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Mahanagar Doorsanchar Bhawan  
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**Subject: Tata Communications Ltd. response to TRAI Consultation Paper on 'Auction of Spectrum in frequency bands identified for IMT/5G'**

Dear Sir,

This is with reference to the TRAI Consultation Paper No.08/2021 dated 30-11-2021 on Auction of Spectrum in frequency bands identified for IMT/5G.

In this regard, please find enclosed herewith Tata Communications Limited's response to the Consultation Paper as Annexure -I for your kind perusal.

We request you to kindly take on record our response and consider the same while finalizing the recommendations.

Thanking You,  
Yours Sincerely,

**For Tata Communications Limited,**

DocuSigned by:  
  
3737C03BE2844CB...

**Praveen Sharma  
Authorized Signatory**

Enclosure: As mentioned above

**TATA COMMUNICATIONS**

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## Tata Communications Limited's response to TRAI Consultation Paper on Auction of Spectrum in frequency bands identified for IMT / 5G

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### Preamble:

At the outset, we are thankful to TRAI for giving us an opportunity to submit our views and suggestions on various issues related to the spectrum and its valuation for IMT/5G services. The said consultation paper has raised vital issues encompassing various facet of 5G services and enabling factors for roll out of 5G in India.

### Availability of adequate spectrum at optimum reserve price is key for proliferation of affordable telecom services

Spectrum is the most vital element for proliferation of any cellular network and services. From the administrative allocation of spectrum for 2G/CDMA services to first ever allocation of spectrum through auction in 2010 for 3G and BWA technology, Indian Spectrum Policy has come down a long way where different auctions viz. 2010, 2012, 2013, 2014, 2015, 2016 and most recent in 2021 were held with mixed results. While 2010 3G spectrum auction was a grand success for the Government which generated substantial revenue from spectrum and no spectrum which was put for auction remained unsold, the recent spectrum auction of 2016 and 2021 had resulted in sale of only 41% and 37% of the total spectrum put for auction. Number of participants, need of spectrum for continuation of services, financial situation, and requirement of additional spectrum are some of the factors which played their role in mixed results witnessed through out the spectrum auctions, however, spectrum pricing is one factor, which has been key in deciding the acquisition of spectrum and the financial position of the sector.

We wish to most humbly submit that high reserve price of spectrum has been counterproductive for the telecom industry. High price of spectrum is one of the major causes for the current financial crisis being faced by most of the telecom operators, which in fact, forced the Government to come out with various bailout measures e.g., increase in spectrum moratorium period. Government has in recent past changed the strategy and started considering the spectrum as a mean to achieve socio-economic benefit rather than seeing it as an opportunity to generate revenue. This shift in policy is visible in the NDCP-2018 which, in one of the Strategies to achieve 2022 Goals states as under:

*"...1.2 Recognizing Spectrum as a key natural resource for public benefit to achieve India's socio-economic goals, ensure transparency in allocation and optimise availability and utilization..."*

Recently, Hon'ble Telecom Minister's comment that the *"public good" element in spectrum pricing is now widely recognized, leading to a changed thought process that seeks to strike a balance between maximizing revenue and maximizing services to the poor<sup>1</sup>*, has come as a silver lining for the industry that now the spectrum would probably be priced more rationally while keeping in mind the socio-economic benefits and public good from the use of spectrum.

The past approach of TRAI to arrive at spectrum valuation through multipronged approach should be replaced with methodology(ies) based on global benchmarking adjusted with India's ARPU, PPP etc., and benefit from the spectrum in growth of other sectors and Industries. Thus, we are hopeful that TRAI would review and reconsider methods and models adopted in the past to derive

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<sup>1</sup> [https://www.business-standard.com/article/economy-policy/have-to-make-telecom-spectrum-affordable-says-ashwini-vaishnaw-121121400059\\_1.html](https://www.business-standard.com/article/economy-policy/have-to-make-telecom-spectrum-affordable-says-ashwini-vaishnaw-121121400059_1.html)

the valuation of various spectrum band and public good and socio-economic benefit of the spectrum, more so in terms of 5G and its impact on various industries, would become an integral part of the exercise of TRAI to arrive at the valuation and reserve price of the spectrum for forthcoming 5G auction.

### **ISPs are serious contender for participation in Spectrum Auction to rollout their own 5G networks for catering the requirement of Enterprises**

Considering the forthcoming spectrum auction would be focused on 5G services and the importance of 5G in future roadmap of Enterprises, Internet Service Providers (ISPs) can emerge as a key stakeholder in proliferation of 5G services, particularly, for Industry segment. The evolving demands of enterprise customers due to the ongoing technological advancements would lead to easy acceleration to industry 4.0 which will bring enormous economic and social benefits to the nation and ISPs are serious contenders for using 5G technology enabled network/services to fulfil such demands. While ISPs were eligible to bid for BWA (4G) spectrum in the 2010 spectrum auction however ISPs have not been considered post 2010 auction and the eligibility criteria were set forth in a manner that only access service providers or those who undertake to obtain access service license were able to participate in the subsequent auctions.

With the emerging competition in the enterprise business segment due to forthcoming 5G rollout and ongoing technology advancements, it is desirable that ISPs should also have an opportunity to own licensed spectrum for their own 5G network rollout especially in the higher spectrum bands. Unlike 2G/3G which are voice driven and data services were add-on, 4G and upcoming 5G services are data driven and hence players like ISPs, whose core services are data based, cannot be left out from participating in the auction. In fact, participation of ISPs would promote competition in the market by having more players owning licensed spectrum and would lead to better services and value proposition for Enterprise segment who would be the initial benefactor of 5G services. It is our submission that ISPs should be permitted to participate in the 4G/5G spectrum auction and should be allowed to use the spectrum under their ISP license for the services permitted under ISP license.

### **5G Technology is a harbinger of growth for the industry and is providing path breaking efficiencies and development enabling private networks for deployment of customized and sector specific applications under the aegis of Industry 4.0**

We are also thankful to TRAI for considering the issues related to private 5G network and spectrum for private 5G in this consultation paper. 5G Technology is proving a major paradigm & platform for realizing deployment of path breaking industrial applications. 5G technology provides a platform on which Industry 4.0 vision will get realized which is going to be nothing short of an industrial revolution. 5G technology and its deployment as an underlying base along with other cutting-edge platforms based on IoT, AI, Big Data, Cloud Computing, AR/VR, Blockchain will usher the era of Industry 4.0 both globally and in India. The industry 4.0 Platform therefore is going to be highly sector specific and application specific with telecom technology viz 5G being a underlying part on which the edifice of this automated efficient industrial set-up would be built. Industry 4.0 Platform is going to be highly customized for each of the sectors/applications including how various technologies and platforms are used including 5G technology. It is for these reasons that globally 5G spectrum is being allocated to different Industry Verticals directly as scope of implementation of Industry 4.0 is much vast and larger than provision /use of 5G services and it requires specialized efforts which would require domain knowledge of the industrial sectors and technologies /platforms involved than being a TSP simpliciter. It is our submission that Industry 4.0 cannot ride on a public network as it would require special customization and

efficiencies which a public network would not be able to provide so by necessity Industry 4.0 has to ride on a private network built on 5G spectrum allocated directly to the Industry.

The inherent features of Private networks such as enhanced bandwidth, significantly lesser latency, unobstructed connectivity, improved security, etc., offer complete control to Enterprises over their Operational procedures, better privacy protection of process and production related data and security advantage over a public network and also provides for seamless integration of 5G technology platform with other platforms being used for Industry 4.0 applications as listed above. They also offer opportunities to deploy customized use cases for the overall enterprises within their specified geography over the same underlying network infrastructure due to network slicing ability with differential prioritization eventually helping to improve productivity, efficiency, costs optimization, safety and security in manifold.

This will also propel innovation in ways of doing the businesses in near future. It is for above reasons that there is global trend for allocation of 5G spectrum for Industry 4.0 applications (Private Networks) to the industry on easy terms so that Industry can invest in developing platforms for Industry 4.0 applications and harness the benefits of upcoming technological revolution. As per the metrics from Nokia's Private Wireless Network Deployment at their Chennai Conscious factory<sup>2</sup>, significant benefits have been emerged including 31% labour time reduction through robotic automation; 31,000\man hours saved through software robotic process automation (RPA); 16% OEE improvement since recent changes and others. This study not only prove that Industry 4.0 can take root in markets like India but that these new technologies and use cases can enhance productivity and employee wellbeing substantially.

### **Deployment of Private Networks is a highly customized and specific business requirement centric and distinctly different from the Public Networks**

Enterprise connectivity would require utmost customer centric approach where network's reliability, speed, latency, efficiency, density each need to be defined by the Enterprises and can vary for each Enterprises depending on their operational requirement. For example, 5G network for a manufacturing plant with large assembly line would be completely different from the one being used by an educational institution for R&D. It would immensely be difficult for a Telecom service provider to customize its network for each Enterprises and fulfil the desired network with specific values of different connectivity parameters of such enterprises. Building an Industry 4.0 Platform for various Sectors/applications is a complex and complicated project involving use of multiple technologies and platforms and 5G being a very import underlying platform customization of the same by TSP using its public network may not be Possible and /or desirable.

Hence, it would be appropriate that the Enterprises/Industry should decide on its captive Private 5G network and its different parameters as per their requirement of Industry 4.0 platform/applications and establish it themselves within their factory/premises. While doing so Enterprises can collaborate with different OEMs and Service Providers to build Industry 4.0 applications. It is therefore our submission that allocation of spectrum for private networks should be done directly to the Enterprises/Industry in line with global practices which can be used for creating their own dedicated 5G network with specific value of network parameters. This would give complete control to them on their private network without any dependency on TSPs and full freedom to unleash the potential for Industry 4.0 transformation. It will also enable significant opportunity to innovate and create prudent use cases relevant to their industry and business and

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<sup>2</sup> <https://www.nokia.com/sites/default/files/2021-10/MANDALA-INSIGHTS-Nokia-Conscious-factory-in-Chennai-a-case-study-in-Digital-Transformation.pdf>

provide the flexibility to create relevant network topology and architecture needed for their business within their campuses. One important benefit of reserving a certain quantum of spectrum and allocating the same to Enterprises for 5G is that the same spectrum can be reused and allocated to various Enterprises. Since this spectrum would be used by a particular enterprise within its campus, same can also be utilized by a different enterprise whose campus is in the same city but at a reasonable distance.

### **Global trend for allocation of 5G spectrum for Private Networks to the Enterprises on easy terms for developing platforms for Industry 4.0 applications**

Private 5G networks are unleashing sheer innovation and creativity in implementing use cases which is helping to achieve Industry 4.0 objectives. Many countries are bringing revolutionary changes in Telecommunication policies such as allocation of wireless spectrums for private networks to assist rapid deployment of private 5G networks and industry relevant use cases. Such policies are enabling every kind of enterprise with different sizes & shapes to be able to deploy their own captive 5G private cellular networks in their premises, factories, campuses without any dependencies.

Globally various regulators/licensors have earmarked spectrum for private 5G networks. Countries such as Germany, UK, USA, Australia are leading such initiatives Germany has reserved 100 MHz in 3700-3800 MHz for private enterprises, UK's Ofcom has introduced new licensing system covering localized access to the 3.8-4.2 GHz (n77) band, France has offered 2600 MHz band (TDD) to metropolitan businesses, In Netherlands, spectrum at 3400-3450 and 3750-3800 MHz is intended to be made available for local use, Sweden's 5G auction of the 2.3 and 3.5 GHz bands will reserve 80MHz of frequencies between 3720MHz and 3800MHz for local and regional licenses. Other countries outside Europe including the US, Japan, Australia, and Hong Kong are also moving forward with their plans to identify and allocate spectrum for localized private 5G networks with a primary focus on the 3.7, 26 and 28 GHz frequency bands.

We are of the view that similar initiatives to be adopted in India as well. Indian industry has significant potential to adopt deployment of private networks and we sincerely hope that regulatory authorities would give serious consideration on this matter and come out with relevant policy framework to enable Industry 4.0 through private 5G networks.

It is for above reasons that there is global trend for allocation of 5G spectrum for Industry 4.0 applications (Private Networks) to the Enterprises / Industry on easy terms so that Industry can invest in developing platforms for Industry 4.0 applications and harness the benefits of upcoming technological revolution.

### **India also needs to follow global trends on spectrum allocation for private networks so that it is not left behind in the race of industrial development**

India has vast presence of Industries across various sectors ranging from Manufacturing, Transportation, Mining, Land & Sea Ports, Automotive, Steel, Pharma, Education, where true potential of this futuristic technology can be exploited to drive "Make in India" initiative and eventually contributing to the national GDP. TRAI should see its role beyond the telecom service providers and facilitate the roll out of telecom networks (captive) across various Industry vertical. This would also in line with the NDCP 2018 i.e. *To harness the power of emerging digital technologies, including 5G, AI, IoT, Cloud and Big Data to enable provision of future ready products and services; and to catalyse the fourth industrial revolution (Industry 4.0) by promoting Investments, Innovation and IPR.*

Given the global momentum towards adoption and deployment of Private 5G networks in view of the benefits and advantages, India should not be left behind and earmarking/reserving certain quantum of spectrum in suitable frequencies. We are of the view that some part of spectrum in sub-6GHz band (at least 100MHz) and mm-wave band (minimum 400MHz) should be reserved for private 5G networks for potential Industrial applications and to be allocated administratively under registration mechanism to the Enterprises directly (to be used within their campus) at nominal fee for private, captive and local network deployments in 5G technology in line with global practices to enable Industry 4.0. Ideally the identified spectrum should be contiguous within the band to keep the costs of private network deployments minimal. Further, reuse of allocated spectrum should also be ensured as spectrum is expected to be allocated for specific campus/localised area, thus it suggested to allocate same spectrum to multiple enterprises or Industry verticals at different locations to achieve optimal spectrum efficiency.

Keeping above in view, our response to various issues raised in the consultation paper are provided hereunder.

### 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.**

**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.**

**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.**

#### Tata Communications Response to Q1 to Q3:

We are of the view that the spectrum in the frequency range 526-617 MHz should not be put for auction in the forthcoming auction as these spectrum bands in the frequency range 526-617 MHz are not yet defined by 3GPP

In its reference to TRAI, DoT has stated that the use of 526-582 MHz for IMT/5G will be in coordination with Ministry of Information and Broadcasting (MIB) and same will be coordinated with minimum keep out distance from MIB transmitters. In this regard, we would like to draw your kind attention towards one of the studies conducted by the ITU namely '*Sharing and compatibility studies between digital terrestrial television broadcasting and terrestrial mobile broadband applications, including IMT, in the frequency band 470-694/698 MHz*' published on 8<sup>th</sup> May 2018 by the ITU<sup>3</sup>. In this study, apart from other interference issues, ITU had conducted the study of Co-channel and adjacent channel sharing and compatibility study of digital terrestrial television broadcasting (DTTB) System A (ATSC) interference into an IMT base-station in the 470-694/698 MHz band outside the GE06 planning area.

The said study concluded that the required separation distances for interference of DTTB into IMT base-stations are significant for both co-channel and adjacent-channel scenarios. Since the

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<sup>3</sup> <https://www.itu.int/pub/R-REP-BT.2337-1-2018>

separation distances exceed radio horizons, it is unlikely that spectrum sharing between DTTB and IMT is possible within a given geographic location.

Hence, in order to use the said frequency range for IMT/5G, study similar to the one conducted by ITU, should be undertaken to identify the level of interference and the suitable keep out distance from the DTTB sources for India as clean spectrum (interference free) should be used for IMT/5G services to ensure Quality of Service. **Until Govt. ensures availability of clean spectrum in this band, it is submitted that the said band should not be used for IMT/5G and therefore should not be made part of the forthcoming auction.**

Further, the WRC 15 had considered that some administrations of regions 2 and 3 are planning to use the frequency band 470-694/698 MHz, or part of that frequency band, for IMT. The NFAP-2018 of India is in sync with the WRC 15 resolution wherein the said band is identified both for fixed mobile, broadcasting, and Radio Astronomy services. The NFAP-2018 also states that these bands (470-520, 520-585 MHz) may also be considered for fixed and mobile services (IND foot note 24).

It is also pertinent to mention that presently in these spectrum band i.e. frequency range 526-617 MHz, there is a lack of ecosystem which will make the services expensive to the service providers as well as the customers. Thus, these bands should be made available for auction after 3GPP defines appropriate band plans for these bands and fair amount of eco-system gets developed around it.

Thus, while the said band has been identified for IMT services in India (along with broadcasting services), it is important that before putting the said band for IMT spectrum auction with a condition to use it for 5G/IMT in coordination with MIB (i.e. Prasar Bharti), Government should optimally rearrange the assignment of spectrum to Prasar Bharti and other Govt. agencies and post conducting this exercise to vacate most of the spectrum in the said band, the available spectrum (without any interference) should be considered for the auction to deploy IMT services.

In view of above, we are of the view that this frequency range in question should not be part of the forthcoming auction.

**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.**

**Tata Communications Response:**

Tata Communications suggests not to put 600 MHz band to auction as the alternate band plan '3GPP Option B1' has not been adopted yet either by 3GPP or the APT region and there is no ecosystem currently available.

The existing band plan 71/n71 defined by ITU/3GPP for 600 MHz band is based on reverse FDD configuration and been adopted to guarantee compatibility with the adjacent spectrum band B28. There is an inter-band gap of 5MHz for interference free operation of these two bands. However, since band n71 works on reverse FDD, need for the gap of 5 MHz is technically not required. Therefore, if band plan n71 is adopted, it leads to waste of 5 MHz spectrum.

The ITU-APT Foundation of India has proposed an alternate band plan '3GPP option B1' that will provide 80 MHz of spectrum as against 70 MHz as per n71. Though the proposed band plan will result in better spectrum utilization, there is no eco-system available around it.

**Q.5 For 3300-3670 MHz frequency range, which band plan should be adopted in India? Kindly justify your response.**

**Tata Communications Response:**

There are 2 band plans viz "n77" & "n78" that support frequency range 3300-3670 MHz. Tata Communications suggests band plan "n77" to be adopted as it takes care of future requirements where some more spectrum in this band could be made available for IMT. Already, there is proposal to extend this band up to 4200 MHz.

This would also provide the benefit of volume of scales on cost of devices and equipment to the service providers while deploying the services in this band which will make the services offers to the end customers affordable.

**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**

**Tata Communications Response:**

Yes, we agree that TDD based configuration should be adopted for 24.25 to 28.5 GHz frequency range. The 3GPP Rel 15 has identified various bands for 5G termed as New Radio (NR) bands and for the same the duplex mode has also been specified. The two NR operating bands n257 (26.5 GHz to 29.5 GHz) and n258 (24.25 GHz to 27.5 GHz) covers the frequency range from 24.25 to 28.5 GHz and since the duplex mode for both these bands have been specified as TDD, we are of the view that for the frequency range in question, TDD mode should be prescribed. The FDD based configuration would have challenges of ecosystem availability.

**Q.7 In case your response to Q6 is in 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.**

**Tata Communications Response:**

Frequency band 24.25 – 27.5 GHz is a globally harmonised band for IMT applications and the band plan 'n258' covers this entire band, hence, for frequencies from 24.25 – 27.5 GHz, the band plan 'n258' should be adopted. For frequencies from 27.5 – 28.5 GHz, the band plan 'n257' should be adopted

**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.**

**Tata Communications Response:**

Tata Communications recommends the entire spectrum of 3250 MHz from band plan n258 (24.25 – 27.5 GHz) should be used for IMT/5G applications. It is worth noting that ITU-R (WRC-19) has identified frequencies 24.25 – 27.5 GHz as a globally harmonized band for IMT/5G applications.

Here it is important to note that ITU-R has not identified the following band 27.5 – 28.5 GHz frequencies for IMT applications yet. Rather, as per ITU-R, this part of the spectrum is a part of a globally harmonized frequencies of 27.5 – 29.5 GHz for satellite applications already, ITU has assigned this band globally for multiple satellite operators and taking out part of this band for IMT may have implications to upcoming satellite constellations over India. In view of the above, Tata Communications recommends not to use 27.5 – 28.5 GHz spectrum for IMT/5G use and the same should be assigned for satellite applications.

However, given the large amount of spectrum in the band, applicability for other applications and optimal use, we are of the view that some part of spectrum, as suggested in preamble, should not be auctioned and should be reserved for private 5G networks for potential Industrial applications and to be allocated administratively to the Enterprises directly (to be used within their campus) in line with global practices to enable Industry 4.0. Further, since higher frequency bands (e.g. mmWave) have high RF propagation loss which in turn supports better frequency reuse for TSPs hence, reserving some part of mmWave band for private 5G will not impact the consumer/public 5G services to be offered by the TSPs using their public network. Further, private 5G network is a crucial building block for achieving Industry 4.0 along with other technologies/platforms like AI, AR/VR, IoT, Block chain, Big Data, Cloud Computing etc. and requires kind of network parameters which can be achieved in a private network mode only and since Industry 4.0 is a complex and complicated integration of all these advanced technologies to achieve efficiency and scales, which would be sector and application specific, it would be appropriate that spectrum is allocated to the Industries as per global practices to develop the Industry 4.0 platform/application.

Private 5G would be a catalyst for the growth of the industries/economy and would lead to easy acceleration to industry 4.0 which is bringing enormous benefits such as:

- Massive reduction in setup of production lines and inventories resulting in significant annual saving for manufacturers
- Substantial increases in flexibility, versatility, productivity, and resource efficiency
- Predictive maintenance of machines and machine part enabling just-in-time servicing and replacement
- Zero touch factory operations enabled through IoT, 5G, AI and big data analytics technologies
- Significant increases in efficiency of Warehousing and supply-chain.

Given the advantages of private and dedicated 5G networks for Enterprises and various Industry verticals; many leading countries have already rolled out or in the process of rolling out policy frameworks for allocating part of millimeter wave and mid bands directly to the enterprises and industry verticals. Also, to encourage maximum adoption by these entities; commercially such spectrums are being allocated on very nominal fees.

NDCP 2018 also specifies earmarking of adequate licensed and unlicensed spectrum for IoT/ M2M services in one of its strategies for catalyzing investments for Digital Communication sector which is vital in achieving the goal of Accelerate Transition to Industry 4.0 by 2022. Below table gives some details for specific countries who have either already planned the allocation or in the process of doing so for deployment of Private 5G Networks.

<b>Sr. No.</b>	<b>Country</b>	<b>Spectrum Band</b>	<b>Total Bandwidth</b>
1	UK	3.8 - 4.2GHz	400MHz
2	Germany	3.7 - 3.8GHz	100MHz

3	Finland	24.25 - 25.1GHz	850MHz
4	Brazil	27.5 - 27.9GHz	400MHz
5	Korea	28.9 - 29.5GHz	600MHz
6	Japan	4.6 - 4.9GHz	300MHz
		28.2-29.1 GHz	900MHz
7	Australia	24.7 - 25.1GHz	400MHz

As it can be seen from the table spectrum allocation for Private Networks are upwards of 400MHz specifically in Millimeter wave band and both in 26GHz and 28GHz bands. Apart from these countries indicated below, we understand that USA, Sweden, France, Netherland, Hongkong, etc. are also in the process of such spectrum allocation and relevant policy framework.

India has significant potential and opportunity to realize a contiguous band from 24.25 GHz to 31.3 GHz, which is total bandwidth of 7.05 GHz for IMT services and specifically for 5G. Thus, in order to deploy private 5G networks, we are of the view that spectrum allocation of minimum 400MHz in millimeter wave band (24.25 to 27.5GHz, 27.5 to 29.5GHz and 29.5 to 31.3GHz) directly to the Enterprises & Industry verticals in India for private, captive & local Network deployments in 5G Technology. The frequency allocation to Enterprises can be done on campus-wise/factory-wise so that same frequency can be used/allocated to other Enterprises as well.

In view of the above, we suggest that some part of mmWave band should be reserved for private networks and same should not be part of the forthcoming auction.

### 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)

**Tata Communications Response:**

No Comments

**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.**

**Tata Communications Response:**

No Comments.

**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.**

**Tata Communications Response:**

Please refer our response to Q.1 regarding auctioning the spectrum band in the frequency range of 526-698 MHz wherein we have not recommended auctioning of this spectrum in the forthcoming auction.

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

**Tata Communications Response:**

Block size should be 10 MHz (TDD) with minimum bidding quantity being 2 blocks. This band is primarily meant to provide optimum coverage with optimum capacity, which can only be realised with a reasonable spectrum of minimum 20 MHz upwards. This recommendation is also in line with 3GPP band plan.

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

**Tata Communications Response:**

The 26 GHz mmWave band spectrum offers very low coverage but demonstrates the ability to deliver solutions for high capacity and low latency requirement. The low coverage allows better frequency re-use in mmWave band which supports high data rate and increases network capacity. As this band is known for its abundant spectrum, a channel size of 100 MHz would enable to realize true potential of this band. Hence, we suggest that 100 MHz (TDD) as block size and as minimum quantum of spectrum in this band to support various 5G use cases. It is further submitted that some part of spectrum in this band should be reserved for private network use cases.

#### **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.**

**Tata Communications Response:**

Tata Communications strongly suggest that ISPs should again be allowed to participate and bid in the 5G Auction as they were eligible to bid for BWA (4G) spectrum in the 2010 auction. There is no reason to exclude ISPs from participating in spectrum auction particularly for the spectrum which can be used not only for broadband services but also be deployed to rollout their own 5G networks for offering services to Enterprise customers.

5G is going to be the key enabler for the next wave of Industrial Transformation. 5G features (eMBB, URLLC, mMTC etc.) are more attuned to Enterprise services driving use cases for Enterprise Digital Transformation. Internet Service providers are focused on serving enterprise

customers are required to roll-out Fixed Wireless Access to meet enterprise demand for high capacity and low latencies. Thus, Internet Service Providers are serious contenders for using 5G technology enabled network /services in their future business plan and towards that end are contemplating their participation in forthcoming 5G auction especially in the 5G Spectrum band.

Moreover, considering the use of 5G spectrum for data services and use cases built in a data network, ISPs should be seen as an obvious choice to build their 5G network and provide services. Therefore, in order to promote competition in the market by having more players owning licensed spectrum and competing in the market leading to more broadband proliferation, ISPs should be allowed to participate and bid in the forthcoming 5G spectrum auction along with TSPs. Proliferation of internet and broadband services in the country cannot be done if there are only three to four entities owning spectrum and there is a need to have more spectrum owning players in the market.

Hence, the eligibility criteria of previous auctions should be amended suitably to include ISPs as a potential bidder for the 5G spectrum auction.

**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 Auction? Kindly justify your response.**

**Tata Communications Response:**

We are of the view that there should only be a one eligibility criteria which includes ISPs as participant, should be prescribed for all spectrum bands (new as well as existing bands).

#### **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.**

**Tata Communications Response:**

4G and 5G uses OFDMA technique which defines inherent guard band within the system, thus, there is no requirement of prescribing any guard band in 3300-3670 MHz and 24.25-28.5 GHz TDD bands.

Further, 5G technology facilitates implementation of Dynamic TDD, wherein each cell in the network can adapt its uplink-downlink ratio depending on the traffic. Prescribing a frame structure with a downlink and uplink configuration could come in way of implementation of dynamic TDD. In short, use of compatible frame structures is not always possible.

In view of the above, Tata Communications recommends allocation of large contiguous blocks of spectrum so that operators can manage the interference by mutual coordination and control their out of band radiations, if any, by way of technical solutions like RF cavity filters or even provisioning a guard band themselves.

We suggest TRAI that there is no necessity to prescribe a guard band and issue of interference should be left to the TSPs to manage the same.

**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.**

**Tata Communications Response:**

Not applicable in view of our 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?**

**Tata Communications Response:**

No Comments

**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.**

**Tata Communications Response:**

No Comments.

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

**Tata Communications Response:**

No, there should not be any rollout obligations in 3300-3670 MHz bands.

Unlike low frequency bands that are appropriate for providing wider coverage, frequencies in the 3300-3670 MHz band are more popular for building higher network capacity with shorter distances, as these have relatively higher propagation losses vis-à-vis the lower frequencies, hence more suitable for densely populated urban and sub-urban areas. Moreover, the technical characteristics of 3.3 GHz spectrum bands are not conducive for extending the geographical reach, the cost of providing ubiquitous carpet coverage using these frequencies is going to be prohibitively high.

Further, TRAI, vide its recommendations on “Auction of Spectrum in 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz, 2500 MHz, 3300-3400 MHz, 3400-3600 MHz Bands” (dated August -01, 2018) did not recommend roll out obligations for spectrum in 3300-3600 MHz band.

Hence, Tata Communications suggests having no roll-out obligation for the 3300-3670 MHz band.

**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.**

**Tata Communications Response:**

Unlike low frequency bands that are appropriate for providing wider coverage, the technical characteristics of 24.25 – 28.5 GHz spectrum band are not conducive for extending the geographical reach. As the high frequency spectrum waves do not travel longer due to higher propagation losses, the cost of providing ubiquitous carpet coverage using these frequencies is going to be prohibitively high. Consequently, as relatively large bandwidth is available in these frequency bands, these can be used primarily to enhance the network capacity in isolated patches (hot spots) wherever required (and not for carpet coverage). Moreover, these frequencies are primarily used for provision of high speed, ultra-reliable and low latency applications and would be deployed selectively where such use cases exist.

In view of the above, Tata Communications suggests that there should not be any roll-out obligation for the 24.25 – 27.5 GHz band.

**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.**

**Tata Communications Response:**

We are of the view that the BTSs installed by the VNOs should be included while assessing the fulfilment of the roll out obligations.

### **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.**

**Tata Communications Response:**

We are of the view that overall spectrum cap in sub-1 GHz bands should be prescribed at 35% of the total combined available spectrum in sub-1 GHz. This will ensure adequate availability of spectrum to build coverage for 5G services (particularly rural coverage) for existing TSPs (3 private +1 PSU) as well as allow the new entrants to opt for coverage bands by restricting the holding of existing players to 35% in the sub-1 GHz bands.

**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.**

**Tata Communications Response:**

Yes, Tata Communications recommends prescribing spectrum cap for the 3300-3670 MHz bands. We further recommend a band specific limit of 50 MHz be imposed on the holding in 3300-3670 MHz bands. This will ensure that more participants will get the fair chance to acquire spectrum in these bands in the auction.

We would like to reiterate that creating a framework where more operators are able to acquire spectrum in 5G bands is necessary to create the 5G ecosystem in India for growth of 5G services and use cases at a faster pace. More number of Operators would create different 5G networks which would be available for supporting various use cases along with safeguarding the necessary competitiveness in the market to make available 5G services at affordable price.

In the 24.25-27.5 GHz band Tata Communications suggests intra-band spectrum cap of 400 MHz per operator to ensure competition in this 5G segment. In view of an abundant spectrum available in this band, this band is of interest to both mobile operators and ISPs to create high-capacity zones for serving enterprises and retail customers. s. In view of the above, there is a need for spectrum cap and a spectrum cap of 400 MHz per operator would ensure fair competition in this band.

**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.**

**Tata Communications Response:**

No Comments.

**Q.26 Whether overall spectrum cap of 35% requires any change to be made? If yes, kindly suggest the changes along with detailed justification.**

**Tata Communications Response:**

No Change is required in the overall spectrum cap of 35%.

**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.**

**Tata Communications Response:**

No Comments

**Q.28 Any other suggestion regarding spectrum cap may also be made with detailed justification.**

**Tata Communications Response:**

No Comments

## 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.**

### **Tata Communications Response:**

Tata Communications suggests surrender of spectrum after 10 years with a provision of one-year prior intimation to surrender such spectrum. The spectrum purchase dues for the remaining (post surrender) period should not be levied and excess fee collected if any, should be returned.

As DoT is going to auction spectrum every year, one year's prior intimation is sufficient, because surrendered spectrum can be put to auction in the following year.

**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.**

### **Tata Communications Response:**

We do not see any requirement to create additional provisions as proposed provision of surrender of spectrum after 10 years with a provision of one-year prior intimation seems to be enough to discourage possible misuse.

**Q.31 In case a TSP acquires spectrum through trading, should the period of 10 years to become eligible for surrender of spectrum, be counted from the date of original assignment of spectrum or from the date of acquisition through spectrum trading? Kindly justify your response.**

### **Tata Communications Response:**

Tata Communications suggests 10 years terms to become eligible for surrender of spectrum with a provision of one-year prior intimation. The date of original assignment of spectrum should be considered for spectrum surrender eligibility rather than considering the date of acquisition through spectrum trading.

Spectrum, which can be traded are already won in the auction by the TSP to whom the spectrum gets assigned at first place. Further, the validity period of the spectrum starts from such date of assignment. In case of trading of this spectrum, there is no loss to the exchequer in terms of revenue, also, the validity period of the spectrum remains the same (i.e. if spectrum won in 2016 with validity till 2036 being traded now in year 2022, then the TSPs acquired the spectrum through trading will get the rights to use that spectrum from 2022 till 2036).

Hence, it would be fair and reasonable that the period to become eligible for surrender of spectrum be counted from the date of original assignment.

**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.**

**Tata Communications Response:**

In case the existing spectrum holdings are acquired through auction process, same principle as applicable to forthcoming spectrum auction for surrender of spectrum should be applied on the existing spectrum holding of the TSPs. This would ensure level playing field for both old and new players as well as uniform spectrum policy for all spectrum holding through auction.

**Q.33 Whether spectrum surrender fee be charged from TSPs? If yes, what amount be levied as surrender fee? Kindly justify your response.**

**Tata Communications Response:**

Tata Communications suggests not to charge spectrum surrender fee. The Government can auction such surrendered spectrum in a timely manner as the provider is required to inform one year in advance.

**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.**

**Tata Communications Response:**

One of the key strategies of the NDCP-2018 to achieve the 2022 Goals is recognizing Spectrum as a key natural resource for public benefit to achieve India's socio-economic goals, ensure transparency in allocation and optimize availability and utilization. The policy further recognizes that optimal Pricing of Spectrum is necessary to ensure sustainable and affordable access to Digital Communications.

In India, the prescribed reserve prices for various spectrum bands have always been at higher side with the aim to maximize the revenue from spectrum auction, however, the impact of Spectrum in various socio-economic development of the country which eventually generate more revenue and uplift the social position of the common man has never been factored in while prescribing the reserve price or valuation of the spectrum.

Spectrum valuation and its reserve price computation in India as an input cost to the Products/Services which it delivers has been on the higher side as compared to low Product prices leading to financial distress. In other fields, be product or service, the cost of input (say raw materials) are low in comparison to the price at which the end products/services are being sold whereas, in case of spectrum pricing, it has been endeavor of the Government to keep the reserve price at a level to gain maximum revenue from the auction and post the same where TSPs provide services using the same, the price of such services for end consumers should be most affordable in the entire world.

Moreover, it is worthwhile to mention that the price of the past spectrum auctions cannot be taken as a benchmark for valuation of spectrum reserve price for forthcoming auction. At various occasion, TSPs spectrum were at the verge of getting expired and due to the same, it became compulsory for such TSPs to buy back the spectrum at whatever cost. Such situation created an unrealistic higher price of spectrum and continued to be the benchmark for next spectrum auctions.

This approach of spectrum pricing, coupled with lowest APRU across the world, is one of the key reason for the current financial position of most of the telecom operators wherein many operators struggled to pay their annual installment towards spectrum, many TSPs getting bankrupt/shut down their services, job losses and impacting the overall financial condition of not just the telecom sector but also some of the banks who had to bear the losses due to their exposure to the bankrupt telecom operators. So much so that finally in September 2021, Govt. had to come out with the 'telecom reforms' to ensure that the number of TSPs in the market should not be reduced further which would have turned the Indian telecom market in duopoly.

Globally, spectrum has been assigned through auction process and the valuation of the spectrum by various countries should be seen (while factoring India's per capita, Purchasing power parity). In past, TRAI has recommended Rs 492 crore per MHz as base price for 3.3 GHz spectrum band. In comparison, the auction determined price in Italy was Rs 182 crore per MHz, Rs 70 crore in the UK, Rs 35 crore in Australia, Rs 14 crore in Spain and just Rs 7 crore in Austria. Thus, the last recommendations of TRAI for 3.3GHz band spectrum reserve price was extremely high to the tune of 3-70 times the global auction determined prices. Even if the proposed reserve price is compared after considering the Population, GDP per Capita and ARPU, it is our submission that recommended reserve price in India for 3.3 GHz spectrum band is still substantially higher than what would be determined considering above factors.

The Hon'ble Standing Committee on Information technology in the 21<sup>st</sup> Report 'India's Preparedness for 5G' presented to Lok Sabha on 8<sup>th</sup> February 2021, has stated that:

*.....the Committee are of the view that long-term consumer benefit should be the guiding principle and not short term revenue maximization. TRAI need to take the TSPs on board as it is they who are contributing to the growth of the sector. The concerns expressed by TSPs and COAI cannot be ignored but merit attention. Factors such as per capita income and ARPU should also be taken into consideration. The Committee recommend that the issue of high spectrum prices is looked into and DoT/TRAI should come out with a convincing spectrum pricing policy that is sustainable, affordable and acceptable to all, focusing on consumer interest and socio economic goals of our country. The Committee also recommend that the concerns raised by COAI for rationalization of levies and duties on the telecom sector should also be given time bound consideration by the Government, so that financial burden neither acts as a deterrent for TSPs in their move towards 5G nor places an unsustainable burden on the Indian customers.....*

it is also worth noting the observations made by Hon'ble Standing Committee that Telecommunications sector provides the basic backbone and infrastructure for digital connectivity and broadband. The sector has direct and indirect linkage in advancing growth, employment, ease of living, empowering citizens, enhancing transparency in governance etc. Advanced technology and applications envisaged in Industry 4.0 rely heavily on robust and state-of-the-art telecommunication networks. For transitioning to 5G technology, the telecom service providers need to be in good health with sufficient capacities to make regular and substantial capital expenditure. There is a need to strike balance between revenue generation from the auction on one hand, and the long-term growth/ sustainability of the telecom sector, introduction of new services/ technologies, on the other. These should be the guiding principles while undertaking spectrum valuation exercise.

Considering the above, we are of the view that there is a need to strike a balance between the Government's expectation to generate revenue from the spectrum auction as a contributor to their annual budget, and the growth of the telecom sector considering the overarching impact of

telecom sector and upcoming 5G services across various Industry vertical. COVID-19 situation is the prime example to understand the importance of telecom sector and the digital communication infrastructure the operators have created to serve the enterprises and customer's requirement. The impact of telecom services in the growth of various sectors has received more visibility due to the covid situation where the whole economy of a country has been running on the underlying telecom infrastructure and services being provided by the operators.

Thus, spectrum pricing, which is both sustainable as well as affordable to the TSPs/ISPs, factored in the long-term gain by achieving the socio-economic benefit, global benchmarking of the spectrum pricing while considering India's per capita income and purchasing power parity should be considered as the relevant factors while deriving the valuation and reserve price of the spectrum for forthcoming auctions.

**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.**

**Tata Communications Response:**

In view of our response to Q.34, we would like to submit that instead of using the past spectrum pricing as benchmark and extrapolating the same in view of the extended spectrum allotment tenure, TRAI should initiate the fresh exercise of spectrum valuation considering various factors as outlined in our said response.

The extension of tenure of spectrum allotment was primarily meant to relieve existing financial stress of the sector. If it is accounted in the spectrum valuation, it would render spectrum unviable and defeat its very purpose. As mentioned above, there is a need to strike a balance between revenue generation from the auction on one hand, and long-term growth/ sustainability of the telecom sector, introduction of new services/ technologies, on the other. These should be the guiding principles while undertaking spectrum valuation exercise.

**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.**

**Tata Communications Response:**

The various steps taken by the Government as 'telecom reforms' are to boost employment, growth, competition and consumer interests and address the liquidity needs of Telecom Service Providers. These should not be linked with the spectrum pricing and the valuation of spectrum. In fact, if these factors, in any manner contribute to higher spectrum cost, then the whole purpose of these reforms would be counterbalanced, and no actual benefit would be derived from these reforms.

The entire telecom industry is under financial stress and the operating environment continues to remain challenging due to unsustainable pricing and hyper-competition. If these reforms are accounted in the spectrum valuation, it would render spectrum unviable and defeat the very purpose of introducing these structural reforms.

As per GSMA report<sup>4</sup>, 5G networks offer the potential to transform industrial sectors and deliver significant social and economic benefits in India. Over the period 2023–2040, GSMA forecast that 5G technologies will make an overall contribution of approximately \$450 billion to the Indian economy (0.6% of GDP by 2040). The manufacturing sector is set to benefit the most from 5G applications (accounting for 20% of the total benefit), followed by retail (12%) and ICT (11%).

Thus, the telecom sector has direct and indirect linkage in advancing growth, employment, ease of living, empowering citizens, enhancing transparency in governance etc. Advanced technology and applications envisaged in Industry 4.0 rely heavily on robust and state-of-the-art telecommunication networks.

To achieve these objectives, the telcos need to be in good health with sufficient capacities to make regular and substantial capital expenditure. However, if structural reforms are factored in spectrum valuation, it would make spectrum further costly which will have serious implications to business viability.

**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.**

**Tata Communications Response:**

In the March 2021, only 37% of the total spectrum put to auction was sold and most of the spectrum was sold at the base price. One of the reasons for lower spectrum sale was high base price. Therefore, any spectrum that is sold at the base price cannot be termed as an auctioned determined price and considered for forthcoming auction as the value of spectrum.

Tata Communications recommends following multiple valuation methods for ascertaining spectrum value.

**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?**

**Tata Communications Response:**

Please refer our submissions made in the response to Q.34. The guiding principles suggested above may kindly be considered while undertaking spectrum valuation exercise.

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<sup>4</sup> <https://www.gsma.com/spectrum/wp-content/uploads/2020/11/mmWave-5G-in-India.pdf>

**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.**

**Tata Communications Response:**

Yes, 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. However, auction determined prices of any of the earlier auctions should not be considered while undertaking a fresh valuation exercise as modern business environment is very dynamic with economic and business conditions changing fast in addition to ongoing technological advances

Please also refer our submissions made in the response to Q.34.

**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.**

**Tata Communications Response:**

Tata Communications recommends following multiple valuation methods for ascertaining spectrum value including the auction determined prices of the auctions held in the previous two years as per current practice and ensure maintenance of level playing field. In case Government prescribes an annual calendar for spectrum auction, then the valuation exercise can be done each year to take into account the current economic and business conditions which changes from time to time with limited or no linkages with earlier conditions.

**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.**

**Tata Communications Response:**

Please refer our submissions made in the response to Q34.

**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.**

**Tata Communications Response:**

We are of the view that the non-availability of device ecosystem could be one of the reasons for the lack of interest in 2500 MHz band. Alternatively, spectrum should be allocated on administrative basis to ISPs as replacement spectrum in lieu of spectrum surrendered in 3.3GHz band so that users of this spectrum can kick start the ecosystem development in this band.

**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.**

**Tata Communications Response:**

Please refer our submissions made in the response to Q34 & Q.37.

**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.**

**Tata Communications Response:**

Please refer our submissions made in the response to Q34 & Q.39.

**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.**

**Tata Communications Response:**

No Comments.

**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)?**

**Tata Communications Response:**

No Comments

**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.**

**Tata Communications Response:**

No Comments.

**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.**

**Tata Communications Response:**

No Comments.

**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.**

**Tata Communications Response:**

Kindly refer our submission made in the response to Q.34 for factors which should also be considered while deriving the value of spectrum.

The valuation of any new spectrum band is dependent on the availability of cost, revenue and other financial and non-financial information pertaining to that band. However, unlike the other spectrum bands, neither the auction determined value nor the other related information like financial and non-financial, is available for the 3300-3670 MHz spectrum band. Hence, in absence of these, technical efficiency method of determining spectrum value seems to be the more appropriate approach.

The closest band for which the auction determined value is available is the 2300 MHz / 2500 MHz band. Hence, we suggest ascertaining value of the 3300-3670 MHz band based on technical efficiency of this band vis-à-vis the 2300/2500 MHz band as per Global practices.

**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.**

**Tata Communications Response:**

This band should not be put to auction. Please refer our submissions made in the response to Q.1 to Q4.

**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.**

**Tata Communications Response:**

No Comments.

**Q.52 Whether the value of spectrum in 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.**

**Tata Communications Response:**

We are of the view that technical efficiency is not a right measure for ascertaining value of the 26/28 GHz band owing to its peculiar propagation characteristics and the use cases that it can support. The frequencies in the mmWave band are prone to high losses as compared to sub-6 GHz band frequencies and are very sensitive to environmental conditions like rain. Consequently, achievable ranges in this band are very short.

However, this band is quite valuable for creating capacity as there is abundant spectrum available. Due to high propagation losses, applications portfolio in this band gets limited to primarily high-speed hotspots and FWA use cases. Its inability to support nLOS (non-line-of-sight) operation renders it unfit for reliable mobile applications. Therefore, owing to its limited coverage and the limited services that it can be used for, ascertaining its value with technical efficiency would not be an appropriate method. Accordingly, a separate exercise should be carried out to derive the value of this spectrum.

**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.**

**Tata Communications Response:**

The 26 GHz band is being contemplated for auction for the first time and, therefore, there is no historical auction and market data available to undertake valuation exercise using methods like Producer Surplus Model, Multiple Regression Model, Correlation with AGR Model, Correlation with ARPU Model, Revenue Surplus Model, Economic Efficiency, etc.

Also, Technical Efficiency is not an option as explained above vide response to Q.52. Therefore, under the given situation, using international benchmarking is the most suitable method to determine the price of 26 GHz band.

The 3.5 GHz and the 26 GHz are the prime 5G bands and many countries have already concluded auctions in these two bands. Tata Communications suggests using international benchmarking for determining relative value of the 26 GHz band in comparison with 3.5 GHz. The table below captures auctioned determined prices for 3.5 GHz and 26/28 GHz bands from Chile, Hongkong, Italy, South Korea, Taiwan, Thailand, US, Japan, Australia, and Greece.

SI No.	Country	26/ 28 GHz Results			3.5-3.7 GHz Results			3.5 GHz to 26 GHz Ratio	% Cost / MHz
		Bandwidth (MHz)	Cost (USD Mn)	Cost/MHz	Bandwidth (MHz)	Cost (USD Mn)	Cost/ MHz		
1	Chile	1200	Admin allocation (no cost)		150	347	2.313		NA
2	Hongkong	1200	Admin allocation (no cost)		300	213.29	0.711		NA
3	Italy	1000	189.7	0.190	200	5037.87	25.189	132.785	0.75%
4	South Korea	2400	560	0.233	280	2698.2	9.636	41.299	2.41%
5	Taiwan	1600	55	0.034	270	4555.19	16.871	490.795	0.20%
6	Thailand	2600	372	0.143	Auction yet to be conducted				NA
7	US 26 GHz	700	2022.7	2.890	280	81168	289.886	100.321	1%

8	Japan	1600	Admin allocation (no cost)		700	Admin allocation (no cost)			NA
9	Australia	2400	501.1	0.209	125	615.4	4.923	23.55	4.24%
10	Greece	1000	19.72	0.02	195	119.93	0.615	30.75	3.25%

*Table-2: Auctioned determined prices for 3.5GHz & 26/28 GHz bands for international markets*

As is evident from the table above, while some countries have adopted administrative allocation, majority of them have sold it through the auction. In the markets where it was auctioned, the relative price of 26/28 GHz varied from 0.2% to around 4.24% of the price of 3.5 GHz.

Hence valuation/reserve price of the spectrum in 26/28GHz band should not be prescribed higher than the above given percentage of the 3.3/3.6 GHz band.

**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.**

**Tata Communications Response:**

Please refer our submissions made to the response to Q.53.

**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.**

**Tata Communications Response:**

The valuation method recommended by Tata Communications vide its response to Q.53 doesn't require any normalization. The method suggested negates impact of market variations like population, population density, size, per capita income, GDP, the development status (developed / under development) and the license tenure, therefore, not necessitating any normalization.

**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.**

**Tata Communications Response:**

No Comments

**Q.57 Whether the extrapolated ADP based on a time-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?**

**Tata Communications Response:**

Kindly refer our response to Q.39

**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.**

**Tata Communications Response:**

Tata Communications believes that it is not possible to deterministically ascertain if any one valuation is the 'right' valuation. Each model has certain strengths as well as limitations. Where some models better capture intrinsic technical features, others are more strongly grounded in economic and market realities. So, no one model completely captures every variable- technical, economic, sectoral, geographic and regulatory- that influences the valuation of spectrum.

If a particular band is being auctioned for the first time without any historical market data, then single valuation approach viz 'relative spectrum efficiency' and/or 'international benchmarking' should be used based on spectrum band. However, if a particular band is already in production with enough historical market data, then valuation of such a band should be arrived at by adopting multiple valuation methods.

Further, while doing the valuation of spectrum through any method, the relevant factors as highlighted in our response to Q.34 may kindly be considered.

**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 approach like taking weighted mean, median etc. should be followed? Please justify your response.**

**Tata Communications Response:**

Tata Communications suggests taking lowest of all valuations as a spectrum value of that band.

The main aim of the valuation exercise is to estimate a base price, and hence, taking lowest of the valuations arrived at following different methods is a more logical and sensible approach to follow and is also in spirit of the whole exercise. Taking simple mean or weighted mean or median leads to an artificially inflated value. It is to be noted that the aim of spectrum valuation is to establish a base (a lower bound) and allow market conditions determine actual price through auction. If there is enough demand, prices would go up automatically irrespective of the base price (as was witnessed in the 2010 spectrum auctions). However, if base price is set high, it would discourage free play of market forces, thus, defeating the very purpose of holding competitive auctions.

**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.**

**Tata Communications Response:**

Kindly refer our submissions made in the response to Q.53.

**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?**

**Tata Communications Response:**

We would request that the prevailing economic conditions in the country may be taken into account along with various factors as submitted in our submissions made in the response to Q.34. Even at a reserve price of 80% of the average value, previous auctions held in October 2016/March 2021 saw limited to no participation for certain bands particularly in the last round. The underlying principle of an auction is to discover the market price of a commodity. Therefore, Tata Communications is of the view that the 'Reserve Price (RP)' be revised from 80% of the average perceived valuation to a range of 50-60%.

We would like to reiterate that the aim here is to establish a base (a lower bound) and allow market conditions determine actual price through auction. If there is enough demand, prices would go up automatically irrespective of the base price (as was witnessed in the 2010 spectrum auctions). However, if base price is set high, it would discourage free play of market forces, thus, defeating the very purpose of holding competitive auctions.

**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?**

**Tata Communications Response:**

We suggest that the past auction determined prices should not be used as benchmark for the forthcoming spectrum auctions.

**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.**

**Tata Communications Response:**

Tata Communications suggests collecting balance bid amount, pro-rated to population of the LSA, as per the method followed by DoT in the previous auctions. We do not suggest for indexing the balance pro-rated amount at the time of collection as it was licensors inability to make the spectrum available in those districts and, therefore, licensees should not be forced to bear that burden.

**Q.64 What percentage rate of upfront payment should be fixed in case of each spectrum band?**

**Tata Communications Response:**

In view of prevailing financial stress in the sector, Tata Communications recommends a uniform upfront payment of 10% of the bid amount irrespective of the spectrum band. This will leave more cash in the hands of the telcos, which can then be utilised to roll-out network and services faster.

**Q.65 What should be the applicable period of moratorium for deferred payment option?**

**Tata Communications Response:**

In line with government's recent announcement, a moratorium period for up to five years be allowed for all future spectrum purchases. As stated above, this would enable telcos to spend more on network build and faster roll-out services.

**Q.66 How many instalments should be fixed to recover the deferred payment?**

**Tata Communications Response:**

Tata Communications suggests the instalments to be equal & quarterly payable post completion of the moratorium period till the end of the validity period of the spectrum.

**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?**

**Tata Communications Response:**

Tata Communications suggests rate of discount should be equal to the G-Sec (Government Security) yield for 30 years.

**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.**

**Tata Communications Response:**

We believe that Private Cellular Networks are required to be built for Industry 4.0 initiatives and such networks would be complex and complicated and it would be appropriate if we follow the global practices in respect of Private 5G networks in order to harness the full benefits of Industry 4.0 to the economy in a time bound manner. As per the global practices, spectrum for private 5G networks to the industry is being allocated directly by the Spectrum Managers in various geographies on administrative basis at nominal fee.

The concept of Private Network is not new and rise in "Internet of Things" and connected assets are driving more and more enterprises across the industry segments to explore opportunities that dedicated Private 5G network can offer for their specific locations, campuses, factories, area of operations, etc. The inherent features of Private 5G networks such as enhanced bandwidth, significantly lesser latency, unobstructed connectivity, improved security, etc., offer complete control to Enterprises over their Operational procedures, better privacy protection of process and production related data and security advantage over a public network. They also offer opportunities to deploy customized use cases for the overall enterprises within their specified geography over the same underlying network infrastructure due to network slicing ability with differential prioritization eventually helping to improve productivity, efficiency, costs optimization, safety and security in multifold. This will also propel innovation in ways of doing the businesses in near future.

Given the advantages of private and dedicated 5G networks, many countries are opening the 5G spectrums for private enterprises which can be deployed within their captive campuses. Further, we are of the view that Private 5G networks for enterprises will exploit new capabilities available in the next phase of the 5G standard, known as 3GPP Release 16. Release 16 aims to enable 5G to substitute for private wired Ethernet, Wi-Fi, and LTE networks, and includes multiple capabilities designed specifically for industrial environments. It is predicted that by 2026, most companies will be likely to deploy 5G in combination with existing connectivity, including wired Ethernet networks. However, in the long term—over the next 10 to 15 years—5G may become the standard of choice in demanding environments, when flexibility is paramount, reliability is mandatory, or for installations that require massive sensor density.

The NDCP 2018 also supports such initiatives in the mission under Propel India as follows:

*To harness the power of emerging digital technologies, including 5G, AI, IoT, Cloud and Big Data to enable provision of future ready products and services; and to catalyse the fourth industrial revolution (Industry 4.0) by promoting Investments, Innovation and IPR.*

Further, NDCP 2018 also specifies earmarking of adequate licensed and unlicensed spectrum for IoT/ M2M services in one of its strategies for catalyzing investments for Digital Communication sector which is vital in achieving the goal of Accelerate Transition to Industry 4.0 by 2022.

#### Private 5G will enhance the adoption of Industry 4.0 revolution

Private 5G is transforming enterprises in an effective way by enhancing network availability, Reliability, Interworking, Quality of service, high data throughput, Ultra low latency, high device density, high network security and automation, so that enterprise can easily adopt to industry 4.0 revolution.

Industry 4.0 i.e. the fourth industrial revolution which is the trend towards automation and data exchange in manufacturing technologies and processes which include cyber-physical systems (CPS), the internet of things (IoT), industrial internet of things (IIOT), cloud computing, cognitive computing, Big Data, Augmented reality, Autonomous robots, Machine learning and artificial intelligence.

There are a few main requirements which are required by companies/Enterprises in identifying and implementing the Industry 4.0 scenarios. Smart Factory, smart product, strategy and innovation, smart operations and data driven services to fulfil the new era requirement of Industry 4.0.

- Connectivity: The ability of machines, devices, sensors, and people to connect and communicate with each other via the Internet of Things (IoT) or the Internet of People (IoP) as well as better links into enterprise and B2B systems.
- Massive connection density capability: Industry 4.0 will have an ecosystem where massive device connection will be key, and that is one of the significant requirements of industry 4.0 enablement.
- High data rates and Low latency: In Industry 4.0 some applications will have high data rates as the most important feature; similarly certain applications will be more keenly focused on the latency part.

- Information transparency: Inter-connectivity allows operators to collect immense amounts of data and information from all points in the manufacturing process, thus aiding functionality and identifying key areas that can benefit from innovation and improvement.
- Technical assistance: First, the ability of assistance systems to support humans by aggregating and visualizing information comprehensively for making informed decisions and solving urgent problems on short notice. Second, the ability of cyber physical systems to physically support humans by conducting a range of tasks that are unpleasant, too exhausting, or unsafe for their human co-workers.
- Decentralized decisions: The ability of cyber physical systems to make decisions on their own and to perform their tasks as autonomously as possible. Only in the case of exceptions, interferences, or conflicting goals, are tasks delegated to a higher level.
- Higher safety and security: Industry 4.0 will have complex density and Web, mobile and API-based applications are increasingly the targets of automated bot attack campaigns.

Thus, Industry 4.0 envisions environmentally sustainable manufacturing by having green manufacturing processes, green supply chain management, and green products.

*Private 5G as enabler for Industry 4.0 adoption by the Enterprises:*

In the industrial sector, private 5G will unlock use cases that were impossible with previous generations of mobile network technology. Equally importantly, successful enterprise uptake will be essential if mobile service providers are to recover the investments needed to implement private 5G networks. Private 5G is witnessing many changes in enablement of enterprises that would lead to easy acceleration to industry 4.0 which is brining enormous benefits such as

- Massive reduction in setup of production lines and inventories resulting in significant annual saving for manufacturers
- Substantial increases in flexibility, versatility, productivity and resource efficiency
- Predictive maintenance of machines and machine part enabling just-in-time servicing and replacement
- Zero touch factory operations enabled through IoT, 5G, AI and big data analytics technologies
- Significant increases in efficiency of Warehousing and supply-chain

Private 5G is the business focused 5G Cellular Networks where a dedicated network is built for an Enterprise campus wide connectivity for reasons of cost, performance, accountability or guaranteed coverage. The key business drivers for such private wireless networks are lack of good 4G/5G coverage from public mobile network operators (MNOs) at relevant sites such as indoor coverage in large factories, remote areas such as mines and oil and gas sites, on industrial sites such as chemical plants/quarries/ports, islands and off-shore facilities, etc. Prospective Users are Remote Mines, Sea-port Authorities, Oil & Gas Exploration companies, Oil Refineries, Electricity Grids, Large Petrochemical Companies, Big Pharmaceutical Companies, Automotive Industry, Fertilizer Companies, Airport Authorities, Power Stations, High-tech Engineering, Off-shore Oil-rig companies, etc.

High-throughput, low-latency communication, Cost Efficiency, Full Control, Security and Privacy, High Availability, High Performance, Lower Power, Operational Efficiency, Network Flexibility and Business Agility are other key characteristics of Private 5G which makes it suitable for Industry 4.0.

## Wireless Spectrum – A Key Prerequisite for Private 5G deployments

The most critical ingredient for Private 5G deployment is suitable wireless spectrum. Across all the bands, millimeter wave spectrum specifically in 26 & 28GHz bands is one of the quite suitable wireless spectrums for Private 5G deployments with high throughput requirements as this millimeter wave spectrum has adequate bandwidth (overall around 3000MHz) as well as the coverage which can be confined to an extent within the stipulated campus or geography due to its propagation characteristics thereby mitigating interference issues with other deployments. This also enables reuse of the same spectrum as the same channels can be allocated to different enterprises at multiple locations.

This band has been globally harmonized for 5G deployments with channel bandwidth profiles of 50, MHz, 100MHz, 200MHz... and so on. For Private 5G kind of deployments channel bandwidth profiles of 50MHz, 100MHz can easily meet the initial requirements of the enterprises. The same can be identified for direct allocation to the Enterprises at nominal fees.

For campuses with applications spread out throughout the facility, we propose that a slice of sub 6 GHz spectrum band is also reserved for direct allocation. This will enable applications like asset tracking, video surveillance, automated guided vehicles etc., within the enterprise premises.

As enterprises across industries have started exploring digital transformation opportunities, they have started evaluating technologies based on a few important criteria – affordability, reliability, continuity, flexibility, and security. **Thus, dedicated spectrum should be reserved for private networks with the enterprises having control to apply and deploy a private network in order to fulfil all the above evaluation criteria. Enterprises should be allowed to deploy the network with their in-house capabilities or with the help of System Integrators and TSPs.**

### **Our Suggestions:**

Given the global momentum towards adoption and deployment of Private 5G networks in view of the benefits and advantages, **Tata Communications suggest TRAI to recommend for consideration of allocation of suitable frequencies including specifically in 26-28 GHz band and 6 Ghz band for nominal fees to Enterprises directly, instead of creating dependency on cellular networks of Mobile operators.**

India has vast presence of Industries across various sectors ranging from Manufacturing, Transportation, Mining, Land & Sea Ports, Automotive, Steel, Pharma, Education, Health, Agricultural, Food processing etc. where true potential of this futuristic technology can be exploited to drive “Make in India” initiative and eventually contributing to the national GDP.

However, if at all, any leasing of spectrum is allowed by TSPs to the Industry, then TRAI should also recommend a framework for the same including prescription of formula for ceiling price at which such spectrum can be leased out to the Industry/Other ISPs by the TSPs.

**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.**

## **Tata Communications Response:**

To meet the full potential of private networks, TSPs sub-leasing spectrum to enterprises might look like a viable option, however, sub-leasing of spectrum from a cellular operator should be considered very carefully, as additional measures are needed to ensure that enterprise networks do not overlap with any public network or interfere with other enterprise networks which can affect the QoS requirements for the specific use-cases being deployed by the Enterprise.

We suggest creation of a new central entity either in a co-operation between all established service providers or as a government entity (similar to WPC or within WPC), that is equipped with sufficient spectrum resources to satisfy enterprise requirements. The allocation of spectrum should follow careful assessment of how much spectrum enterprises need and should remain flexible to a degree that it can react to future increases in demand for spectrum.

Apart from above suggestion, in case spectrum sub-leasing to Enterprises happens only from individual cellular operators, it may bring lot of complexity in administering the lease policy. Some of these complexities are -

1. It may be difficult for industries to get spectrum from TSPs due to unavailability of network in their geographical area.
2. There could be a dilemma for the TSPs to balance between the public network roll-out at the location and the private network demands.
3. The price charged by the TSPs may work as a deterrent as TSPs can form a monopoly in specific regions based on their licenses.
4. Certainty of continuity of operations could become an issue if spectrum sub-leasing is not monitored and regulated keenly.

Due to the above complexities and ambiguities around the leasing process, spectrum leasing is not a viable option for Private 5G networks and should not be considered as a way for allocation of spectrum for private networks. TATA communications is of the view that TRAI should suggest a policy framework which gives private entities an option to obtain spectrum directly from the Government. or any central entity established by the Government for allocation of spectrum to Enterprises for private 5G network.

Hence, we recommend the following:

- a) Spectrum should be reserved in mmWave band and sub-6 Ghz band for private 5G networks to enable Industry 4.0 for Enterprises.
- b) Enterprises should be directly allocated the spectrum either by DoT or by creating a centralized Entity to manage the spectrum allocation to Enterprises under a light touch regulatory framework.

### **Q.70 In case spectrum leasing is permitted,**

**i. Whether the enterprise be permitted to take spectrum on lease from more than one TSPs?**

## **Tata Communications Response:**

Allowing enterprises to lease spectrum from different TSPs might unnecessarily complicate network deployment, add to their costs, and consequentially act as an additional barrier to network deployment. Some of the challenges with this proposal are –

- **Lack of Benefits for enterprises** – Benefits to Enterprises from leasing spectrum from multiple TSPs would be marginal, as most TSPs are expected to have sufficient spectrum assets in different bands to serve different connectivity needs, which enables them to lease the spectrum. Hence, there is no reason of non-availability of spectrum within one TSP which would require the Enterprise to sub-lease spectrum from multiple TSPs.
- **Higher cost and complexity** - Allowing to multisource spectrum assets would complicate network deployment and management unnecessarily. Further, cost of the infrastructure is expected to increase substantially due to the complexity of carrier aggregation.
- **Lack of accountability** – Multisource spectrum leasing can open a whole set of new issues to be solved, such as SLA governance, issue of ownership and resolution accountability.
- **Governance difficulties** – Central authority regulating sub-leasing activities will face difficulties in monitoring and governing multi-source sub-leasing due to its complex nature.

**Hence, we recommend that leasing of spectrum from TSP(s) by the Enterprises for their private 5G network is not a viable option. In fact, our suggestion of allocation of spectrum directly to Enterprises would be the most suitable solution wherein as per their requirement, Enterprises can approach DoT/Central agency for spectrum allocation.**

**ii. What mechanism may be prescribed to keep the Government informed about such spectrum leasing i.e., prior approval or prior intimation?**

**Tata Communications Response:**

As stated above, leasing of spectrum from TSPs for private 5G network should not be considered due to the reasons stated above in response to Q no 70 (i) and therefore, allocation of spectrum to Enterprises for private 5G networks should be done directly by the Government /Central Agency.

However, if at all, any sub-leasing of spectrum is allowed, then TRAI should implement a policy that requires TSPs to report any subleasing agreement between themselves and an enterprise customer to the government once it is in place. The government authority shall be given the right to audit such deployments and seek additional information, if need be. Government may have a separate guideline, similar to spectrum sharing and trading, on technical and management compliance. Both the parties should be mandated to comply those norms. If at all, any leasing of spectrum is allowed by TSPs to the Industry, then TRAI should also recommend a framework for the same including prescription of formula for ceiling price at which such spectrum can be leased out to the Industry/Other ISPs by the TSPs.

**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?**

**Tata Communications Response:**

While we are of the view that spectrum to the Enterprises should be allocated directly by the Government / Central Agency. However, if TSPs are allowed to sub-lease the spectrum to Enterprises then both the parties, the Enterprise, and the TSP, should provide a joint spectrum sub-leasing request/intimation at least 30 days prior to leasing the spectrum. This will give adequate time to government to analyse and put objection, if any. In case of no objection in those 30 days, the sub-leasing intimation/request should be considered as approved.

**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?**

**Tata Communications Response:**

As mentioned earlier, DoT has already prescribed spectrum sharing and trading guidelines. In line with the same, while considering light touch regulatory approach, we suggest that there should be clear guidelines for leasing the spectrum among TSPs or by TSPs to ISPs/other licensed Service Providers.

In case spectrum on lease is permitted to be given by TSPs, the guidelines for the same may include the following:

- **Pricing** – Pricing cap needs to be applied to private networks to ensure even small enterprises can sub-lease the spectrum.
- **Duration** - A duration of 10 years is advisable, as it provides all parties with necessary reliability for long-term planning, with possibility of cancelling in case of any business environment changes. Flexibility should be provided in the duration.
- **QoS** – It should be the responsibility and liberty of TSPs to set out their own terms & conditions for sub-leasing arrangements. In case of public networks, both the parties should adhere to the pre and post impact analysis on public network. Rights of public consumer shall be protected with QoS regulations.
- **Rollout obligation** - For effective utilization of spectrum, there must be rollout obligation of 12 months after leasing the spectrum at the enterprise premises.

**v. What other associated terms and conditions may be prescribed?**

**Tata Communications Response:**

No Comments

**vi. Any other suggestion relevant to leasing of spectrum may also be made in detail. (Kindly justify your response)**

**Tata Communications Response:**

Leasing of spectrum by TSPs to other licensed Service Providers including ISPs should be freely permitted.

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

**Tata Communications Response:**

Global developments are corroborating the fact that private cellular networks would be the founding stones for the industrial revolution. To realize the full potential of this 5G-based revolution, spectrum access should be available to large enterprises as well as SMEs to ensure mass adoption. Hence, spectrum allocation and governance framework need to be such that even a small enterprise should be able to avail and use it.

There are a few incentives which will ensure SMEs adopt for private networks –

- **Affordability** – Spectrum should be available either free of costs or alternatively at nominal (annual or one time) fees to ensure fair opportunity to SMEs.
- **Ease of governance** – Application process needs to be simple allowing easy use of spectrum across the geographies including rural areas.
- **Flexible period** – Spectrum allocation period is needed to use the spectrum according to need of SMEs.

To fulfil these criteria, we propose the following –

- **Light touch regulation for spectrum allocation** – In addition to the IMT band allocated to TSPs which can be used for private networks, a separate band should be earmarked for private network setup, dedicated spectrum should be reserved for enterprises, both large and small.
- **Multiple bands availability** - Dedicated spectrum need to be available across sub-6 GHz and mmWave bands. This will give freedom to the enterprise to choose the most viable option as per its application suitability.
- **Affordable** – Licenses need to be allocated at nominal (annual or one time) fees to ensure fair opportunity to all the sizes of enterprises and Industry verticals in India. Like Germany, India can set licensing fee based on various parameters like coverage area, frequency, bandwidth, rural or urban location, license duration etc.
- **Ease of governance** – Allocation process needs to be simple and transparent registration-based process allowing easy use of spectrum across the geographies including rural areas.
- **Reuse of Spectrum** - Since Spectrum is expected to be allocated for specific campus/ localised area, it is suggested to allocate same spectrum to multiple enterprises or Industry verticals at different locations to achieve optimal spectrum efficiency. The applications shall also take care of the z-axis to ensure that enterprises in multi-dwelling units can use a private network in their respective floors.
- **Flexible period** – Licensing period for private networks needs to be flexible where a companies can acquire license as per their needs. This is necessary to ensure need-based spectrum allocation and optimal spectrum utilization.

Direct allocation of spectrum at reasonable price would provide multiple benefits to the enterprise / industry verticals. Few of those benefits are -

- **Control:** It will provide complete control to them on their private network without any dependency on telco operator or others and full freedom to unleash the potential for Industry 4.0 transformation.
- **Innovation:** It will enable significant opportunity to innovate and create prudent use cases relevant to their industry and business.
- **Flexibility:** It will provide flexibility to create relevant network topology and architecture needed for their business within their campuses.

. Below table gives some details for specific countries who have either already planned the allocation or in the process of doing so for deployment of Private 5G Networks.

Sr. No.	Country	Spectrum Band	Total Bandwidth
1	UK	3.8 - 4.2GHz	400MHz
2	Germany	3.7 - 3.8GHz	100MHz
3	Finland	24.25 - 25.1GHz	850MHz

4	Brazil	27.5 - 27.9GHz	400MHz
5	Korea	28.9 - 29.5GHz	600MHz
6	Japan	4.6 - 4.9GHz	300MHz
		28.2-29.1 GHz	900MHz
7	Australia	24.7 - 25.1GHz	400MHz

As it can be seen from the table spectrum allocation for Private Networks are upwards of 400MHz specifically in Millimeter wave band and both in 26GHz and 28GHz bands. Apart from these countries indicated below, we understand that USA, Sweden, France, Netherland, Hongkong, etc. are also in the process of such spectrum allocation and relevant policy framework.

**In view of the above, we recommend the reservation of spectrum for private 5G networks and allocation of the same directly to the Enterprises.** Further, it is recommended that some part of spectrum in sub-6GHz band (at least 100MHz) and mm-wave band (minimum 400MHz) should be reserved for private 5G networks for potential Industrial applications and to be allocated administratively under registration mechanism to the Enterprises directly (to be used within their campus) at nominal fee for private, captive and local network deployments in 5G technology in line with global practices to enable Industry 4.0. Ideally the identified spectrum should be contiguous within the band to keep the costs of private network deployments minimal. Further, reuse of allocated spectrum should also be ensured as spectrum is expected to be allocated for specific campus/ localized area, thus it suggested to allocate same spectrum to multiple enterprises or Industry verticals at different locations to achieve optimal spectrum efficiency.

**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.**

**Tata Communications Response:**

There is a huge demand arising for private networks across the globe and impact of private networks on economy is going to be multi-fold in coming few years. Hence there must be proper allocation & reservation of spectrum for private use. Based on the global scenarios for spectrum availability for private networks, there can be multiple ways a regulatory body can allocate spectrum for a private network setup. These mechanisms are outlined below:

- Dedicated reserved spectrum for private enterprises
- Allowing TSPs to lease their spectrum to private enterprises
- Shared spectrum uses in some blocks with other incumbent services (FSS/P2P)

However, leasing through TSP has its own trade-offs which are well acknowledged and highlighted in consultation paper itself (Page no 103). The same are reproduced below:

- It may be difficult for industries to get spectrum from TSPs
- The price charged by the TSPs may work as a deterrent

- Certainty on continuity of operations could become an issue
- High order dependence on the TSPs

Few more issues in leasing spectrum through TSPs are highlighted herewith:

- TSPs network tends to be highly interfered due to improper network optimization, environmental (Ducting) interference which is not suitable for mission critical applications.
- Compromised quality of service for public network

As a general global trend among most of the developed countries, either a separate spectrum block has been reserved and dedicated for private network setup and/or allowed shared spectrum usage by private enterprises and incumbent in coexistence manner. **Tata Communications recommends TRAI to make flexible norms like USA's CBRS (Citizen Broadband Radio Service), where some spectrum band for private networks will be shared with incumbents based on the geographical location and some will be dedicated only for private network usage. This will ensure optimal utilization of this scarce resource.**

**Q.73 In case it is decided to earmark some quantum of spectrum for private captive networks, either on 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.**

**Tata Communications Response:**

We would like to suggest the following for consideration for earmarking certain spectrum to be used for private captive networks:

*Spectrum reservation in unsold bands:*

Big chunk of spectrum is lying unsold in different band categories. India may consider adopting policies similar to countries like UK where unused spectrum is allowed to be used by private networks. This will ensure maximum utilization of scarce resource like spectrum and create more value proposition for various entities.

*Spectrum reservation in IMT bands:*

**3400MHz - 3425MHz:** As mandated in the consultation paper that even though this band is earmarked for IMT, there must be 40-130Km of protection for some locations. Since private network is low power, limited emission, confined boundary network so this band easily comply the technical requirements which makes it suitable to private network allocation. 20MHz block size can be made reserved for private networks.

*Coexistence with incumbent services:*

**3670MHz – 4200MHz:** Coexistence of FSS & Private network. Although this band is IMT designated band but as per India scenario this is being used for FSS (Fixed Satellite Station) and coexistence with IMT may not be possible because of higher emission power of regular public cellular network. Private networks can coexist with FSS due to their low power emission and confined geographic operations. This makes a win-win situation for all. This band makes best choice for private networks due to the virtue of confined geographic operation; same spectrum

can be used by multiple private enterprises hence there should not be any scarcity of the spectrum. We recommend having minimum 100MHz of bandwidth for industrial allocation. Australia has made similar reservation in 3800-4200 band. Further, this band is globally harmonized and 3GPP endorsed band n77 and have significant device ecosystem support. This supports economy of scale as well.

**mmWave Bands: 24.25GHz - 27.5GHz & 27.5GHz-29.5GHz:** These mmWave bands specifically called out as 26GHz and 28GHz, are globally harmonized for 5G services. These bands have significant bandwidth of over 4GHz and can meet capacity requirements of country like India. Around 400Mhz to 800MHz can be easily carved out for the private networks without compromising the capacity and other requirements of mobile operators for deployment in public networks. Some parts of 27.5Ghz - 29.5GHz are also being used for FSS (Fixed Satellite Stations) for uplink services but at limited locations. With suitable measures of co-existence, significant part of this band could be freed up for 5G services specifically for private networks which are anyway confined to a specific campus or a location of an enterprise or industrial company.

Shared spectrum usage for private networks:

There could also be a possibility of using already allocated spectrum to MNOs / TSPs which has not been put to use in specific areas and with formal due diligence the same could be allocated for private networks in that geography on a fixed period basis with extremely light commercials. UK has implemented such a policy framework.

Provision for unlicensed bands:

**NR-U 5-6GHz - 5-6 GHz** band should be made liberal to use for both LTE as well NR for private network setups and should be made technology agnostic. Let enterprise decide the best fit technology for their operation. While using the unlicensed band inside an enterprise premises, the maximum power output may be increased to suit applications like open cast mines.

**b) What should be the eligibility conditions for assignment of such spectrum to private entities?**

**Tata Communications Response:**

Tata Communications recommends following eligibility criteria to ensure fair access and optimal usage of spectrum -

- The applicant should possess the required use-case knowledge and financial resources to build, install and operate a private network.
- The applicant should be the owner or lessee of the property on which the private network is to be installed.
- The applicant should be ready to attest/undertake that the spectrum will be used only within its campus, location, factory or premises and private network coverage will be confined within the same.
- The applicant should have no history of non-compliance with regulatory obligations, including fee-payments.
- The applicant should agree to licence terms and payment of fees.
- The applicant should comply the technical restrictions mandated by regulatory authorities.
- In addition to the above, the application should fulfil all the license conditions applicable/will be applicable for such Enterprise services.

**c) What should be the assignment methodology, tenure of assignment and its renewal, roll-out obligations?**

**Tata Communications Response:**

In order to enable enterprises and industry verticals to understand and follow the process, spectrum allocation needs to be hassle-free. DoT should create an easy, transparent, digital, and time bound process for spectrum allocation so that any industry wanting to deploy private network can apply easily and obtain the spectrum within a stipulated timeline. To achieve this goal, Tata Communications proposes following -

- 1. Administrative allocation:** There should be an administrative way of allocating the spectrum which should enable every size and shape of enterprise/ industry vertical to apply on a web-based platform with necessary required documentation.
- 2. Time-bound process:** Policy framework should include time bound approvals which can expedite the overall allotment process so that enterprises can take the spectrum. There should be simple process for application and allocation, and complete end to end process should conclude within 30 days with formal spectrum (frequency channel and other technical details) allocation to the end enterprise / industry vertical.
- 3. Timely rollout:** Enterprises requesting spectrum at a single location should deploy at least 50% of allotted spectrum within 12 months of allocation. Enterprises requesting access for multiple locations should deploy at least 10% network for allotted spectrum within 3-6 months. If an enterprise fails to meet the rollout obligation, spectrum should be considered as unused and should get released immediately to ensure optimal utilization.

**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 valuation of such spectrum?**

**Tata Communications Response:**

Spectrum allocation for private networks should be done through an administrative process and should be completely delinked from auction process or even market determined price. Since private networks would be captive networks within a geographical boundary, pricing of the spectrum should be based on duration, required bandwidth, and area to be covered. Globally different countries have devised their own formula to calculate the spectrum pricing, however base factors remain the same.

We recommend using Germany's model for price calculation which includes the one-time administrative charges and variable charges based on requirement of network specifications. This formula will ensure even smallest of the enterprise in a rural area can afford a spectrum access.

**Fee = One-time administrative charges +  $B * t * 5 * (6a1 + a2)$**

B - bandwidth in MHz

t - duration of allocation in years

a - area in km<sup>2</sup> (surface area covered by the assignment, broken down into a1 and a2)

a1 - settlement and traffic area

a2 – other rural areas

**e) What should be the block size and spectrum cap for different spectrum band(s) suggested in response to point (a) above.**

### **Tata Communications Response:**

To ensure fair opportunity for all enterprises and avoid hoarding of spectrum, Tata Communications proposes following block size -

- Sub-6 GHz: 10MHz block size (max 100MHz)
- mmWave: 50MHz block size (max 400 MHz)

**f) What should be the broad framework for the process of**

**(i) filing application(s) by enterprise at 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)**

### **Tata Communications Response:**

To ensure fair opportunity for all size of enterprises and avoid hoarding of spectrum, Tata Communications proposes following broad guidelines for consideration while framing the process/policy for spectrum allocation to Enterprises for captive use-

- Complete process should be digital and on web-based application where all companies can apply for the required spectrum, with options for single or multiple location application.
- Citizen Service Centers (CSC) in rural areas can be leveraged to enable rural business owners to get online spectrum access easily.
- There must be provision to pay online for allotted spectrum or renewal of spectrum. After successful application there must be time bound approvals.
- Policy framework should include and mandate the technical requirements which needs to be fulfilled by private network.

Further, 3GPP standards used in 5G has virtualized many components of the network in the latest release. This has enabled different types of enterprises like cloud service providers, industrial automation providers, and software service providers to deploy a 5G network in enterprises. These service providers have expertise in software and good domain knowledge to ensure enterprise use-case needs can be met with their services. Hence, it is essential to allow these services providers in addition to TSPs and System Integrators to collaborate with enterprises to deploy a private network. This will also help India meet its private network demand more quickly as there will be no dependency on the resources of major players.

**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.**

### **Tata Communications Response:**

5G private networks have capability to bring industrial revolution to enable industries to deploy plethora of industry-specific use cases. It is necessary to try out various 5G use cases in a controlled environment first even for early adopters to validate their profitability and feasibility. These control environments can be a test lab, customer experience centre or co-innovation centre

which can identify and validate different use cases and help customers gain better confidence of this new technology.

As these testbeds also need a spectrum access to deploy a private network, government should permit enterprises to set up a lab in their own premises using an allocation of private network spectrum license. These licenses should be temporary and free of charge in nature or at nominal charges which are limited to specific area. The licensing process needs to be time-bound with 10 days approval period to ensure quick execution. Enterprises should have obligation to deploy test labs within 3-6 months of allotment to achieve optimal spectrum utilization.

System integrators and other service providers shall also be permitted to apply for trial licenses in enterprise premises in case of any proof-of-concepts or use-case trials that the enterprise needs to conduct before the final private network spectrum application. This will help in the enterprises in quick starting their private network and do all the tests before they acquire a long-term spectrum.