

**ISPAI response to TRAI Consultation Paper on "Auction of Spectrum in frequency bands identified for IMT/5G"**

**PREAMBLE**

At the outset, we are thankful to TRAI for giving Internet Service Providers Association of India (ISPAI) an opportunity to submit its 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.

As you are aware, Spectrum is a lifeline for the Indian telecommunications industry. In the National Digital Communication Policy 2018 (NDCP-2018), Spectrum has been recognized as a key natural resource for public benefit to achieve India's socio-economic goals. We believe that advance technology like 5G based services will have major role in future roadmap for enterprise business segment. ISPAI believes that 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.

In this regard, we are hereby submitting our inputs and views for your kind consideration on the following issues related to Spectrum –

**1. Eligibility of ISPs to bid for 5G Spectrum:**

- ISPs were eligible to bid for BWA (4G) spectrum in the 2010 spectrum auction however thereafter ISPs have been removed from the eligibility list in the subsequent spectrum auctions. In the meeting it was assured that matter will be looked into and necessary action would be taken.
- With the emerging competition in the enterprise business segment due to forthcoming 5G rollout and ongoing technology advancements, it is desirable for ISPs should also have an opportunity to own licensed spectrum for their own 5G network rollout especially in the higher spectrum efficiency bands.
- 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. As we had pointed out during our meeting, 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.
- 5G spectrum should be allowed to be leased out to other licensed Service Providers by the winners of the spectrum auction which would ensure optimal utilization of the Spectrum, sharing upfront capex cost of the spectrum by number of Service Providers bidding as a Consortia and other such innovative measures leading to higher broadband proliferation.
- With the emerging competition in the Enterprise Segment due to 5G rollout it is desirable for ISPs to own licensed spectrum for their own 5G network rollout especially in the higher spectrum efficiency bands like 26 GHz band. This band is most suitable for Fixed Wireless Access (FWA) use cases of ISPs to meet the growing data requirements of fixed line broadband services. Further, 26GHz is a cost efficient alternative suitable for Fixed Wireless Access (FWA) use case of ISPs. Globally, 26 GHz Spectrum cost is 0.2% to 5% of the 3.5 GHz spectrum cost which is optimal for ISP business.
- The 26 GHz band is primarily meant for creating capacity in the network as, these being high frequencies, have relatively higher free space & rain losses and, therefore, limited coverage. Hence, full potential of 26 GHz band can be realised only if substantial portion of the 3250 MHz spectrum (24.25GHz to 27.50GHz) is auctioned. Internationally, most countries have

auctioned substantial portion of this band to enable networks deliver true gigabit broadband capacities.

## **2. Lower reserve price for 5G spectrum auction:**

- The reserve price for 5G spectrum in forthcoming auction is an important factor. It has been observed that, internationally, the cost of 26 GHz band has been at a 0.2% to 5% of the cost of the 3.5 GHz band.
- The mmWave frequencies merit substantially lower charges as these are primarily meant for creating capacity and not for coverage.
- India should plan for quick auction of the 26 GHz band following the globally established pricing norms else, we may miss the opportunity of realizing a much-cherished dream of 'digital India'.
- Thus, it is requested that reserve price for 26 GHz band spectrum should be in line with global standards.

## **3. Spectrum for Private 5G Network:**

- The concept of Non-Public Network is not new and with rise in "Internet of Things" and connected assets is 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.
- 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
  - o Massive reduction in setup of production lines and inventories resulting in significant annual saving for manufacturers
  - o 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
  - o 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.

## **4. Issue of replacement spectrum allocation to ISPs and availability of spectrum for ISPs in general:**

- ISP AI would like to highlight that there is no spectrum made available to ISPs while earlier ISPs held spectrum in 2.5 GHz band and 3.3 GHz band which helped them in proliferating internet services in the country.

- In the year 2009-10 when DoT got the 2.5 GHz band spectrum vacated from the ISPs for the BWA spectrum auction, DoT allocated replacement spectrum in 2.7 GHz band to the ISPs. At that time the replacement spectrum which could not be used because of absence of equipment eco-system in 2.7 GHz band while there was equipment available in 3.3 GHz band which was already allocated to some of these ISPs since 2006. Now that 3.3 GHz band which the ISPs were using on administrative allocation basis has also been got vacated by DoT as spectrum in that band being classified as 5G spectrum and is being put up for auction, there is no replacement spectrum being allocated to the ISPs who have vacated the spectrum in 3.3 GHz band to facilitate auction of 5G spectrum by the Government despite of the fact that there was an assurance given in the vacation notice of WPC DoT that replacement spectrum will be allocated and consistent past practice of DoT having allocated replacement spectrum in 2009. During the meeting we had requested that those ISPs who have surrendered 3.3 GHz Sr.

#### **5. Opening up of E&V Band for all Licensed Service Providers:**

- There is a dire need to have fibre like capacity, in the wireless backhaul for further expansion and increase in capacity of the networks which can only be provided by high-capacity waves like E and V bands. These will complement the fibre connectivity in the long term as extending fibre to all the places is practically not feasible due to various challenges in the ground.
- There are over a thousand ISPs in India who are providing connectivity in various parts of the country and their participation is imperative in the Digital India so that the telecom market does not become concentrated in the hands of a few bigger service providers. Therefore, it is important to open E and V bands for all categories of service providers, including ISPs, NLD and ILD providers to be used for Backhaul, High capacity P2P links in respect to each of their individual network architecture / layout. It is especially in the light of the fact that technological developments have steadily progressed towards data-based applications which requires participation of all types of service providers.

#### **6. Allow leasing of spectrum by TSPs/MNOs to ISPs :**

In order to ensure optimal use of Spectrum, TSPs/MNOs should be allowed to share / lease their spectrum to other TSPs/ISPs on mutually agreed commercial terms and conditions.

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

## Issue for Consultation

### Issues related to Quantum of Spectrum and Band Plan

**Q.1 Whether spectrum bands in the frequency range 526-617 MHz, should be put to auction in the forthcoming auction? Kindly justify your response.**

**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.**

### ISPAI Response -

ISPAI is of the view that spectrum bands in the frequency range 526-617 MHz should not be put to auction in the forthcoming auction.

As explained in its reference to TRAI, DoT has elaborated that use of 526-582 MHz for IMT/5G will be in coordination with MIB and same will be coordinated with minimum keep out distance from MIB transmitters. In this regard, in the past the ITU has conducted one study i.e. *'Sharing and compatibility studies between digital terrestrial television broadcasting and terrestrial mobile broadband applications, including IMT, in the frequency band 470-694/698 MHz'* which was published on 8<sup>th</sup> May 2018 by the ITU<sup>1</sup> wherein it was concluded that the required separation distances for interference of DTTB into IMT base-stations are significant for both co-channel and adjacent-channel scenarios. As the separation distances exceed radio horizons, it would be highly unlikely that spectrum sharing between DTTB and IMT is possible within a given geographic location. Therefore, similar study like the one conducted by the ITU, should be undertaken by DoT which can help to identify the level of interference so that the suitable keep out distance from the DTTB sources for India as clean spectrum can be used for IMT/5G services to ensure Quality of Service and till that study is conducted and necessary steps are not taken by the Government to ensure clean spectrum band in the frequency range of 526-617 MHz, it is humbly submitted that the said band in the frequency range of 526-617 MHz should not be made part of the forthcoming auction.

It is pertinent to mention that presently in these spectrum band i.e. frequency range 526-617 MHz are yet to be defined by 3GPP and in the absence of appropriate ecosystem, the services can become 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 clear eco-system gets developed around it. Therefore, as soon as the Government completes the exercise to conduct similar study on the lines of ITU which is explained above and thereafter, Government should optimally ensure assignment of spectrum to Prasar Bharti and other Govt. agencies and the remaining available spectrum (without any interference) should be considered for the auction to deploy IMT services.

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

**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.**

**ISPAI Response –**

ISPAI 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.

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

**ISPAI Response -**

ISPAI would like to submit that the Government had allocated 3.3 GHz band spectrum to some of the ISPs on administrative allocation basis but the same was also got vacated by DoT as spectrum in that band being classified as 5G spectrum and is being put up for auction. Despite, explicit assurance given by the DoT that the ISPs would be allocated replacement spectrum in 2.7 GHz band, no replacement spectrum has been allocated till date. There is a need to allocate replacement spectrum to the ISPs in 2.7 GHz band to those ISPs who have surrendered 3.3 GHz.

Be that as it may, with regard for 3300-3670 MHz frequency range, it is submitted that this frequency band is supported on 2 band plans viz “n77” & “n78” and there is already a proposal to extend n77 band to 4200 MHz which will take care of future requirements where some more spectrum in this band could be made available for IMT and therefore is most suitable.

**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**

**ISPAI Response –**

It is submitted that TDD based configuration should be adopted for 24.25 to 28.5 GHz frequency range since the two NR operating bands n257 and n258 covers the frequency range from 24.25 to 28.5 GHz and as 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.

**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.**

**ISPAI Response –**

Band plan n258 have been globally allocated for IMT applications and therefore Frequency band 24.25 – 27.5 GHz under 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.**

**ISPAI Response –**

We are of the view that some part of spectrum 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.

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.

Globally a number of countries have either already planned the allocation of spectrum or in the process of doing so for deployment of Private 5G Networks primarily for Private Networks which would 400MHz and above, specifically in Millimeter wave band and both in 26GHz and 28GHz bands.

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. Therefore, spectrum allocation of minimum 400MHz in millimeter wave band should be done directly to the Enterprises & Industry verticals in India for private, captive & local Network deployments in 5G Technology.

#### **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)**

**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.**

**ISP AI Response** - Spectrum should be auctioned at optimal reserve price as per Global standards so that more operators can participate and acquire spectrum.

**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.**

**ISP AI 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.**

**ISPAI Response – No Comments**

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

**ISPAI Response –**

TRAI vide its recommendations on Auction of Spectrum dated 1stAugust 2021 and response dated 8thJuly, 2021 to DoT's back reference, had recommended that the maximum quantum of spectrum an operator is allowed to acquire would be 100 MHz. Hence, we suggest that 100 MHz (TDD) be optimal block size and minimum quantity for bidding in 24.25-28.5 GHz. It is also submitted that some part of spectrum in this band should be reserved for private network use cases. Also, given the fact that 26 GHz mmWave band spectrum offers very low coverage which allows better frequency re-use in mmWave band which supports high data rate and increases network capacity.

**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 116 forthcoming auction? If yes, suggestions may be made in detail with justification.**

**ISPAI Response:**

With the emerging competition in the enterprise business segment due to forthcoming 5G rollout and ongoing technology advancements, it is desirable for ISPs should also have an opportunity to own licensed spectrum for their own 5G network rollout especially in the higher spectrum efficiency bands.

ISPs were eligible to bid for BWA (4G) spectrum in the 2010 spectrum auction however thereafter ISPs have been removed from the eligibility list in the subsequent spectrum auctions. With the emerging competition in the enterprise business segment due to forthcoming 5G rollout and ongoing technology advancements, it is desirable for ISPs should also have an opportunity to own licensed spectrum for their own 5G network rollout especially in the higher spectrum efficiency bands. 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.

5G spectrum should be allowed to be leased out to other licensed Service Providers by the winners of the spectrum auction which would ensure optimal utilization of the Spectrum, sharing upfront capex cost of the spectrum by number of Service Providers bidding as a Consortia and other such innovative measures leading to higher broadband proliferation.

Hence, the eligibility criteria of 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.**

**ISPAI Response –**

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, we reiterate that ISPs should be allowed to participate and bid in the forthcoming 5G spectrum auction along with TSPs.

As 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.

We are of the view that 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.**

**ISPAI Response -**

As both 4G and 5G uses OFDMA technique which defines inherent guard band within the system, thus, there is no need to prescribe any measure to mitigate possible interference issues in 3300-3670 MHz and 24.25-28.5 GHz TDD bands and therefore use of compatible frame structures is not always possible. Therefore, it is suggested that it should be left to TSPs to manage the interference by mutual coordination and provisioning of guard bands.

**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.**

**ISPAI Response -** In view of our response above, we have no further comments.

**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?**

**ISPAI Response -**



ISPAI believes that 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.

Therefore, it is essential for the Government to take all the necessary steps for spectrum management for ensuring transparency in allocation, availability and optimal utilization of the spectrum to all the licensees including both TSPs and ISPs.

We are of the view that Spectrum leasing would further expand the market by way of more Operators using the licensed spectrum which will strengthen the competition thereby benefitting both the end customer as well as Government. Thus, allowing spectrum leasing would be win-win for all stakeholders.

**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.**

**ISPAI 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.**

**ISPAI Response-**

No, there should not be any rollout obligations in 3300-3670 MHz bands. In this regard, it is submitted that 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.

**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.**

**ISPAI Response** – Same as Q.18

**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.**

**ISPAI Response –**

ISPAI submits that 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.**

**ISPAI Response-**

Overall spectrum cap in sub-1 GHz bands should be prescribed at 35% of the total combined available spectrum in sub-1 GHz to ensure adequate availability of spectrum to build coverage for 5G services for existing TSPs as well as allow the new entrants to opt for coverage 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.**

**ISPAI response –**

ISPAI recommend prescribing spectrum cap for the 3300-3670 MHz band of 100 MHz on the holding in 3300-3670 MHz bands.

Overall framework should be such which facilitates more operators to acquire spectrum in 5G bands which 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 we suggest 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. 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.**

**ISPAI response -** No Comment

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

**ISPAI response -** No Comment

**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.**

**ISPAI response -** No Comment

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

**ISPAI response -** No Comment

#### **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.**

**&**

**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.**

**ISPAI Response –**

In our view, 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.

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.**

**ISPAI Response –**

In our view 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).

**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.**

**ISPAI 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.**

**ISPAI Response –**

We are of the opinion that no surrender fee should be charged. This is because if a TSP is surrendering spectrum, the Government can very well put to auction such surrendered spectrum in a timely manner as the TSP 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.**

**ISPAI Response -**

In India, the prescribed reserve prices for various spectrum bands have always been at higher side 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.

It is our submission 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.

The approach of spectrum pricing, considering past spectrum price 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 then what would be determined considering above factors.

The Hon'ble Standing Committee on Information technology in the 21st Report 'India's Preparedness for 5G' presented to Lok Sabha on 8th 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.

&

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.

**ISPAI Response –**

It is our submission that these incentives should have no bearing on the valuation of spectrum and the reserve price of spectrum, which is the starting point of the auction. These reforms are incentives given to the telecom sector and any effect of these reforms in raising the reserve price of spectrum will have a negative bearing on the results of the auction.

**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.**

**ISPAI Response -**

No. The auction determined prices of March 2021 auction should not be taken as the value of spectrum in the respective band for the forthcoming auction in the individual LSA. In March 2021, only 37% of the total spectrum put to auction was sold and most of the spectrum was sold at the reserve price. One of the reasons for lower spectrum sale was high reserve 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.

We need to follow multiple valuation methods for ascertaining spectrum reserve price including predominant consideration of global norms indexed and adjusted to Indian parameters.

**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?**

**ISPAI Response –** Please see our Response to Q34 above.

**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.**

**ISPAI Response –** Please 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.**

**ISPAI Response –** Yes.

**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.**

**ISPAI Response -** Please refer our submissions made in the response to Q.34.

**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.**

**ISPAI 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. We suggest that TRAI may conduct the exercise to evaluate availability of equipment and devices to operate in this band. This 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.**

**ISPAI Response –**

No Comment

**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.**

**ISPAI Response –**

No Comment

**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. ISPAI Response –**

No Comment

**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)?**

**ISPAI Response –**

No Comment

**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.**

**ISPAI Response –**

No Comment

**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 122 spectrum band? Please support your response with detailed methodology.**

**ISPAI Response –**

No Comment

**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.**

**ISPAI 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.**

**ISPAI Response –**

Not applicable as we have not recommended auction of frequencies in the range 526- 698 MHz.

**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.**

**ISPAI Response –**

Not applicable as we have not recommended auction of frequencies in the range 526- 698 MHz.

**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.**

**ISPAI 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. International benchmarking can be considered. Further, correction for India specific condition may be applied in term of Per Capita income/PPP and ARPU difference to arrive at the value of this spectrum for auction.

**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.**

**ISPAI Response –**



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

ISPAI suggests using international benchmarking for determining relative value of the 26 GHz band in comparison with 3.5 GHz.

**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.**

**ISPAI 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.**

**ISPAI Response** –

The valuation method recommended by us as in our response to Q.53 will require normalization. The normalization method should take care of market variations like population, population density, size, per capita income, GDP, the development status (developed / under development), tariffs and license tenure etc.

**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.**

**ISPAI 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?**

**ISPAI Response** –No Comments

**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.**

**ISPAI Response** –

ISPAI 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**

**ISPAI Response –**

If at all, TRAI calculates the value of spectrum using different approach then ISPAI 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.**

**ISPAI Response –** Please 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?**

**ISPAI Response –**

ISPAI 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, it 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?**

**ISPAI 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.**

**ISPAI Response –**

No comments.

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

**ISPAI Response –**

In view of prevailing financial stress in the sector, ISPAI 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?**

**ISPAI 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/ISPs to spend more on network build and faster roll-out services.

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

**ISPAI Response –**

ISPAI 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 prepayment/deferred payment option, in order to ensure that the net present value of payment/ bid amount is protected? (Please support your suggestions for Q64 to Q67 with proper justifications.)**

**ISPAI Response –**

ISPAI 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.**

#### **ISPAI 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.

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.

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 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

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.

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 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.

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. ISPAI suggests 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.**

However, if 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. Leasing of spectrum therefore should be permitted not only to the Enterprises but also to all other licensed Service Providers including ISPs.

**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.**

**ISPAI 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.

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 may not be a viable option for Private 5G networks and should not be considered as a way for allocation of spectrum for private networks.

ISPAI 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 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?**

**ISPAI 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?**

**ISPAI 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?**

**ISPAI 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 126 obligations. If yes, what terms and conditions should be prescribed?**

**ISPAI 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?**

**ISPAI Response -** In case spectrum on lease is permitted to be given by TSPs then it should be applicable both for Enterprises as well as other licensed Service Providers including ISPs.

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

**ISPAI 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**

**ISPAI 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.**

**ISP AI 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.

**ISPAI 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.**

**ISPAI 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?**

**ISPAI Response -**

ISPAI 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?**

**ISPAI 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, ISPAI 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 127 localized captive use and what factors should be considered for arriving at valuation of such spectrum?**

**ISPAI 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.**

**ISPAI Response –**

To ensure fair opportunity for all enterprises and avoid hoarding of spectrum, ISPAI 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)**

**ISPAI Response –**

To ensure fair opportunity for all size of enterprises and avoid hoarding of spectrum, ISPAI 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.**

**ISPAI 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.

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