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Shri Syed Tausif Abbas
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Mahanagar Doorsanchar Bhawan,
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Subject: Cisco Response to TRAI Consultation Paper on Auction of Spectrum in frequency bands identified for IMT/5G

Dear Sir,

At the outset, we would like to thank TRAI for conducting this comprehensive consultation on the future of telecom service market in India. The paper presents some of the key perspectives that require a public deliberation that are of critical importance to the sector.

As a global partner to enterprises and governments, we have shared our perspective about Private captive networks. These include recommendations pertaining to access to spectrum, recommended bands of spectrum, regulatory requirements on assignment, pricing, et al.

It is our vision that India leverages its resources to its potential which will not only result in increased access, but be the stepping stone to a truly Digital India and shares its digital talent with the world. Our company's vision is to "Power an inclusive future for all" and we believe that this consultation will truly empower Indian citizens and industry for the future.

Please find enclosed our detailed submission for your kind reference. We look forward to hearing from you.

Best Regards

Harish Krishnan

Telecom Regulatory Authority of India
Cisco Systems, Inc.
Response to the Consultation Paper on
Auction of Spectrum in frequency bands identified for IMT/5G
Consultation Paper No. 8/2021

Cisco Systems, Inc. hereby responds to Consultation Paper No. 8/2021. Cisco congratulates the Telecom Regulatory Authority of India (TRAI) for launching this comprehensive evaluation of radio spectrum for IMT/5G technologies. TRAI joins leading regulators around the world in assessing the new spectrum requirements that will enable IMT technologies to support India in its broadband connectivity objectives. Cisco has seven offices in Gurgaon, Mumbai, Bangalore, Chennai, Pune, Kolkata and Hyderabad, and supports about 12,700 employees in India. The Cisco Global Development Center is in Bangalore, and it is Cisco's largest center outside of the US. Cisco Networking Academies have trained more than 900,000 students in IT skills for ICT employment. In India, Cisco serves enterprise, government and service provider customers throughout the country.

A significant portion of this consultation document focuses on issues of critical importance to telecommunications services providers (TSPs). Cisco offers core networking technologies and transport technologies to TSPs and we are deeply appreciative of TRAI's attention to the health and future growth requirements of the TSP market. Many parties and many trade organizations will be offering comment on those issues, and we are confident that TRAI will receive good guidance from industry on the issues raised. Where Cisco can add value to the consultation is on the questions relating to Private Cellular Networks. As a global vendor to enterprises and governments, we have witnessed a strong and growing interest on the part of our enterprise and governmental customers in 5G technologies – in some cases delivered "as a service" from TSPs but increasingly as an "owned and operated" model where an enterprise uses its own licensed spectrum to deploy 5G technology within the enterprise network. In our view, enterprise access to spectrum that can be exclusively licensed to the enterprise for its use is becoming increasingly important to future economic competitiveness as more and more countries with strong manufacturing sectors allocate and assign spectrum for private captive networks. Cisco therefore limits responses to Questions 68 – 74.

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.

ANSWER – The question, as written, assumes that TSPs will be meeting the demand for Private Cellular Networks. A better way to think about it is that TSPs will be meeting a portion of the need for Private Cellular Networks including 5G. In today's environment, TSPs provide mobile services to enterprises so that their employees can stay connected via smartphones or other devices, and TSPs may offer fixed wireless or satellite connectivity to meet specific use cases – e.g., fixed wireless backhaul when fiber is not available or economical, or satellite services to remote users who cannot be served by terrestrial IMT networks. With the advent of 5G, TSPs will be able to address more use cases than in the past. It is important to note that it is still "early days" for 5G and exactly what services can be offered by TSPs profitably cannot be answered with clarity even though the possibilities are numerous.[1] However, there is no regulatory bar that exists to prevent TSPs from designing and offering services that they believe will

[1] Examples of 5G offerings might be fixed wireless broadband to small businesses (in addition to residential) or a nationwide interoperable mobile data and voice service to public safety utilizing a network slice.

address users' needs. No change is required to the licensing/policy framework for enterprise offerings. TSPs can utilize spectrum licensed to them to offer services, including services targeted to enterprise verticals and including offerings based on 5G "network slicing." With the advent of 5G, Cisco fully expects TSPs will play a bigger role in meeting enterprise's IP networking needs than in the past, and where the enterprise is happy with receiving capabilities "as a service" from a TSP, government policy should continue to support those arrangements.

However, as will be discussed below, it is unrealistic to expect that enterprise networking requirements can be fully met with 5G technologies. Moreover, adopting policies that assume TSP-provided 5G services will fully address India's private sector wireless needs would be a mistake.

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.

ANSWER: Other jurisdictions that have spectrum leasing available have had little luck with a leasing option operating as a solution to private captive networks. This is generally because spectrum leasing is lightly regulated except as to radio frequency characteristics - matters such as duration of the lease, geographic footprint, spectrum coordination are generally unspecified as a matter of regulation and are left to business negotiation. This means that lease conditions rarely match enterprise needs. Moreover, TSPs are generally reluctant (and correctly so) to lease spectrum to others unless the TSP's use of the frequency band is non-existent. If the TSP is using the band while leasing some geographic use to others, it presents a complicated and difficult coordination scenario. Leasing may be an option only when spectrum is lying fallow and only if the enterprise is willing to lease a significantly large geographic footprint of spectrum. Globally, Cisco has not seen spectrum leasing as a solution to enterprise networking needs except in a few narrow and highly exceptional cases.[2] Even where it has been applied, the leases took years to negotiate. Relying on a lease option to fill the demand for private captive networks would be a poor policy choice and would not serve India's enterprise sector for their 5G technology needs.

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

ANSWER: Per the answer to Question 69, leasing is not a strong option for Private 5G, although it may have some utility if a TSP licensed spectrum band is completely unused. If a leasing policy is pursued, it should be in addition to a policy that awards licensed exclusive use spectrum to enterprises. In response to question (i), enterprises that are national in scope may have a need to lease spectrum from multiple TSPs which in our view underscores the difficulties and complexities enterprises would face in acquiring rights to radio spectrum using this method. Even if reasonable leases could be negotiated, enterprises will be left managing a patchwork of spectrum bands with multiple Lessors that will complicate their ability to take advantage of the spectrum in their business operations. Cisco believes that enterprises should be the licensee of the spectrum. The process of leasing will create unnecessary procedural and logistical delays that will take away from the merits of this initiative.

[2] In the United States, freight and passenger train operators have leased narrowband spectrum to operate Positive Train Control technologies to enable remote speed control of trains. The leasing process took years, and was only completed due to a government mandate to install Positive Train Control capability.

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

ANSWER: In jurisdictions where spectrum leasing is available, the regulator would require the Lessor to specify in the lease that whatever applicable radio frequency limits are established under the Lessor's license with TRAI must be honoured by the Lessee. Business terms (length of the lease, payment, geographic footprint, etc.) are left to business negotiation. No government approval of the lease is required. In Cisco's view, asking enterprises to lease radio spectrum from TSPs will not provide India's private sector with the access to spectrum that they will need to utilize 5G inside their networks.

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?

No response.

iv. Whether the spectrum leasing guidelines should prescribe duration of lease, charges for leasing, adherence of spectrum cap provisions, roll out obligations, compliance obligations. If yes, what terms and conditions should be prescribed?

ANSWER: A decision by the government to prescribe lease terms would make the spectrum leasing option even less friendly to enterprises than it otherwise would be. Each enterprise will have its own unique needs. Government is in a poor position to "negotiate" terms, because the government has little first-hand knowledge of what enterprises need or want. A "one-size-fits-all" approach is certain to doom the leasing option, which we have already stated is unlikely to be a meaningful approach to putting spectrum in the hands of enterprises.

v. What other associated terms and conditions may be prescribed?
No response.

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

No response.

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

ANSWER: Earmarking a spectrum band for localized private captive networks is the best policy approach, following the approaches adopted in Europe, Asia and elsewhere. This ensures that enterprises themselves can be licensed for spectrum use and that the licenses are tailored to their needs, including exclusive use in a geographic footprint that corresponds to their business premises and tailored for their industry use-cases. Moreover, a license provides certainty that enterprises have spectrum access for the duration of the license.
Cisco provides networking technologies and services to a wide range of enterprises in India, both domestic and multinational. As the leading provider of IP-based technology and services to enterprises globally, Cisco has seen for years our customers take advantage of wireless technologies in their operations, with a heavy emphasis on Wi-Fi. Today, our customers want to add 5G capabilities to their enterprise networks

for highly deterministic wireless capability that is unavailable in a Wi-Fi band shared with consumer devices. The interest level is quite strong and spans all vertical markets globally. As business operations become increasingly digitized, enterprises want both more and better Wi-Fi, but also 5G capabilities. These include businesses that have a single and large presence in a particular geography (e.g., Oil & Gas, manufacturing plants) but also those whose physical presence is scattered across the nation (e.g., warehouse operations).

Interest in 5G within the enterprise, using spectrum licensed to the enterprise, has resulted in a global market for 5G technology that is tailored to enterprise needs. Enterprises do not need to operate the complex mobile core networking solutions designed for top level TSPs in order to take advantage of 5G capabilities. Much simpler solutions, including cloud-based solutions, are available that will allow the enterprise control over its RF emissions and adherence to regulatory licensing requirements.

Globally, regulators have taken note that the needs of enterprises (clean and dedicated spectrum, security and privacy, deterministic and configurable QoS, permeability of the QoS across the network, coverage areas with varied capacity requirement) mean that many enterprises prefer to own and manage radio spectrum technologies themselves, operating on licensed exclusive use spectrum. As discussed in response to Q.68, there will be services that enterprises will purchase from TSPs. However, in our experience, few enterprises are willing to outsource networking operations that lie at the heart of their business operations. As they have done for decades, enterprises will continue use an "owned and operated" model, using spectrum available to them. Enterprises might also choose to have third parties manage their licensed wireless networks, which could include integrators and even TSPs. The core policy is that enterprises control who operates their on-premises wireless network and within the limits of the license, how the spectrum is applied in their business operations.

Beyond the practical business model concerns that the enterprise community has, from a regulatory policy perspective, providing flexible spectrum options to the enterprise will accelerate the adoption of 5G networks in the country thereby enabling a whole new eco-system of innovation. In 5G, innovation is not a function of the 5G network as a matter of TSP or vendor concern. Innovation using 5G in business processes is a much broader and expansive opportunity for India's private sector. Importantly, this broader innovation opportunity can help advance India's goals to increase productive capacity and continue its path to be a leader in global trade.

TRAI correctly refers to the enterprise spectrum allocations in countries such as Japan, Germany, Brazil, Taiwan, United Kingdom etc. where shared or dedicated spectrum has been allocated in limited quantity and can be used by enterprises on their premises, mostly in the n77, n78 and n79 bands of the sub 6 GHz range, and n257 and n258 in the mmWave range for 5G. A similar approach can be taken by the regulator in India to make available spectrum earmarked for private 5G use that is service and technology neutral with some basic tenets of accountability.

There have been arguments that localized private captive spectrum somehow "wastes" spectrum in that not all spectrum will be utilized. This observation is odd, in that TSP spectrum also underutilizes the spectrum licensed – both as a function of time and geography. In any event, Cisco sees very strong demand among enterprises for 5G technology, both as a national matter but also for companies doing business internationally.

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.

ANSWER: The best policy approach is to allocate a specific band (e.g., 100 MHz) for localized private captive networks, requiring those networks to synchronize as necessary if they are adjacent geographically and spectrally. Next, allow the enterprise to decide whether to operate the network itself as part of its IT network, to utilize a third party to manage the network (or some combination of the two), or to outsource the management of the private captive network to a TSP to operate on the enterprises' behalf. That maximizes the choices for enterprises and will best ensure take up of the spectrum.

Globally, the bands of n77, n78 and n79 in the Sub 6 and n257, n258 are the preferred bands dedicated for private cellular (5G) networks. It is our suggestion that India adopt similar strategies in order to ensure easy access to eco-system partners, keep costs low and stay ahead in the technology evolution. A channel bandwidth of 100MHz in <6GHz can be envisaged for initial assignment with an ability to review the same in subsequent phases. Such spectrum can be contained within limited areas by limiting the maximum permissible transmit power and hence harmoniously co-exist with spectrum re-use for other enterprise networks.

Millimetre wave bands (n257 and n258) due to their sheer nature of propagation losses, might some day be useful for enterprise networking, but for the moment should be considered for backhaul or potentially broadband access offered by a TSP. This is due not just to the relatively smaller size of the radio equipment market, but also because practical applications of millimetre wave are much less understood relative to mid-band spectrum. That said, in the event this is being evaluated for enterprises, a channel bandwidth of 400MHz is suggested.

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.

ANSWER: The best spectrum for private captive networks is spectrum for which equipment exists. TRAI's global analysis provides an excellent overview of the bands that are in use around the world, including a heavy focus on spectrum in the 3-4 GHz range. Please also refer to our response to Q. 72.

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

ANSWER: Registered business entities that have a real property interest defined by ownership of buildings and/or land, or a tenancy in buildings/land should be a requirement for a private 5G license. From a regulatory perspective, it is important that the entities receiving licenses have the capability to understand regulatory requirements in order to stay within the boundaries of the license. A license application itself implies the existence of an IT manager capable of administering the license, and a real property interest ensures that the business operation is substantial enough to stand behind the license. Very small businesses are probably better served by a TSP offer, such as connectivity for retail operations. License applicants should also identify a responsible party, and provide contact information, to enable future coordination

among licensees and to manage communications and inquiries from TRAI. This responsible party should affirm his or her ability to alter RF emissions at TRAI's request and in response to synchronization requests.

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

ANSWER: The assignment methodology should be light licensing to allow easy access to spectrum for those enterprises who want to use it. A simple online process would be ideal. License terms (length of license period) should be no different than for TSPs, but we suggest an annual "check-in" or renewal to make certain that the business continues to exist and continues to use the spectrum. There should be no roll-out obligation. The annual check in process should require the entity to affirm that it remains in business and that the spectrum is (or is not) in use at each of the locations licensed.

Here are a few potential criteria that the regulator may want to consider as part of the licensing and assignment process:

- The enterprise shall not offer commercial for-profit services on the awarded spectrum.
- A stipulated time duration for the re-evaluation of the license award with an expectation of renewal if in good standing.
- A requirement to synchronize network operations as needed when an adjacent network is established.
- Whether transmitters will be located only indoors, outdoors, or both, and how to amend the license should deployment change over time.
- A technical description of steps the licensee will take to ensure it meets e.i.r.p. boundary conditions at the edge of its real property interest.

d) What should be the pricing mechanism for assignment of spectrum in the band(s) suggested for private entities for localized captive use and what factors should be considered for arriving at valuation of such spectrum?

ANSWER: As articulated in Q68 and Q72 the licensing framework should be area/location specific. The spectrum should be assigned administratively and should be licensed for use at a rate that reflects the administrative costs associated with licensing the same. Care should be taken to ensure that any fees associated with the license are not onerous. This will maximize uptake, and hence the value to Indian productivity and economy.

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

ANSWER: 100MHz in the Sub 6GHz band and 400MHz in the mmW band.

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

ANSWER: Cisco suggests that the process of filing an application, including payment of fees, should be online, and that the enterprise be required to pre-register with TRAI before submitting its application so that there is a permanent record for the entity. The goal should be to make the license application process as simple as possible. Once an application has been filed and payment made, the assignment of frequencies should be routine provided the application is complete. When a license is issued, the face of the license should state that licensees are obligated to coordinate with adjacent licensees and resolve interference concerns, including synchronization of wireless operations, and that failure to do so will result in revocation of the license. Licensees should also be required to maintain a current "responsible party" in TRAI's license records.

Cisco does not propose TRAI monitor for spectrum utilization. Doing so would be an enormous task. Licensees should be required as part of an annual check-in process to file a statement affirming that the spectrum licensed is or is not in use for each location where licensed. This will enable TRAI to evaluate how its policy is being utilized. It is important to note that a business occupying radio spectrum on its physical premises (and using a band earmarked for enterprise) is not foreclosing the ability of a different entity to utilize spectrum on its premises.

g) Any other suggestion on the related issues may also be made with details.

No response.

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.

5G provides a unique opportunity for India to showcase its technology talent and also export the same to the world. The most important contribution government can make is to provide spectrum for enterprises. Enterprises are not novices at wireless networking. They can be expected to innovate their business processes using spectrum inputs, and are probably the best source of innovation across the economy.

In addition, 5G innovation centres can be formulated in alliance with the several IITs & also at prestigious technology-driven centres such as IISc. Each of these incubation centres could need to be made responsible for innovation in the various fields of Agriculture, Medicine, Manufacturing, Infrastructure, Power and other verticals that will benefit from such investment of R&D. Such programs can also leverage investments from large corporates and is commonplace in other parts of the world. The investments will need to be SMART (Specific, Measurable, Achievable, Relevant and Time bound).

Government Smart cities programs and NIC also plays a vital role in this journey to evaluate the relevance of 5G in connecting the country's rural populations and bridging the digital divide.