite communications, as it was not practicable. These administrations rescinded that approach and moved back to administrative assignment.
- The United States passed legislation that is still in effect today (the ORBIT Act[3]) that prohibits the FCC from auctioning satellite spectrum and requires the President to advocate against international satellite spectrum auctions.

[3] ORBIT Act: Open-Market Reorganization for the Betterment of International Telecommunications Act, Pub. L. No. 106-180, 114 Stat. 48 (2000), as amended, Pub. L. No. 107-233, 116 Stat. 1480 (2002), as amended, Pub. L. No. 108-228, 118 Stat. 644 (2004), as amended, Pub. L. No. 108-371, 118 Stat. 1752

- In the case of Saudi Arabia, portions of MSS "S band" were auctioned only once in Saudi Arabia's history, and no other country has replicated that practice. There are several reasons why this case of MSS spectrum was a one-off, and never replicated anywhere else. Firstly, it is noted that MSS spectrum is also subject to multilateral agreements for frequency use, for example, the L band Multilateral MoU (MLM), which would preclude issuing rights outside that MoU (ITU's Region 1 and Region 3 are part of the MoU). Secondly, in the case of S band, some regions have allocated parts of this band to terrestrial services, including Saudi Arabia. Moreover, half of the S band spectrum auctioned in Saudi Arabia was sold specifically for terrestrial use (i.e., 3GPP carriers), and the other half was sold as MSS. However, the MSS blocks were sold with a path to convert their usage to terrestrial[4]. Therefore, it is arguable whether, in reality, the Saudi Arabia auction of S band spectrum was targeted for space-based communications for the long term. Instead, its conditions of use and expected deployment path, specific to Saudi Arabia, implied that only terrestrial uses may occupy this band in the long term – which was not consistent either with a balanced supply-demand assessment for long term spectrum requirements for space-based communications. Furthermore, this auction ended up with only one buyer for all the lots on offer – placing significant doubts about the benefits of the process.

iii. Spectrum to the satellite operators in C band, Ku band and Ka band, should only be assigned on non-exclusive basis. Allocating spectrum on a non-exclusive basis allows for more efficient use of the limited spectrum resources available. This is particularly important for satellite services, which require large portions of the spectrum to operate effectively. Any spectrum serving an area on Earth can be used by multiple satellites.

iv. Non-exclusive spectrum assignment enables multiple satellite operators to share the same spectrum, which can result in lower costs and better service for consumers. Sharing can also increase the flexibility of spectrum use, as operators can adjust their operations to fit changing demand.

v. Contrary to the exclusive spectrum rights that are enjoyed by terrestrial cellular operators for decades, space-based communications reuse the same spectrum repeatedly to service multiple countries from the same satellites from both the GSO and non-GSO systems, as also by multiple satellites serving the same area on Earth.

vi. Non-exclusive assignment of spectrum can reduce the interference, as satellite services cover large geographic areas for instance, increasing the flexibility in frequency reuse.

(2004) (2004 ORBIT Act Amendments), as amended, Pub. L. No. 109-34, 119 Stat. 377 (2005) (2005 ORBIT Act Amendment), codified at 47 U.S.C. § 701 *et seq*., https://www.congress.gov/106/plaws/publ180/PLAW-106publ180.pdf.

[4] Excerpt from CITC public consultation document (section 3.4, page 10): "the winner of Block A2 may subsequently apply for an upgrade of its license to authorise the use of terrestrial technologies".

Non-exclusive spectrum assignment allows for coordination and cooperation between countries, reducing the risk of interference and ensuring that satellite services can operate without disruption.

vii. Satellite spectrum is also shared between multiple Fixed Satellite Service (FSS) and Broadcasting Satellite Service (BSS) operators.

viii. The assignment of spectrum is governed by international treaties and agreements, established by the International Telecommunication Union (ITU) as well as bilateral coordination among different countries,, so coordination at a global level has to be followed as per the ITU Radio Regulations (RRs). In case of satellite services, the ITU and national regulatory agencies aim to promote the efficient use of spectrum by allowing multiple users to share the same frequency bands through various coordination and interference mitigation techniques.

ix. Satellite systems have a predefined range of frequencies, filed with the ITU and follow long and rigorous process of notification and registration into MIFR, so cannot be subsequently pick and choose depending on the outcome of the spectrum assignment of a market.

x. It will create anti-competitive and monopolistic conditions and augment the price of satellite spectrum by artificially making it a scarce resource.

xi. It will exclude some operators/service providers from the market entirely.

Q - 5. 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 up to 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.

IAFI response 5 (a to c):

i. Satellite spectrum must be assigned on a non-exclusive basis.

ii. The concepts of block size, spectrum cap and intra-band share, as used in terrestrial mobile spectrum management, are not applicable in case of satellites. Please also see our response to Question 2 above.

iii. In case of satellites, spectrum is shared among several operators and coordinated at ITU /international level.

iv. The whole band needs to be assigned to each satellite network as, depending on systems design, full band is required to provide uninterrupted service.

v. Unlike terrestrial, concept of block size, minimum number of blocks, etc. will not be applicable to satellite systems as satellite systems involve a gateway and user terminals, which need to access spectrum over the entire frequency in different frequency bands for the uplink and the downlink.

vi. Satellite frequency use is not implemented through the aggregation of standardized frequency carriers or waveforms as found in IMT standards such as 3GPP.

vii. Satellite spectrum availability is directly proportional to the number of users that can be served by a satellite network. It is crucial to have spectrum availability and harmonization of the bands allocated to satellite services by WRCs (World Radiocommunication Conferences).

viii. The 26 GHz band is the frequency range of the millimeter-wave band identified for IMT by the ITU at WRC-19, among other mmWave bands. Spectrum above 27.5 GHz is not identified for 5G/IMT by the ITU.

ix. he ITU's Radio Regulations (RR) is a binding international treaty document that identifies 41 Radio Services to which the spectrum from 8.3 kHz to 275 GHz is allocated, in accordance with No. 31 of ITU's Constitution.

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.

i. Significant uncertainties will impact investment on space communications in India if exclusive assignment is considered as the spectrum assignment mechanism for satellite systems

ii. Furthermore, any requirement to have exclusive frequency licensees coordinating amongst themselves and/ or having these licensees coming up with their own coordination regime, this is likely to result in challenging dispute resolution processes. It is unclear whether any benefit would be possible from having a different resolution process, detached from the already available ITU process. Having two parallel regimes in India, one dealing with private-exclusive users and another for public-shared users (for example ISRO) is unlikely to simplify the already complex frequency coordination process for space radiocommunications, as well as being unlikely to provide investment certainty.

iii. The consultation paper cites some examples of auctions in other jurisdictions. As explained in Q4 above, current status of those examples validate our view that auctions are not feasible for satellite spectrum,

Q-6. What provisions should be made applicable on any new entrant or any entity who could not acquire spectrum in the auction process/assignment cycle?

(a) Whether such entity should take part in the next auction/ assignment cycle after expiry of the validity period of the assigned spectrum? If yes, what should be the validity period of the auctioned/assigned spectrum?

(b) Whether spectrum acquired through auction be permitted to be shared with any entity which does not hold spectrum/ or has not been successful in auction in the said band? If yes, what measures should be taken to ensure rationale of spectrum auction and to avoid adverse impact on the dynamics of the spectrum auction?

(c) In case an auction based on exclusive assignment is held in a spectrum band, whether the same spectrum may again be put to auction after certain number of years to any new entrant including the entities which could not acquire spectrum in the previous auction? If yes,

(i) After how many years the same spectrum band should be put to auction for the potential bidders?

(ii) What should be the validity of spectrum for the first conducted auction in a

band? Whether the validity period for the subsequent auctions in that band should be co-terminus with the validity period of the first held auction?

IAFI response:

a. Any new entrant willing to start satellite services, has to submit the application to the national administration/regulator of the country, who after examining the application in detail and after coordination as per ITU procedure, will permit to start the satellite services. Spectrum will also be assigned to the new entrant by the national administration depending up on the types of service, willing to be started.
b. Spectrum to the satellite operators should only be assigned on non-exclusive basis. Assigning spectrum on a non-exclusive basis allows for more efficient use of the limited spectrum resources available. This is particularly important for satellite services, which require large portions of the spectrum to operate effectively (though on shared basis with other satellite systems)
c. Furthermore, an auction could create "super providers/spectrum holders" controlling access to the spectrum, and therefore controlling the market for other entities. This may lead to valuable spectrum lying unused with one of the operators waiting for a new applicant. This will also lead to spectrum hoarding of valuable satellite spectrum. This may also lead to hoarding of spectrum.
d. Due to the technical characteristics of satellite services and the spectrum sharing mechanisms already used by the most of the administrations worldwide, auctioning spectrum for satellite services in not prevalent and providing exclusive rights to its use will hinder the development of satellite networks in India, as it will decrease its usability and, consequently, decrease its overall value.
e. Unlike terrestrial players who have various spectrum bands and can decide to switch on and off on their base stations, satellite is designed to operate on the same frequency range across the service area. It cannot use a different frequency depending on the market it serves. Hence the reason for the satellite spectrum assignment in done by the national administration after coordination with ITU.
f. Adopting auction mechanism for satellite spectrum, it is quite possible that an operator could not secures required spectrum band or only partial access to its required spectrum in a given country, so no service can be provided by that operator.
g. Satellite spectrum assignment also needs to take into consideration services that benefit

society, such as disaster recovery and universal connectivity besides serving the difficult terrain & unconnected areas. Auctioning satellite spectrum might prioritize revenue generation over these public interest considerations.

h. US Orbit Act 2000: prevent any assignment by competitive bidding of orbital locations or spectrum used for the provision of such services.

Q-7. 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?

IAFI response:

Satellite Spectrum should be assigned administratively, so there is no question of permitting trading of satellite spectrum, as in case of terrestrial services.

Q-8. 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?

IAFI response:

Same as question-6.

Q-9. 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.

IAFI response:

a. IAFI is of clear opinion that satellite spectrum in C, Ku and Ka band or any other band likely to be assigned in future for satellite communication services, should by assigned only on non-exclusive basis, to ensure the efficient utilization of the satellite spectrum resource.
b. The framework for coordination already exists at ITU level, and not at national level. ITU Radio Regulations -2020 may kindly be seen.
c. It may be noted that due to the present ITU framework and Coordination Procedures, 99.95% of spectrum assigned to various satellite networks is free from reported harmful interference. This is testament of the robustness of the current framework. The principle that the right to use orbital and spectrum resources for a satellite network or system is acquired through negotiations concerned by actual usage of the same portion of the spectrum and orbital resources - has proven to be the best means of achieving rational, cost-effective, and efficient spectrum and orbital management.
d. Reference to provision CS196 of ITU constitution and convention.
e. IAFI is of the view that the current ITU process for the management of the shared spectrum-orbit resource is already well developed and there is no value in duplication.

Q-10. 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.

IAFI response:

i. The frequency range 27.5-28.5 GHz is already used in many of the satellites that are either launched or in the build stage and will deploy to offer broadband services around the world, including to customers in India.

ii. The frequency band 27.5-28.5 GHz band is used by satellite systems to provide coverage to subscribers who live in un-served and underserved areas, where terrestrial options for

access to broadband solutions are lacking.

iii. The 27.5-28.5 GHz band is a part of the 27.5-31 GHz globally allocated FSS band. Several satellites also in the Asia-Pacific region, already use, amongst others. Globally, there is a trend to develop and deploy "High Throughput Satellites" (HTS) offering wideband connections to end users through large numbers of small spot beams with extensive frequency re-use.

iv. The 28 GHz band (Ka-Band) has long been allocated for Satellite Service. The risk of interference will arise if terrestrial mobile services are authorized in this band. This band however was not accepted as a potential IMT band at ITU WRC-15 and WRC-19, ITU Members States has instead harmonized a total of 17 GHz of other mm-Wave band for 5G.

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

vi. In order for India to be able to enjoy the benefits of both satellite broadband services and terrestrial IMT/5G, TRAI and DOT should allocate the 28 GHz band exclusively for satellite services and identify other frequency bands (e.g., 24.25-27.5 GHz, 37-43.5 GHz, 45.5-47 GHz, 47.2-48.2 and 66-71 GHz) which have been globally harmonized for terrestrial IMT/5G.

vii. We note that IMT has the full 26 GHz band already, not fully utilized.

viii. It is not feasible, in one hand, to seek a supply-demand balance on spectrum for space-based communications, while, in the other hand, plans are being suggested to assign half of the 28 GHz band to terrestrial services; thus constraining the potential spectrum supply to satellite services.

ix. India will benefit from maintaining a harmonised used of the Ka band, as this band has emerged as the global choice for Ultra High Throughput Satellite systems, particularly for use by ubiquitous FSS and ESIM. Over 100 countries have now adopted or are planning to use the Ka band, and the 28 GHz band in full (27.5-29.5 GHz) in full and

exclusively for FSS and ESIM.

x. Countries who went against ITU rules are currently making reversals:

a. The FCC chairwoman[5] said that the FCC made a mistake a few years ago when it focused all of its energy in the early 5G days on milli-meter wave. Recently, Verizon is also reportedly selling off some of its 28 GHz in secondary market.

b. Korea government recently revoked 2 operator licenses in the 28 GHz band, in their assessment[6], MSIT stated "Despite these efforts by the government, the carrier operators remain lukewarm about expanding 28 GHz networks. The terminal devices they have built thus far account for only 10% of what was promised three years ago"

c. Another example of a full allocation of the Ka band in full for satellite systems in Australia

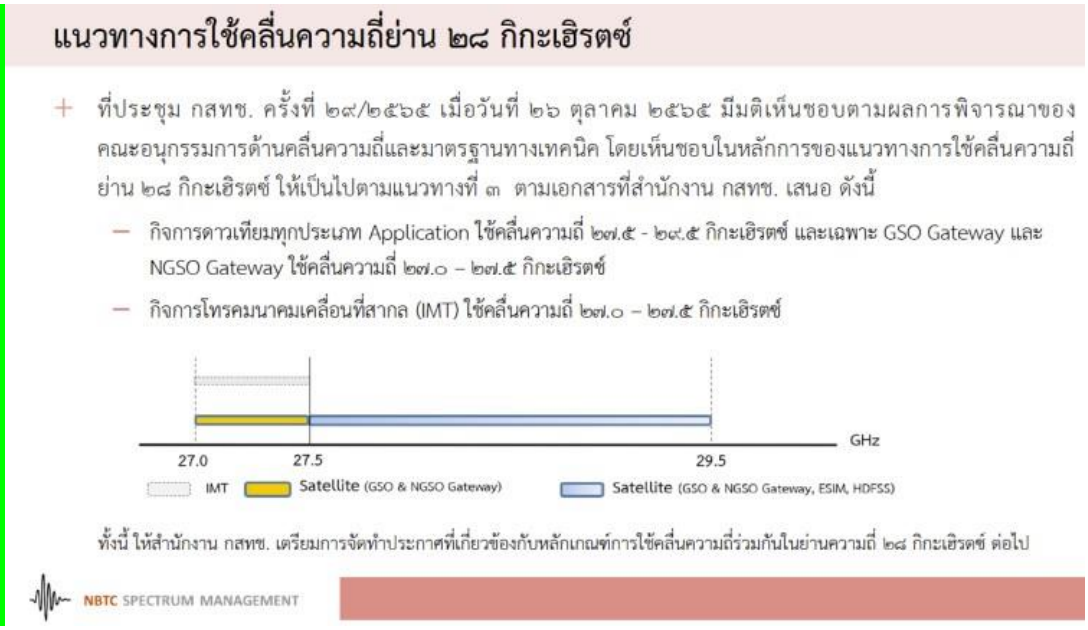
d. Recent examples in the Asia Pacific region include China, Philippines, Australia, Thailand and many others. Many countries like Singapore, Japan are revisiting the 28 GHz plans. All these countries continue to maintain the globally shared spectrum regime managed and coordinated by the ITU, and their frequency allocation is harmonised with the International Radio Regulations. Thailand for example – as global tourism destination - has recognised the growing need for high-capacity broadband in mobility and has allocated the full 28 GHz for satellite connectivity to deploy ubiquitous FSS and ESIM for aviation, maritime and land uses. The decision by the NBTC[7] is depicted below:

[5] https://www.axios.com/2021/07/16/fcc-5g-midband-milimeter-spectrum-digital-divide

[6] https://www.msit.go.kr/eng/bbs/view.do?sCode=eng&mId=4&mPid=2&pageIndex=&bbsSeqNo=42&nttSeqNo=753&searchOpt=ALL&searchTxt=28ghz

[7] The NBTC decision and related analysis can be found at: https://dpolit.com/2023/01/08/thailand-secures-next-generation-inflight-connectivity-nbtc-allocates-the-full-28-ghz-spectrum-band-for-satellite-broadband/.

xi.



Q-11. 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?

IAFI response:

i. Same as Q-10.

ii. In addition, spectrum that is assigned either through auction or an administrative mechanism is assigned for a given service. The pricing of the spectrum takes into account the use of the spectrum by a particular service and does not envisage a flexible use case. Therefore, it will be incorrect to determine the price and then apply the flexible sharing principle. In addition, such a move will create an imbalance where spectrum assigned for IMT (allowing flexible use) could be used for both gateway stations, Earth Stations in Motion (ESIM), and user terminal operations, whereas spectrum assigned for satellite use will be permitted only for gateway stations and ESIM use and not for user terminal use. 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. Therefore, the only possible arrangement would be for IMT to be allowed as a secondary use, on a non-interference/non-protection basis.

Q-12. 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?

IAFI response:

i. CNPN users want dedicated spectrum in various low and mid bands where there is extensive ecosystem for 4G and 5G to benefits from economies of scale, however this ecosystem in the 29GHz is non existing since it is not part of the band adopted by US, and other few markets who adopted it are rolling back.

ii. Considering the low demand of spectrum by industry for developing mm wave band CNPN network by directly acquiring spectrum from DoT through auction in these bands and lot of unsold spectrum is available in 26 GHz band, so there no requirement to allow 5G/CNPN services in 28.5-29.5 GHz band, as it is not needed by CNPN users

iii. On the other hand, CNPN users have been waiting for spectrum in various low and mid bands and their progress has been held up due to delay in the DOT for grant of direct spectrum in bands below 6 GHz to the CNPN applicants.

Q-13. 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.

IAFI response:

IAFI response at Q-12 may also be seen. CNPN users are only looking for spectrum below 6GHz, in particular around 4 GHz.
Assigning spectrum between 28.5 - 29.5 GHz to both 5G and satellite services can create several problems and challenges, as detailed below.

The assignment of the same frequency band to two different services can cause interference between them, which can affect the quality and reliability of the services.

a. Sharing the same spectrum band between two services can increase the cost of deploying and operating both services. Both satellite and 5G networks require

expensive equipment and infrastructure to operate, and sharing the same frequency band may require additional investment to mitigate the interference and capacity issues.

b. Satellite networks and 5G networks use different technologies and standards, which may not be compatible with each other. This can create challenges for the coordination and management of the shared frequency band.

c. The assignment of the 28.5 - 29.5 GHz band to both satellite and 5G services can create challenges for international coordination and harmonization of spectrum use. Different countries and regions may have different policies and requirements for spectrum assignment, which can create inconsistencies and conflicts in the use of the frequency band.

So, assigning the same frequency band to two different services can create technical, economic, and regulatory challenges. Hence, the importance of exclusive assignment in the 28.5-29.5 GHz for satellite services only.

Q-14. Whether space-based communication service 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 of this consultation paper) for the financial year 2018-19, 2019-20, 2020-21, 2021-22, and 2022-23 in the format given below:

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

b) Projections on revenue, subscriber base and capital expenditure for each type of service (as mentioned in the Table 1.3 of this consultation paper) for the whole industry for the next five years starting from financial year 2023-24, in the format given below:

Type of service: _____			
Financial Year	**Revenue (Rs.lakh)**	**Subscriberbase**	**CAPEXfortheyear (Rs.lakh)**
2023-24			
2024-25			
2025-26			
2026-27			
2027-28			

IAFI Response:

a. Space-based satellite communication services can be classified in many ways. One most common terminology used to categorize the satellite services is -
   - FSS
   - BSS
   - MSS

b. In addition to the above, the satellite services can be classified in the following two categories.
   - One-way satellite communication link service
   - Two-way satellite communication link service

c. In **one-way** satellite communication link means, the information can be transferred from one earth station to one or more earth stations through a satellite. That means, it provides both point to point connectivity and point to multi point connectivity.

d. Following are some examples of the **one-way** satellite communication link **services**.
   - Broadcasting satellite services (BSS) like Radio, TV and Internet services.
   - Space operations services like Telemetry, Tracking and Commanding services.
   - Radio determination satellite service like Position location service.

e. In **two-way** satellite communication link, the information can be exchanged between any two earth stations through a satellite. That means, it provides only point to point connectivity.

f. Following are some of the two-way satellite communication link **services**.
   - Fixed satellite services like Telephone, Fax and Data of high bit rate services (FSS).

- Mobile satellite services like Land mobile, Maritime and Aero mobile communication services (MSS).

g. Regarding spectrum assignment for various types of satellite services, WPC wing has already released NFAP-2022, in which spectrum for various types of services has been earmarked including of link direction i.e. earth to space or space to earth direction.

h. Regarding year-wise revenue earned from the various types of satellite services – the details can be provided by the service providers.

Q-15. 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?

IAFI Response:

i. IAFI is of the view that the spectrum for all types of the satellite services should be assigned through fair and transparent administrative processes, for space stations and earth stations.

ii. While these lower frequency bands do indeed require exclusive use also for satellite service provision, IAFI notes that, depending on the application (e.g. safety and security service, air-to-ground), global or at least regional harmonization of spectrum may be required, which is not well served by domestic auction processes.

iii. IAFI is of the firm view that administrative assignment is a more appropriate approach than auction-based approach for Mobile Satellite Service spectrum. The International Telecommunication Union (ITU), the United Nations specialized agency for information and communication technologies, recommends administrative assignment as the preferred approach for the allocation of satellite spectrum. This approach has been adopted by many countries worldwide. Further, the administrative assignment of satellite spectrum enables efficient spectrum allocations.

iv. There are several factors that should be considered when assigning spectrum for user links for space-based communication services in the L and S-band such as the extensive societal advantages that satellite services offer, including connecting the unconnected, disaster forecasting and recovery, logistical tracking, and defence communications. These essential services depend on the availability and efficient utilization of satellite spectrum to function effectively. In India, MSS in these bands

would improve coverage of rural areas in the community, thus bridging the digital divide in terms of geography, strengthening rural economies and contributing to the competitiveness of Indian ICT industries. However, high up-front investment required for the development of mobile satellite systems and the associated high technological and financial risks necessitate a predictable administrative framework for licensing, so that MSS can remain economically viable.

v. Additionally, given the global nature of satellites, MSS operators must seek spectrum assignments in many Administrations around the world. The complexity of multiple licensing regimes is costly and time-consuming, but auctions bring about another level of uncertainty and thus cost to the global licensing model, which can impact economies of scale and the ability to deliver services in a cost-effective manner. Where government priority is digital inclusivity, particularly for India's most underserved and citizens, auctioning spectrum would add to the expense of providing service in India, thus risking that services become too expensive for these potential consumers, or worse, unavailable.

vi. The Government of India can execute its policy goals more easily in an administrative approach than through auction. These goals can include the applicant meeting certain minimum requirements and milestones which can be grouped into business, operational and technical conditions defined in the licensing process. Examples of operational requirements include proposed coverage, agreement with ITU registered satellite operator/ or operator experience, timeframe for providing MSS, availability of end user equipment. The technical requirements can relate to the technical and commercial development of the MSS systems, satellite launch, radio frequency coordination at the ITU level, etc. Overall, there must be reasonable, cost-based licensing as highlighted elsewhere in this consultation.

vii. Finally, an auction of satellite spectrum will create anti-competitive and monopolistic conditions and augment the price of satellite spectrum by artificially making it a scarce resource and it will exclude some operators/service providers from the market entirely.

Q-16. 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 inTable1.3 of this consultation paper).

IAFI Response:

i. IAFI is of the view that the spectrum for all types of the satellite services should be assigned through fair and transparent administrative processes, for earth stations as well as for the user stations

ii. IAFI is of the firm view that administrative assignment is a more appropriate approach than auction-based approach for Fixed and Broadcasting Satellite service spectrum. Unlike the mobile services, where each operators needs a separate dedicated spectrum band, the satellite spectrum is used as a shared resource and the same spectrum is used by a multiple number of satellites and there are ITU rules for such sharing. The administrative assignment of satellite spectrum is consistent with international best practices. This approach has been adopted by many countries worldwide. Further, the administrative assignment of satellite spectrum enables efficient spectrum allocation.

iii. The assignment of spectrum for satellite services is governed by international treaties and agreements, established by the International Telecommunication Union (ITU), so coordination at a global level has to be followed as per the Radio Regulations (RRs) issued by ITU. Spectrum to the satellite operators in C band, Ku band and Ka band, should only be assigned on non-exclusive basis. Allocating spectrum on a non-exclusive basis allows for more efficient use of the limited spectrum resources available. This is particularly important for satellite services, which require large portions of the spectrum to operate effectively. Any spectrum serving an area on Earth can be used by multiple satellites. Satellite systems have a predefined range of frequencies, filed with the ITU and follow long and rigorous process of notification and registration into MIFR, so cannot be subsequently pick and choose depending on the outcome of the spectrum assignment of a market.

iv. Non-exclusive spectrum assignment enables multiple satellite operators to share the same spectrum, which can result in lower costs and better service for consumers. Sharing can also increase the flexibility of spectrum use, as operators can adjust their operations to fit changing demand. Contrary to the exclusive spectrum rights that are enjoyed by terrestrial cellular operators for decades, space-based communications reuse the same spectrum repeatedly to service multiple countries from the same satellites from both the GEO and non-GSO systems, as also by multiple satellites serving the

same area on Earth. Further, non-exclusive assignment of spectrum can reduce the interference, as satellite services cover large geographic areas for instance, increasing the flexibility in frequency reuse. Non-exclusive spectrum assignment allows for coordination and cooperation between countries, reducing the risk of interference and ensuring that satellite services can operate without disruption.

v. Satellite systems have a predefined range of frequencies, filed with the ITU and follow long and rigorous process of notification and registration into MIFR, so cannot be subsequently pick and choose depending on the outcome of the spectrum assignment of a market.

vi. Finally, an auction of satellite spectrum will create anti-competitive and monopolistic conditions and augment the price of satellite spectrum by artificially making it a scarce resource and it will exclude some operators/service providers from the market entirely.

vii. This is the only way to:
- allow for the usual sharing of spectrum among operators;
- ensure an efficient spectrum use;
- not impose any artificial limit to the number of operators servicing the Indian market;
- guarantee the best choice and service provision to Indian consumers; and
- avoid anti-competitive and monopolistic situations.

Q-17. Whether spectrum for user links should be assigned at the national level, or telecom circle/ metro-wise?

IAFI Response:

Spectrum for user links should be assigned administratively at the national level, as VSATs, ESIMs, and other user Terminals deployment would be ubiquitous.

IAFI is of the firm view that administrative assignment is a more appropriate approach than auction-based approach for satellite spectrum. Unlike the mobile services, where each operators needs a separate dedicated spectrum band, the satellite spectrum is used as a shared resource and the same spectrum is used by a multiple number of satellites and there are ITU rules for such sharing. The administrative assignment of satellite spectrum is consistent with international best practices. This approach has been adopted by many countries worldwide. Further, the administrative assignment of satellite spectrum enables efficient spectrum allocation.

The assignment of spectrum for satellite services is governed by international treaties and

agreements, established by the International Telecommunication Union (ITU), so coordination at a global level has to be followed as per the Radio Regulations (RRs) issued by ITU. Spectrum to the satellite operators in C band, Ku band and Ka band, should only be assigned on non-exclusive basis. Allocating spectrum on a non-exclusive basis allows for more efficient use of the limited spectrum resources available. This is particularly important for satellite services, which require large portions of the spectrum to operate effectively. Any spectrum serving an area on Earth can be used by multiple satellites. Satellite systems have a predefined range of frequencies, filed with the ITU and follow long and rigorous process of notification and registration into MIFR, so cannot be subsequently pick and choose depending on the outcome of the spectrum assignment of a market.

Non-exclusive spectrum assignment enables multiple satellite operators to share the same spectrum, which can result in lower costs and better service for consumers. Sharing can also increase the flexibility of spectrum use, as operators can adjust their operations to fit changing demand. Contrary to the exclusive spectrum rights that are enjoyed by terrestrial cellular operators for decades, space-based communications reuse the same spectrum repeatedly to service multiple countries from the same satellites from both the GEO and non-GSO systems, as also by multiple satellites serving the same area on Earth. Further, non-exclusive assignment of spectrum can reduce the interference, as satellite services cover large geographic areas for instance, increasing the flexibility in frequency reuse. Non-exclusive spectrum assignment allows for coordination and cooperation between countries, reducing the risk of interference and ensuring that satellite services can operate without disruption.

Satellite systems have a predefined range of frequencies, filed with the ITU and follow long and rigorous process of notification and registration into MIFR, so cannot be subsequently pick and choose depending on the outcome of the spectrum assignment of a market.

Finally, an auction of satellite spectrum will create anti-competitive and monopolistic conditions and augment the price of satellite spectrum by artificially making it a scarce resource and it will exclude some operators/service providers from the market entirely.

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.

IAFI Response:

IAFI is of the view that the spectrum for all types of the satellite services should be assigned through fair and transparent administrative processes, for earth stations and user stations.
Auction of satellite spectrum, based on type of satellite services would add an additional degree of confusion and unsustainability, as an entity would potentially have to participate in multiple auctions for the same spectrum. This would further remove flexibility for possible transitions from one service provision to another.

Q-19. 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.

IAFI Response:

IAFI is of the view that the spectrum for all types of the satellite services should be assigned through fair and transparent administrative processes, for earth stations and user stations due to following reasons:

i. Satellite spectrum to be assigned through fair and transparent administrative processes, for earth stations and user stations.
ii. In India, Satellite Spectrum is assigned administratively, and auction process has not been followed till date. Even in almost all countries of the world, satellite spectrum is administratively assigned everywhere, and charges taken essentially covering the cost of administration.
iii. Satellite spectrum assignments is to be shared (multiple satellite operators/service providers use the same frequencies), is facilitated via coordination with other satellite operators. Auctions gives exclusive rights to a few satellite operators by dividing the spectrum among them, but it will limit the use of spectrum and would constrain the viability and inherent flexibility of satellite systems.
iv. Spectrum assignment methodology for any service, either by auction or administrative or unlicensed utilization, are subjected to the physical and technical complexity aspects of the technology in use, resource supply-demand mismatch, past precedence and global practices. Hence, no methodology is superior to another or should have a preference or priority over another. Due to the technical characteristics of satellite services and the spectrum sharing mechanisms already used by the various administrations worldwide, auctioning spectrum for satellite services and providing exclusive rights to its use will hinder the development of satellite networks in India, as it will decrease its usability and, consequently, decrease its overall value.

a. Unlike the assignments of spectrum for terrestrial networks, the fragmentation of spectrum will result in a loss of satellite capacity, so the auction is not used.

Q-20. 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.

IAFI Response:

IAFI is of the view that the spectrum for all types of the satellite services should be assigned through fair and transparent administrative processes, for space stations and earth stations.

Q-21. 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 any other 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?

IAFI Response:

IAFI is of the view that the spectrum for all types of the satellite services should be assigned through fair and transparent administrative processes, for earth stations and user stations.

Q-22. 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 stake holders? 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.

IAFI Response:

(i) IAFI is of the very clear view that the gateway and user links spectrum should be assigned through fair and transparent administrative processes. Spectrum should be assigned administratively, and in a bundled manner for gateway link and user link.

(ii) Assignment of spectrum for both user links and gateway links are both necessary and cannot go one without the other. A satellite service provider cannot operate partially, if only gateway link or user link spectrum is assigned.

Q-23. 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?

IAFI Response:

i. No protection distances are required between GSO and NGSO, and operators/service providers can be licensed after ensuring that such inter-system coordination has been duly notified and/or such protection mechanisms, as prescribed by Article 22 and Resolution 76, have a favorable finding by the ITU.

ii. Multiple gateways of GSO systems using the same spectrum can coexist in the same location, thanks to the angular separation and satellite selection, as it is the case in the various teleports around the world.

iii. GSO and NGSO gateways can also coexist, due to various implementation of GSO arc avoidance by NGSO systems to comply with EPFD limit.

iv. Coordination is needed to work out the details of coexistence between NGSO gateways and whether separation distances are necessary. This can also be ensured by taking into account the agreed interference criterion and the technical characteristics of the systems involved, as part of the overall system coordination. Appropriate frequency coordination and mitigation mechanisms are required to allow co-location of both gateway stations and user terminals with other GSO/NGSO systems.

v. Overall, the matter is better left to satellite operators in the context of the coordination process, as this is entirely dependent on the specific characteristics of the different gateways/systems/networks.

Q-24. What should be the eligibility conditions for assignment of spectrum for each type

of space-based communication service (as mentioned in theTable1.3 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.

IAFI Response:

i. Indian satellite services are going through an interesting phase, now in the best of times, due to repeated initiative by the Hon'ble Prime Minister. There has been a steady flow of reforms in the satellite sector by Government – ISRO, INSPACe, NSIL, DoT and TRAI.

ii. With the present TRAI consultation paper, a lot of confusion has been created among satellite industry regarding the auction of the satellite spectrum.

iii. Satellite spectrum is quite different from mobile spectrum in several key characteristics – being shared resource as compared to discrete and exclusive chunks, as dependent on ITU frequency coordination, different spectrum management rules and several precious rights. Satellite spectrum is to be shared with multiple satellite operators/service providers use the same frequencies and same is facilitated via coordination with other satellite operators.

iv. TRAI in the consultation paper, itself explained the international practices adopted by countries like US, Mexico and Brazil to auction the frequency band, but could not succeed and at last resorted to administrative licensing. So, there is no merit in ignoring international learning as regards satellite spectrum assignment.

v. Satellite broadcasting and communication are the most powerful tools for to connect the unconnected and serve the underserved population of rural, remote and difficult-to-reach areas, as still more than 30% population of the country is not having meaningful broadband internet connectivity.

vi. The new Spacecom Policy is aimed at promoting Private Sector participation in the space sector and raising India's share in the global space economy from less than 2% to 10% soonest. However, satellite spectrum auctions would inexorably push back the emerging space sector which holds enormous promise for Digital India.

Q-25. 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.

IAFI Response:

i. IAFI is of the view that the spectrum for all types of the satellite services should be assigned through fair and transparent administrative processes, for space stations and earth stations.

ii. Spectrum to the satellite operators should only be assigned on non-exclusive basis.

iii. Validity of the spectrum assigned to the satellite operators should be linked with the validity of the license/permission granted by DoT.

iv. Start of the Commercial satellite based services should be at least five years, as developing a satellite and its launching takes four years of time and process starts only after acquiring all types of regulatory approvals and frequency assignments.

Q-26. 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.

IAFI Response:

i. Clause 42.3 of the Unified License is meant for the companies holding Access Spectrum.

   a. **42.3**- *In the event of holding/obtaining Access spectrum, no licensee or its promoter(s) directly or indirectly shall have any beneficial interest in another licensee company holding "Access Spectrum" in the same service area.*

ii. License area of any satellite-based service providers is at a national level, so the restrictions mentioned in the clause- 42.3 of Chapter-VII of the Unified License should also be applicable to satellite based service providers.

Q-27. 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.

IAFI Response:

i. Article-21 of the Radio Regulation is meant for coexistence of terrestrial and space services sharing frequency bands above 1 GHz.

ii. Interference between a satellite station and a microwave station may occur when they operate on similar frequencies or when they are located in close proximity to each other. Following mitigation measures can be adopted to avoid interference between these two types of stations.

   a. It should be ensured that satellite stations and microwave stations operate on different frequency bands or using frequency coordination to prevent interference.
   b. Selecting sites that are far apart or with suitable terrain features (e.g. hills or mountains) to reduce the likelihood of interference.
   c. Using directional antennas with high gain and narrow beamwidths to minimize the amount of energy radiated in unwanted directions.
   d. Transmission power of the stations can be adjusted to minimize interference.
   e. Using filters to eliminate or reduce the amount of unwanted signals or noise that can cause interference.
   f. Maintaining communication and coordination between the operators of the satellite station and the microwave station to ensure that any interference is identified and addressed promptly.

Q-28. 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.

IAFI Response:

Overall, use of polarization should not be considered, as it's purely a way to further increase spectrum efficiency by the satellite operators. Satellite systems in Ka-band typically use circular polarization. Increased efficiency by using both Left Hand Circular and Right Hand Circular should be up to the satellite operator (similarly to using higher orders of modulation and coding). It has no impact on the spectrum usage/spectrum denial for other systems.

Q-29. 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 as 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.

IAFI Response:

Issues regarding Model #1:

i. Exclusive spectrum assignment to a satellite operator cannot be used.

ii. The notion of spectrum block and spectrum caps are terrestrial mobile spectrum concepts. Satellite systems have a predefined range of frequencies, filed at ITU and followed long and rigorous process of notification and registration into MIFR. They cannot subsequently pick and choose depending on the outcome of the spectrum assignment of a market.

Issues regarding Model #2:

i. This model will un-necessary create artificial scarcity by limiting the number of satellite service providers.

ii. TRAI in the consultation paper explicitly mentioned that "Thus, in order to reflect true value of satellite spectrum, the auction design/model should create some sort of scarcity in case where supply is non-rivalrous and shareable". Similarly, as mentioned in the consultation paper regarding price discovery process of the spectrum, it appears as artificial and lead, rather than to the "true value" of satellite spectrum, to an inflated price, driven also by terrestrial mobile operators participating to the auction.

iii. The spectrum can be shared and is coordinated at a global level, limiting the number of operators is in fact not allowing the spectrum to be used at its full potential, and it's contrary to the most basic principle of spectrum management.

iv. Furthermore, both design models lead to the exclusion of some operators which would need to enter into extensive negotiations with existing spectrum holders and/or wait years together for another auction round before entering the market.

v. Furthermore, if the Indian authority decide to limit the number of operators on their market for the sake of government revenue, the ones that lose out are not only the

satellite operators who did not get the license, leaving consumers with less choice than any other market. Less competition ultimately translates into higher consumer prices and lower adoption.

Q-30. In your opinion, which of the two models mentioned in Question 29 above, should be used? Kindly justify your response.

IAFI Response:

As explained in the previous answer, IAFI opposes both the models as auction is not an appropriate spectrum assignment method for Satellite.

Q-31. In case it is decided to assign spectrum for user links using model # 2 i.e., non-exclusive spectrum assignment to limited bidders (n+ Δ), then what should be

a. **The value of Δ, in case it is decided to conduct a combined the auction for all services.**
b. **The values of Δ, in case it is decided to conduct separate auction for each type of service.**

Please provide detailed justification.

IAFI Response:

IAFI opposes any models for auction of satellite spectrum as mentioned above.

Q-32. 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.

IAFI Response:

IAFI opposes any models for auction of satellite spectrum as mentioned above.

Q-33. 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?

IAFI Response:

There are no issues linked to administrative assignment of spectrum for gateway links. This is the standard process successfully applied all over the world. On the other hand, the idea of a possible auction determined price for user links to be used as a basis for charging for spectrum for gateway links does not make sense. Spectrum for the gateway is to be used at a specific location (instead than on a nation-wide basis) by an entity that could be different from the one providing the user links (e.g.. a teleport owner).

Q-34. 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?

IAFI Response:

- IAFI does not agree with the auction of spectrum for gateway. An operator does not need to have more than a few gateways, for a country as vast as India there is no scarcity of location.
- Furthermore, gateways can easily coexist between several GSOs on the same location, even collocated with a NGSO antenna farm.

Q-35. In your view, which spectrum assignment option for gateway links should be implemented?

IAFI Response:

Spectrum assignment for gateway links should be on an administrative basis only.

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 f fair auction i.e., market discovery of price?

IAFI Response:

Spectrum assignment for gateway links should be on an administrative basis only.

Q-37. Any other issues/suggestions relevant to the subject, may be submitted with proper explanation and justification.

IAFI Response:

We refer to the executive summary section where we have provided detailed 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.

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 the following issues:

1. The provision of internet services to consumers in India can be effectively addressed

by satellite services provided under the Internet Services Authorisation (or ISP License) of the UL. However, currently, there is no prescribed charging mechanism for spectrum for the provision of satellite services under the ISP License. We urge the TRAI to address this gap by recommending a charging model for spectrum for providing satellite services under this authorization. A recommendation for a charging model for spectrum for space-based communications could also address this gap.

2. The UL allows the provision of satellite services under service authorisations with varied scope, such as as GMPCS, VSAT CUG and ISP. In order to efficiently use spectrum, it should be feasible to deploy a single network that has access to spectrum and the service provided under different authorisations depending on the scope. In its recommendations on the use of VSAT for cellular backhaul connectivity, the TRAI recommended that the sharing of active and passive infrastructure owned by a licensee under any of the service authorisation be allowed.[8] However, the sharing of spectrum between service authorisations for the efficient use of spectrum was not addressed, and the same needs to be addressed.
3. 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 use dynamic frequency usage. NGSO gateways are comprised of multiple identical antennas operating with same spectrum. While each antenna may be pointing at a different satellite at any one time, the envelope of operation of all the antennas is not significantly different from that of a single one. Thus, there should be no additional fees for additional antennas on the same site, as they are virtually co-located, use the same spectrum, operate within the same satellite system and managed by the same licensee. This principle has already been adopted by in most countries where NGSO gateways are being deployed. Also, there will be a significant administrative overhead resulting in delays of deployment of services if spectrum is to be assigned carrier-by-carrier. Instead, spectrum should be assigned as a block, and the operator should have the flexibility to dynamically use the frequencies assigned across different user terminals, gateway stations, and satellites serving India.

In the Consultation Paper, the TRAI notes that:

"*In another reference on 'frequency assignment for data communication services between aircraft and ground stations for services provided by organizations other than the Airport Authority of India' dated 12.04.2022, DoT has requested TRAI to provide recommendations on the following:*

i. An appropriate mechanism to regulate the services provided by these organizations:

ii. The manner in which the frequency assignment should be made to these organizations, 'in light of the supreme Court judgment made in the 2G case in 2012 - to assign radio frequencies only through auction.'"

Indeed, the TRAI and the DoT seem to assume that spectrum for use by satellite communications services must be auctioned. As is explained more fully below, IAFI respectfully disagrees and submits that the 2G Judgment, when viewed in the broader context of a subsequent 2012 five-judge Presidential Reference ruling[9] and several other Supreme Court judgments,[10] does not bind the Indian Government to assign spectrum only through auctions. In fact, a better reading of existing law and

[8] Clause 3.4 [Para 2.43] of Chapter 3 of the recommendations on "Provision of Cellular Backhaul Connectivity via satellite through VSAT under Commercial CUG Service authorization" dated 28th July 2020.

[9] Judgment dated 27 September 2012 in Re: Special Reference 1 of 2012 ("Presidential Reference").

[10] Kasturi Lai Lakshmi Reddy v. State of Jammu and Kashmir, AIR 1980 SC 1992; Tinsukhia Electric Supply Co. Ltd v. State Of Assam, AIR 1990 SC 123; Reliance Natural Resources Ltd. v. Reliance Industries Ltd. etc., (2010) 7 SCC 1.

precedent indicates that spectrum for satellite communications should be allocated administratively.

a. The Supreme Court's 2G Judgment does not apply to the assignment of spectrum for satellite communications.

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.[11] The Supreme Court determined that these should have instead been auctioned. However, the 2G Judgment created confusion, especially on the issue of distribution methods of these types of resources. This led the then President of India to seek clarity from the Supreme Court on the scope and applicability of the 2G Judgment.[12] 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.*" [13] 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.

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.[14] Thus, the Supreme Court found that the first-come-first-served policy unfairly excluded other players from accessing spectrum.[15] The Supreme Court also considered whether auctions would help meet the government's objective of revenue maximization.[16]

These considerations are inapplicable to the question of how to assign spectrum for satellite communications services, including for the following reasons:

- Unlike spectrum for terrestrial services, spectrum for satellite communications can be shared amongst multiple operators, subject to certain conditions.[17] There are no exclusive rights to use the spectrum or resultant exclusion of other operators. 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.[18]

- 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.[19]

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[11] Paragraph 1, Issues (iii) and (iv) framed by the Supreme Court, 2G Judgment.
[12] Text of the President's Reference to the Supreme Court, as contained in the Presidential Reference judgment.
[13] In Paragraph 78 of the Presidential Reference judgment, the Supreme Court further noted that "*the recommendation of auction for alienation of natural resources was never intended to be taken as an absolute or blanket statement applicable across all natural resources, but simply a conclusion made at first blush over the attractiveness of a method like auction in disposal of natural resources. The choice of the word 'perhaps' suggests that the learned Judges considered situations requiring a method other than auction as conceivable and desirable.*"
[14] Paragraph 75, 2G Judgment.
[15] Paragraph 76, 2G Judgment.
[16] Arguments of the Petitioner in the 2G Judgment, as reiterated in the Presidential Reference judgment, captured in Paragraph 116, Presidential Reference judgment.
[17] Paragraph 3.28, TRAI Consultation Paper on Assignment of Spectrum for Space-based Communication Services.
[18] *See*, https://www.gsma.com/spectrum/wp-content/uploads/2022/06/5G-Spectrum-Positions.pdf.
[19] Paragraph 1, Mission, National Telecom Policy 2012, https://dot.gov.in/sites/default/files/NTP-06.06.2012-final.pdf; Paragraph 1.3, Mission, National Digital Communications Policy 2018, https://dot.gov.in/sites/default/files/EnglishPolicy-NDCP.pdf; Introduction, Explanatory Note to the draft Indian Telecommunication Bill 2022,

> 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.[20]

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.[21] Several Supreme Court judgments direct the Government to conduct periodic evaluations of existing distribution modes so that natural resources are allocated for optimum utilization.[22] 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.[23] To the extent that the Supreme Court of India has considered spectrum is akin to a natural resource,[24]

We submit 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.

Q-38. 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.

IAFI Response:

While there is internationally no doubt on the suitability of administrative assignment for

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https://dot.gov.in/sites/default/files/Explanatory%20Note%20to%20the%20draft%20Indian%20Telecommunication%20Bill%2C%202022.pdf.

[20] *See*, https://www.itu.int/en/itunews/Documents/2019/2019-04/2019_ITUNews04-en.pdf.

[21] Indeed, there are existing alternatives to auctions under Indian law. For example, the Mines and Minerals (Regulation and Development) Act, 1957, prescribes other, non-auction methods for the dispensation of natural resources. Additionally, the Biological Diversity Act 2002 mandates the National Biodiversity Authority (NBA) regulate and grant access rights to biological resources as it deems fit in the best interest of the biological resources. Prior approval of the NBA is necessary for accessing biological resources, and the NBA can impose benefit-sharing conditions upon applicants. This suggests that executive bodies have authority under existing Indian laws to distribute resources using methods other than auctions.

[22] Paragraph 250 (3) and (4), Reliance Natural Resources Ltd. v. Reliance Industries Ltd. etc., (2010) 7 SCC 1.

[23] Paragraph 3, Monnet Ispat and Energy Ltd. v. Union of India, JT 2012 (7) SC 50; MANU/SC/0601. The Supreme Court held that "*Management of minerals should be in a way that helps in country's economic development and which also leaves for future generations to conserve and develop the natural resources of the nation in the best possible way*".

[24] The constitutional principles referenced when determining the appropriate mechanism for distribution of natural resources are "maximum public interest," "common good," and "public trust." Administrative assignment is one mechanism that can be used to advance these principles.

satellite spectrum, the cost of spectrum can vary significantly from country to country. There is however a general tendency towards spectrum fee reduction (e.g. Australia, Canada, Colombia, Saudi Arabia), especially in microwave frequencies, also due to the recognition that modern satellite systems can use large amount of spectrum (e.g. around 4GHz in Ka-band). This was unforeseeable a few years ago, when some of the bandwidth related fees were set. Spectrum fees in Europe in Ka-band are mostly aimed at recovering administrative cost and spectrum is generally free to use for user terminal that do not require coordination (e.g. ubiquitous VSAT, UTs, ESIM). Gateway link spectrum fees are typically different from user links fees.

Also, it is now generally recognized (e.g. Australia, US, Canada, Japan, New Zealand, Colombia, Mexico, UAE, Nigeria) that authorization/license of ubiquitous , UTs and ESIM operation is very well suited by a "class" or "network" authorization/license (also referred to as "blanket" authorization/license), a license that authorizes a "family" of user terminals with given characteristics. In other words, there is no need for individual terminal-by-terminal authorization as, due to the ubiquitous nature of ESIM and portable , UTs, specific coordination for individual user terminals is neither possible nor necessary.

In the Indian context, considering that the main concern seems to be the discovery of the "true value of spectrum", IAFI is of the view that it is reasonable to use the already proposed 1% of the 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.

High spectrum fees should not be a disincentive to operators to efficiently/flexibly use spectrum and should not become an artificial barrier to entry.

Spectrum charges such as the ones in the formula involving the Royalty, R (in Rs.) = 35000 x Bs (Bs is the Bandwidth factor which is 1 for every 500 KHz band) would lead to exorbitant fees for High Throughput Satellites (HTS) in Ka-band that can flexibly and efficiently use up to approximately 4 GHz of spectrum (overall for uplink and downlink).

There is normally an individual license for the gateway earth station, inclusive of spectrum use, also as the earth station typically requires coordination with terrestrial systems in the band – e.g. point-to-point microwave links. The spectrum should be authorized separately to the gateway operator, which could be the satellite operator, a teleport owner or a service provider. This differentiation between the gateway and the user link licenses allows:

- greater flexibility and an equal footing in the market for local service providers;

- optimization of resources, as the gateway function can be centralized and managed by a teleport operator.

Bearing in mind that the gateway is considered as an infrastructure, also to comply with Indian regulatory requirements, and involves significant upfront financial investment, spectrum cost should be reasonable and aimed at solely covering administrative costs. This fee could be fixed per each gateway or based on a reasonable bandwidth multiplying factor

Q-39. 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.

IAFI Response:

Auction determined prices for IMT.5G bands cannot be used as a basis for valuation of space-based communication spectrum bands due to the following reasons.

- Mobile and satellite address different user groups in India.
- Satellite is addressing the rural population, which the MNO business model failed to address, and partly pushed by the high price MNOs acquire spectrum. As the revenue is prioritized, MNO would only cover highly concentrated urban area, and there is often no business cases for rolling out to rural and remote areas.
- Basing the pricing of satellite on the mobile economic model is not taking into account the needs of connectivity for all.
- It should be kept in mind that total revenue from mobile services has crossed Rs. 2,50,000/- crore, while the revenue from satellite service not even reached to Rs 1,000/- crore and majority revenue is from UT service.

Q-40. If response to the above question is yes, please specify the detailed methodology to be used in this regard?

IAFI Response:

Not applicable in view of above.

Q-41. 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.

IAFI Response:

The value of space-based communication spectrum bands for user link and for gateway links can be derived by relating it to the values used in other countries such as Australia. This is best linked to the AGR.

Q-42. 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.

IAFI Response:

Yes, the method of levying spectrum fees/charges based on AGR as followed by DoT and paid annually by linkage to 1% of the AGR, not only ensures the "true value of spectrum", but also avoids the need for "guessing" entirely.

Formula based on the quantum of spectrum may make sense where spectrum is individually and exclusively assigned to a specific user on administrative basis, such as for captive purposes, but it is not the right method for satellite services where the same spectrum is shared by multiple operators

Q-43. 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.

IAFI Response:

Revenue surplus model implies assumptions, and therefore uncertainty, on the possible revenue over 20 years. While this may make sense for an auction where spectrum is individually and exclusively assigned for a number of years, it is not necessary for administrative assignment. In the case of the latter, the fee is paid annually and the proposed linkage to 1% of the AGR not only ensures the "true value of spectrum", but also avoids the need for "guessing" entirely.

Q-44. 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 and /quantity put to auction, quantity bid, reserve price, auction determined price etc. Please support your response with detailed justification.

IAFI Response:

- As noted in the consultation paper "US, Mexico, and Brazil had attempted to sell frequencies for satellite usage but eventually did not succeed and at last resorted to administrative licensing."
- Only example of auction is for Saudi for MSS Spectrum. However, MSS is notably different than FSS in several aspects. MSS terminals are deployed ubiquitously and use omnidirectional antennas which make it difficult to share spectrum among the MSS operators or with other services, therefore an MSS operator usually needs exclusive access to their spectrum in order to ensure there is no interference to their operation. This is similar to the way terrestrial mobile operators use spectrum. Therefore, the auction could be justified in the particular case of MSS bands, but this is very different scenario than FSS where sharing is much easier due to coordination between satellite operators, including gateways.
- It must be noted that in another much wider consultation, CITC made it very clear that satellite bands were out of the discussion for auction and are protected. "Continued guaranteed and protected access to all existing satellite bands for current and future uses, which include L, C, Ku and Ka bands."

Q-45. 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.

IAFI Response:

Spectrum fees can vary greatly from country to country. Several good examples of administrative pricing adopted in other countries could be used.

It is worth noting that the sharing possibility in satellite microwave bands is recognized by all regulators around the world together with the societal benefits of the services provided. As such, the international trend has been clearly in the direction of a general reduction of fees, especially for Ka-band. It is also worth noting that a blanket license approach is typically adopted for the user terminals such as ubiquitous UTs and ESIM.

Q-46. 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?

IAFI Response:

Would require extensive studies to normalize administrative spectrum charges/fees due to several factors (e.g. comparison due to cost of living, administrative processes required for licensing, etc.)

Q-47. 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.

IAFI Response:

As mentioned in the reply to Q38, a spectrum fee for user links of the order of 1% AGR would seem a suitable valuation approach.

Q-48. Should the valuation arrived for spectrum for user link be used for valuation for spectrum for gateway links as well? Please justify.

IAFI Response:

No, it should not be used. The evaluation of spectrum price for gateway and user link is different, for a variety of reasons.

While gateways normally need coordination with terrestrial services at a single location and can be considered as an infrastructure deployment (i.e. not for service provision), user links can be deployed nationwide, typically don't need coordination with terrestrial services (e.g. ESIM and ubiquitous UTs) and can be adequately covered under a blanket license. Also, a %AGR fee for the gateway link would not make sense, as the deployment of the gateway will not be directly linked to service provision, if the two licenses will be separated.

Q-49. 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.

IAFI Response:

As already mentioned in the reply to Q38, also bearing in mind that the gateway should be considered as infrastructure, also to comply with Indian regulatory requirements, and involves significant financial investment, spectrum cost should be reasonable and aimed at covering administrative costs. The fee could be fixed or based on a reasonable bandwidth multiplying factor.

Q-50. 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.

IAFI Response:

IAFI DOES NOT SUPPORT AUCTION OF SPECTRUM FOR SATELLITE SERVICES

Q-51. 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.

IAFI Response:

IAFI DOES NOT SUPPORT AUCTION OF SPECTRUM FOR SATELLITE SERVICES

Q-52. 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.

IAFI Response:

IAFI DOES NOT SUPPORT AUCTION OF SPECTRUM FOR SATELLITE SERVICES

Q-53. 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.

IAFI Response:

IAFI DOES NOT SUPPORT AUCTION OF SPECTRUM FOR SATELLITE SERVICES

Q-54. 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. **Up-front payment**
ii. **Moratorium period**
iii. **Total number of installments to recover deferred payments**
iv. **Rate of discount in respect of deferred payment and pre-payment**

IAFI Response:

IAFI DOES NOT SUPPORT AUCTION OF SPECTRUM FOR SATELLITE SERVICES

Annex 1

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WPC wing of DoT has released the National Frequency Allocation Plan (NFAP -2022) based on the ITU Radio Regulation-2020. Frequency bands earmarked for telecommunications and broadcasting services viz FSS, BSS and MSS services are summarized as below.

S. No.	Frequency Band	Purpose	Link
1.	137.000 – 137.025 MHz	MOBILE-SATELLITE	space to Earth
2.	137.025 – 137.175 MHz	Mobile-satellite	space to Earth
3.	137.825 – 138.00 MHz	Mobile-satellite	space to Earth
4.	148.000 – 149.900 MHz	MOBILE-SATELLITE	Earth to space
5.	149.900 – 150.500 MHz	MOBILE-SATELLITE	Earth to space
6.	156.7625 – 156.8375 MHz	Mobile-satellite	Earth to space
7.	156.8125 – 156.8375 MHz	Mobile-satellite	Earth to space
8.	157.1875 – 157.3375 MHz	Maritime mobile -satellite	-----
9.	161.7875 – 161.9375 MHz	Maritime mobile -satellite	----
10.	161.9375 – 161.9625 MHz	Maritime mobile -satellite	Earth to space
11.	161.9625 – 161.9875 MHz	Mobile-satellite	Earth to space
12.	161.9875 – 162.0125 MHz	Maritime mobile -satellite	Earth to space
13.	162.0125 – 162.0375 MHz	Mobile-satellite	Earth to space
14.	312.000 - 315.000 MHz	Mobile -satellite	Earth to space
15.	387.000 – 390.000 MHz	Mobile -satellite	space to Earth
16.	399.900 – 400.050 MHz	MOBILE-SATELLITE	Earth to space
17.	400.150 – 401.00 MHz	MOBILE-SATELLITE	space to Earth
18.	406.000 – 406.100 MHz	MOBILE-SATELLITE	Earth to space
19.	1 452.000 – 1 492.00 MHz	BROADCASTING SATELLITE	
20.	1 518.000 – 1 525.000 MHz	MOBILE-SATELLITE	space to Earth
21.	1 525.000 – 1530.000 MHz	MOBILE-SATELLITE	space to Earth
22.	1 530.000 – 1 535.000 MHz	MOBILE-SATELLITE	space to Earth
23.	1 535.000 – 1539.000 MHz	MOBILE-SATELLITE	space to Earth
24.	1 610.000 – 1 610.600 MHz	MOBILE-SATELLITE	Earth to space
25.	1 610.600 – 1 613.800 MHz	MOBILE-SATELLITE	Earth to space
26.	1 613.800 – 1 621.350 MHz	MOBILE-SATELLITE	Earth to space
		Mobile -satellite	space to Earth
27.	1 621.350 – 1 626.500 MHz	MARITIME MOBILE SATELLITE	space to Earth
		MOBILE-SATELLITE	Earth to space
		Mobile -satellite except maritime	space to Earth
28.	1 626.500 – 1 660.00 MHz	MOBILE-SATELLITE	Earth to space
29.	1 660.000 – 1 660.500 MHz	MOBILE-SATELLITE	Earth to space
30.	1 668.100 – 1 668.400 MHz	MOBILE-SATELLITE	Earth to space
31.	1 668.400 – 1 670.000 MHz	MOBILE-SATELLITE	Earth to space

32.	1 670.000 – 1 675.000 MHz	MOBILE-SATELLITE	Earth to space
33.	1 980.000 – 2 010.000 MHz	MOBILE-SATELLITE	Earth to space
34.	2 170.000 – 2 200.000 MHz	MOBILE-SATELLITE	space to Earth
35.	2 310.000 – 2 360.000 MHz	BROADCASTING SATELLITE	
36.	2 483.500 – 2 500.000 MHz	MOBILE-SATELLITE	space to Earth
37.	2 500.000 – 2 515.000 MHz	FIXED SATELLITE	space to Earth
		MOBILE-SATELLITE	space to Earth
38.	2 515.200 – 2 516.500 MHz	FIXED SATELLITE	space to Earth
		MOBILE-SATELLITE	space to Earth
39.	2 516.500 – 2520.000 MHz	FIXED SATELLITE	space to Earth
		MOBILE-SATELLITE	space to Earth
40.	2 520.000 – 2535.000 MHz	FIXED SATELLITE	space to Earth
		BROADCASTING SATELLITE	
		AERONAUTICAL MOBILE-SATELLITE	space to Earth
41.	2 535.000 – 2655.000 MHz	BROADCASTING SATELLITE	----
42.	2 655.000 – 2670.000 MHz	FIXED SATELLITE	Earth to space
		BROADCASTING SATELLITE	
43.	2 670.000 – 2 690.000 MHz	FIXED SATELLITE	Earth to space
		MOBILE-SATELLITE	Earth to space
44.	3 400.000 – 3 500.000 MHz	FIXED SATELLITE	space to Earth
45.	3 500.000 – 3 600.000 MHz	FIXED SATELLITE	space to Earth
46.	3 600.000 – 3 700.000 MHz	FIXED SATELLITE	space to Earth
47.	3 700.000 – 4 200.000 MHz	FIXED SATELLITE	space to Earth
48.	4 500.000 – 4 800.000 MHz	FIXED SATELLITE	space to Earth
49.	5 000.000 – 5 100.000 MHz	AERONAUTICAL MOBILE-SATELLITE	---
50.	5 010.000 – 5 030.000 MHz	AERONAUTICAL MOBILE-SATELLITE	---
51.	5 030.000 – 5 091.000 MHz	AERONAUTICAL MOBILE-SATELLITE	----
52.	5 091.000 – 5 150.000 MHz	FIXED SATELLITE	Earth to space
		AERONAUTICAL MOBILE-SATELLITE	-----
53.	5 150.000 – 5 216.000 MHz	FIXED SATELLITE	Earth to space
54.	5 216.000 – 5 250.000 MHz	FIXED SATELLITE	Earth to space
55.	5 850.000 – 5 925.000 MHz	FIXED SATELLITE	Earth to space
56.	5 925.000 – 6 700.000 MHz	FIXED SATELLITE	Earth to space
57.	6 700.000 – 7 075.000 MHz	FIXED SATELLITE	Earth to space
			space to Earth
58.	7 250.000 – 7 300.000 MHz	FIXED SATELLITE	space to Earth
59.	7 300.000 – 7 375.000 MHz	FIXED SATELLITE	space to Earth
60.	7 375.000 – 7 450.000 MHz	FIXED SATELLITE	space to Earth
		MARITIME MOBILE SATELLITE	space to Earth
61.	7 450.000 – 7 550.000 MHz	FIXED SATELLITE	space to Earth
		MARITIME MOBILE SATELLITE	space to Earth
62.	7 550.000 – 7 750.000 MHz	FIXED SATELLITE	space to Earth
		MARITIME MOBILE SATELLITE	space to Earth

63.	7 900.000 – 8 025.000 MHz	FIXED SATELLITE	Earth to space
		MOBILE SATELLITE	Earth to space
64.	8 025.000 – 8 175.000 MHz	FIXED SATELLITE	Earth to space
65.	8 175.000 – 8 215.000 MHz	FIXED SATELLITE	Earth to space
66.	8 215.000 – 8 400.000 MHz	FIXED SATELLITE	Earth to space
67.	10.700 – 10.950 GHz	FIXED SATELLITE	space to Earth
68.	10.950 – 11.200 GHz	FIXED SATELLITE	space to Earth
69.	11.200 – 11.450 GHz	FIXED SATELLITE	space to Earth
70.	11.450 – 11.700 GHz	FIXED SATELLITE	space to Earth
71.	11.700 – 12.200 GHz	BROADCASTING SATELLITE	----
72.	12.200 – 12.500 GHZ	FIXED SATELLITE	space to Earth
73.	12.500 – 12.750 GHz	FIXED SATELLITE	space to Earth
74.	12.750 – 13.250 GHz	FIXED SATELLITE	Earth to space
75.	13.750 – 14.000 GHz	FIXED SATELLITE	Earth to space
76.	14.000 – 14.250 GHz	FIXED SATELLITE	Earth to space
		Mobile satellite	Earth to space
77.	14.250 – 14.300 GHz	FIXED SATELLITE	Earth to space
		Mobile satellite	Earth to space
78.	14.300 – 14.400 GHz	FIXED SATELLITE	Earth to space
		Mobile satellite	Earth to space
79.	14.400 – 14.470 GHz	FIXED SATELLITE	Earth to space
		Mobile satellite	Earth to space
80.	14.470 – 14.500 GHz	FIXED SATELLITE	Earth to space
		Mobile satellite	Earth to space
81.	14.500 – 14.800 GHz	FIXED SATELLITE	Earth to space
82.	15.430 – 15.630 GHz	FIXED SATELLITE	Earth to space
83.	17.300 – 17.700 GHz	FIXED SATELLITE	Earth to space
84.	17.700 – 18.100 GHz	FIXED SATELLITE	space to Earth
85.	18.100 – 18.400 GHz	FIXED SATELLITE	space to Earth
86.	18.400 – 18.600 GHz	FIXED SATELLITE	space to Earth
87.	18.600 – 18.800 GHz	FIXED SATELLITE	space to Earth
88.	18.800- 19.300 GHz	FIXED SATELLITE	space to Earth
89.	19.300 – 19.700 GHz	FIXED SATELLITE	space to Earth
90.	19.700 – 20.100 GHz	FIXED SATELLITE	space to Earth
		Mobile satellite	space to Earth
91.	20.100 – 20.200 GHz	FIXED SATELLITE	space to Earth
		MOBILE SATELLITE	space to earth
92.	20.200 – 21.200 GHz	FIXED SATELLITE	space to Earth
		MOBILE SATELLITE	space to earth
93.	21.400 – 22.000 GHz	BROADCASTING SATELLITE	----
94.	24.650 -24.750 GHz	FIXED SATELLITE	Earth to space
95.	24.750 – 25.250 GHz	FIXED SATELLITE	Earth to space
96.	27.000 – 27.500 GHz	FIXED SATELLITE	Earth to space
97.	27.500 – 28.500 GHz	FIXED SATELLITE	Earth to space
98.	28.500 – 29.100 GHz	FIXED SATELLITE	Earth to space
99.	29.100 – 29.500 GHz	FIXED SATELLITE	Earth to space
100.	29.500 – 29.900 GHz	FIXED SATELLITE	Earth to space
101.	29.900 – 30.000 GHz	FIXED SATELLITE	Earth to space

		MOBILE SATELLITE	Earth to space
102.	30.000 – 31.000 GHz	FIXED SATELLITE	Earth to space
		MOBILE SATELLITE	Earth to space
103.	37.500 – 38.000 GHz	FIXED SATELLITE	space to Earth
104.	38.000 – 39.500 GHz	FIXED SATELLITE	space to Earth
105	39.500 – 40.000 GHz	FIXED SATELLITE	space to Earth
		MOBILE SATELLITE	space to Earth
106.	40.000 – 40.500 GHz	FIXED SATELLITE	space to Earth
		MOBILE SATELLITE	space to Earth
107.	40.500 – 41.000 GHz	FIXED SATELLITE	space to Earth
		BROADCASTING SATELLITE	----
108.	41.000 – 42.500 GHz	FIXED SATELLITE	space to Earth
		BROADCASTING SATELLITE	---
109.	42.500 – 43.500 GHz	FIXED SATELLITE	Earth to space
110.	43.500 – 47.000 GHz	MOBILE SATELLITE	--
111.	47.200 – 47.500 GHz	FIXED SATELLITE	Earth to space
112.	47.500- 47.900 GHz	FIXED SATELLITE	Earth to space
113.	47.900 -48.200 GHz	FIXED SATELLITE	Earth to space
114.	48.200 – 50.200 GHz	FIXED SATELLITE	Earth to space
115.	50.400 – 51.400 GHz	FIXED SATELLITE	Earth to space
116.	51.400 – 52.400 GHz	FIXED SATELLITE	Earth to space
117.	71.000 – 74.000 GHz	FIXED SATELLITE	space to Earth
		MOBILE SATELLITE	space to Earth
118.	74.000 – 76.000 GHz	FIXED SATELLITE	space to Earth
		BROADCASTING SATELLITE	----
119.	81.000 – 84.000 GHz	FIXED SATELLITE	Earth to space
		MOBILE SATELLITE	Earth to space
120.	84.000 – 86.000 GHz	FIXED SATELLITE	Earth to space
121.	158.50 – 164.00 GHz	FIXED SATELLITE	space to Earth
		MOBILE SATELLITE	space to Earth
122.	191.80- 200.00 GHz	MOBILE SATELLITE	
123.	209.00 – 217.00 GHz	FIXED SATELLITE	Earth to space
124.	217.00 – 226.00 GHz	FIXED SATELLITE	Earth to space
125.	232.00 – 235.00 GHz	FIXED SATELLITE	space to Earth
126.	235.00 – 238.00 GHz	FIXED SATELLITE	space to Earth
127.	238.00 -240.00 GHz	FIXED SATELLITE	space to Earth
128.	252.00 – 265.00 GHz	MOBILE SATELLITE	Earth to space
129.	265.00 – 275.00 GHz	FIXED SATELLITE	Earth to space
130.	275.00 – 3 000.00 GHz	**Not yet allocated**	