

Response from ABS Global Ltd- 17 May 2023

Consultation Paper on Assignment of Spectrum for Space Based Communication Services Issued by The Telecom Regulatory Authority of India -6 April 2023

1. The Telecom Regulatory Authority of India (“TRAI”) issued a consultation paper on assignment of spectrum for space-based communication services on 6 April 2023 and solicited comments from interested parties by 4 May 2023.
2. ABS Global Ltd (“ABS”) has reviewed the consultation document in detail and provided its views on the various issues of interest to it. The consultation process coincides with India’s issuance of The Indian Space Policy 2023, which allows Indian private companies to set up, operate and own satellite networks for communication within and outside of India. The Space Policy 2023 permits the non-government entities (“NGEs”) to use Indian and/or non-Indian orbital resources to establish space objects for communication services. The NGEs can offer national and international communication services through self-owned or procured or leased GSO/NGSO communication satellites.
3. The space industry has reacted positively to the Indian Space Policy 2023 and considers the policy to be forward looking and will help to fulfil the vision for the growth of the space industry in India. As a result, the policy will help create opportunities for private sector to engage in all aspects of space industry.
4. ABS’s view expressed in this document has considered the important elements of the new Indian Space Policy to facilitate private sector to enter into the space industry.
5. Overall, ABS is of the view that satellite spectrum considered in the consultation document is unsuitable for auctioning. In particular, in view of the recently released Indian Space Policy 2023, this is not the appropriate time to consider auctioning of spectrum as it is not conducive to bringing NGEs into the space industry. In order for the NGEs to participate in the Indian space industry with some certainty, the primary resource to be made available to them with certainty would be to make available the scarce resource of spectrum. The NGEs should be encouraged to secure spectrum through the well-known ITU process of coordination that is available to all users in an equitable manner.
6. The TRAI should be aware that most satellite spectrum bands are used to provide both domestic and international services, making them unsuitable for auction. The TRAI should also be aware that if spectrum fees or auctions are replicated in numerous countries, the cumulative financial burden on international satellite operators could be substantial and threaten the viability of the sector’s overall business and impose great uncertainty on the sustainability of the space-based telecommunication business.
7. Satellite spectrum is allocated by the ITU on a Worldwide basis or ITU Regional basis. There are national allotments of satellite spectrum, similar to India’s National Frequency Allocation Plan 2022 (NFAP-2022), which follows in general the ITU allocation.

8. Frequency bands used by satellite systems typically provide services to wide geographic areas. Moreover, a multitude of (appropriately spaced) satellites can provide service in the same geographic areas on the same frequency and polarization. Thus, making auctioning of spectrum inappropriate and unnecessary. Even if same spectrum is auctioned to multiple interested parties, frequency coordination will still be required to ensure that new and existing services can co-exist.
9. Satellites require international approvals in accordance with the ITU Radio Regulation process including extensive coordination requirements with adjacent satellite operators. The process of achieving coordination is time-consuming, and typically take many years to complete. The frequency assignment(s) must be brought into use within 7 years for non-Plan FSS and 8-years for Plan BSS/FSS bands, in accordance with the ITU Radio Regulations. In general, under the ITU process, in the C, Ku and Ka bands of interest in the Consultation Paper, satellite operators share the same frequency bands thus making any auctions for satellite spectrum difficult to structure.
10. The satellite operators make substantial financial commitments to build and launch satellites that usually provide coverage of multiple countries. Consequently, satellite companies rely on consistent long-term spectrum policies to design and invest in space-based networks. This is particularly important in India for the NGEs, as they will be entering into the Indian space industry as a newcomer.
11. Satellite networks operating in the C, Ku, Ka (and higher) frequency bands utilize highly directional Earth station antennas that help to reduce interference to/from other satellite networks as well as most terrestrial networks. Consequently, multiple satellites can provide service to the same geographic area in the same frequency and polarization. This contrasts with satellites that operate in the lower S and L frequency bands and IMT-type cellular terrestrial networks that utilize either omni-directional antennas or antennas with very low directionality where the primary method for co-existence is through spectrum segmentation or large geographic separation. Consequently, as a practical, operational matter, auctioning of satellite spectrum is not appropriate for the commonly used C, Ku and Ka bands.
12. It is recognized that there are cases where portion(s) of spectrum allocated to satellites have been repurposed nationally to (terrestrial) IMT systems. However, there will be incompatibility between these systems, as IMT utilizes non-directional terrestrial antennas with relatively high transmit power and the Earth stations of space-based networks receive very low power signals from the satellite and are also ubiquitous. There are no cases of any nation auctioning the entire satellite spectrum listed in Table 3-1 of the consultation document.

ABS provides additional views (shown in blue) for consideration by TRAI with regards to specific sections of the consultation document.

- a) Section 1.6 – explains that use of Plan bands by foreign GSO satellites is not permitted in India. The Plan bands used by GSO systems in accordance with Appendix 30/30A/30B or the ITU Radio Regulations are reserved by the ITU for national systems.

While the ITU has developed a BSS/FSS Plan for use by national systems, the ITU also has made provisions for use of these bands that may not be in conformity with the technical parameters in the Plan. In the case of India, there are two orbital locations (55.8 E.L. and 68 E.L.) that are reserved for Plan BSS and orbital location of 74 E.L. is reserved for Plan FSS. The Indian satellites providing DTH services using Plan BSS bands at other orbital locations not reserved by the ITU for national systems. In view of this, it is recommended that India permit the use of BSS band for DTH and non-DTH services, including two-way services, at any coordinated orbital location(s).

- b) Section 2.28 – as per Appendix 5.492 of NFAP-2022, BSS allocations may also be used for transmissions in FSS provided that such transmissions do not cause more interference, or require more protection from interference, than BSS transmissions.

Accordingly, if operators and associated service providers can agree to use the BSS bands for FSS applications, as stipulated in Appendix 5.492 of NFAP-2022, such use should be permitted.

- c) Annexure 1 – provides list of Plan bands including the BSS bands, and page 144 lists GSO systems used by customers in India, in particular it lists Dish-TV, Sun TV Limited, TATA Play limited, Bharti Telemedia Private Limited, Doordarshan providing DTH services in the band 11.7-12.2 GHz in India. As far as ABS is aware, Dish-TV, Bharti Telemedia Private Limited are using foreign satellites operated by SES.

There has been a precedent of Dish TV Sri Lanka using Sri Lanka Teleport where it has taken a DTH license to uplink channels in BSS in free to air mode and those are being received in India. These channels are received on Set Top Boxes of DD free dish and also Dish TV boxes without any issue.

The use of foreign satellites using BSS frequency bands should be permitted as it is currently being used by various Indian service providers. This will increase the amount available spectrum that may be used in India for DTH purposes, thus relieving the much-wanted Ku band FSS spectrum that is being heavily used by the current DTH operators.

In summary, ABS is of the strong opinion that instead of auctioning spectrum for space-based networks, which is specified as being considered as an option by the TRAI, the government of India must consider developing and implementing a spectrum fee for satellite operators for use of C, Ku, and Ka bands as part of the landing rights/licensing process. The spectrum fee must be different for C, Ku and Ka bands and must also be based on the amount of spectrum proposed for usage in each band for services over India by the operator.

ABS Responses to various questions posed in the Consultation Paper are in the Attachment.

ATTACHMENT

Responses to Selected Questions in the TRAI Consultation Paper of 6 April 2023

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

ABS: All Ku and Ka band frequencies including Plan band and non-Plan band frequencies listed in Table 3.1 of this Consultation Paper are appropriate for both gateway and user links. No attempt should be made to identify separate segments of these frequency bands for exclusive use by Gateway links or for user links or for any service, as long as the bands selected are consistent with the ITU and/or National Table of Frequency Allocation. It should be left to the satellite operator to decide which frequency bands should be used for Gateway and/or user links, and/or the type of service to be provided and to coordinate its operation with any other allocated services within India. This permits both Indian and non-Indian satellite operators to provide a multitude of services to the Indian market, including VSAT, maritime, DTH, etc., and to utilize these frequency bands efficiently.

Satellite links utilize highly directional Earth station antennas for transmission to and reception from a satellite with the Earth station antenna typically pointed at elevation angles in excess of 10° above the horizon. By contrast, most terrestrial antennas are pointed at elevation angles of less than 5°. The combination of Earth station antenna directionality and pointing, generally serves to provide interference immunity to/from terrestrial services allowing satellite and terrestrial services to co-exist on a co-frequency basis. Earth station operating limits are typically driven by the need to protect other co-frequency satellites that operate in the vicinity of a targeted satellite. This is typically achieved through coordination discussions among the various satellited operators.

The primary terrestrial service which is incompatible with satellite services is that of wireless cellular systems, e.g., 5G, IMT, etc. Since the satellite transmission received by an Earth station has very low power, the comparatively high power (and deployment density) of wireless cellular base stations, will result in harmful levels of interference to the receiving Earth station. Accordingly, wireless cellular systems should not be permitted to operate in the same frequency band as satellite networks.

Further, it should be emphasized that under the ITU Rules and Regulations, operators are permitted to operate satellites in the Plan BSS frequency bands and provide FSS services in addition to DTH, e.g., VSATs, etc., if FSS services do not cause harmful interference to BSS or require additional protection from interference. Such use of BSS bands for FSS services is also in line with the India allocation. It should further be noted that due to inefficiency of the Planned system parameters for building a dedicated BSS satellite for national use, the ITU Radio Regulations permits the use of Plan bands for satellite networks having parameters different than those specified in the Plan. Such satellite networks are categorized as “Additional Use” systems. There are many satellite networks that are already operating under the Additional Use category to provide both BSS and FSS services. In this regard, ABS also has been successfully operating its satellites with capacity using the Plan BSS and Plan FSS frequency bands at two of its orbital locations.

Q2. What quantum of spectrum for (a) gateway links and (b) user links in the appropriate frequency bands is required to meet the demand of space-based communication services? Information on present demand and likely demand after about five years may kindly be provided in two separate tables as per the proforma given below:

ABS: Frequency assignments of space-based systems should not be segregated between gateway and user links. It should be left to the satellite operator the types of services it wishes to provide and whether it wishes to use a gateway-user link architecture.

The satellite service provider is best suited to determine the current and projected demand for any type of service. Moreover, demand for services vary over time depending new technologies, new services and changes to the regulatory environment. As such, no effort should be made to allocate any specific spectrum/bandwidth to any specific space-based service.

Q3. Whether there is any practical limit on the number of Non-Geo Stationary Orbit (NGSO) satellite systems in Low Earth Orbit (LEO) and Medium Earth Orbit (MEO), which can work in a coordinated manner on an equitable basis using the same frequency range? Kindly justify your response.

ABS: ABS has not performed any studies on this issue. It is believed that the current ITU PFD limits (to protect GSO) are based upon 3.5 NGSO constellations. Further studies must be conducted to determine whether a larger number of NGSO networks can operate and protect GSOs and other co-services, in addition to co-existing with other NGSOs.

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

ABS: Space-based communication services assigned for use by GSO satellites in the C, Ku and Ka bands should not be assigned on an exclusive basis. The same frequency band can be used repeatedly within a given geographic area (and polarization) by multiple GSO co-frequency, co-coverage satellites provided that there is sufficient orbital separation between these satellites. In the case of co-located operations, frequency coordination must ensure frequency segmentation or coverage segmentation or polarization segmentation to establish technical compatibility between co-located networks. This is due to the use of highly directional Earth station antennas that greatly amplify the signal to/from the targeted satellite but greatly attenuate the signal to/from another nearby adjacent co-frequency satellites.

In view of the foregoing, assignment of frequency bands to GSO FSS on an exclusive basis is inappropriate and leads to inefficient use of the limited orbit spectrum resources. Also, restricts re-assignment to additional operators.

- Q5.** In case it is decided to assign spectrum in higher frequency bands such as C band, Ku band and Ka band for space-based communication services to licensees on an exclusive basis,
- (a)** What should be the block size, minimum number of blocks for bidding and spectrum cap per bidder? Response may be provided separately for each spectrum band.
 - (b)** Whether intra-band sharing of frequency spectrum with other satellite communication service providers holding spectrum upto the prescribed spectrum cap, needs to be mandated?
 - (c)** Whether a framework for mandatory spectrum sharing needs to be prescribed? If yes, kindly suggest a broad framework and the elements to be included in the guidelines.
 - (d)** Any other suggestions to ensure that that the satellite communication ecosystem is not adversely impacted due to exclusive spectrum assignment, may kindly be made with detailed justification.

Kindly justify your response.

ABS: See response to Q4, above.

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

- (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?

Kindly justify your response.

ABS: ABS is not supportive of the auction process. Satellite operators and service providers continually innovate, resulting in more efficient use of satellite spectrum. Today's satellites have greater efficiency than their predecessors. Consequently, auctioning of satellite will decrease competition and increase prices for the end user.

Also, see responses to Q4 and Q5.

- Q7.** Whether any entity which acquired the satellite spectrum through auction/assignment should be permitted to trade and/or lease their partial or entire satellite spectrum holding to other eligible service licensees, including the licensees which do not hold any spectrum in the concerned spectrum band? If yes, what measures should be taken to ensure rationale of spectrum auction and to avoid adverse impact on the dynamics of the spectrum auction? Kindly justify your response.

ABS: The assignee of a given frequency assignment should not be permitted to lease their satellite spectrum holding to other eligible service licensees, including those that do not hold any spectrum in the concerned band. Such “trading” has the significant potential for abuse and speculation and spectrum warehousing by one or more assignees. Spectrum warehousing will ultimately lead to higher prices for the consumer.

In short, under the assignment process, the assignee must commit to building its network using the frequency band assigned to it. Otherwise, the assigned spectrum should be returned to the regulator for future assignments.

Although ABS is not supportive of auctioning spectrum for space-based networks, India should not permit trading or leasing of the auctioned spectrum by the holder to another party for a price that is greater than that paid in the auction. As a condition for securing the spectrum under the auction process, India must also place a time limit for the implementation of the service for which it was intended.

- Q9.** In case you are of the opinion that the frequency spectrum in higher frequency bands such as C band, Ku band and Ka band for space based communication services should be assigned on shared (nonexclusive) 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. Kindly justify your response.

ABS: With respect to coordination between GSO satellite operators, they should simply be required to coordinate their service.

With respect to coordination between NGSO and GSO satellite networks, NGSO operators should be permitted to operate in a manner that is consistent with the EFPD limits specified in the ITU Radio Regulations not only in the frequency bands for which these limits are specified but also in the frequency band for which no EFPD limits have been specified. Additionally, the minimum elevation angle for NGSO services should be limited to 10°.

GSO operators should be permitted to transmit in the Earth-to-space direction with a maximum power density in the range of -40 to -45 dBW/Hz using transmitting Earth station antennas that have off-axis gains that are compliant with Recommendation ITU-R 580-6.

With respect to coordination between GSO and terrestrial services, excluding wireless cellular systems, e.g., 5G, IMT, GSO and terrestrial operators should simply be required to not exceed the power limits contained in the ITU Radio Regulations and any other applicable existing domestic operating limits.

IMT type systems, either through assignment or auction, should not be allocated to the same frequency bands allocated to satellite systems as such systems are inherently incompatible.

- Q10.** In the frequency range 27.5-28.5 GHz, whether the spectrum assignee should be permitted to utilize the frequency spectrum for IMT services as well as space-based communication services, in a flexible manner? Do you foresee any challenges arising out of such flexible use? If yes, in what manner can the challenges be overcome? Kindly elaborate the challenges and the ways to overcome them.

ABS: Operation of IMT and space-based communication systems are inherently incompatible.

Despite TRAI's view that the use of the 27.5-28.5 GHz will most likely not be ubiquitous and focused on hotspots and micro cells, it is highly likely that these systems will become ubiquitous and will ultimately not permit the use of the band for space-based systems or relegate space-based systems to remote geographic areas, even with the use of a software defined process on a portal having database of coordinates of the IMT base stations.

- Q11.** In case it is decided to permit flexible use in the frequency range of 27.5 - 28.5 GHz for space-based communication services and IMT services, what should be the associated terms and conditions including eligibility conditions for such assignment of spectrum? Kindly justify your response.

ABS: Recognizing that IMT services are permitted to operate in the 27.5 – 28.5 GHz band, then space-based communications systems will not be able to operate in meaningful and commercially viable manner. The eligibility condition should be based on IMT not causing harmful interference to space-based networks.

- Q12.** Whether there is a requirement for permitting flexible use between CNPN and space-based communication services in the frequency range 28.5-29.5 GHz? Kindly justify your response.

ABS: It is recommended that CNPN not be permitted in the 28.5-29.5 GHz band. Space-based and CNPNs are ubiquitous services and technically incompatible. The use of software databases of Earth stations so as to ensure that some minimum safe distance is maintained with these stations by CNPN is not an adequate solution because in any given geographic area the space-based

communication service would be frozen and limited to the specific Earth station(s) contained in the database.

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

ABS: ABS provides no response to this question as it has not conducted any assessment on this issue.

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

ABS: Space-based communication services should not be categorized as different classes of services requiring different treatment. As long as the satellite operator has coordinated its services in various bands, it should be permitted accordingly.

- Q16.** What should be the methodology for assignment of spectrum for user links for space-based communication services in higher spectrum bands like C-band, Ku-band and Ka-band, such as
- (a) Auction-based
 - (b) Administrative
 - (c) Any other?

Please provide your response in respect of different types of services (as mentioned in Table 1.3 of this consultation paper). Please support your response with detailed justification.

ABS: Assignment of space-based communication services in C, Ku and Ka band should be Administrative. Moreover, the Indian government should permit the use of both Indian (domestic) and foreign (non-domestic) satellite networks to provide service to India. As such, the primary administrative requirement, from an operational and technical perspective, should be that the satellite networks have coordinated their operation within the territory of India and that they also protect non-space-based communication networks through technical means, e.g., not exceeding power density levels at the Earth surface, etc.

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

ABS: Frequency assignments of space-based networks should be on a national level. Space-born systems are expensive and are not designed to provide service to only a small portion of the national territory. Even those satellites that use spot-beam technology are designed to provide service nationally or internationally.

Q18. 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.

Q19. What should be the methodology for assignment of spectrum for gateway links for space-based communication services, such as
(a) Auction-based
(b) Administrative
(c) Any other?

Please provide your response in respect of different types of services. Please support your response with detailed justification.

ABS: Assignment of frequencies for space-based communication services should not be segregated by service application, where one refers to Gateway links or User links. The frequency allocation should be general in nature to permit its use for various services. Also, as more fully explained in Q16, any allocation of frequency for space-based communication services should be on an administrative basis – not auction based.

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

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

or

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

ABS: Frequency bands should simply be allocated for use by space-based communication service. There should be no attempt made to assign a specific frequency band/segment for user and/or gateway links as this makes the use of the band restrictive to certain types of application(s) which leads to under-utilization of the band and inefficient use of the spectrum. It should be left to the user of the space-based communication service provider as to how it wants to use the band, i.e., whether its systems will be segregated into Gateway and/or user links, the portion of the band it wants to use for Gateways and user links, etc.

Q23. Whether any protection distance would be required around the satellite earth station gateway to avoid interference from other satellite earth station gateways for GSO/ NGSO satellites using the same frequency band? If yes, what

would be the protection distance (radius) for the protection zone for GSO/NGSO satellites?

ABS: The technical requirements for operation between GSO/NGSO satellite operators should be conducted by the operators themselves.

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

ABS: In the C, Ku and Ka bands, terrestrial microwave links use directional antennas that are generally pointed 5° or less above the horizon, whereas Earth stations of space-based networks utilize directional antennas that are pointed 5° or more above the horizon. Hence, there is a fairly large degree of compatibility between these two systems due to their respective (Earth) antennas' gain isolation toward the other. Additionally, the antennas of the terrestrial microwave link and the Earth station antenna of the space-based system may be pointed in different directions, thus providing even greater isolation between the two system.

Nevertheless, there would still be potential of interference between the two systems if the receiving antenna of either system is pointed in the approximate direction of the other system's transmitting antenna. However, this interference potential can be mitigated through coordination between the respective terrestrial and space-based operators, whereby a combination of power limits, and/or separation distance and/or polarization isolation would be instituted. However, such coordination is not viewed as being overly constraining for either operator.

The primary exception to the above, pertains to wireless cellular systems, i.e., IMT. Such systems are incompatible with space-borne systems. Consequently, these two systems should not be allocated for use in the same frequency band(s).

- Q28.** In what manner should the practice of assignment of a frequency range in two polarizations should be taken into account in the present exercise for assignment and valuation of spectrum? Kindly justify your response.

ABS: Frequency polarization should not be considered in the assignment of frequency ranges for any service. This should be left to the operators of the services/systems allocated in the frequency band. Moreover, the use of polarization segmentation should be something that is addressed in coordination discussions between the operators of two services or systems.

Q33. What could be the likely issues, that may arise, if Option # 1: (Area specific assignment of gateway spectrum on administrative basis) is implemented for assignment of spectrum for gateway links? What changes could be made in the proposed option to mitigate any possible issues?

ABS: It would limit the use of the frequency band specific types of applications, e.g., Direct-to-home. It would not permit other sufficiently separated space-based networks to use the frequency band for other applications even though the interference impact would be minimal. Consequently, this will lead to under-utilization of the frequency band by space-based networks.

Area specific assignments should not be considered for space-based systems operating in the C, Ku, Ka and other higher frequency bands where highly directional Earth station antennas are used. Frequency assignments should be allocated, at a minimum, on a national basis.

Q34. What could be the likely issues, that may arise, if Option # 2: Assignment of gateway spectrum through auction for identified areas/ regions/ districts is implemented for assignment of spectrum for gateway links? What changes could be made in the proposed option to mitigate any possible issues? In what manner, areas/ regions/ districts should be identified?

ABS: Auctioning of frequency assignments by space-based networks operating in the C, Ku, Ka and higher frequency bands is inappropriate as multiple space-based networks having sufficient orbital separation (between their respective satellites) can provide service to the same geographic area on the same frequency and polarization.

Auctioning of spectrum may be possible if the space-based networks are in the L-band where the Earth station antennas are generally non-directional or have very little directionality. Auctioning of S-band may also be appropriate if it is determined that for most applications that operate in this band use non-directional Earth station antennas, otherwise it should not be auctioned but assigned administratively.

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

ABS: For space-based systems operating in the C, Ku, Ka and higher frequency bands, spectrum assignment should be, at a minimum, for national coverage and conducted administratively – not through auction.

Q39. Should the auction determined prices of spectrum bands for IMT /5G services be used as a basis for valuation of space-based communication spectrum bands

i. For user link

ii. For gateway link

Please support your answer with detailed justification.

ABS: It is generally different services have different implementation costs and are designed to provide service to various segments of the population or business. In short, the business model for each type of service different. Accordingly, it is inappropriate to assume that the value of spectrum that is used for one kind of service is also applicable to another service.

Q41. Whether the value of space-based communication spectrum bands

i. For user link

ii For gateway link

be derived by relating it to the value of other bands by using a spectral efficiency factor? If yes, with which spectrum bands should these bands be related to and what efficiency factor or formula should be used? Please support your response with detailed justification.

ABS: The value of frequency bands to be assigned to space-based communication should not be related to any spectral efficiency factor, as different applications within a service have different technical requirements by the customer. A given communication service, will typically have multiple applications servicing different customers each having different technical requirements. Ultimately, the value of any given spectrum is based on what the interested parties are willing to pay for it based upon their experience, their existing and projected customer base, etc.