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10 January 2022

Subject: Consultation Paper No. 8/2021 on "Auction of Spectrum in frequency bands identified for IMT/5G"

Dear Sir,

Thank you for the opportunity provided to the industry stakeholders to submit comments on the spectrum auction.

In order to achieve a successful outcome to the auction of the spectrum bands, we consider it is important to recognise the current situation in terms of spectrum supply and demand and to adopt a more balanced approach in auctioning of the spectrum bands, taking into consideration the needs of various sectors as well as to ensure efficient take-up whilst generating a reasonable value to the Government. With this in mind, we suggest the following factors for your consideration.

1. Managing Supply & Demand for Radio Spectrum

Radio spectrum is essential to provide all forms of wireless communications and services. Its value and contribution to the economy and society have risen tremendously over the last two decades. However, spectrum is a scarce national resource that should be utilised for the benefits of all the citizens and allocated optimally, auctioning spectrum beyond that which is essential is an oversupply, will only lead to abundance that will leave spectrum unsold and dampened auction prices, as per the two previous auctions in India.

India has made a lot of spectrum available for mobile services, but much of it remains unsold (including in the 700 MHz band). In other words, TRAI will have to carefully plan the next auction to match demand in the lower bands, as per many other countries. Providing excessive spectrum for 5G poses the risks of the spectrum being unsold or, even worse, underutilised by terrestrial

players at the expense of other players such as Satellite Operators. These outcomes will result in a costly regulatory failure for India through loss of substantial overall economic opportunities.

ITU Article 4.1 of the Radio Regulations states that "*Member States shall endeavour to limit the number of frequencies and the spectrum used to the minimum essential to provide satisfactorily the necessary services. To that end, they shall endeavour to apply for the latest technical advances as soon as possible.*" Allocating too much spectrum for a given service can be as inefficient as allocating too little.

The report "India's preparedness for 5G" also mentions the statement[1] of the Secretary, DoT, stated during evidence as "*The bandwidth of 3,300 MHz. to 3,600 MHz. is not yet used in the 2G, 3G and 4G. It is envisaged to be used for 5G, but that does not mean that 5G will not use other spectrum bands. So, 5G would also come in 700 MHz., 800 MHz., 900 MHz bands in the time to come. 5G would also be coming in the millimetre wave bands, which are 24.25 GHz. to 27.5 GHz. This is also where the international ecosystem is coming up."*

The statement of the Secretary DOT to the Parliamentary "Standing Committee on Information Technology (2020-2021)" mentioning 3300-3600 MHz (and not 3300-3670 MHz) in the mid-band and 24.25-27.25 GHz (and not 24.25-28.5 GHz) in millimetre wave (mmWave) band conveys the government's assertion to use these frequency bands for 5G/IMT services that also adheres to NFAP 2018 and ITU RR stipulations.

Furthermore, article 4.4 of the Radio Regulations continues by stating that: "*Administrations of the Member States shall not assign to a station any frequency in derogation of either the Table of Frequency Allocations in this Chapter or the other provisions of these Regulations, except on the express condition that such a station, when using such a frequency assignment, shall not cause harmful interference*[2] *to, and shall not claim protection from harmful interference caused by, a station operating in accordance with the provisions of the Constitution, the Convention and these Regulations.*"

In line with this, any new service has had to ensure the continued availability of existing services in the same or adjacent spectrum bands. The same principle needs to be applied while allocating spectrum for the new services of 5G being introduced to ensure that the 5G operations do not interfere, impact or hamper the existing operations of satellite services.

2. A Balanced Approach to Radio Spectrum Allocation

The drawback of a terrestrial mobile focus instead of a multi-technology approach is highlighted by the drafted response of Hon. Minister of State for communications, Shri Sanjay Dhotre in Lok

[1] Page 19, Para 22 Report on "India's Preparedness for 5G" presented by the Parliamentary "Standing Committee on Information Technology (2020-21)" to the Indian Parliament on 08 Feb. 2021

[2] Article 1.166 of the Radio Regulations defines interference as "The effect of unwanted energy due to one or a combination of emissions, radiations, or inductions upon reception in a radio communication system, manifested by any performance degradation, misinterpretation, or loss of information which could be extracted in the absence of such unwanted energy."

Sabha on 10th Feb 2021 that an estimated 37,439 inhabited villages in the country do not have 3G/ 4G mobile internet coverage.[3] The importance of addressing this gap cannot be underestimated, and an action plan with technology choices and execution timelines needs to be there in place.

With lack of connectivity, it's not just that these villages do not have access to essential government to citizen services, such as tele-health, tele-education, disaster response systems, but also that for lack of satellite-based delivery, would also be deprived of TV services that are crucial for information dissemination of the government, welfare schemes besides entertainment and information. This lack of connectivity can certainly not be attributed to a lack of spectrum. The ability of satellite-based services to provide connectivity to these unserved and many other underserved areas is demonstrated amply, and the solutions are available now instead of alternatives with a multi-year rollout period. Thousands of such villages are in landlocked, hilly and inaccessible terrain and need to be connected with appropriate technology solutions.

It is of utmost importance to the country that no one solution can fill the broadband connectivity gap. What is necessary is the right mix of access technologies, including fixed-line, satellite, Wi-Fi and mobile broadband, to ensure a more inclusive penetration. With the advent of IMT-2020 5G radio technologies, policy-makers and regulators are facing considerable pressure from terrestrial mobile operators to repurpose spectrum to meet new technical requirements. It is important to note that 5G advances are not unique to terrestrial networks. Satellite broadband is already using many of these advances and has been doing so for many years. These 5G type advances include the use of low latency radio interfaces, network slicing, and edge computing or caching.

However, any policy would have to account for the dynamics of providing connectivity in rural and remote areas from those of urban areas. The strategies, which work in urban areas, are not suited for rural areas. Each technology option comes with its capabilities and limitations, and, of course, spectrum requirements. Earmarking enormous resources for a single technology and relying solely on it is not only an imprudent strategy but also impacts the business ecosystem for other service providers and technology alternatives. The result will be limited options, less innovation and likely higher prices for consumers. This will also limit the scope of FDI, manufacturing and employment generation in the country.

C-Band Considerations

The satellite industry is highly concerned to the possible identification of a particular spectrum in mid-band and mmWave band for IMT/5G, given that this band is currently in use at substantial investment by the Satellite sector to support a variety of applications, including video distribution businesses like Cable TV, Headend in the sky (HITS) and DTH, video broadcasting businesses, In-flight and Maritime Communications (IFMC), Disaster management, Tele-education, Tele-health, agriculture, animal husbandry etc. Each of these businesses, solutions, and application areas

[3] See http://164.100.24.220/loksabhaquestions/annex/175/AU1383.pdf

have invested and established under existing laws, rules, and regulations. These investments must be kept secure from disruption by any alternative or adjacent use of the spectrum bands.

While researching the ability of mobile operators to launch 5G services in mid-band, OFCOM, the UK communications regulator, found that[4] *"(…) there was no evidence that 5G could not be delivered with smaller [e.g. 40 MHz blocks] or non-contiguous carriers in other frequency bands [i.e. spectrum other than C-band]."* This suggests that the 300 MHz of spectrum in 3.3-3.6 GHz band identified in the NFAP 2018 provides enough spectrum to satisfy India's mid-band 5G requirements while ensuring a competitive auction. With three private mobile network operators (MNOs) accounting for 90% of the market, each of them would be able to secure 80-90 MHz while leaving 30-60 MHz for the state-owned MNOs that account for the remainder of the market. Providing an extra 70 MHz of spectrum is unnecessary and will result in an uncompetitive auction at the expense of important satellite services.

Preserving the entire 3.6-3.7 GHz for FSS will also ensure that the bulk of satellite services in the C-band (3.7-4.2 GHz) can be maintained without the prospect of interference from 5G transmissions in the adjacent band, using a combination of a suitable guard band, out-of-band emission limits on 5G emitters, and the installation of filters. Multiple international studies, including ITU-R Report S. 2368 [5] and deployment experiences worldwide, have proved the strong potential for interference from 5G Services into adjacent Satellite services, wherever co-existence is attempted. Mitigation measures like band pass filters are NOT a standalone solution and are effective only when applied with a suitable guard band and emission limits on the high levels of 5G transmissions compared to the earth station receive signals.

Ka-Band Considerations

The World Radio-communication Conference in 2019 **did not** include the 27.5-28.5 GHz band as part of the 5G/IMT identification, as stated in the TRAI Consultation Paper[6]. In most countries, the assignment of the mm-wave spectrum has been in the 26 GHz band, which is fully harmonised on a global basis for IMT. Therefore, it follows that the similar 26GHz (n258) band would have a higher value for 5G services than 28GHz. The spectrum used for 5G/IMT in the 27.5-28.5 GHz band would be inconsistent with the RRs and the international binding treaty signed by India at the WRC-19.

Given that more than 120 countries (and rising) expressed their intention to follow the ITU decisions and preserve the 27.5-31 GHz and 17.7-21.2 GHz bands for satellite broadband services, this global consensus reaffirmed maintaining the 27.5 GHz and above for FSS. Europe's "5G Roadmap" re-affirms this determination, recognizing the critical nature of this spectrum for satellite broadband, and explicitly stating its policy: "*Signal clearly that Europe has harmonised*

[4] *See,* Ofcom, *A7.39, Award of the 700 MHz and 3.6-3.8 GHz spectrum bands: Annexes* (13 March 2020), available online at https://www.ofcom.org.uk/data/assets/pdf_file/0017/192410/annexes-award-700mhz-3.6-3.8ghz-spectrum.pdf.

[5] https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-S.2368-2015-PDF-E.pdf

[6] TRAI Consultation Paper, paragraphs 1.42 and 3.41.

the 27.5-29.5 GHz band for broadband satellite and is supportive of the worldwide use of this band for ESIM. This band is therefore not available for 5G."[7]

For the mmWave bands, the Cellular Operator's Association of India (COAI) recommended a spectrum block size of at least 400 MHz per 5G operator[8]. The 26 GHz band (24.25 to 27.5 GHz) that is globally harmonised with 3.25 GHz of the available spectrum should be ample for the four mobile operators in India.

At present, there is a limited uptake for mmWave spectrum in the different regions of the world, for instance: -

- South Korea licensed each of their 3 MNOs with 800 MHz of 5G spectrum in 26/28 GHz in 2018, with an obligation to build out more than 45,000 5G base stations by the end of 2021. However, by the end of August 2021, the three MNOs had only built out a total of 161 base stations due to a lack of demand and applications to justify the investment[9].
- Similarly, the European Commission found a lack of demand for a 26 GHz spectrum for 5G, noting that while millimetre-wave bands were once popular, "*their popularity had now waned*."[10]

In addition, Jessica Rosenworcel, Commissioner of the Federal Communication Commission, has said: *"… our focus on millimetre wave spectrum is threatening to create 5G haves and have-nots in the United States. That's because while these airwaves have the substantial capacity, their signals do not travel far. As a result, commercializing them is costly—especially in rural areas. The sheer volume of antenna facilities required to make this service viable will limit deployment to the most populated urban areas. This will deepen the digital divide that already plagues too many rural communities nationwide."*[11]

3. Achieving Successful Auction Results

To ensure a successful outcome to the auctions, there must be a proper balance in the supply and demand for the spectrum. It may be more prudent to auction lower and mid bands since they have a higher value and are in demand as per the global experience. However, it should be noted that 40 MHz or so per operator in mid-band would be more than adequate. So, as argued above, 3.4 to 3.6 GHz should be quite sufficient without impacting the existing satellite user base that is contributing to the national economy. In the case of mmWave, 400 MHz or so per operator

[7] *See* European Conference of Postal and Telecommunications Administrations (CEPT), *Spectrum for wireless broadband – 5G*, Section B.3 (Version 10, Revised 6 March 2020) at https://www.cept.org/Documents/ecc/57839/ecc-20-055-annex-15_cept_5g_roadmap

[8] Page 20, Para 23 Report on "India's Preparedness for 5G" presented by the Parliamentary "Standing Committee on Information Technology (2020-21)" to the Indian Parliament on 08 Feb. 2021

[9] http://www.koreaherald.com/view.php?ud=20210910000417.

[10] https://5gobservatory.eu/26-ghz-holds-back-achievement-of-eu-5g-goals/

[11] Jessica Rosenworcel (2020), Statement of Jessica Rosenworcel, Commissioner, Federal Communications Commission before the Committee on Commerce, Science, and Transportation, United States Senate "Industries of the Future", 15 January 2020. Available at https://www.commerce.senate.gov/2020/1/industries-of-the-future

within the band, meaning that the 24.25 to 27.5 GHz (which provides 3250 MHz of spectrum) should be ample without impacting other existing users of the spectrum in the band 27.5GHz and above. Such an approach by TRAI/DoT to the auctioning of the spectrum would result in a successful outcome both in terms of revenue and in the socio-economic development of provisioning 5G and satellite broadband services nationwide.

The international best practice for rationally planning spectrum use for different applications examines alternative uses to identify which use maximises the value of that spectrum. At the previous World Radio-communication Conference in 2019 (WRC-19), a total of 17.25 GHz of the spectrum was identified for IMT services to support 5G development that is more than enough to cater to the existing requirement of 400 MHz per operator with abundant headroom for future growing need, if any. The majority of the new spectrum identified for IMT was in the high-band range (or mm-wave frequencies), including 24.25–27.5 GHz (3GPP n258 band), 37–43.5 GHz, 45.5–47 GHz, 47.2–48.2 GHz and 66–71 GHz.

4. Concluding Remarks

Reallocating spectrum from other services/applications to facilitate only one option, i.e. terrestrial mobile, will negatively impact a whole range of alternatives that are already serving the connectivity and information dissemination needs of the country, and will disincentivise the adoption of the latest technologies in these sectors that add to FDI, GDP and employment generation. In sum:

1. 28 GHz band: Encroaching on this band has the effect of substantially impairing the viability of many satellite communication business models and depriving the nation of this connectivity option. Billions of dollars of investment have gone into this industry, and handing over one GHz of (the band 27.5-28.5GHz) to IMT/5G has a significant impact on the cost of services that these satellites could provide given that their business cases were built on the availability of the full 2 GHz of the spectrum from 27.5 to 29.5GHz. There is simply no need to do this when there is ample spectrum in 26 GHz to meet 5G spectrum demand in the mmWave.

2. C-Band: Identification of the 3.3-3.6 GHz band for 5G provides enough mid-band spectrum for 5G, especially when combined with the unsold spectrum at 2300 MHz and 2500 MHz. UK OFCOM's analysis showed that 40 MHz would be enough for an MNO to provide all 5G applications, and the 300 MHz of spectrum in 3.3-3.6 MHz would provide more than that per Indian MNO. Providing an additional 70 MHz, over and above the NFAP 2018 identified mid-band range of 3.3-3.6 GHz is unnecessary, and would result in an uncompetitive auction. Preserving the entire 3.6-3.7 GHz for satellite services will ensure the bulk of C-band satellite services can continue, provided there is adequate adjacent band protection measures. Otherwise, the loss of that spectrum will be felt across the media and entertainment industry value chain that includes broadcast and 50000+ digital platform operators (DTH/HITS/Cable TV) that have been contributing to

GDP and employment by using a band that has been earmarked for these services over the last 20 years.

3. Sub GHz band: The high peak to average power ratio (PAPR) of 5G signals and cumulative interference of signals from the multitude of base stations and user devices can impair the existing cable distribution networks. The frequency range for cable TV distribution should be excluded from the spectrum identified for 5G/IMT services in the sub-GHz lower bands.

Offering excessive spectrum resources in the upcoming 5G auction will result in Indian citizens being denied the benefits of high-demand, advanced satellite broadband services and risk lost GDP increases per annum to India's economy of up to USD 184.6 billion.[12] Similarly, the impact of the loss of C-band spectrum in the 3.6-3.67 GHz band will be felt across the entire Indian broadcasting industry.

At SIA-India, as a vibrant body for the satellite communications ecosystem, we aim to present the industry's interest to the Government, Regulators, Policymakers, domestic and international standards bodies for policymaking, regulatory and licensing matters. We are happy to provide any further clarifications that may be required.

Respectfully

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Encl. SIA-India Comments - Consultation Paper on Auction of Spectrum in frequency bands identified for IMT/5G

[12] Plum Consulting, *Expanding Digital Connectivity through Satellite Broadband in the 28 GHz Band* (Oct. 2021), *at* https://plumconsulting.co.uk/expanding-digital-connectivity-through-satellite-broadband-in-the-28-ghz-band/.

SIA-INDIA RESPONSE TO TRAI ISSUES FOR CONSULTATION

Issues related to Quantum of Spectrum and Band Plan

Q.1 Whether spectrum bands in the frequency range 526-617 MHz should be put to auction in the forthcoming auction? Kindly justify your response.
The said band of 526-617 MHz is used to provide cable TV and broadband services (one of the potential mediums for urban and rural broadband) which remains coaxial or hybrid coaxial. With nearly 800 channels, including HD channels and 50-100 Mbps broadband speed, being delivered to homes, the use of this spectrum is an essential need for the industry. Identification of VHF, UHF and upper UHF bands for IMT services would herald severe disruptions to 100 Mn cable TV households, and over 20 Mn wired broadband subscribers receiving the services through cable. It is also essential that the bidders be made aware and accountable that it is incumbent upon the successful bidders to use the spectrum on the express condition that IMT networks when using a frequency assignment, shall not cause harmful interference to existing services that are working in their allocated spectrum bands. For purposes of clarity, Article 1.166 of the Radio Regulations defines interference as "*The effect of unwanted energy due to one or a combination of emissions, radiations, or inductions upon reception in a radio communication system, manifested by any performance degradation, misinterpretation, or loss of information which could be extracted in the absence of such unwanted energy.*"

Q.2 If your answer to Q1 above is in affirmative, which band plans and duplexing configuration should be adopted in India? Kindly justify your response.
No Comments from SIA-India

Q.3 In case your answer to Q1 is in negative, what should be the timelines for adoption of these bands for IMT? Suggestions to make these bands ready for adoption for IMT may also be made along with proper justification.
The nation should go with globally harmonized bands and wait for direction from the next WRC. A detailed proposal should be sent to ITU through Indian Administration for discussion by the intended beneficiary of the frequency band.

Q.4 Do you agree that 600 MHz spectrum band should be put to auction in the forthcoming auction? If yes, which band plan and duplexing configuration should be adopted in India? Kindly justify your response.
The 600 MHz spectrum band provides cable TV and broadband services (one of the potential mediums for urban and rural broadband) which remains coaxial or hybrid coaxial. With nearly 800 channels, including HD channels and 50-100 Mbps broadband speed, being delivered to homes, the use of this spectrum is an essential need for the industry. Identification of VHF, UHF and upper UHF bands for IMT services would herald serious disruptions to 100 Mn cable TV households and over 20 Mn wired broadband subscribers who are receiving the services through cable. It is also important that the bidders be made aware and accountable that it is incumbent upon the successful bidders to use the spectrum on the express condition that IMT networks when using a frequency assignment, shall not cause harmful interference to existing services that are working in their allocated spectrum bands. For purposes of clarity, Article 1.166 of the Radio Regulations defines interference as "*The effect of unwanted energy due to one or a combination of emissions, radiations, or inductions upon reception in a radio communication system, manifested by any performance degradation, misinterpretation, or loss of information which could be extracted in the absence of such unwanted energy.*"

Q.5 For 3300-3670 MHz frequency range, which band plan should be adopted in India? Kindly justify your response.
While the 5G/IMT industry often advocates for an immediate need of 80-100 MHz in the mid-band for operations, UK Ofcom's analysis has demonstrated that an MNO will be able to deliver

all the primary services anticipated under 5G – including, but not limited to, connected cars, virtual reality cloud broadband, and live 4K streaming – with 40 MHz of spectrum[13]. Indeed, there are ample examples of IMT operators in the world operating with an average of 40-80 MHz spectrum allocation.

In India, with four MNOs in the country, an allocation of 300 MHz from 3300-3600 MHz (as referred to time and again in the NFAP 2018, statement of Secretary DOT[14] and other forums) is sufficient to allow each operator to obtain at least 40 MHz while ensuring a competitive auction. It should also be remembered that mid-band spectrum in the 3.3-3.6 GHz range can be combined with frequencies in the 2300 and 2500 MHz band through spectrum aggregation, if additional mid-band spectrum is required for 5G.

The disadvantage of stretching the 5G/IMT beyond 3600 MHz however, is the impact of critically impairing the C Band operations of the satellite industry. This, unfortunately, is the direction proposed in TRAI consultation Paper. Identification of an additional 70 MHz, over and above the NFAP 2018 identified mid-band range of 3.3-3.6 GHz provides excessive mid-band spectrum for 5G and creates the risk of an uncompetitive auction. At the same time, it unnecessarily disrupts C-band satellite services in the 3.6-3.7 GHz band being used to provide tele-education, tele-health and to support India's vibrant broadcasting industry.

Preserving the entire 3.6-3.7 GHz for FSS will ensure that the bulk of satellite services in the C-band can be maintained without the prospect of interference from 5G transmissions in the adjacent band, using a combination of a suitable guard band, out-of-band emission limits on 5G emitters, and the installation of filters. Multiple international studies, including ITU-R Report S. 2368[15] and deployment experiences worldwide, have proved the interference from 5G Services to adjacent band Satellite services. Mitigation measures like band pass filters are NOT a standalone solution and are effective only when applied with a suitable guard band and emission limits on the high levels of 5G transmissions compared to the earth station receive signals.

A huge investment has gone into the C Band satellites over the last twenty years by ISRO and Foreign-owned satellites providing services for applications in India with the C Band operations also having a significant contribution to the national Indian economy including GDP, employment generation and the benefits of various services that are enabled by these C-band

[13] *See,* Ofcom, *A7.39, Award of the 700 MHz and 3.6-3.8 GHz spectrum bands: Annexes* (13 March 2020), available online at https://www.ofcom.org.uk/data/assets/pdf_file/0017/192410/annexes-award-700mhz-3.6-3.8ghz-spectrum.pdf.

[14] Page 10, Para 22 Report on "India's Preparedness for 5G" presented by the Parliamentary "Standing Committee on Information Technology (2020-21)" to the Indian Parliament on 08 Feb. 2021

[15] https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-S.2368-2015-PDF-E.pdf

satellites. The INR 685Bn broadcast sector alone, carrying 900+ registered channels to 21 Cr Households in urban and rural India through ~1730+ digital platform operators and 50000+ cable operators, provides direct and indirect employment to 1.83 M people.

Usage of C-Band cannot be substituted, it has become of the national infrastructure and the current DOT notification of 3.3-3.67 GHz for IMT will impair the capability of satellite services operating in C-Band, while creating risks of uncompetitive 5G auctions in the mid-band (including in the 2300 MHz and 2500 MHz) due to the excessive amount of spectrum made available.

It is pertinent to note that the National Frequency Allocation Plan 2018 (NFAP-2018[16]) limits the allocation of frequencies to IMT services within the upper limit of 3.6 GHz. DoT has sought TRAI's recommendation to allocate additional 70 MHz spectrum frequencies over and beyond the NFAP 2018 in the range of 3.6 - 3.67 GHz.

SIA-India recommends that the spectrum allocation for 5G/IMT services in this band is retained as per NFAP 2018 to be 3.3-3.6 GHz. In addition, adjacent band protection measures should be put in place, including a suitable guard band and out-of-band emission limits on 5G. Moreover, the 5G operators should be mandated to ensure their emissions do not interfere with existing satellite services in the adjacent band.

It is also essential that the bidders be made aware and accountable that it is incumbent upon the successful bidders to use the spectrum on the express condition that IMT networks when using a frequency assignment, shall not cause harmful interference[17] to existing services that are working in their allocated spectrum bands.

Q.6 Do you agree that TDD based configuration should be adopted for 24.25 to 28.5 GHz frequency range? Kindly justify your response

Any discussion on spectrum allocation must first determine the availability and best allocation of the said spectrum for a given service. Nations are better equipped in delivering inclusive

[16] National Frequency Allocation Plan 2018

[17] For purposes of clarity, Article 1.166 of the Radio Regulations defines interference as "*The effect of unwanted energy due to one or a combination of emissions, radiations, or inductions upon reception in a radio communication system, manifested by any performance degradation, misinterpretation, or loss of information which could be extracted in the absence of such unwanted energy.*"

broadband to urban, underserved and unserved populations by approaching this with a wide arsenal of wireless infrastructure solutions that includes 5G terrestrial and satellite-enabled connectivity. As a core enabler of these connectivity solutions, spectrum is a fundamental necessity and inadequate and sub-optimal spectrum allocation is detrimental to the capabilities of these respective services and industries, and ultimately the nation as a whole. Therefore, a balanced approach in spectrum allocation is critical to maximise the individual delivery capabilities of terrestrial and satellite network providers. While the trend is towards TDD in terrestrial 5G/IMT, a discussion on the FDD or TDD configuration model will be pre-empting the allocation. It is important that regulators and policymakers carefully assess and provide the required spectrum resources for these varied service options to avoid forgoing the benefits provided by each of them.

The 26 GHz band provides a substantial 3.25 GHz of spectrum for 5G networks to realize the enhanced benefits of a modern 5G network. Adhering to the 5G ecosystem for a globally harmonized 26 GHz band will provide emerging markets with a cost advantage in building the mmWave band 5G network. No wonder the majority of interest from terrestrial service providers globally has been exploring the 26 GHz band (31%) versus those evaluating usage of the 28 GHz band (15%).

The 3.25 GHz frequency spectrum from 24.25-27.5 GHz, as referred to time and again in the NFAP 2018[18], statement of Secretary DOT[19] and other forums is more than sufficient to accommodate the needs of a minimum of 400 MHz for all 4 operating MNOs while ensuring a competitive auction. As noted above, demand for more 5G mmWave spectrum remains uncertain. Even in South Korea[20], one of the biggest proponents for 5G in the mmWave, the MNOs have deployed less than 200 5G base stations in the mmWave since each of them were assigned 800 MHz at auction in 2018 against a build-out requirement of 45,000 base stations.

In contrast, the decisions of the Radio Spectrum Policy Group (RSPG) and the CEPT Roadmap for 5G, in which they have identified the 28 GHz frequency band as an essential band for satellite-based mobility services (ESIMs), exemplifies the importance of Ultra-High Throughput Satellites to serve the needs of end-users through services in the 28 GHz. The 28 GHz band for satellite communications has seen satellite operators' financial commitments, deployment decisions, and operational strategies, being cemented to deliver ubiquitous connectivity to end-users via satellite-enabled broadband.

[18] National Frequency Allocation Plan 2018

[19] Page 20, Para 23 Report on "India's Preparedness for 5G" presented by the Parliamentary "Standing Committee on Information Technology (2020-21)" to the Indian Parliament on 08 Feb. 2021

[20] http://www.koreaherald.com/view.php?ud=20210910000417

Indeed, the 28 GHz spectrum enables Very High Throughput Satellites (VHTS) and Ultra-High Throughput Satellites (UHTS) capabilities for network connectivity that has a great potential for generating significant economic benefits to emerging markets by bridging the 5G broadband gap. This should be taken into account as countries make critical spectrum allocation and licensing decisions. VHTS and UHTS coming into operation are designed to support 5G deployment nationally and globally and in future to be part of the 6G architecture that India would benefit.

It is important that TRAI and DOT decide the configuration within the spectrum band 24.25-27.5 GHz for terrestrial 5G/IMT, and not encroach on satellite services above 27.5 GHz.

Q.7 In case your response to Q6 is affirmative, considering that there is an overlap of frequencies in the band plans n257 and n258, how should the band plan(s) along with its frequency range be adopted? Kindly justify your response.

SIA-India has recommended in response to Q.6 that the mmWave spectrum for 5G/IMT be limited to 24.25-27.5 GHz instead of 24.25-28.5 GHz as the 3.25 GHz spectrum available is more than sufficient to accommodate a minimum of 400 MHz for all 4 operating MNOs while ensuring a competitive auction. The need for a minimum 400 MHz spectrum for each MNO is asserted by COAI[21] in its submission that is reflected in a report of last year only. There is no need to provide more than the 3.25 GHz available in 24.25-27.5 GHz at the expense of satellite services above 27.5 GHz. Evidence from the international scenario indicates that the demand for more mmWave spectrum remains uncertain. Even the South Korean MNOs, with 800 MHz of spectrum each, have struggled justify investing in mmWave 5G[22] due to the lack of demand and applications. Three years after auction, the South Korean MNOs have deployed only 161 base stations in the mmWave as against a build-out requirement of 45,000 base stations.

It is also important to note the current ITU Radio Regulations (ITU RR) allocations in the 27.5-29.5 GHz band as shown in figure ahead. The primary allocations are for the fixed, mobile and fixed satellite services. There is also a secondary allocation in the upper half of the band to Earth exploration-satellite service (EESS).

[21] Page 11, Para 23 Report on "India's Preparedness for 5G" presented by the Parliamentary "Standing Committee on Information Technology (2020-21)" to the Indian Parliament on 08 Feb. 2021

[22] http://www.koreaherald.com/view.php?ud=20210910000417

The international best practice for rationally planning spectrum use for different applications examines alternative uses to identify which use maximises the value of that spectrum. At the previous World Radio-communication Conference in 2019 (WRC-19), a total of 17.25 GHz of the spectrum was identified for IMT services to support 5G development. The majority of the new spectrum identified for IMT was in the high-band range (or mm-wave frequencies), including 24.25–27.5 GHz (3GPP n258 band), 37–43.5 GHz, 45.5–47 GHz, 47.2–48.2 GHz and 66–71 GHz. In most countries, the assignment of the mm-wave spectrum has been in the 26 GHz band, which is fully harmonised on a global basis for IMT.

Frequency range (GHz)	Service allocations
27.5-28.5	FIXED 5.537A FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.517A 5.539 MOBILE 5.538 5.540
28.5-29.1	FIXED FIXED-SATELLITE (Earth-to-space) 5.484A 5.516B 5.517A 5.523A 5.539 MOBILE Earth exploration-satellite (Earth-to-space) 5.541 5.540
29.1-29.5	FIXED FIXED-SATELLITE (Earth-to-space) 5.516B 5.517A 5.523C 5.523E 5.535A 5.539 5.541A MOBILE Earth exploration-satellite (Earth-to-space) 5.541 5.540

Note: Primary service is indicated in caps; secondary service in lower case. The numbers refer to footnotes in the Radio Regulations.

Allocating access to 27.5 –28.5 GHz spectrum for 5G/IMT and hence making it unavailable to the satellite industry would significantly impact the existing and ongoing investments made on satellite systems and ground equipment, especially considering that the operating frequency ranges of Ka-band satellite systems cannot be changed. Subsequently, this will also reduce the benefits reaped by the end-users of satellite connectivity. 27.5-28.5 GHz is of paramount importance to modern satellite systems. Newer systems leverage on high bandwidth to revolutionise and enhance the quality of connectivity and the economics of novel applications, including backhauling of 5G networks in more remote areas. Multi-billion-dollar extensive investments have been and are being made to meet the growing demand for satellite connectivity to connect the unconnected.

The 28 GHz band (27.5-29.5 GHz) is part of the Ka-band (17.7-21.2 and 27.5-31 GHz) which is allocated for fixed satellite services (FSS). It is not among the identified IMT bands, and only a small number of countries have assigned (or partially assigned) this band for IMT.

The 27-27.5 GHz band is allocated to FSS in ITU-R Regions 2 and 3. This helps in the co-existence of communications links across NGSO and GSO satellites and provide essential

enabling sufficient uplink gateway bandwidth for GSO and NGSO HTS networks. This is important to avoid NGSO gateways blocking access to GSO communication links.

Any reduction in the 28GHz spectrum allocated for providing satellite services will result in a higher cost of satellite capacity due to reduced economies of scale and the socio-economic benefits of satellite connectivity are significantly diminished. The Australian Communications and Media Authority (ACMA), an Australian government statutory authority within the communications portfolio, believed that a sufficient spectrum had already been identified in the 26GHz band for wide-area broadband use (including 5G). Thus, options in which such services were also allocated a portion of the spectrum in the 28GHz band were not expected to maximise public benefit and thus were not considered to be an appropriate use of the band. There is currently no valid evidence that actual usage of the 26 GHz band for IMT services will not be sufficient to meet such public interest needs.

In 3GPP's plenary meeting of 6-17 December 2021, various enhancements were agreed for NTN[23] work for Release 18. Specifically, an NTN-NR Work Item was approved with one objective being to look at NR-NTN deployment in above 10 GHz bands - this will start with a study using harmonized Ka-band frequencies[24] (17.7-20.2 and 27.5-30.0 GHz) as the reference, providing important recognition of satellite services that will be provided in the Ka-band.

The 28 GHz spectrum band is currently assigned to satellite services, providing connectivity to ESIM applications and users without, or with insufficient, access to terrestrial services, particularly high-speed broadband services. These users could be in urban and beyond urban areas, on ships or in the air, and without satellite services utilising 28GHz the options for high-speed broadband are limited. Assessing the economic value of 28GHz for 5G must take into account the loss of value associated with the removal of the arrangements for satellite services. This loss in value may have implications for national policy objectives as well as efforts to improve global trade.

For a balanced and fair approach of spectrum allocation in the mmWave towards securing the benefits of the economy, businesses and users at large, the following is recommended:

- The spectrum from 27.5-28.5 GHz should be excluded from the auction for IMT/5G.
- Access to the 27.5-28.5 GHz band should be maintained for FSS, both for gateway feeder links and customer terminals.
- The frequency bands identified for IMT/5G in India should be aligned with the internationally harmonized 3GPP n258 (26 GHz) band (24.25-27.5 GHz).

[23] Non-terrestrial networks (satellite, etc.).
[24] 3GPP TSG RAN Meeting #94e RP-213690.

- The utilization of frequency band 27-27.5 GHz be in a manner that would not limit the ability to develop and deploy transmitting gateway stations in the band.

While high-speed terrestrial broadband options, such as FTTH, are available in urban locations, the latest generation of HTS networks can deliver much higher capacity at lower costs ubiquitously. This enhances the satellite's role in providing non-urban connectivity, particularly in areas beyond urban centres which are either unserved or underserved by existing terrestrial technology options in India, to accelerate projects like BHARATNET and PM-WANI where the connectivity can be provided instantly instead of waiting for a multi-year fibre rollout timeline.

With more than 120 countries (and rising) expressing their intention to follow the ITU decisions and preserve the 27.5-31 GHz and 17.7-21.2 GHz bands for satellite broadband services, The global consensus continues to be affirmed. Europe's "5G Roadmap" re-affirms this determination, recognizing the critical nature of this spectrum for satellite broadband, and explicitly stating its policy: "*Signal clearly that Europe has harmonised the 27.5-29.5 GHz band for broadband satellite and is supportive of the worldwide use of this band for ESIM. This band is therefore not available for 5G.*"[25]

As indicated by the ITU decisions and the European 5G Roadmap, choosing one technology over another is not an issue. A wide range of opportunities exist to accommodate 5G/IMT in other spectrum bands that specifically has been identified for 5G/IMT, and that would not have any of the adverse effects the ITU considered in deciding where to accommodate the 5G/IMT spectrum needs:

(i) changing the sharing situation regarding the satellite broadband services for which the 27.5-31 GHz and 17.7-21.2 GHz bands already are allocated;

(ii) impairing the ability of satellite broadband

This has resulted in satellite operators designing, constructing and deploying satellite broadband networks around the world based on these ITU decisions, and the identified global allocations for satellite services in the 27.5-31 GHz and 17.7-21.2 GHz bands. There are already over 120 Ka-band satellite systems in service, including those from ISRO, with many more currently under construction and future deployment. If the 27.5-28.5 GHz band is allocated for IMT/5G, some of these programs will be set back by several years severely impacting the rural connectivity initiatives of the Government of India.

The consultation paper mentions a few countries, (e.g., the U.S., South Korea, Japan etc.), making the use of part of the 28 GHz band for terrestrial 5G services outside of the ITU and

[25] *See* European Conference of Postal and Telecommunications Administrations (CEPT), *Spectrum for wireless broadband – 5G*, Section B.3 (Version 10, Revised 6 March 2020) at https://www.cept.org/Documents/ecc/57839/ecc-20-055-annex-15_cept_5g_roadmap .

WRC-19 process. The global community rejected their attempts to have the WRC-15 include the 28 GHz band in Agenda Item 1.13 for consideration for terrestrial 5G. The 10 administrations that have assigned parts of the 28 GHz band for IMT represent a population of just over 600 million (under 8% of the global population). It is important to note that a common characteristic of these countries is their high availability and penetration of fibre. In cases where regulators have assigned the 28 GHz for IMT, there are usually some coexistence measures (e.g. geographic separation, restrictions) in place to manage potential interference between IMT and other uses including satellite services.

Over 120 countries and growing, including Europe[26], China, Australia, Brazil, Russia, Mexico, Nigeria, and other important economies, representing more than half the global population, have secured the full 28 GHz for ubiquitous satellite broadband to provide nationwide satellite broadband services. Accordingly, there is no justification for taking the 27.5-28.5 GHz away from productive satellite uses in order to satisfy uncertain 5G demand, especially when there is plenty of other unencumbered mmWave spectrum available.

Therefore, it follows that the similar 26GHz (n258) band would have a higher value for 5G services than 28GHz. It would be prudent to deploy 5G in the 26GHz as with the majority of the countries to benefit from economies of scale and ensuring effective utilization of the 26GHz with each operator having 400 MHz allocation at the outset and a headroom to aggregate to 800 MHz in future that is in line with many other countries.

Q.8 Whether entire available spectrum referred by DoT in each band should be put to auction in the forthcoming auction? Kindly justify your response.

The Spectrum is a national resource and should be carefully deployed for the technological development and welfare of the citizen, the ITU has been through an arduous task for four years in processing the member country's requirement and coming out with a collective decisions by the member states including India.

Article 4.1 of the Radio Regulations states that "*Member States shall endeavour to limit the number of frequencies and the spectrum used to the minimum essential to provide in a satisfactory manner the necessary services. To that end, they shall endeavour to apply for the latest technical advances as soon as possible.*"

[26] https://docdb.cept.org/download/1675

Even the consultation paper under discussion states at 3.1 that "*Thus, besides ensuring inter-sectoral coordination for efficient allocation and utilization of the spectrum, the control on supply and pricing of various spectrum bands lies in the hands of the Government (i.e. the Licensor).*"

Any spectrum allocated beyond that which is essential will only lead to abundance that will leave spectrum unsold and dampened auction prices, as has happened in the past couple of auctions. That's a double whammy where satellite connectivity options may not be able to serve the objectives that have not been served by terrestrial mobile.

Allocating too much spectrum for a given service can be just as inefficient as allocating too little. The following inefficiency and loss of value risks are associated with Spectrum Oversupply to 5G.

- Risk of saturating the demand for MNOs for additional spectrum – leads to non-competitive auction and lower auction revenues
- Risk that valuable spectrum goes unsold or underutilized for an extended period
- Risk of reallocating valuable satellite spectrum to mobile operators with unproven business strategies at the expense of proven and essential existing FSS services

Article 4.4 of the Radio Regulations continues by stating that: "*Administrations of the Member States shall not assign to a station any frequency in derogation of either the Table of Frequency Allocations in this Chapter or the other provisions of these Regulations, except on the express condition that such a station, when using such a frequency assignment, shall not cause harmful interference to, and shall not claim protection from harmful interference caused by, a station operating in accordance with the provisions of the Constitution, the Convention and these Regulations.*"

In deciding on the allocation of spectrum, it will be important for DOT and TRAI to carefully consider the needs of satellite and IMT uses and associated trade-offs in terms of economic value and opportunity costs involved. Regulators and policymakers should carefully assess and provide the required spectrum resources for satellite services to avoid forgoing the benefits provided by satellite communications. Satellite systems usually have a long investment cycle and, therefore, long-term strategic planning is carried out for satellite spectrum utilization especially for high capacity space segments and therefore having regulatory and spectrum certainty is of paramount importance to these long term investment decisions.

Contrary to the objectives as stated above, the current consultation paper goes way and beyond in identifying the Spectrum specified in NFAP 2018 for the mid-band and mm Wave Band required for 5G/IMT operation. The report "India's preparedness for 5G" also mentions

the statement[27] of the Secretary, DoT, stated during evidence as "*The bandwidth of 3,300 MHz. to 3,600 MHz. is not yet used in the 2G, 3G and 4G. It is envisaged to be used for 5G, but that does not mean that 5G will not use other spectrum bands. So, 5G would also come in 700 MHz., 800 MHz., 900 MHz. bands in the time to come. 5G would also be coming in what are called the millimeter-wave bands, which are 24.25 GHz. to 27.5 GHz. Sir, that is also where the international ecosystem is coming up.*"

The statement of the Secretary DOT to the Parliamentary "Standing Committee on Information Technology (2020-2021)" mentioning 3300-3600 MHz (and not 3300-3670 MHz) in mid-band and 24.25-27.25 GHz (and not 24.25-28.5 GHz) in mmWave band conveys the government's assertion to use these frequency bands for 5G/IMT services that also adheres to NFAP 2018 and ITU RR stipulations. The industry notes with concern that this additional spectrum identified for 5G/IMT impacts the satellite industry negatively.

Satellite connectivity is a key technology for advancing India's goal of universal broadband, and India should not unnecessarily reallocate spectrum away from satellite services to terrestrial 5G services, especially when there is ample other spectrum available to satisfy the latter. In addition, satellite connectivity has been a key to ensuring the resiliency of terrestrial networks in times of crisis or natural disasters. Fibre cables can be cut, and terrestrial networks are often knocked out after natural disasters. Satellites have been key to restoring communications quickly for disaster recovery and emergency telecommunications in each case.

Mid Band Spectrum: At the ITU's World Radio Congress (WRC-19) 2019, member states universally upheld additional support for satellite communication. Notably, the ITU agreed to protect the existing satellite spectrum and provide access to an additional spectrum which will enable satellite service providers to maintain and expand satellite communications and provide satellite-enabled connectivity to end-users. The ITU also recognizes the critical issue of adequate spectrum access for the satellite industry to provide the necessary connectivity solutions to heterogeneous groups of end-users, by validating the use of expanded spectrum access for both fixed and mobile users. It is a fact that over the next four-year ITU cycle, IMT studies will give little consideration to the 3700 to 4200 MHz band in general. An agenda item, AI 1.2, was created at the last WRC for the WRC-23 cycle to focus on possible identification of IMT in the 3600 to 3800 MHz band, specific to Region 2, with opposition from the other ITU Region 1 and Region 3 members.

[27] Page 10, Para 22 Report on "India's Preparedness for 5G" presented by the Parliamentary "Standing Committee on Information Technology (2020-21)" to the Indian Parliament on 08 Feb. 2021

While researching the ability of mobile operators to launch 5G services with 40 MHz of the spectrum. OFCOM, the UK communications regulator found that[28] *"(…) there was no evidence that 5G could not be delivered with smaller [e.g. 40 MHz blocks] or non-contiguous carriers in other frequency bands [i.e. spectrum other than C-band]."* A theoretical cell site throughput model[29] was developed to estimate network performance based on various assumptions on the type of antenna used, the bandwidth of the C-band carrier, and signal strength received by the user.

Ofcom used 3GPP document TR 22.891 as the primary source of information about potential future 5G services, which has 74 use cases. Ofcom selected a sample of the most demanding use cases listed to test technical feasibility, including 40 MHz of spectrum. The results demonstrate that terrestrial mobile operators will be able to deliver all the primary services anticipated under 5G – including, but not limited to, connected cars, virtual reality cloud broadband, and live 4K streaming – with 40 MHz of spectrum.

This means that 300 MHz of spectrum in 3.3-3.6 GHz provides enough spectrum for India's mid-band 5G needs while ensuring a competitive auction. For example, India's three private MNOs with 90% of mobile subscribers could secure 80 MHz each (i.e. twice the minimum 40 MHz identified by Ofcom) while leaving 60 MHz for the state-owned MNOs serving the remaining 10%. It should also be remembered that spectrum in the 2300 MHz and 2500 MHz can also be used to satisfy mid-band 5G requirements.

mmWave spectrum: The international best practice for rationally planning spectrum use for different applications examines alternative uses to identify which use maximises the value of that spectrum. At the previous World Radio-communication Conference in 2019 (WRC-19), a total of 17.25 GHz of the spectrum was identified for IMT services to support 5G development[30]. The majority of the new spectrum identified for IMT was in the high-band range (or mm-wave frequencies), including 24.25–27.5 GHz (3GPP n258 band), 37–43.5 GHz,

[28] *See,* Ofcom, *A7.39, Award of the 700 MHz and 3.6-3.8 GHz spectrum bands: Annexes* (13 March 2020), available online at https://www.ofcom.org.uk/data/assets/pdf_file/0017/192410/annexes-award-700mhz-3.6-3.8ghz-spectrum.pdf.

[29] See 3.41 "Conclusions to further consultation on modelling and technical matters available online at https://www.ofcom.org.uk/__data/assets/pdf_file/0034/199717/statement-sut-modelling-700mhz-3.6-3.8ghz-spectrum.pdf

[30] ITU Press Release, WRC-19 identifies additional frequency bands for 5G, Nov. 22, 2019 ("While identifying the frequency bands 24.25-27.5 GHz, 37-43.5 GHz, 45.5-47 GHz, 47.2-48.2 and 66-71 GHz for the deployment of 5G networks, WRC-19 also took measures to ensure an appropriate protection of the Earth Exploration Satellite Services, including meteorological and other passive services in adjacent bands. In total, 17.25 GHz of spectrum has been identified for IMT by the Conference, in comparison with 1.9 GHz of bandwidth available before WRC-19. Out of this number, 14.75 GHz of spectrum has been harmonized worldwide, reaching 85% of global harmonization.") https://news.itu.int/wrc-19-agrees-to-identify-new-frequency-bands-for-5g/.

45.5–47 GHz, 47.2–48.2 GHz and 66–71 GHz. In most countries, the assignment of the mm-wave spectrum has been in the adjacent 26 GHz band, which is fully harmonised on a global basis for IMT. Therefore, it follows that the similar 26GHz band would have a higher value for 5G services than 28GHz.

In the United States, 5G deployment to date has focused on mmWave bands, including 28GHz. However, there has been an increasing awareness that this focus will worsen the digital divide. As noted by Jessica Rosenworcel, Commissioner of the Federal Communication Commission: *"… our focus on millimetre wave spectrum is threatening to create 5G haves and have-nots in the United States. That's because while these airwaves have the substantial capacity, their signals do not travel far. As a result, commercializing them is costly—especially in rural areas. The sheer volume of antenna facilities required to make this service viable will limit deployment to the most populated urban areas. This will deepen the digital divide that already plagues too many rural communities nationwide*."[31]

TRAI should also note that the viability of 5G use cases remains uncertain. For example,

- In China many 5G use cases previously showcased by the mobile industry – including remote surgery and 5G VR – are being abandoned[32] as too niche or expensive.
- South Korea licensed each of their 3 MNOs with 800 MHz of 5G spectrum in 26/28 GHz in 2018, with an obligation to build out more than 45,000 5G base stations by end of 2021. However, by end of August 2021, the three MNOs had only built out a total of 161 base stations due to a lack of demand and applications to justify the investment[33].
- Similarly, the European Commission has found a lack of demand for 26 GHz spectrum for 5G, noting that while mmWave bands were once popular, "*their popularity had now waned.*"[34]

Summary: In other words, most benefits arising from the implementation of 5G services, both for the economy and for consumers, will be obtained through the deployment by each MNO of the first 40 MHz of the spectrum in mid-band. Additional spectrum, if any, can only bring incremental advantages. The 300 MHz spectrum from 3.3-3.6 GHz can provide each of India's 4 MNOs with more than the minimum 40 MHz required for mid-band 5G applications. On similar lines, the n258 band (24.25-27.5 GHz) provides more than the minimum 400 MHz of

[31] Jessica Rosenworcel (2020), Statement of Jessica Rosenworcel, Commissioner, Federal Communications Commission before the Committee on Commerce, Science, and Transportation, United States Senate "Industries of the Future", 15 January 2020. Available at https://www.commerce.senate.gov/2020/1/industries-of-the-future

[32] https://www.lightreading.com/asia/china-culls-unprofitable-5g-use-cases-as-it-narrows-focus/d/d-id/772855

[33] http://www.koreaherald.com/view.php?ud=20210910000417.

[34] https://5gobservatory.eu/26-ghz-holds-back-achievement-of-eu-5g-goals/

the spectrum to each of India's MNOs[35] required for mmWave applications, for which demand remains highly uncertain.

Additional spectrum, if any, should only be brought to auction when there is sufficient justification by the MNOs for the need and compliance to roll-out obligation of the initial spectrum that they may acquire through the current auction. At some stage, DOT or TRAI need to call an audit regarding the fair and sensitive treatment of incumbents versus increasing demands for spectrum from the protagonists of IMT/5G. There is also an unassigned spectrum in the 2300 MHz and 2500 MHz bands that could be used to meet 5G spectrum demand – all without having to disturb satellite services in the 3600-4200 MHz bands.

Issues related to Block Size

Q.9 Since upon closure of commercial CDMA services in the country, 800 MHz band is being used for provision of LTE services, a. Whether provision for guard band in 800 MHz band needs to be revisited? b. Whether there is a need to change the block size for 800 MHz band? If yes, what should be the block size for 800 MHz band and the minimum number of blocks for bidding for existing and new entrants? (Kindly justify your response)
No Comments from SIA-India

Q.10 Do you agree that in the upcoming auction, block sizes and minimum quantity for bidding in 700 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz and 2500 MHz bands, be kept same as in the last auction? If not, what should be the band-wise block sizes and minimum quantity for bidding? Kindly justify your response.
No Comments from SIA-India

[35] 5G specifications in ITU-R M.2150 require a minimum average spectral efficiency of 7.8 bps/Hz in dense urban areas for a cell capacity of 3 Gbps per cell in a 400 MHz channel

Q.11 In case it is decided to put to auction spectrum in 526-698 MHz bands, what should be the optimal block size and minimum quantity for bidding? Kindly justify your response.
The 526-698 MHz spectrum band provides cable TV and broadband services (one of the potential mediums for urban and rural broadband) which remains coaxial or hybrid coaxial. With nearly 800 channels, including HD channels and 50-100 Mbps broadband speed, being delivered to homes, the use of this spectrum is an essential need for the industry. Identification of VHF, UHF and upper UHF bands for IMT services would herald serious disruptions to 100 Mn cable TV households and over 20 Mn wired broadband subscribers who are receiving the services through cable. It is also important that the bidders be made aware and accountable that it is incumbent upon the successful bidders to use the spectrum on the express condition that IMT networks when using a frequency assignment, shall not cause harmful interference to existing services that are working in their allocated spectrum bands. For purposes of clarity, Article 1.166 of the Radio Regulations defines interference as "*The effect of unwanted energy due to one or a combination of emissions, radiations, or inductions upon reception in a radio communication system, manifested by any performance degradation, misinterpretation, or loss of information which could be extracted in the absence of such unwanted energy.*"

Q.12 What should be optimal block size and minimum quantity for bidding in 3300-3670 MHz band? Kindly justify your response.
In response to Q.5 and Q.8 above SIA-India has established and recommended per MNO spectrum of 40 MHz in mid-band to be put for auction initially The 5G/IMT industry often advocates for a minimum of 80-100 MHz in the mid-band for operations. While validating this claim, Ofcom established that MNO will be able to deliver all the primary services anticipated under 5G – including, but not limited to, connected cars, virtual reality cloud broadband, and live 4K streaming – with 40 MHz of spectrum[36]. There are ample examples of IMT operators in the world operating with an average of 50-80 MHz spectrum allocation, and with four operators in the country, an allocation of 300 MHz

[36] *See,* Ofcom, *A7.39, Award of the 700 MHz and 3.6-3.8 GHz spectrum bands: Annexes* (13 March 2020), available online at https://www.ofcom.org.uk/data/assets/pdf_file/0017/192410/annexes-award-700mhz-3.6-3.8ghz-spectrum.pdf.

from 3300-3600 MHz is sufficient to allow 40 MHz for each operator and sufficient headroom for future requirements. OFCOM states that "*We maintain that bidders will be able to make use of this spectrum in multiples of 5 MHz for 5G, given there are equipment options for 15 MHz.*"[37]

Q.13 What should be optimal block size and minimum quantity for bidding in 24.25-28.5 GHz? Kindly justify your response.

In response to Q.6, Q.7 and Q.8 above SIA-India has established and recommended per MNO spectrum of 400 MHz in mmWave (n258: 24.25-27.5 GHz) to be put for auction initially.

With more than 120 countries (and rising) expressing their intention to follow the ITU decisions and preserve the 27.5-31 GHz and 17.7-21.2 GHz bands for satellite broadband services, The global consensus continues to be affirmed. Europe's '5G Roadmap' re-affirms this determination, recognizing the critical nature of this spectrum for satellite broadband, and explicitly stating its policy: "*Signal clearly that Europe has harmonised the 27.5-29.5 GHz band for broadband satellite and is supportive of the worldwide use of this band for ESIM. This band is therefore not available for 5G.*"[38]

As indicated by the ITU decisions and the European 5G Roadmap, choosing one technology over another is not an issue. A wide range of opportunities exist to accommodate 5G/IMT in other spectrum that specifically has been identified for 5G/IMT, and that would not have any of the adverse effects the ITU considered in deciding where to accommodate 5G/IMT spectrum needs:

(i) changing the sharing situation regarding the satellite broadband services for which the 27.5-31 GHz and 17.7-21.2 GHz bands already are allocated;

(ii) impairing the ability of satellite broadband

This has resulted in satellite operators designing, constructing and deploying satellite broadband networks around the world based on these ITU decisions, and the identified global allocations for satellite services in the 27.5-31 GHz and 17.7-21.2 GHz bands. There are already

[37] See, 5.72, Award of the 700 MHz and 3.6-3.8 GHz spectrum bands available online at https://www.ofcom.org.uk/__data/assets/pdf_file/0020/192413/statement-award-700mhz-3.6-3.8ghz-spectrum.pdf

[38] *See* European Conference of Postal and Telecommunications Administrations (CEPT), *Spectrum for wireless broadband – 5G*, Section B.3 (Version 10, Revised 6 March 2020) at https://www.cept.org/Documents/ecc/57839/ecc-20-055-annex-15_cept_5g_roadmap .

over 120 Ka-band satellite systems in service, including those from ISRO, with many more currently under development.

The consultation paper mentions a few countries, barely a handful (e.g., the U.S., South Korea, Japan, etc.), promoting any part of the 28 GHz band for terrestrial 5G services outside of the ITU WRC-19 process. The global community rejected their attempts to have the WRC-15 include the 28 GHz band in Agenda Item 1.13 for consideration for terrestrial 5G. In ITU-R Region 3, the 27- 31 GHz band is allocated to the fixed satellite services (FSS) (Earth-to-space) on a primary basis. The 10 administrations that have assigned parts of the 28 GHz band for IMT represent a population of just over 600 million (under 8% of the global population). It is important to note that a common characteristic of these countries is the high availability and penetration of fibre. In cases where regulators have assigned the 28 GHz for IMT, there are usually some coexistence measures (e.g. geographic separation, restrictions) in place to manage potential interference between IMT and other uses including satellite services.

In the United States, 5G deployment to date has focused on mmWave bands, including 28GHz. However, there has been an increasing awareness that this focus will worsen the digital divide. As noted by Jessica Rosenworcel, Commissioner of the Federal Communication Commission: *"… our focus on millimetre wave spectrum is threatening to create 5G haves and have-nots in the United States. That's because while these airwaves have the substantial capacity, their signals do not travel far. As a result, commercializing them is costly—especially in rural areas. The sheer volume of antenna facilities required to make this service viable will limit deployment to the most populated urban areas. This will deepen the digital divide that already plagues too many rural communities nationwide."*[39]

Any reduction in the 28GHz spectrum allocated for providing satellite services will diminish the economic benefits that satellite connectivity can bring and result in a higher cost of satellite capacity due to reduced economies of scale. The ACMA believed that sufficient spectrum had already been identified in the 26GHz band for wide-area broadband use (including 5G). Thus options in which such services were also allocated a portion of the spectrum in the 28GHz band were not expected to maximise public benefit and , therefore, were not considered an appropriate use of the band.

The 28GHz spectrum band is currently assigned to satellite services, providing connectivity to ESIM applications and users without, or with insufficient, access to terrestrial services,

[39] Jessica Rosenworcel (2020), Statement of Jessica Rosenworcel, Commissioner, Federal Communications Commission before the Committee on Commerce, Science, and Transportation, United States Senate "Industries of the Future", 15 January 2020. Available at https://www.commerce.senate.gov/2020/1/industries-of-the-future

particularly high-speed broadband services. These users could be in urban and beyond urban areas, on ships or in the air, and without satellite services utilising 28GHz the options for high-speed broadband are limited. Assessing the economic value of 28GHz for 5G must take into account the loss of value associated with the removal of the arrangements for satellite services. This loss in value may have implications for national policy objectives as well as efforts to improve global trade.

A 2018 study by the London School of Economics estimated that connected aircraft solutions could generate savings for the global airline industry of USD5.5-7.5 billion annually, rising to US$11.1-14.9 billion by 2035. Given the anticipated increase in demand from these use cases, the 28 GHz band will have a crucial role in meeting future satellite capacity needs including for airlines operated by Indian companies.

While high-speed terrestrial broadband options, such as FTTH, are available in urban locations, the latest generation of HTS networks can deliver a much higher capacity at lower costs. This enhances the satellite's role in providing non-urban connectivity, particularly in areas beyond urban centres which are either unserved or underserved by existing terrestrial technology options in India, to accelerate projects like BHARATNET and PM-WANI where the connectivity can be provided instantly instead of waiting for a multi-year fibre rollout timeline.

Issues related to Eligibility Conditions for Participation in Auction

Q.14 Whether any change is required to be made in the existing eligibility conditions for participation in Auction as specified in the NIA for the spectrum Auction held in March 2021, for the forthcoming auction? If yes, suggestions may be made in detail with justification.
No Comments from SIA-India

Q.15 In your opinion, should the suggested/existing eligibility conditions for participation in Auction be made applicable for the new spectrum bands proposed to be auctioned? If not, what should be the eligibility conditions for participating in the Auction? Kindly justify your response.
No Comments from SIA-India

Issues related to Interference mitigation in TDD bands

Q.16 Is there a need to prescribe any measure to mitigate possible interference issues in 3300-3670 MHz and 24.25-28.5 GHz TDD bands, or it should be left to the TSPs to manage the interference by mutual coordination and provisioning of guard bands? Kindly provide justification to your response.
Article 1.166 of the Radio Regulations defines interference as "*The effect of unwanted energy due to one or a combination of emissions, radiations, or inductions upon reception in a radio communication system, manifested by any performance degradation, misinterpretation, or loss of information which could be extracted in the absence of such unwanted energy.*" Under Article 4.4 states that "*Administrations of the Member States shall not assign to a station any frequency in derogation of either the Table of Frequency Allocations in this Chapter or the other provisions of these Regulations, except on the express condition that such a station, when using such a frequency assignment, shall not cause harmful interference to, and shall not claim protection from harmful interference caused by, a station operating in accordance with the provisions of the Constitution, the Convention and these Regulations.*" The report ITU-R BT.2337-1 on the study of Sharing and compatibility studies between digital terrestrial television broadcasting and terrestrial mobile broadband applications, including IMT, in the frequency band 470-694/698 MHz states that "*The results show that the excess of the cumulative interference from MS network over the single interferer can be up to 21 dB what causes a significant increase of required separation distance when using the same field strength threshold for cumulative interference as for single entry interference. This study shows that cumulative interference of signals from the MS base stations should be considered.*"[40] Issues of Interference to other existing services (Satellite communication, broadcast, cable TV, Headend in the sky, cable broadband etc.) for co-existence and co-channel existence and mitigation measures required need to be seen in the light of cumulative interference of signals from the multitude of base stations and user devices that will need to be deployed for 5G network rollout in proposed bands. The IMT industry has introduced very stringent limits for out-of-band and spurious emissions into other IMT services, especially those into pre-5G IMT services and co-located services. It should be required to adopt more stringent limits for such emissions into non-IMT services, m where the received signal levels of those interfered non-IMT services are millions to billions of times weaker than the IMT levels.

[40] See Results section 2.2.1.1.1.2.3 at https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-BT.2337-1-2018-PDF-E.pdf

24.25-28.5 GHz band proposed for auction by DOT

It should be noted that the use of the 27.5-29.5 GHz band has not been identified as a key band for IMT, and there are therefore a limited number of sharing studies addressing the potential for co-channel coexistence between FSS and IMT in this band. The majority of studies address the 24.25-27.5 GHz band only. Two of such studies concluded the following:

"In case a frequency band is used for ubiquitous deployment of small FSS earth stations (ESIM), sharing between IMT and the FSS is not practicable."

"For the case of ubiquitous deployment of small FSS earth stations, sharing between IMT [5G] and the FSS is not practicable within the same geographical areas, particularly as it is not feasible to individually coordinate large numbers of ubiquitous earth stations, nor is it even possible to determine a coordination contour around ubiquitous earth stations."

Also, emerging FSS requirements and new demands requiring additional FSS deployment areas make using both IMT and FSS in the same band not feasible in practice.

In essence, co-channel use of FSS, FSS ESIM and IMT pose regulatory challenges of managing interference risks due to incompatibility, particularly in ubiquitous applications. This indicates that deploying these different services in separate bands would better mitigate interference risks while reducing inefficient spectrum use due to geographical exclusion zones.

The Department of Space (DoS) recognizes the critical space operations in the 28 GHz band and previously objected to the band being allocated to the mobile industry.[41] The allocation of the 27.5-28.5 GHz frequency range to IMT/5G will severely impair the deployment and operation of these satellites and curtail the capacity available to offer broadband services. Any requirement for FSS and IMT (mobile 5G) to share any portion of the 27.5-28.5 GHz band will constrain and, at the same time, prevent both services from reaching their full potential due to the geographical separation distances required to ensure compatibility.

If IMT services are deployed in the 28 GHz band, in that case, potential interference between satellite earth stations and IMT receivers (base stations and terminals) is likely to occur, HTS services are expected to be deployed ubiquitously and on the move through earth stations in motion (ESIM), and in such a situation co-channel uses of HTS services and IMT in 28 GHz is not feasible. In cases of ubiquitous services provided by FSS ESIM and IMT, the services cannot coexist if operating co-channel.

[41] *See*, https://economictimes.indiatimes.com/industry/telecom/telecom-news/dept-of-space-isro-refuse-to-free-up-28-ghz-band-for-5g-rollout/articleshow/68714554.cms.

3300-3670 MHz band proposed for auction by DOT

With FSS earth stations being susceptible to interference from IMT networks, it is a matter of concern for the industry to ensure the protection of C-Band operations and the impact of adjacent band compatibility between FSS and IMT. Multiple international studies, including ITU-R Report S. 2368[42] and deployment experiences worldwide, have proved the interference from 5G Services to adjacent band Satellite services GHz wherever co-existence is attempted. Mitigation measures like band pass filters are NOT a standalone solution and are effective only when applied with a suitable guard band and emission limits on the high levels of 5G transmissions compared to the earth station receive signals.

OFCA engaged third-party experts to perform a technical study aimed at determining what level of technical upgrades would be required, in conjunction with limits on out of the band and spurious emissions, to enable coexistence of IMT in 3.4 - 3.6 GHz band and FSS in 3.7 - 4.2 GHz band. The experts determined that an LNB upgrade alone would not provide sufficient protection and that waveguide bandpass filters would need to be retrofitted in front of the LNB.[43]

Mutual interference is probable if NR (IMT) and FSS operate at the same or adjacent frequency. Hence, careful consideration should be given to adjacent band compatibility issues as indicated in Figure 1 below, where interference to satellite receive earth stations could happen. There are three types of possible interference into FSS caused by co-existence with NR (IMT):

1. Interference from In-band NR emission
    a. Due to the long distance to the satellite and the power limitations of the satellite, the incoming FSS signal's power flux density at the earth station location is very low
    b. IMT equipment which is much closer to the earth station, can produce significantly higher power levels at the input to the FSS receiver than the desired satellite signal
2. Interference from Adjacent Band NR emission
    a. Due to the very low power level of the incoming FSS signals, unwanted emissions generated by IMT system operating in an adjacent frequency band can create interference to FSS
3. LNA / LNB Overdrive

[42] https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-S.2368-2015-PDF-E.pdf

[43] 9 Consultancy Report – Assessments on and Recommendations to Enable the Electromagnetic Compatibility between Public Mobile Services and Fixed Satellite Service Operating in the C-Band, Rhode & Schwarz Hong Kong Limited https://www.ofca.gov.hk/filemanager/ofca/common/reports/consultancy/cr_201803_28_en.pdf

a. Earth station LNAs and LNBs are optimized for the reception of very low power level of the incoming satellite signal and hence should have a very high sensitivity
b. Incoming BS NR signals at much higher power levels can severely affect the operating point of the LNA/LNB and drive it out of its dynamic range to where it exhibits a non-linear behaviour
c. This results in the creation of intermodulation products and gains compression (within the device) that in turn result in distortion of FSS signal

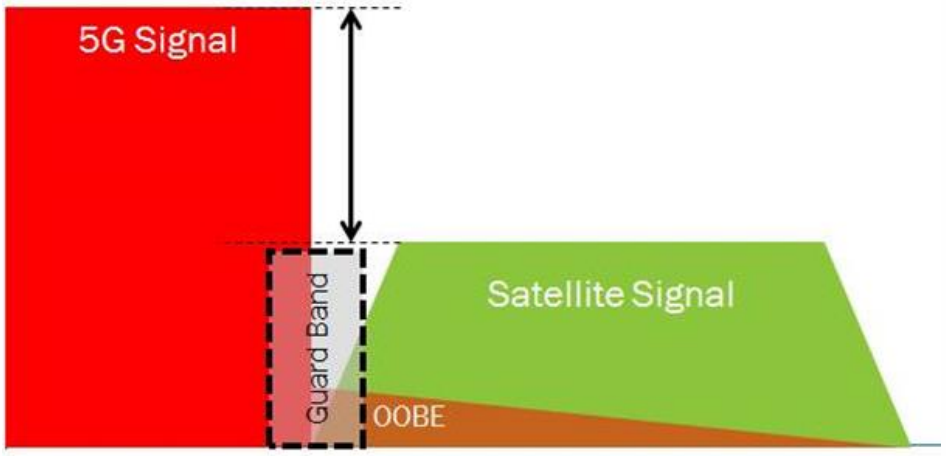

Figure 1: Representation of Adjacent Band Interference from IMT to FSS

One of the solutions is to lower the magnitude of the interfering IMT signal received that can be achieved by adding a filtering function before the LNB. The band pass filter (BPF), however, could only be adequately operated if there is frequency separation (i.e. Guard band) between the edge of the IMT/5G transmission and the FSS transmission to provide the waveguide filter with the necessary bandwidth to reject the 5G interference at the earth station.

The implementation of such filters on the FSS earth station receivers, however raises specific concerns: if the guard band is smaller than 100 MHz, some tailor-made band pass filter is required, or unique technology have to be used in the filter and this will drive up the cost of the filter. In addition to the roll-off of the filter characteristics, there are other parameters that have to be carefully examined and noted, including rejection ratio in the 5G band, insertion loss in satellite receiving band. Moreover, there are also concerns on the wind loading and deformation of the receiving pattern due to the weight and size of the filter.

- Cost of filter and implementation rollout as this has to be implemented in tens of thousands of earth stations installed and planned.

- If the guard band is smaller than 100 MHz, some tailor-made bandpass filter is required, or unique technology has to be used in the filter which will drive up the cost of the filter.
- Special enhanced filters for a response with rapid attenuation increase within lower guard bands will imply elevated insertion losses that may generate the need to change the antenna to maintain the original G/T (and station operation) and avoid service interruption.
- There are also concerns about the wind loading and deformation of the receiving pattern due to the weight and size of the filter.
- The insertion of a BPF also impacts the receiver performances concerning filter insertion loss, an increase of the system noise temperature, phase and group delay).
- According to calculations made by satellite operators, it is observed that for systems employing adaptive coding and modulation, the introduction of the enhanced filter will reduce the throughput by over 30% in some cases.

Regulation on specific IMT/5G unwanted emissions limits versus frequency separation is critical in this context to limit the impact of these unwanted emissions on adjacent band operating services. The use of BPF is an additive measure that can only perform with adequate frequency separation using a guard band and not a standalone solution by itself.

It will be essential to establish adjacent band protection criteria for FSS earth stations vis a vis 5G/IMT, e.g. a guard band in the IMT portion of the band and an out-of-band PFD limit for IMT transmitters to protect FSS earth stations in the adjacent band.

Several countries have done some field test experiments on how to deploy IMT, including 5G while preserving satellite services in the band 3400 – 4200 MHz. Some Asia Pacific countries have performed field tests to study the coexistence between IMT and FSS and implement those field test outcomes into their 5G spectrum roadmap in their countries. The table ahead summarises those results:

	Unit	Hong Kong[1]	Singapore[2]	China[3]	Indonesia[4]	Myanmar[5]
IMT Spectrum	MHz	3400-3600	3450-3650	3300-3600	3400-3600	3400-3520
Guard Band	MHz	100	50	100	100	105
Guard Boundary	MHz	3600-3700	3650-3700	3600-3700	3600-3700	3520-3625
FSS Allocation	Mhz	3700-4200	3700-4200	3700-4200	3700-4200	3625-4200
BPF Filter Rejection	dB	>55 dB below 3600 MHz	>45 dB below 3650 MHz	>55 dB below 3600 MHz	>60 dB below 3600 MHz	
Additional Remarks		Adoption of restriction zones to protect TT&C stations	• 3600 – 3650 MHz & 3450 – 3500 MHz will be limited for indoor and underground use • Adoption of 2 Exclusion zones to protect critical FSS operations and 5 precautionary zones for high density areas of C-band FSS operations	• 3300 – 3400 MHz will be limited for indoor use • Adoption of interference coordination areas with a specific separation distance between IMT and FSS	• Data above is based on recently performed test experiments to study IMT-FSS co-existence in 3400-4200 MHz	

Notes on this table

1) The details on OFCA decision on the reallocation of the 3.5 GHz band for IMT deployment, including its applicable mitigation measures, could be referred to the following link https://www.coms-auth.hk/filemanager/statement/en/upload/441/ca_statements20180328_en.pdf
2) The details on IMDA decision on the reallocation of the 3.5 GHz band for IMT deployment, including its applicable mitigation measures, could be referred to the following link https://www.imda.gov.sg/-/media/Imda/Files/Regulation-Licensing-and-Consultations/Consultations/Consultation-Papers/Second-Public-Consultation-on-5G-Mobile-Services-and-Networks/5G-Second-Consultation-Decision.pdf
3) The details on the MIIT decision on the reallocation of the 3.5 GHz band for IMT deployment, including its applicable mitigation measures, could be referred to the following link (in the Chinese language) http://www.srrc.org.cn/article22361.aspx.
4) The details of the Indonesian study and conclusions were submitted to the AWG 27 meeting of the APT and is attached for reference.

Adobe Acrobat Document

5) The details on Myanmar decisions on this band can be found at the following link: https://www.ptd.gov.mm/Uploads/Reports/Attach/122020/200471330122020_Spectrum%20Roadmap%20(2020)'%20Facilitate%20the%20sustainable%20growth%20of%20Industry%20(Draft).pdf.

In addition, SIA-India believes India also needs to protect other existing C-band primary services (e.g. FSS) in its neighbouring countries such as Bhutan, Nepal, Bangladesh, Pakistan, Sri Lanka, China, and Myanmar from harmful interference due to 5G deployment in India.

Conventionally any new service has had to ensure the continued availability of existing services in the same or adjacent bands. The same principle needs to be applied while allocating spectrum for the new series of 5G being introduced to ensure that the 5G operations do not interfere, impact or hamper the existing operations of satellite services in the C band. Multiple international studies, including ITU-R Report S. 2368[44] and deployment experiences worldwide, have proved the interference from 5G Services to adjacent band Satellite services wherever co-existence is attempted. Mitigation measures like band pass filters are NOT a standalone solution and are effective only when applied with a suitable guard band and emission limits on the high levels of 5G transmissions compared to the earth station receive signals.

Q.17 In case your response to the above question is in affirmative,
a. whether there is a need to prescribe provisions such as clock synchronization and frame structure to mitigate interference issues, as prescribed for existing TDD bands, for entire frequency holding or adjacent frequencies of different TSPs? If yes, what should be the frame structure? Kindly justify your response.
b. Any other measures to mitigate interference related issues may be made along with detailed justification.

Same as response to Q 16

Issues related to Roll-out Obligations

Q.18 Whether the roll-out obligations for 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz and 2500 MHz as stipulated in the NIA for last auctions held in March 2021 are appropriate? If no, what changes should be made in the roll out obligations for these bands?

[44] https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-S.2368-2015-PDF-E.pdf

No Comments from SIA-India

Q.19 What should be associated roll-out obligations for the allocation of spectrum in 526-698 MHz frequency bands? Should it be focused to enhance rural coverage? Kindly justify your response.
No Comments from SIA-India

Q.20 What should be associated roll-out obligations for the allocation of spectrum in 3300-3670 MHz frequency band? Kindly justify your response.
For all the benefits of eMBB, URLLC and mMTC that 5G can bring, if not deployed timely, efficiently and effectively, there is a risk of losing out on these benefits or not maximizing the reach of these benefits to large swaths of the population. TRAI should also note that the viability of 5G use cases remains uncertain. For example, In China, many 5G use cases previously showcased by the mobile industry – including remote surgery and 5G VR – are being abandoned[45] as too niche or expensive. Besides the efficient usage of spectrum for 5G rollout and effective use of spectrum to have a timely widespread deployment of 5G services that the authorities need to ensure, it is also essential that the Government of India reviews the feasibility of the MNO's business plans and monitors the implementation of such business plans regularly. This would include verifying the correct implementation of their systems with respect to compliance with execution concerning the regulatory provisions set out to protect other services in the band and the adjacent band. For the specific case of FSS protection in the 3700-4200 MHz, it is vital that a process is put into place to ensure that defined adjacent band protection levels are respected, e.g.: • 5G/IMT emissions must comply with in-band and out of band unwanted emissions limits. • Ensuring that there is ample frequency separation with a suitable guard band for the effectiveness of BPF in lowering these emissions further.

[45] https://www.lightreading.com/asia/china-culls-unprofitable-5g-use-cases-as-it-narrows-focus/d/d-id/772855

- Key FSS earth station sites need to be protected by implementing exclusion zones.
- Ensuring funding to compensate the costs associated with the necessary measures to counteract any degradation in the reception of the signal (due to filter installations), to ensure that the quality of the transmissions that are currently being made will be maintained without imposing additional costs to satellite or earth station operators.

Q.21 What should be associated roll-out conditions for the allocation of spectrum in 24.25 to 28.5 GHz frequency range? Kindly justify your response.

The text in the consultation states in Sec. 2.67 that "*24.25–28.5 GHz (mmWave) spectrum is likely to be used for the provision of 5G use cases/applications requiring very high data rates and ultra-low latency. Therefore, the TSPs would be deploying it selectively in the areas where the demand for such use cases/applications exists. Further, the technical characteristics of the high band are such that it cannot be used for meeting coverage requirement.*"

Given the contention in the 24.25-28.5 GHz band, and the high value of the 27.5-28.5 GHz band for satellite services, national allocation to 5G of the 27.5-28.5 GHz band is not the best way forward, as it would unnecessarily sterilize valuable spectrum in areas where 5G will never be deployed using these frequencies. Faced with a choice of using the 27.5-28.5 GHz band for satellite services that will help close the digital divide or using the band to provide more 5G capacity in places that already have 5G, the Government of India should choose the former, especially when international evidence suggests that demand for mmWave 5G is uncertain and can be met using the 3.25 GHz of spectrum in 24.25-27.5 GHz.

If the Government still decides that 27.5-28.5 GHz band will be used for 5G, stringent rollout obligations will be very important, especially given the substantial opportunity cost from the loss of satellite services in the band. For all the benefits of eMBB, URLLC and mMTC that 5G can bring, if not deployed timely, efficiently and effectively, there is a risk of losing out on these benefits or not maximizing the reach of these benefits to large swaths of the population. Besides the efficient usage of spectrum for 5G rollout and effective use of spectrum to have a timely widespread deployment of 5G services that the authorities need to ensure, it is also essential that the Government of India reviews the feasibility of the MNO's business plans and monitors the implementation of such business plans regularly. This would include verifying the correct implementation of their systems with respect to compliance with the regulatory provisions set out to protect other services in the band and the adjacent band.

Satellite stakeholders actively participate in 5G standardisation bodies such as 3GPP and ETSI. Within 3GPP, work is ongoing to incorporate non-terrestrial networks into the 5G radio access standards. For example, 3GPP technical report 22.822 (published as part of Release 16 specifications) provides three categories of potential applications (comprising service continuity, ubiquity and scalability) for satellite access in 5G together with 12 primary use cases scenarios.

Q.22 While assessing fulfilment of roll out obligations of a network operator, should the network elements (such BTS, BSC etc.), created by the attached VNO, be included? If yes, kindly suggest the detailed mechanism for the same. Kindly justify your response.
No Comments from SIA-India

Issues related to Spectrum Cap

Q.23 Whether there is a need to review the spectrum cap for sub-1 GHz bands? If yes, what should be the spectrum cap for sub-1 GHz bands. Kindly justify your response.
No Comments from SIA-India

Q.24 Keeping in mind the importance of 3300-3670 MHz and 24.25-28.5 GHz bands for 5G, whether spectrum cap per operator specific to each of these bands should be prescribed? If yes, what should be the cap? Kindly justify your response.
There are ample examples of IMT operators in the world operating with an average of 50-80 MHz spectrum allocation and with 4 operators in the country, an allocation of 300 MHz from 3300-3600 MHz is sufficient to allow 75 MHz for each operator. OFCOM states that "*We*

maintain that bidders will be able to make use of this spectrum in multiples of 5 MHz for 5G, given there are equipment options for 15 MHz."[46]

Conventionally any new service has had to ensure the continued availability of existing services in the same or adjacent bands. The same principle needs to be applied while allocating spectrum for the new series of 5G being introduced to ensure that the 5G operations do not interfere, impact or hamper the existing operations of satellite services in the C band. Multiple international studies, including ITU-R Report S. 2368[47] and deployment experiences worldwide, have proved the interference from 5G Services to adjacent band Satellite services wherever co-existence is attempted. Mitigation measures like band pass filters are NOT a standalone solution and are effective only when applied with a suitable guard band and emission limits on the high levels of 5G transmissions compared to the earth station receive signals.

As per Ofcom findings, MNO will be able to deliver all the primary services anticipated under 5G – including, but not limited to, connected cars, virtual reality cloud broadband, and live 4K streaming – with 40 MHz of spectrum[48].

In addition, it is essential to establish spectrum caps per operator to avoid monopoly and create fair and reasonable competition among available MNOs in India. In other words, most benefits arising from the implementation of 5G services, both for the economy and for consumers, will be obtained through the deployment by each MNO of the first 40 MHz of the spectrum in mid-band. Additional spectrum, if any, can only bring incremental advantages. The 300 MHz spectrum from 3.3-3.6 GHz is more than sufficient to accommodate 40 MHz each for all 4 MNOs in India. On similar lines, 400 MHz of the spectrum should be initially be made available[49] to the MNOs only in the n258 band (24.25-27.5 GHz).

Additional spectrum, if any, should only be brought to auction when there is sufficient justification by the MNOs for the need and compliance to roll-out obligation of the initial spectrum that they may acquire through the current auction. At some stage, DOT or TRAI need to call an audit regarding the fair and sensitive treatment of incumbents versus increasing demands for spectrum from the protagonists of IMT/5G.

[46] See, 5.72, Award of the 700 MHz and 3.6-3.8 GHz spectrum bands available online at https://www.ofcom.org.uk/__data/assets/pdf_file/0020/192413/statement-award-700mhz-3.6-3.8ghz-spectrum.pdf

[47] https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-S.2368-2015-PDF-E.pdf

[48] *See,* Ofcom, *A7.39, Award of the 700 MHz and 3.6-3.8 GHz spectrum bands: Annexes* (13 March 2020), available online at https://www.ofcom.org.uk/data/assets/pdf_file/0017/192410/annexes-award-700mhz-3.6-3.8ghz-spectrum.pdf.

[49] 5G specifications in ITU-R M.2150 require a minimum average spectral efficiency of 7.8 bps/Hz in dense urban areas for a cell capacity of 3 gbps per cell in a 400 MHz channel

Q.25 Whether there should be separate spectrum cap for group of bands comprising of 1800 MHz, 2100 MHz, 2300 MHz and 2500 MHz bands together? If yes, kindly suggest the cap along with detailed justification.
No Comments from SIA-India

Q.26 Whether overall spectrum cap of 35% requires any change to be made? If yes, kindly suggest the changes along with detailed justification.
No Comments from SIA-India

Q.27 For computation of overall spectrum cap of 35%, should the spectrum in 3300-3670 MHz and 24.25-28.5 GHz bands be included? Kindly justify your response.
In addition to an overall spectrum cap across multiple bands, SIA-India favour in-band spectrum caps to avoid a monopoly and create conditions for fair and good competition.

Q.28 Any other suggestion regarding spectrum cap may also be made with detailed justification.
No Comments from SIA-India

Issues related to Surrender of Spectrum

Q.29 What should be the process and associated terms and conditions for permitting surrender of spectrum for future auctions? Kindly justify your response.
No Comments from SIA-India

Q.30 What provisions may be created in the spectrum surrender framework so that any possible misuse by the licensees, could be avoided? Kindly justify your response.
No Comments from SIA-India

Q.31 In case a TSP acquires spectrum through trading, should the period of 10 years to become eligible for the surrender of the spectrum, be counted from the date of original assignment of the spectrum or from the date of acquisition through spectrum trading? Kindly justify your response.
No Comments from SIA-India

Q.32 Whether provision for surrender of spectrum should also be made available for the existing spectrum holding of the TSPs? If yes, what should be the process and associated terms and conditions? Kindly justify your response.
No Comments from SIA-India

Q.33 Whether spectrum surrender fee be charged from TSPs? If yes, what amount be levied as surrender fee? Kindly justify your response.
No Comments from SIA-India

Issues related to Valuation and Reserve price of Spectrum

Q.34 Which factors are relevant in the spectrum valuation exercise and in what manner should these factors be reflected in the valuation of spectrum? Please give your inputs with detailed reasoning.
Any changes on the purpose of spectrum allocations to be sold in the market would require a study of public resource valuation. Mobile spectrum pricing is valued using international price benchmarking across mobile spectrum auctions. It would be expected that TRAI will consider pricing data from proxy 5G/IMT auctions leading to a resource value decision and subsequent long-term spectrum allocation.

Q.35 In what manner, should the extended tenure of spectrum allotment from the existing 20 years to 30 years be accounted for in the spectrum valuation exercise? Please support your response with detailed rationale/ inputs.
No Comments from SIA-India

Q.36 What could be the likely impact of the following auction related telecom reforms announced by the Government in September 2021 on the valuation of various spectrum bands? (a) Rationalization of Bank Guarantees to securitize deferred annual spectrum payment instalments in future auctions (b) No spectrum usage charges (SUC) for spectrum acquired in future auctions (c) Removal of additional SUC of 0.5% for spectrum sharing (d) Provision for surrender of spectrum In what manner, should the above provisions be accounted for in the valuation of spectrum? Please support your response with detailed justification.
No Comments from SIA-India

Q.37 Whether the auction determined prices of March 2021 auction be taken as the value of spectrum in the respective band for the forthcoming auction in the individual LSA? Should the prices be indexed for the time gap (even if less than one year or just short of one year)? If yes, please indicate the basis/ rate at which the indexation should be done, with reasons.
No Comments from SIA-India

Q.38 If the answer to the above question is in negative, whether the valuation for respective spectrum bands be estimated on the basis of the various valuation approaches/methodologies being followed by the Authority in the previous recommendations, including for those bands (in an LSA) for which either no bids were received, or spectrum was not offered for auction?
No Comments from SIA-India

Q.39 Whether the method followed by the Authority in the Recommendations dated 01.08.2018 of considering auction determined prices of the auctions held in the previous two years be continued, or the prices revealed in spectrum auctions conducted earlier than two years may also be taken into account? Kindly justify your response.
No Comments from SIA-India

Q.40 Whether the valuation exercise be done every year in view of the Government's intention to have an annual calendar for auction of spectrum? Please support your response with detailed justification.
No Comments from SIA-India

Q.41 Whether there is a need to bring any change in the valuation approaches/ methodologies followed by the Authority for spectrum valuation exercises in view of the changing dynamics

in the telecom sector largely due to the usage of various spectrum bands by the TSPs in a technologically neutral manner? If yes, please provide suggestions along with a detailed justification about the methodology.
No Comments from SIA-India

Q.42 In your opinion, what could be the possible reasons for the relative lack of interest for the spectrum in the 2500 MHz band? Could this be attributed to technological reason(s) such as development of network/device ecosystem or availability of substitute spectrum bands or any other reasons(s)? Please support your response with detailed justification.
No Comments from SIA-India

Q.43 Whether the March 2021 auction determined prices be used as one possible valuation for the spectrum in 2300 MHz band for the current valuation exercise? If yes, should these prices be indexed for the time gap and at what rate? Please justify your response.
No Comments from SIA-India

Q.44 Whether auction determined prices of October 2016 (i.e. for the auction held earlier than two years) be used as one possible valuation for the spectrum in 2500 MHz band for the current valuation exercise? If yes, should these prices be indexed for the time gap and at what rate? Please justify.
No Comments from SIA-India

Q.45 Whether the value of the spectrum in 2300 MHz/ 2500 MHz bands should be derived by relating it to the value of spectrum in any other band by using technical efficiency factor? If yes, which band and what rate of efficiency factor should be used? If no, then which alternative

method should be used for its valuation? Please justify your response with rationale and supporting studies, if any.
No Comments from SIA-India

Q.46 In your opinion, what could be the possible reasons for the relative lack of interest for the spectrum in the 700 MHz band? Could this be attributed to technological reason(s) such as development of network/device ecosystem or availability of substitute spectrum bands or any other reasons(s)?
No Comments from SIA-India

Q.47 Whether the value of spectrum in 700 MHz band be derived by relating it to the value of other spectrum bands by using a technical efficiency factor? If yes, with which spectrum band, should this band be related and what efficiency factor or formula should be used? Please justify your views with rationale and supporting studies, if any.
No Comments from SIA-India

Q.48 If your response to the above question is in negative, what other valuation approach(es) be adopted for the valuation of 700 MHz spectrum band? Please support your response with detailed methodology.
No Comments from SIA-India

Q.49 Whether the valuation of the 3300-3670 MHz spectrum band should be derived from value of any other spectrum band by using technical efficiency factor? If yes, what rate of efficiency factor should be used? If no, which other method(s) should be used for its valuation? Please justify your response with rationale and supporting documents, if any.

No Comments from SIA-India

Q.50 In case you are of the opinion that frequencies in the range 526-698 MHz should be put to auction in the forthcoming spectrum auction, whether the value of 526-698 MHz be derived by using technical efficiency factor? If yes, with which spectrum band, should this band be related and what efficiency factor or formula should be used? Please justify your suggestions.
No Comments from SIA-India

Q.51 If your response to the above question is in negative, which other valuation approach(es) should be adopted for the valuation of these spectrum bands? Please support your suggestions with detailed methodology, related assumptions and any other relevant factors.
No Comments from SIA-India

Q.52 Whether the value of spectrum in the 24.25 - 28.5 GHz band be derived by relating it to the value of other bands by using technical efficiency factor? If yes, with which spectrum band, should this band be related and what efficiency factor or formula should be used? Please justify your suggestions.
No Comments from SIA-India

Q.53 If your response to the above question is in negative, which other valuation approaches should be adopted for the valuation of these spectrum bands? Please support your suggestions with detailed methodology, related assumptions and other relevant factors.
No Comments from SIA-India

Q.54 Whether international benchmarking by comparing the auction determined price in countries where auctions have been concluded be used for arriving at the value of these new bands? If yes, then what methodology can be followed in this regard? Please explain. Q.55 For international benchmarking, whether normalization techniques be used for arriving at the valuation of these new bands in the Indian context? If yes, please justify your response with rationale /literature, if any.
No Comments from SIA-India

Q.56: Whether a common methodology/ approach should be used for valuation of all sub-1 GHz bands, which are currently planned for IMT? If yes, suggest which methodology/ approach should be used. Please give your views along with supporting reasoning and documents/ literature, if any.
No Comments from SIA-India

Q.57 Whether the extrapolated ADP based on atime-series analysis may be considered as the valuation itself or some normalization may be performed taking into account the financial, economic and other parameters pertaining to a particular auction? If yes, which factors should be considered and what methodology should be followed?
No Comments from SIA-India

Q.58 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 justify your response.
No Comments from SIA-India

Q.59 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 process like taking weighted mean, median etc. should be followed? Please justify your response
No Comments from SIA-India

Q.60 Is there any valuation approach other than those discussed above or any international auction experience/ approach that could be used for arriving at the valuation of spectrum for 700 MHz/ 800 MHz/ 900 MHz/ 1800 MHz/ 2100 MHz/ 2300 MHz/ 2500 MHz/ 3300-3670 MHz/ 24.25 - 28.5 GHz/ 526 - 698 MHz bands? Please support your suggestions with a detailed methodology and related assumptions.
The current mobile spectrum landscape in India indicates oversupply, considering the 700 MHz band remains unsold over two previous auctions. In other words, the current mobile spectrum landscape in India indicates excess supply, which would require TRAI to carefully plan the next auction to match demand. SIA urges TRAI to limit the inclusion of mmWave spectrum in any 5G/IMT auction to the internationally harmonized 24.25-27.5 GHz spectrum. The 3.25 GHz of spectrum available is more than adequate to meet any of the nascent and still uncertain 5G/IMT requirements for mmWave spectrum. Similarly, the 300 MHz of spectrum available between 3300-3600 MHz is more than adequate to cater to the 40 MHz requirement per MNO currently with sufficient headroom for future growth requirements. Moreover, any changes on the purpose of spectrum allocations to be sold in the market would require a study of public resource valuation, which at this point, has not been concluded. Mobile spectrum pricing is valued using international price benchmarking across mobile spectrum auctions. It would be expected that TRAI will consider pricing data from proxy 5G/IMT auctions leading to a resource value decision and subsequent long-term spectrum allocation based on real market data.

Q.61 Should the reserve price be taken as 80% of the valuation of spectrum? 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 and why?
No Comments from SIA-India

Q.62 Whether the realized/ auction determined prices achieved in the March 2021 auction for various spectrum bands can be directly adopted as the reserve price in respective spectrum bands for the forthcoming auction? If yes, should these prices be indexed for the time gap since the auction held in March 2021 and at which rate the indexation should be done?
No Comments from SIA-India

Q.63 Should the method followed by DoT in the previous auction in respect of collecting bid amount from the successful bidder in case spectrum is not available in a part of the LSA be followed in the forthcoming auction? Please justify your response in detail.
No Comments from SIA-India

Q.64 What percentage rate of upfront payment should be fixed in the case of each spectrum band?
No Comments from SIA-India

Q.65 What should be the applicable period of moratorium for deferred payment option?
No Comments from SIA-India

Q.66 How many instalments should be fixed to recover the deferred payment?
No Comments from SIA-India

Q.67 What rate of discount should be used while exercising pre-payment/deferred payment option, in order to ensure that the net present value of payment/ bid amount is protected? (Please support your suggestions for Q64 to Q67 with proper justifications.)
No Comments from SIA-India

Issues related to Spectrum for Private Cellular Networks

Q.68 To facilitate the TSPs to meet the demand for Private Cellular Networks, whether any change(s) in the licensing/policy framework, are required to be made. If yes, what changes are required to be made? Kindly justify your response.
No Comments from SIA-India

Q.69 To meet the demand for spectrum in globally harmonized IMT bands for private captive networks, whether the TSPs should be permitted to give access spectrum on lease to an enterprise (for localized captive use) for a specific duration and geographic location? Kindly justify your response.
No Comments from SIA-India

Q.70 In case spectrum leasing is permitted, i. Whether the enterprise be permitted to take spectrum on lease from more than one TSPs?

ii. What mechanism may be prescribed to keep the Government informed about such spectrum leasing, i.e., prior approval or prior intimation? iii. What timeline should be prescribed (in number of days) before the tentative date of leasing for submitting a joint request by the TSPs along with the enterprise, for approval/intimation from/to the Government? iv. Whether the spectrum leasing guidelines should prescribe duration of lease, charges for leasing, adherence of spectrum cap provisions, roll out obligations, compliance obligations. If yes, what terms and conditions should be prescribed? v. What other associated terms and conditions may be prescribed? vi. Any other suggestion relevant to leasing of spectrum may also be made in detail. (Kindly justify your response)
No Comments from SIA-India

Q.71 Whether some spectrum should be earmarked for localized private captive networks in India? Kindly justify your response
SIA-India opposes earmarking additional spectrum for localized private captive networks, especially the 3670-4200 MHz and 28.5-29.5 GHz suggested in the Consultation. Reserving specific parts of the spectrum for specialised local private applications is not the most efficient method for spectrum use, especially when it comes at the cost of less spectrum for productive satellite services. SIA-INDIA believes the localized private captive networks in India do not need a dedicated spectrum since the frequency bands that have been identified for IMT/5G could be reused for the localized private captive networks in specific geographic location, whether through spectrum leasing or through 'network slicing'. It is noted that one of the principal technical features of 5G/IMT highlighted by mobile operators is the possibility to implement services to private networks through 'Network Slicing.[50] To minimise risks of the spectrum being hoarded, underutilised, or traded by private local users back to 5G/IMT operators (resulting in losses to the India Government and windfall gains to private network licensees), TRAI will benefit from first assessing the level of long-term

[50] *See* GSMA, An Introduction to Network Slicing, at 14 (2017) (describing the use of a "network slice" for an enterprise network so that "[t]he private network is no longer needed"), *at* https://www.gsma.com/futurenetworks/wp-content/uploads/2017/11/GSMA-An-Introduction-to-Network-Slicing.pdf.

demand, roll-out success, and spectrum efficiency of the use of licensed bands by 5G/IMT operators before committing any exclusive long-term use of spectrum to private networks.

Q.72 In case it is decided to earmark some spectrum for localized private captive networks, whether some quantum of spectrum be earmarked (dedicatedly) from the spectrum frequencies earmarked for IMT services and/or spectrum frequencies earmarked for non-IMT services on location-specific basis (which can coexist with cellular-based private captive networks on shared basis)? Kindly justify your response with reasons.
See response to Q.71 above.

Q.73 In case it is decided to earmark some quantum of spectrum for private captive networks, either on an exclusive or shared basis, then a) Spectrum under which band(s) (or frequency range) and quantum of spectrum be earmarked for Private Network in each band? Inputs may be provided considering both dedicated and shared spectrum (between geographically distinct users) scenarios. b) What should be the eligibility conditions for the assignment of such spectrum to private entities? c) What should be the assignment methodology, tenure of assignment and its renewal, roll-out obligations? d) What should be the pricing mechanism for assignment of spectrum in the band(s) suggested for private entities for localized captive use and what factors should be considered for arriving at a valuation of such spectrum? e) What should be the block size and spectrum cap for different spectrum band(s) suggested in response to point (a) above. f) What should be the broad framework for the process of (i) filing application(s) by the enterprise at a single location, enterprise at multiple locations, Group of companies. (ii) payment of spectrum charges, (iii) assignment of frequencies, (iv) monitoring of spectrum utilization, (v) timeline for approvals, (vi) Any other g) Any other suggestion on the related issues may also be made with details. (Kindly justify your response with reasons)
Should the Government of India decide to earmark exclusive spectrum for the deployment of private captive networks, it should not come at the expense of even more spectrum being lost from productive satellite services. Instead, spectrum for private captive networks should be found in other bands already identified for IMT (please refer to Figure 2, below). A study

conducted by LS Telcom[51] indicates that there are around 400 MHz of spectrum identified for IMT in Region 3 that have not yet been licensed and utilized in India. Should there be a need to identify spectrum for private captive networks, the 400 MHz of spectrum that have not yet been licensed and utilized for IMT should be the primary candidate band for the deployment of private captive networks in the country – all without having to encroach upon spectrum being used for satellite communications.

SIA-India notes that private captive networks using 5G technology support bandwidths of 10, 15, 20, 30, 40, 50, 60, 70, 80, 90, and 100 MHz, and carrier aggregation can be used for combining spectrum in different frequency bands. Thus, we believe there is no imminent need for wide contiguous spectrum blocks for 5G spectrum.

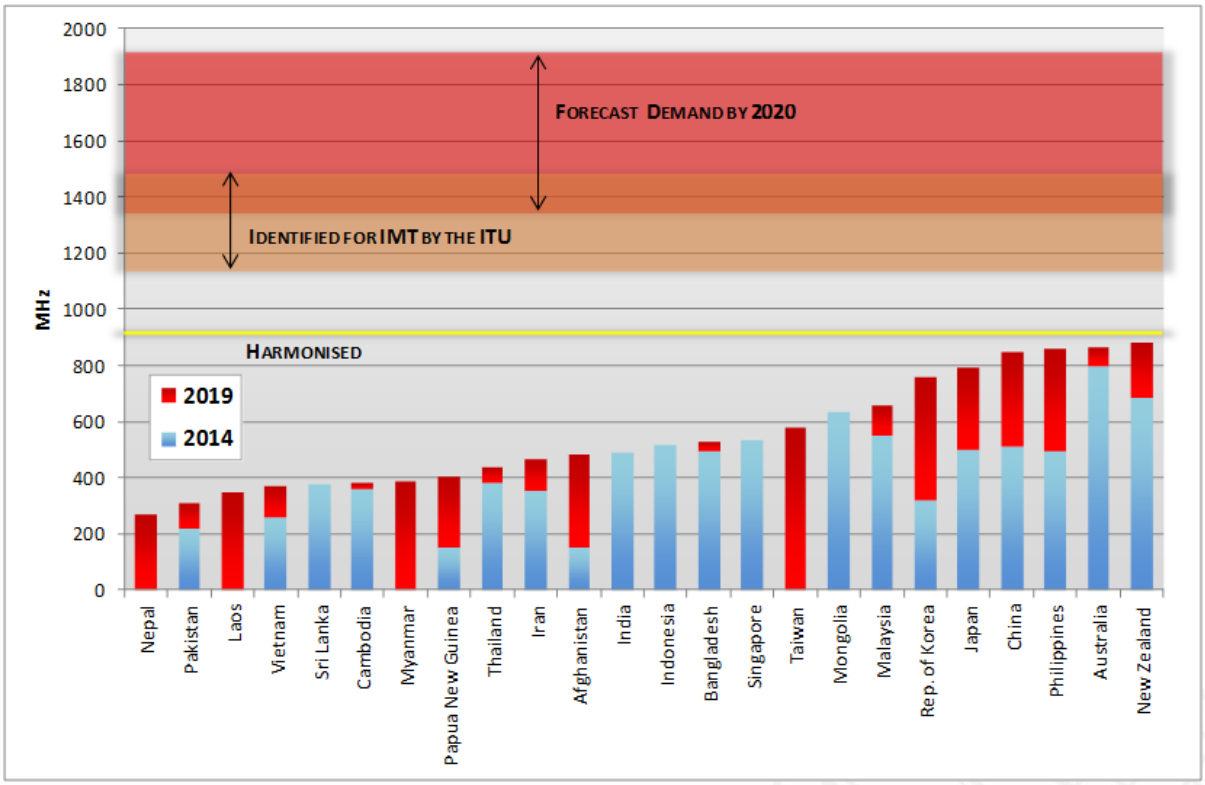

Figure 2. Harmonized IMT Spectrum in Region 3.

As an additional reference, the information in Table 1, below, shows the harmonized spectrum for terrestrial mobile services that is available in Region 3. A total of approximately 915 MHz could be used for the private captive network deployments in India in a harmonized manner. The TRAI could review and identify which harmonized IMT spectrum has not yet been licensed

[51] https://www.lstelcom.com/fileadmin/content/lst/marketing/media/2019_Study_LicensingUseofMobileSpectrum.pdf

and utilized in the country and then could make available that spectrum for private captive network deployments.

3GPP Band		Uplink (MHz)	Downlink (MHz)	Region 3
FDD Bands				
31	450 MHz	452.5 - 457.5	462.5 - 467.5	10
28	700 MHz	703 - 748	758 - 803	90
5	850 MHz	824 - 849	869 - 894	Up to 130
8	900 MHz	880 - 925	935 - 960	
3	1800 MHz	1710 - 1785	1805 - 1880	150
1	2100 MHz	1920 - 1980	2110 - 2170	120
7	2600 MHz	2500 - 2570	2620 - 2690	140
Sub-Total				640
TDD Bands				
75/76	1400 MHz	1427 - 1517		90
33	1900 MHz	1900 - 1920		20
34	2000 MHz	2010 - 2025		15
40	2300 MHz	2300 -2400		100
38	2600 MHz	2570 - 2620		50
Sub-Total				275
TOTAL				915

Table 1. List of Harmonized IMT Spectrum in Region 3.

Q.74 What steps need to be taken to facilitate identification, development and proliferation of India specific 5G use cases for different verticals for the benefit of the economy and citizens of the Country? Kindly provide detailed response with rationale.
No Comments from SIA-India

Additional Comments
SIA-India opposes the suggestion (in sections *1.51-1.53* of the consultation document) of a possible auction mechanism for satellite spectrum in any satellite band for GEO or non-GEO systems. The parallel between "access spectrum" for satellite and terrestrial networks does not stand, as the spectrum sharing mechanism is completely different. Spectrum assignment by auction is not suitable for spectrum that can be shared between multiple satellite operators (such as in C/Ku/Ka-band), whether in GEO or non-GEO orbits. Such efficient sharing of the spectrum is made possible also thanks to the directivity of antennas. Spectrum assignment by auction to satellite services in these bands would lead to unnecessary spectrum segmentation and, therefore, inefficient spectrum use. This is a very different situation from spectrum assignment to terrestrial mobile operators where spectrum cannot be shared amongst the mobile operators and has to be managed by a single operator. Spectrum assignment for satellite services should be based on an administrative process, which is standard procedure elsewhere. A few countries have attempted to auction the spectrum along with the NATIONAL orbital resources and either have abandoned or failed. As a result, virtually all countries in the world have abandoned the practice of auctioning satellite spectrum and replaced it with an administrative process.[52] In summary, an auction for satellite spectrum would artificially limit the number of satellite operators sharing the spectrum and exclude them from the market, while satellite operators can (differently from terrestrial mobile operators) coexist in the same frequency range.

[52] Very few countries have auctioned satellite spectrum, with only the U.S., Brazil and Mexico having ever attempted to do so in the past. However, Brazil in 2020 amended its regulatory framework to replace satellite auctions with administrative licensing. Moreover, since 2004, the U.S. has replaced its auction rules with a streamlined administrative process for all satellite spectrum. Mexico is the only country with a satellite auction process still in its regulations, but the last time it attempted to conduct such an auction was in 2014 (which failed).