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Subject: Consultation Paper on Auction of Spectrum in Frequency Bands Identified for IMT/5G Consultation Paper No. 8/2021

Dear Sir,

SES World Skies Singapore Pte Ltd, a wholly owned indirect subsidiary of SES S.A., (together, "SES") is pleased to submit its comments on the Telecom Regulatory Authority of India ("TRAI") Consultation Paper on *Auction of Spectrum in Frequency Bands Identified for IMT/5G*, released on 30 November 2021 ("Consultation").[1]

SES is a global satellite operator that operates a fleet of about 50 satellites in geostationary ("GEO") orbit, as well as the innovative O3b Ka-band constellation of 20 High Throughput Satellites ("HTS") in medium Earth orbit ("MEO"). For over 20 years, through arrangements with the Indian Space Research Organization ("ISRO") and NewSpace India Limited ("NSIL") (formerly Antrix Corporation), SES has helped meet the satellite capacity needs of India. In doing so, it has contributed to the vibrant growth of the Indian broadcast industry and the expansion of satellite data networks across India. Today, two major Indian direct-to-home ("DTH") satellite television platforms and several telecommunications and data service providers use SES satellite capacity to serve over 30 million TV households and to connect over a hundred thousand sites around the country.

With its multi-orbit satellite fleet, SES stands ready to help meet India's rapidly growing need for satellite capacity and services. SES's Broadcasting Satellite Service ("BSS") satellites are ready to support the expansion of India's DTH platforms, while freeing up Fixed Satellite Service ("FSS") capacity for broadband data services. In addition, SES's HTS systems in GEO and MEO can be put to

[1] *See* TRAI, Consultation Paper No.8 of 2021, *Auction of Spectrum in Frequency Bands Identified for IMT/5G* (30 Nov. 2021) ("Consultation"), *at* https://www.trai.gov.in/consultation-paper-auction-spectrum-frequency-bands-identified-imt5g.

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use immediately to extend 4G and 5G coverage,[2] expand broadband availability,[3] and to help meet the Connect India 2022 goals in the *National Digital Communications Policy, 2018*.

SES is therefore keenly interested in the spectrum that India is proposing to auction for 5G/IMT services, especially the 27.5-28.5 GHz and 3600-3670 MHz bands that are being used to provide satellite services in India. For the reasons given below, both of these band segments should be excluded from India's 5G auctions as unnecessarily jeopardizing productive satellite services in order to satisfy uncertain 5G spectrum demand. In SES's view, there is more than enough other, unencumbered spectrum in the mid-band (2300 MHz, 2500 MHz and 3300-3600 MHz bands) and millimetre wave band (24.25-27.5 GHz) to satisfy 5G requirements without needing to take away spectrum from satellite services.

In this regard, SES provides its response to Questions 8, 12, 13, 16, 20, 21, 71 and 72 of the Consultation below. SES also offers initial observations on spectrum for space-based communications, which is mentioned in the Department of Telecommunications ("DoT") reference letter bus has been deferred to a separate consultation process.

Issues related to Quantum of Spectrum and Band Plan

> ***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.***

SES Response to Q.8: SES opposes making the entire available spectrum in the 24.25-28.5 GHz and 3400-3670 MHz bands for 5G auctions. Specifically, in SES's view, too much spectrum is being made available for 5G in these bands at the expense of other valuable services that are being provided in these bands.

27.5-28.5 GHz should be excluded. As TRAI is aware the 27.5-29.5 GHz ("28 GHz") band is used extensively around the world for satellite services. Hundreds of GEO satellites and thousands of non-geostationary ("non-GEO") satellites have been and are continuing to be launched using this frequency band to provide a wide range of broadband satellite services. For example, this band is used to support the SES-12 GEO HTS system with coverage of the Asia-Pacific region, including India. Similarly, this entire band is used on SES's innovative O3b Ka-band constellation to deliver fibre-like, broadband connectivity everywhere by, *e.g.*, expanding the coverage of 4G networks[4] (and soon 5G

[2] *See*, *e.g.*, SES, *iSAT Africa and SES Networks to Provide Reliable 4G Services in East Africa via O3b mPOWER* (15 Jul. 2021), https://www.ses.com/press-release/isat-africa-and-ses-networks-provide-reliable-4g-services-east-africa-o3b-mpower; SES, *SES Leads Satellite-enabled 5G Tests* (13 Jul. 2021), *at* https://www.ses.com/blog/ses-leads-satellite-enabled-5g-tests.
[3] *See*, *e.g.*, SES, *INRED and SES Networks Expand Wi-Fi Access Across Colombia, Connect Nearly One Million People in 424 Municipalities* (4 Nov. 2020), *at* https://www.ses.com/press-release/inred-and-ses-networks-expand-wi-fi-access-across-colombia-connect-nearly-one-million.
[4] *See*, *e.g.*, SES, *iSAT Africa and SES Networks to Provide Reliable 4G Services in East Africa via O3b mPOWER* (15 Jul. 2021), *at* https://www.ses.com/press-release/isat-africa-and-ses-networks-provide-reliable-4g-services-east-africa-o3b-mpower; SES, How the O3b Constellation Helped Catapult the DRC Into the Digital Era (22 Sep. 2021), *at* https://www.ses.com/how-o3b-constellation-helped-catapult-drc-digital-era.

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networks);[5] rapidly restoring network connectivity in response to disaster or fibre cuts;[6] and providing direct "one-hop" connectivity to cloud computing resources.[7] In 2022, SES will be launching its next-generation O3b mPOWER constellation using the 28 GHz band to provide even more throughput with unparalleled flexibility.[8] In addition to SES's own investments in the 28 GHz, other satellite operators around the world are also launching GEO satellites and large constellations of non-GEO satellites using the 28 GHz band to deliver broadband everywhere.[9]

With the imminent release of a new Indian Spacecom Policy to boost private participation in India's space sector, India will soon be able to enjoy the full benefits of broadband satellite services in the 28 GHz band. The HTS systems launched by ISRO and private parties will be able to help immeasurably in meeting the universal broadband goals in the *National Digital Communications Policy, 2018*. Accordingly, satellite use of the 28 GHz should not be precluded by reallocating any portion of the band for public or private 5G networks. As explained below, there is more than enough spectrum in the 24.25-27.5 GHz ("26 GHz") band to support India's 5G millimetre wave ("mmWave") requirements.

At WRC-19, the ITU globally identified the 26 GHz band for 5G/IMT-2020, while the 27.5-28 GHz was *not* identified for such service in any region.[10] The 3250 MHz available in the 26 GHz band is more than enough to meet India's 5G mmWave spectrum requirements. With an 800 MHz spectrum cap, all four of India's mobile network operators ("MNOs") would be able to obtain the maximum amount of spectrum without having to engage in a competitive auction, with 50 MHz leftover. Even with a cap of 1000 MHz, the 26 GHz band could provide India's three private MNOs (with a combined 90% of the subscribers in the market)[11] with up to 1000 MHz each, with 250 MHz

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[5] *See*, *e.g.*, SES, *SES Leads Satellite-enabled 5G Tests* (13 Jul. 2021), https://www.ses.com/blog/ses-leads-satellite-enabled-5g-tests; SES, *Delivering 5G everywhere with satellite*, https://www.ses.com/insights/delivering-5g-everywhere-satellite.

[6] *See*, *e.g.*, SES, *SES's and Gilat Telecom's Resilient Network Restores Connectivity in Africa* (10 Feb. 2020), https://www.ses.com/press-release/sess-and-gilat-telecoms-resilient-network-restores-connectivity-africa; SES, *Restoring Communications to Disaster-stricken Mozambique via Satellite* (27 May 2019), *at* https://www.ses.com/blog/restoring-communications-disaster-stricken-mozambique-satellite.

[7] *See*, *e.g.*, SES, *The Future of Satellite and the Cloud*, https://www.ses.com/insights/future-satellite-and-cloud; Microsoft, *Satellite connectivity expands reach of Azure ExpressRoute across the globe* (9 Sep. 2019), https://azure.microsoft.com/en-us/blog/satellite-connectivity-expands-reach-of-azure-expressroute-across-the-globe/; SES, *SES Expands Cloud Leadership as Amazon Web Services Direct Connect Partner* (17 Jun. 2021), https://www.ses.com/press-release/ses-expands-cloud-leadership-amazon-web-services-direct-connect-partner; SES, *SES Networks Enables Direct Connectivity to IBM Cloud via Global Satellite Network* (4 Oct. 2018), https://www.ses.com/press-release/ses-networks-enables-direct-connectivity-ibm-cloud-global-satellite-network.

[8] *See* SES, *O3b mPOWER*, *at* https://o3bmpower.ses.com/.

[9] *See*, *e.g.*, ViaSat-3, *at* https://www.viasat.com/space-innovation/satellite-fleet/viasat-3/; OneWeb, *at* https://oneweb.net/; Amazon Kuiper, *at* https://www.aboutamazon.com/news/innovation-at-amazon/project-kuiper-announces-plans-and-launch-provider-for-prototype-satellites; Telesat Lightspeed, *at* https://www.telesat.com/leo-satellites/; Inmarsat Orchestra, *at* https://www.inmarsat.com/en/about/technology/orchestra.html.

[10] *See* WRC-19 Resolution 242.

[11] *See* TRAI, Press Release No. 50/2021, *Telecom Subscription Data*, at 6 (30 Sep. 2021), *available at* https://www.trai.gov.in/sites/default/files/PR_No.50of2021_0.pdf.

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leftover. Moreover, there can be no question that an equipment ecosystem is developing in this band, given its global identification by WRC-19 and Europe's choice of the 26 GHz as a pioneer 5G band.

There is no evidence to suggest that any more 5G mmWave spectrum is required to justify taking the 27.5-28.5 GHz from productive satellite uses. To the contrary, most other countries have made available much less total spectrum in the mmWave for 5G than the 4250 MHz proposed by DoT. At the same time, 5G business cases in the mmWave spectrum have been slow to develop and remain highly uncertain. In South Korea, which championed the use of the 26/28 GHz band for 5G, only 2400 MHz of mmWave spectrum was licensed at auction to three MNOs in 2018 (*i.e.*, 800 MHz per licensee). However, since that auction, the South Korean MNOs have installed only 161 base stations in this band as of the end of August 2021, as against a build-out requirement of over 45,000 by the end of 2021.[12] Lack of demand and lack of 5G applications that would take advantage of this band were cited as the reasons for the lack of investment.[13] Similarly, in China, the MNOs and vendors are abandoning many 5G use cases, including high-profile use cases such as remote surgery and 5G VR as "too niche or too expensive."[14] One executive admitted that these 5G "showroom" applications "were ultimately just a promotion for 5G" with little commercial potential.[15] The European Commission's "5G Observatory" has also observed a "lack of demand for the 26 GHz spectrum" in Europe,[16] noting that "although initially, the mmWave bands proved popular, with the US and Japan leading the world in making them available, their popularity had now waned."[17]

In contrast, the global satellite industry has demonstrated massive, continuing and sustained investments in the 28 GHz band to meet continuing, sustained and growing demand for satellite broadband services all around the world (as described above). Given the ample supply of 5G mmWave spectrum in the 26 GHz band, and the lack of 5G demand or applications in the band, *5G mmWave auctions in India should be limited to the 26 GHz band, with the 28 GHz band preserved for satellite services*. By doing so, India will be able to enjoy the full benefits of mmWave 5G in the 26 GHz band (if and when demand develops), while also enjoying the full benefits of 28 GHz satellite

[12] *See Telcos lag in mmWave 5G equipment installation: lawmaker*, The Korea Herald, 10 Sep. 2021, *at* http://www.koreaherald.com/view.php?ud=20210910000417.
[13] *Id*. ("Carriers, however, have been reluctant to invest in mmWave 5G, considering disappointing user migration to 5G networks amid a lack of services that can take advantage of the speeds that even current 5G networks offer.").
[14] *See* Robert Clark, *China culls unprofitable 5G use cases as it narrows focus* (19 Oct. 2021), *at* https://www.lightreading.com/asia/china-culls-unprofitable-5g-use-cases-as-it-narrows-focus/d/d-id/772855.
[15] *Id*.
[16] *See* European Commission, 5G Observatory, *Quarterly Report #13* (Oct. 2021), at 96, *available at* https://5gobservatory.eu/wp-content/uploads/2021/11/5G-Obs-PhaseIII_Quarterly-report-13_final-version-11112021.pdf.
[17] *See* European Commission, 5G Observatory, *26 GHz holds back achievement of EU 5G goals: The lack of demand for this band was identified in the latest 5G Observatory quarterly report* (8 Dec. 2021), *at* https://5gobservatory.eu/26-ghz-holds-back-achievement-of-eu-5g-goals/. *See also* 5G Observatory, *Quarterly Report #13*, at 76 ("Initially, 5G frequencies in the high bands proved to be very popular. The US led the world in making the high bands available for 5G and Japan and South Korea quickly followed. However, it now appears that the band's popularity may have peaked as indicated by the lack of 26 GHz assignments in many European countries."), *available at* https://5gobservatory.eu/wp-content/uploads/2021/11/5G-Obs-PhaseIII_Quarterly-report-13_final-version-11112021.pdf.

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services (for which there is already proven demand). There is absolutely no need (and indeed, it would be irrational) to sacrifice the latter for the former.[18]

If not excluded, the 27.5-28.5 GHz band should be limited to private 5G networks operating on a non-protected, non-interference basis. If, notwithstanding the sound policy arguments to the contrary, India remains intent on using the 27.5-28.5 GHz portion of the 28 GHz band for 5G, TRAI should recommend preserving greater access to the band for satellite services. One option would be to allow only private 5G networks in the 27.5-28.5 GHz band on a non-protected, non-interference basis relative to satellite services. The demand for mmWave spectrum for private 5G networks is as unclear as mmWave demand for public 5G networks (see also Response to Q.71 below). But by allowing private 5G applications on a non-protected, non-interference basis, India would at least ensure that such applications do not constrain the deployment of valuable broadband satellite services in the band. This was the approach taken by Japan in December 2020 for the establishment of local 5G networks in the 28.45-29.1 GHz band shared with satellite services.[19]

If not excluded, India should prioritize the assignment of lower mmWave spectrum before impinging on satellite services in 27.5-28.5 GHz and allow greater satellite access to the band. If India insists on auctioning the 27.5-28.5 GHz band for 5G, SES would urge India to prioritize assigning the lower parts of the 24.25-28.5 GHz band first. This could be achieved by using a two-stage auction whereby bidders first bid on the amount of spectrum they desire. Then, in a second stage, once total spectrum demand is known, specific frequencies can then be bid upon and assigned to ensure contiguity and to avoid unnecessarily impinging on satellite-occupied bands above 27.5 GHz. This will ensure that satellite bands are not disturbed if there is unencumbered mmWave spectrum that could be used to satisfy 5G demand.

In addition, in the event of an auction, SES would urge India to expand the locations at which satellite earth stations can be established in the band. The DoT identified five locations around which the 27.5-28.5 GHz band would not be available for 5G, which SES assumes are the satellite gateway locations for ISRO's Ka-band HTS systems. Given the massive, on-going global investments in 28 GHz satellite systems, India will be artificially limiting its own ability to access the satellite capacity that will be available in this band to deliver broadband-for-all by limiting satellite access to the 27.5-28.5 GHz to these locations. At a minimum, TRAI should recommend an increase in the area around these five locations (beyond the proposed 2.7 km protection zones – see Response to Q.16 below) to provide better protection for 5G services and to enable more satellite gateway earth stations to be co-located at or near these sites.

[18] India should avoid the outcome in Hong Kong, where the regulator made the 24.25-28.35 GHz (4100 MHz) available for free selection by the MNOs without an auction. Even though the spectrum cap was 800 MHz, the three MNOs selected just 400 MHz each, including a portion within the 28 GHz used for satellite. As a result, satellite services were unnecessarily disrupted by a 5G assignment when other unoccupied mmWave spectrum was available for 5G.

[19] *See* Ministry of Internal Affairs and Communication, *Publication of the results of the solicitation of opinions and the revised version of the guidelines regarding the draft notification regarding the area where the radio station is installed based on the radio station license procedure rules* (11 Dec. 2020), at Attachment 3, p.12, *available at* https://www.soumu.go.jp/menu_news/s-news/01kiban14_02000485.html.

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Moreover, TRAI should recommend that additional satellite earth stations be allowed through a frequency coordination agreement between the gateway licensee and the 5G licensee in the area. The short range in terrestrial propagation path of 5G mmWave spectrum suggests that it is unlikely to be deployed everywhere, but will be used as a "capacity band" to provide more broadband in densely populated areas that already have broadband access. This provides an opportunity for transactions between 5G licensees and earth station licensees to allow for greater satellite use of the band. This is the approach being taken by Taiwan in response to growing satellite demand.[20]

3600-3670 MHz should be excluded from auction. As the TRAI is aware, the 3600-3700 MHz band is used for satellite services in India on both ISRO and non-ISRO satellites. Part of the extended C-band frequencies, this band has been instrumental in the growth of the vibrant broadcast sector in India by enabling the cost-effective and reliable distribution of video programming domestically and internationally. The C-band is the primary means by which, for example, Indian cricket matches and Bollywood products are distributed abroad and international news, events and entertainment are brought into India.

In SES's view, the case for expanding the available 5G spectrum from 3300-3600 MHz to 3300-3670 MHz is unclear at best. The ITU has not identified the 3600-3670 MHz for IMT. In the United Kingdom, Ofcom found that mobile operators did not require 80 to 100 MHz of mid-band spectrum each to deliver mobile 5G. Specifically, after detailed studies and multiple rounds of public consultation, Ofcom found that it was "technically feasible for MNOs to support a wide range of 5G services with channel bandwidths in their current holdings smaller than 80 MHz, including 40 MHz."[21] The 300 MHz of spectrum in 3300-3600 MHz is sufficient to provide 100 MHz each to the three private MNOs in India (which serve 90% of India's mobile subscribers), or 75 MHz each to the three private MNOs plus BSNL. There is also additional unassigned 5G mid-band spectrum available in the 2300 MHz and 2500 MHz bands that can be used to deliver mid-band 5G services.

Once again, in light of the ample supply of mid-band spectrum that are not assigned to MNOs in India, and uncertain demand for the most demanding 5G use cases (*i.e.*, those requiring the most bandwidth),[22] TRAI should not be too quick to make the 3600-3670 MHz available for 5G at the expense of existing satellite services in the band. Otherwise, India will risk disrupting valuable, existing satellite services in that band in order to serve demand that can already be met with unassigned spectrum in the 2300 MHz, 2500 MHz and 3300-3600 MHz bands.

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[20] *See* Ministry of Communications, Amendments to the draft radio frequency supply plan (5 Oct. 2021) at p. 12, 16, 17 and 19; and Draft Frequency Amendment Plan (16 Aug. 2021), at p. 3 (allowing satellite users to negotiate agreements with mobile broadband operators for access to 27900-29500 MHz, subject to approval of the regulator). On file. *See* https://gazette.nat.gov.tw/EG_FileManager/eguploadpub/eg027154/ch06/type3/gov50/num25/Eg.htm.

[21] Ofcom, *Award of the 700 MHz and 3.6-3.8 GHz spectrum bands – Conclusions to further consultation on modelling and technical matters*, at ¶ 1.4 (3 Aug. 2020), *at* https://www.ofcom.org.uk/__data/assets/pdf_file/0034/199717/statement-sut-modelling-700mhz-3.6-3.8ghz-spectrum.pdf.

[22] *See* Robert Clark, *China culls unprofitable 5G use cases as it narrows focus* (19 Oct. 2021), *at* https://www.lightreading.com/asia/china-culls-unprofitable-5g-use-cases-as-it-narrows-focus/d/d-id/772855.

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If not excluded from auction, prioritize assignment of lower mid-band spectrum before impinging on satellite services in 3600-3670 MHz. If, despite the sound policy arguments to the contrary, India insists on auctioning the 3600-3670 MHz GHz band for 5G, SES would urge India to use a two-stage auction process to gauge total spectrum demand first, and then prioritizing the assignment of the lower parts of the band to meet this demand in order to avoid unnecessarily impacting the satellite-occupied band in 3600-3670 MHz. This will ensure that in-use satellite bands are not disturbed if it turns out that the 2300 MHz, 2600 MHz and 3300-3600 MHz bands are sufficient to meet total mid-band spectrum demand.

Issues related to Block Size

Q.12 What should be optimal block size and minimum quantity for bidding in 3300-3670 MHz band? Kindly justify your response.

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

SES Response to Q.12 and Q.13: If, notwithstanding the sound policy arguments to the contrary, India were to include the 27.5-28.5 GHz and 3600-3670 MHz bands in the 5G auctions, SES would support the smallest block sizes supportable by the applicable 3GPP band classes (e.g. 10 MHz in C-band and 50 MHz in Ka-band) and the same block size would then be the minimum quantity for bidding in each band so that carriers can bid as precisely as possible for the amount of spectrum that they desire, and are not forced to bid for more spectrum than they wish to use.

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.

SES Response to Q.16: If, notwithstanding the sound policy arguments to the contrary, India were to include the 27.5-28.5 GHz and 3600-3670 MHz bands in 5G auctions, interference mitigation measures will be needed to protect satellite services. Of course, the complications of establishing and enforcing such interference mitigation measures can be largely avoided by not reallocating heavily used satellite spectrum that to 5G (see Response to Q.8 above).

Protection of FSS Uplinks in 24.25-28.5 GHz. Portions of the 24.25-28.5 GHz band are allocated internationally on a co-primary basis with satellite services. In particular, the 27.5-28.5 GHz uplink band is heavily used by both Indian and non-Indian GEO and non-GEO satellites, and measures are required to ensure that 5G deployments do not cause interference into satellite uplinks.

In this regard, India may want to consider the co-existence measures adopted by the Australian Communications and Media Authority ("ACMA"). The ACMA made the 25.1-27.5 GHz available for 5G mobile services (finding that 2400 MHz was enough for such services), and the 27.5-

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28.1 GHz band available for Fixed Wireless Access ("FWA") services on co-primary basis with FSS in selected urban areas. Whereas 28.1-29.5 GHz band is available for FWA services on secondary basis elsewhere. Importantly, the ACMA established stricter interference mitigation measures for 5G mobile in the 27.0-27.5 GHz band and for FWA in the 27.5-28.1 GHz band shared extensively with satellite services. Such measures included lower maximum Total Radiated Power levels for outdoor IMT base stations and fixed IMT user terminals as compared to those in 25.1-27 GHz band, as well as a requirement for outdoor transmissions to point below the horizon, and an EIRP density elevation mask to limit emissions for specified elevation angles in the skyward direction.[23]

Protection Zone Around FSS Uplinks in 27.5-28.5 GHz. The DoT has proposed a "protection zone" of 2.7 km[24] around five locations where (presumably) ISRO's satellite gateway earth stations are operating. It is unclear how this separation distance was derived, but India should consider expanding these zones to better protect 5G services and to enable more satellite services to be co-located at these sites. In SES's experience, a larger separation distance may be needed to protect 5G services from FSS uplinks to GEO satellites, depending on technical parameters and the surrounding terrain. A larger separation distance can also be expected for co-located non-GEO satellite gateway earth stations since such earth stations will typically operate down to lower elevation angles. The complications with defining such protection zones can be avoided by limiting 5G/IMT to the 26 GHz band while preserving the 28 GHz for satellite services.

Protection of FSS Downlinks in the C-band. A portion of the 3300-3670 MHz band is allocated internationally on a co-primary basis with satellite services. The entire 3400-3670 MHz range is allocated as an FSS downlink, of which the most heavily occupied part lies in 3600-3670 MHz, known as the "extended C-band" downlink band. It appears that DoT has taken into account the possibility of co-frequency interference by establishing a "keep off distance of 40 to 130 km"[25] around six locations at which (presumably) ISRO's earth stations using this band are located. Such separation distances may or may not be enough depending on the operational parameters of the earth stations and 5G base stations user terminals.

Even more important is adjacent band protection measures for the thousands of C-band earth stations operating above 3670 MHz. As the TRAI is aware, the "standard C-band" downlink frequencies in 3700-4200 MHz are even more heavily occupied than the extended C-band. Earth stations operating in the adjacent band are receiving very weak signals from space and are therefore susceptible to the out-of-band emissions of 5G transmitters in the earth station receive band. In addition, such earth stations are vulnerable to "receiver blocking" whereby the low-noise block amplifier of the earth station is overloaded by 5G transmission levels in the 5G band.

Countries have addressed these adjacent band issues in a number of ways, including prescribing an out-of-band emission limit (such as a PFD limit to protect earth stations operating in the adjacent band) and a guard band of at least 25 MHz. In addition, earth station operators would be expected to install filters to alleviate receiver blocking. Such matters require careful attention when 5G technical parameters are established in the 3300-3600 MHz band.

[23] ACMA's 26 GHz and 28 GHz bands – consultations and decisions, at https://www.acma.gov.au/26-ghz-band
[24] Consultation at ¶ 1.44.
[25] Consultation at ¶ 1.40.

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Issues related to Roll-out Obligations

Q.20 What should be associated roll-out obligations for the allocation of spectrum in 3300-3670 MHz frequency band? Kindly justify your response.

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.

SES Response to Q.20 and Q.21: If, notwithstanding the sound policy arguments to the contrary, India were to make the 3600-3670 MHz and 27.5-28.5 GHz available for 5G instead of satellite services, it will be very important to have meaningful 5G roll-out conditions in these two band segments. India will be incurring significant opportunity costs by taking these band segments away from satellite and making them available for 5G. The 3600-3670 MHz is currently being used in India for satellite services, while the 27.5-28.5 GHz is a substantial portion of the Ka-band frequencies used by Indian and non-Indian HTS systems to deliver broadband around the world. There must be some assurance that spectrum that is reallocated from productive uses to 5G will actually be used for 5G. Even then, there is a real risk – as seen in South Korea[26] – that roll-out obligations in the mmWave spectrum will not be met due to lack of demand or applications. This will result in such spectrum lying fallow and not being used meaningfully for either 5G or satellite services for an extended period of time. Of course, this risk can be mitigated by not reallocating in-use satellite spectrum to 5G when there is plenty of other unencumbered spectrum available (see Response to Q.8 above).

Issues related to Spectrum for Private Cellular Networks

Q.71 Whether some spectrum should be earmarked for localized private captive networks in India? Kindly justify your response

SES Response to Q.71: SES opposes the suggestion in the Consultation that the 3670-4200 MHz and 28.5-29.5 GHz bands currently being used for satellite communications should be earmarked for local private cellular networks.

It is less than clear that any spectrum should be earmarked specifically for private networks in India. Very few industrial enterprises would have a need for a local private cellular network, and even fewer would have the capabilities or resources to deploy their own network. There is every reason to believe that demand for such applications can be met by MNOs using licensed spectrum more efficiently and cost-effectively than setting aside spectrum for such private networks. Spectrum leasing is only one method by which this can be achieved. In addition, MNOs have access to software-defined networking ("SDN") or "network slicing" capabilities, commonly found in 5G networks, that could be used by an MNO to deploy a "virtual" private cellular network for an industrial enterprise, taking advantage of the MNO's own infrastructure, spectrum, and expertise in building and managing networks. Thus, it would be even more inefficient to take additional spectrum away from productive satellite uses in the C-band and the 28 GHz band in order to provide spectrum

[26] *See Telcos lag in mmWave 5G equipment installation: lawmaker*, The Korea Herald, 10 Sep. 2021, *at* http://www.koreaherald.com/view.php?ud=20210910000417.

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for private cellular networks when the demand can already be met using an MNO's own spectrum and infrastructure.

As explained above (see response to Q.8), there is no justification to take any part of the 28 GHz band (27.5-29.5 GHz) for 5G/IMT, whether for public or private networks. The demand for 5G mmWave spectrum has been slow to develop, remains highly uncertain, and can be fully met with spectrum in the 26 GHz band without disturbing satellite services in the 28 GHz band. In contrast, the 28 GHz band is used extensively for broadband satellite services around the world, and India is poised to be able to take full advantage of the massive investments already made in this band with the issuance of an appropriate new Spacecom Policy.

> ***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.***

SES Response to Q.72: In the 3670-4200 MHz band, which is currently used for satellite services, it will be very difficult to allow private cellular networks without causing interference into the thousands of C-band earth station receivers around the country used for broadcasting and other services. Even with indoor-only restrictions on private 5G networks, there is significant risk of signal leakage from private industrial applications that can interfere with a C-band earth station's ability to receive very weak signals from space. Once deployed, a private network operating in the 3670-4200 MHz band could interfere with or preclude deployment of a C-band earth station within a substantial distance (*e.g.*, 40 to 130 km protection zones suggested by the DoT to protect ISRO's C-band receivers in 3600-3670 MHz).

In the 28 GHz band, as explained above (see Response to Q.8 and Q.71), there is no justification to take any part of that band for private cellular networks. There should be more than enough spectrum in the 26 GHz band to meet public and private 5G requirements. However, if India insists on earmarking some part of the 28 GHz for 5G, it should be limited to the 27.5-28.5 GHz and it should only allow private 5G networks in the band to be deployed on a non-protected, non-interference basis. This was the approach taken by Japan in December 2020 for the establishment of local 5G networks in the 28.45-29.1 GHz band shared with satellite services.[27] Such a condition will ensure that private network applications do not constrain the deployment of valuable broadband satellite services in the band. It will mean, however, that private 5G networks will have to accept any interference from existing and future 28 GHz earth stations.

[27] *See* Ministry of Internal Affairs and Communication, *Publication of the results of the solicitation of opinions and the revised version of the guidelines regarding the draft notification regarding the area where the radio station is installed based on the radio station license procedure rules* (11 Dec. 2020) (in Japanese), at Attachment 3, p.12, *available at* https://www.soumu.go.jp/menu_news/s-news/01kiban14_02000485.html.

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Spectrum for Space-based Communications

In the Consultation, TRAI defers to a separate consultation the request from DoT to provide recommendations on whether and how spectrum for space-based communications could be auctioned.[28] SES offers its initial observations on why spectrum for space-based communications should not be auctioned.

The Indian Constitution does not require Indian natural resources to be assigned by auction; other fair and transparent methods of assignment or alienation are allowed.[29] In any event, the orbital and spectrum resources embodied in an ITU satellite network filing of another country cannot properly be considered Indian natural resources that can be auctioned by India.

Auctions are simply not a good method for assigning the satellite spectrum and orbital resources. Unlike terrestrial mobile spectrum licenses (which are exclusive and well-defined), satellite spectrum "rights" are governed by an international system of priorities and coordination at the ITU, and the same spectrum can be used by multiple GEO and non-GEO satellite operators from different countries. These features of satellite spectrum make them unsuitable for a national level auction process. The analogy between mobile "access spectrum" and satellite "access spectrum" is therefore invalid and does not justify the auction of satellite spectrum.

Internationally, the practice of auctioning satellite spectrum has been almost entirely abandoned.[30] Countries that once auctioned satellite spectrum, such as the United States[31] and Brazil,[32] have discontinued the practice for sound policy and practical reasons and have instead adopted administrative approaches to licensing satellite spectrum.[33]

In SES's view, the introduction of auctions for spectrum for space-based communications would, at best, raise the costs of providing satellite connectivity in India or, at worst, preclude the provision of such services altogether by depriving the satellite operator(s) of access to the spectrum required to provide the service in India.

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[28] Consultation at ¶¶ 1.51-1.53.
[29] *In re: Special Reference No. 1 of 2012*, at ¶¶ 78-80 (Supreme Court of India, 27 September 2012).
[30] To SES's knowledge, the only country in the world that may still auction satellite orbital slots is Mexico, but Mexico has not conducted any such auction since 2014. Moreover, Mexico uses an administrative process to authorize foreign satellite operators to serve Mexico without an auction.
[31] The last time the U.S. FCC auctioned spectrum was in 2005 (*see* https://www.fcc.gov/auction/52/releases). The FCC has replaced all satellite auction rules with an administrative process for licensing GEO and non-GEO satellites in all bands. *See* 47 C.F.R. Part 25.
[32] *See* Brazil, Law No. 9,472 of July 16, 1997, § 172, *as amended by* Law No. 13,879 of October 3, 2019 (in Portuguese) (replacing satellite auctions with administrative process), *at* https://informacoes.anatel.gov.br/legislacao/leis/2-lei-9472#livroIIItituloVcapIII.
[33] *See*, *e.g.*,ANATEL, Analysis No. 241/2020/MM, *Public Consultation regarding the General Satellite Regulation - Item No. 37 of the Regulatory Agenda for the 2019-2020 biennium* (17 Dec. 2020) (in Portuguese), at ¶¶ 4.70-4.81, *available at* https://sei.anatel.gov.br/sei/modulos/pesquisa/md_pesq_documento_consulta_externa.php?eEP-wqk1skrd8hSlk5Z3rN4EVg9uLJqrLYJw_9INcO6WoeHMBfhEpsGdV8m3dD4wT0pjDpc-gcaIS61R3UjJd_ZLKrutrh6DuXQLXjN9HUfMZ9RrUBhEkSkb_KXbDORK.

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Please contact me or my colleague, Tare Brisibe (tare.brisibe@ses.com), if you have any questions.

Yours Sincerely,

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