From: "ravi ramachandran" <ravi.ramachandran@motorolasolutions.com>
To: "Syed Tausif Abbas" <advmn@trai.gov.in>
Sent: Sunday, January 9, 2022 8:49:59 AM
Subject: India Spectrum Consultation on Auction in frequency bands identified for IMT/5G- Incl Spectrum for Private Cellular Networks

For the kind attn of:
Shri Syed Tausif Abbas
Advisor (Networks, Spectrum and Licensing)
TRAI

Dear Sir,

Please find enclosed the Motorola Solutions response to TRAI Consultation Paper on " Auction of spectrum in frequencies identified for International Mobile Telecommunications (IMT)/5G".

We also thank you for considering our response with regard to this subject matter and we are available to address any kind of queries or clarifications that you may require.

We kindly request you to acknowledge the receipt of this mail.

Thanks and Regards

Ravi Ramachandran
Country Head India Business

MOTOROLA SOLUTIONS

TRAI Consultation Paper No. 8/2021

Motorola Solutions Inc. (MSI) thanks the TRAI for the opportunity to comment on its public consultation document No. 8/2021 Consultation Paper on Auction of Spectrum in frequency bands identified for IMT/5G.

Motorola Solutions Inc (MSI) is the leading global provider of mission critical communication solutions and services. Our platforms in communications, command-center software, video security and analytics, and managed and support services, serve more than 100,000 customers across more than 100 countries.

Please find our comments to selected questions.

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.

MSI Answer:

Mobile cellular network technology is generally deployed and operated by licensed public mobile operators. Private networks are a big change to this construct and questions remain about who should design, deploy, operate, and own them. In general, there are two basic forms of private 4G/5G networks (known as non-public networks in 3GPP terminology). At present both options are being adopted in the global market:

- Private networks, which are independent from a licensed public operator or a wide-area network license where integration with the public network is possible but optional.
- Private networks deployed in conjunction with a public network where various levels of integration are possible.

To date, the regulatory practice with respect to radio spectrum identified for IMT is to designate such spectrum exclusively for public networks. However, we believe that 5G technologies and spectrum bands should be equally available to meet the needs of dedicated/captive private broadband LTE/5G networks. It is worth noting that the concept of private LTE has been well accepted and is being supported in many countries.

Network slicing technology using operator networks can meet some of the need for industrial private broadband LTE/5G networks. However, the TRAI should modify its existing licensing framework to address the need for small, localized, independent, private broadband networks for specialized users including critical infrastructure, industrial, utilities and enterprises.

In terms of physical deployment, the term “private network” refers to networks with radio, core, and transmission resources dedicated to the enterprise and crucially controlled by these

enterprises. This generally means that the network equipment will be deployed on the customer's premises, regardless who will manage its operation.

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.

MSI Answer:

While Motorola Solutions generally supports flexible licensing policies, it has been our experience that spectrum leasing has not been an effective tool for promoting spectrum access for private networks. To better address the need, MSI supports the introduction of private, captive 4G/5G networks within the IMT identified frequency ranges for local area licensing for industries, enterprises, R&D institutions, universities, and others.

Private captive networks are designed and deployed by enterprises to optimize or enable business processes. Broadly, there are three drivers to deploy a private mobile network:

- Guarantee optimal coverage: Often in locations with harsh radio frequency (RF) or operating conditions or where public network coverage is limited/nonexistent (e.g., remote areas).
- Gain network control: Enable technical configurations and functionalities that are not supported in a public network. Security and data privacy are also important. The ability to retain sensitive operational data on-premises is crucial to high tech industrial companies.
- Meet a performance profile: Specifically, a profile that will support customized applications and functionalities.

5G technology is expected to facilitate the digital economy and support the next generation of enterprise and industrial users to spur the success of "Industry 4.0." This next generation of broadband wireless technology will be key to secure significant growth in manufacturing, and services industries at competitive levels. To support this new technology, new rules are essential. 5G calls for a new regulatory environment where innovation can thrive. Given the Government's focus on enabling innovation, industrial development, trade and enterprise, we believe that the accelerated adoption of 5G will be based on industries and enterprises. Technology providers are tailoring their 5G solutions to meet these new and growing needs of industrial and other verticals such as oil & gas, mining, utilities.

In order to support these solutions, we recommend that TRAI encourage third-party industrial and enterprise users to build their own captive and dedicated 5G networks. This ensures the provision of diverse 5G services, instead of limiting usage to existing mobile operators that may not emphasize specialized services. As a result of the evolution towards advanced capabilities such as uRLLC and mMTC in 5G, enterprises will have the option to have full control of reliable, secure and seamless high speed data and high-fidelity voice communications across their entire operation over private broadband.

Private LTE/5G Spectrum Related Questions

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

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.

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.

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

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

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

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

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

(i) filing application(s) by 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.

Q.70 In case spectrum leasing is permitted,

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

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

iii. What timeline should be prescribed (in number of days) before the tentative date of leasing for submitting a joint request by the TSPs along with the enterprise, for approval/intimation from/to the Government?

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

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

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

MSI Answer:

The WRC-19 enabled gigahertz of new frequencies in mm wave bands for IMT-2020 (5G) services. We believe that new regulations encouraging the use of mobile technology across

vertical market segments is necessary to stir innovation and digital transformation across industries. To accelerate the process, we encourage a licensing framework that enables enterprises to access mobile spectrum, and a licensing framework to enable local licensing of mobile spectrum vs. national allotments only. We encourage TRAI to allocate part of the spectrum bands, both in mid bands as well as mm wave bands for local area licensing in small geographic areas through local area auction rules.

The table below presents an overview of the different spectrum models for Private LTE/5G networks either adopted or being considered in multiple markets.

Spectrum Type	Description
Licensed Spectrum Owned by Operators	• Continuation of the classic spectrum licensing model • Protected use makes this spectrum attractive to users with reliability concerns • Mechanisms to lease/share spectrum for private networks are in development
Dedicated Enterprise Spectrum	• Model being pursued in multiple markets • E.g., Germany to allocate 100 MHz (3.7-3.8 GHz) to industrial users • Attractive where available; however, some risk of being a niche ecosystem
Unlicensed Spectrum (w/ Asynchronous Sharing)	• 5 GHz is the lead band; U.S. to open 6 GHz, with Europe to follow • Listen-before-talk regulations already embedded in 5 GHz • Most useful for private 5G networks that do not require URLLC
Unlicensed Spectrum w/ Synchronized Sharing	• In new unlicensed allocations (e.g., 6 GHz), there is an opportunity to introduce new sharing mechanisms • Over-the-air synchronization is a lightweight way to improve sharing • Enables more reliable performance in co-sited deployments; makes unlicensed spectrum suitable for URLLC applications

Source: Heavy Reading

In addition, we encourage the adoption of rules to allow access to shared /unlicensed spectrum on a technology neutral basis, including the unlicensed use of private networks in the 6 GHz and V band where local area networks can be more efficient. We propose either a spectrum split between carriers and certain verticals in key bands where 5G is expected to be deployed similar to that adopted by Brazil, Germany and Sweden.

MSI proposes that parts of the segment 3700 – 4200 MHz be made available for the introduction of shared arrangements for small area 4G/5G captive licenses under local/private broadband regulations rules with following power limits:

- Medium Power Shared Access licence in Rural Areas with maximum base station power (EIRP) per sector 42 dBm / carrier for carriers ≤20 MHz; or 36 dBm/5 MHz for carriers > 20 MHz.
    - For Mobile/ Nomadic terminal stations: 28 dBm TRP (28 dBm includes a 2 dB tolerance)
    - Fixed or installed terminal stations: 28 dBm TRP and 35 dBm/5 MHz EIRP (28 dBm includes a 2 dB tolerance)

- Low power shared Access licence based on maximum base station power (EIRP) of 24 dBm / carrier for carriers ≤ 20 MHz; or 18 dBm / 5 MHz for carriers > 20 MHz and terminal power of mobile/ nomadic & fixed terminals/ of TRP 28 dBm +/− 2 dB EIRP.

The antenna system height is limited to 10 metres above ground for low power.

- 3.8-4.2 GHz base station out of band emission limits

Frequency	Maximum mean EIRP density
3795 MHz-3800 MHz 4200 MHz-4205 MHz	(Pmax - 40) dBm / 5 MHz EIRP per antenna
3760 MHz-3795 MHz 4205 MHz-4240 MHz	(Pmax - 43) dBm / 5 MHz EIRP per antenna
Below 3760 MHz Above 4240 MHz	-2 dBm / 5 MHz EIRP per antenna

The band 3.7-3.8 GHz is already being considered as part or extension to the 3.4-3.7 GHz in many countries. In Europe, an EC Implementation Decision[2] harmonizes the radio spectrum in the 3.4-3.8 GHz (or 3.6 GHz) band for the future mobile broadband (5G) and sets a deadline for releasing spectrum. A number of countries have decided to keep part or all of the 3.7-3.8 GHz restricted to commercial carriers but available for shared or local licensing for enterprise customers and private broadband applications.

The band 3.4-3.8 GHz is already supported and commercialized by two non overlapping 3GPP LTE bands and is also supported by two 5G NR bands as per the table below.

NR / LTE operating band	**Uplink (UL)** ***operating band***	**Downlink (DL)** ***operating band***	**Duplex Mode**
	BS receive / UE transmit	**BS transmit / UE receive**	
	$F_{UL\_low} - F_{UL\_high}$	$F_{DL\_low} - F_{DL\_high}$	
n77	3300 MHz – 4200 MHz	3300 MHz – 4200 MHz	TDD
n78	3300 MHz – 3800 MHz	3300 MHz – 3800 MHz	TDD
42	3400 MHz - 3600 MHz	3400 MHz - 3600 MHz	TDD
43	3600 MHz - 3800 MHz	3600 MHz - 3800 MHz	TDD

MSI believes that it is preferred to enable access to administrative licensing in the lower 100MHz of the band (in particular 3.7 – 3.8 GHz) instead of awarding licenses on larger

metro/regional area licensing that is typically suitable only for commercial carriers. The German regulator BnetzA, as an example, decided[3] (November 21, 2019) to make this same frequency band available only for private local & regional broadband applications after it awarded commercial carriers 300MHz in the same band (3.4-3.7 GHz) auctioned for wide area licensing. BnetzA has recently reported[4] 67 private broadband licenses granted in 10 months in the 3.7- 3.8 GHz band. Sweden regulator PTS[5] announced that the 3720-3800 MHz be reserved for a new assignment by local license without selection procedure 2020/21 to support enterprise broadband applications.

From use cases presented at the recent 6th Asia Pacific Spectrum Management conference, we can see that vertical sectors such as healthcare, construction, universities, airports and seaports can benefit from using 5G private networks. We note that in Australia, the locations of ports and airports (e.g. Sydney, Melbourne) are not necessarily in the remote areas. It should not be that the digitalisations of Australia's major airports and ports, as an example, are denied the use of private 5G networks due to non-availability of spectrum in this frequency band within metro areas.

Universities and R&D institutions in India can benefit from access to 5G spectrum for campus operations and for R&D projects in this frequency band and some of the prominent universities are within or near metropolitan areas, not in remote areas.

Given the limited supply of mid-band spectrum for 5G services, the use of automated spectrum access systems for shared use of radio spectrum will likely become the norm in the future as exemplified below:

- In April of this year, in the USA, the FCC authorised[6] the use of the 6 GHz band (5925-7125 MHz) for two types of unlicensed operations - standard-power and indoor low-power operations. FCC authorised standard-power access points using an automated frequency coordination system (AFC) to protect the fixed service (microwave links). This makes the 6 GHz band as the third frequency band in the USA in which FCC authorised the use of automated spectrum access systems to enable spectrum sharing.

- The European Electronic Communications Committee (ECC) Strategic Plan 2020-2025[7] will be promoting spectrum sharing through its technical and regulatory work and balancing the interests of spectrum users including verticals.

- South Korea's Ministry of Science and Technology Information and Communication Announcement No. 2020-384 issued under administrative notice of partial amendment to the technical standards of radio equipment for radio stations that can be operated without licenses, In order to realize the benefits of high-speed data and accelerate the spread of 5G convergence services across the industry, 5G-class performance unlicensed technologies (Wi-Fi 6E, 5G NR-U, etc.) can be used in the 6GHz band[8]

TRAI can lay the groundwork in preparation for the implementation of a future automated Spectrum access system by avoiding the adoption of traditional, exclusive, spectrum Licences.

Traditionally spectrum licences are required and utilised to deploy commercial mobile broadband networks with extensive base station infrastructure serving large geographic areas. These are required to manage spectrum use and coordinate coexistence of adjacent networks. In contrast, with shared arrangements for apparatus licensed LA WBB, the

density of base stations will be relatively lower than those of commercial WBB networks, leading to a lower unwanted emission from 5G base stations into the adjacent band.

1 https://www.ofcom.org.uk/manage-your-licence/radiocommunication-licences/shared-access

2 https://ec.europa.eu/digital-single-market/en/news/commission-decides-harmonise-radio-spectrum-future-5g

3 http://www.bundesnetzagentur.de/lokalesbreitband

4 https://enterpriseiotinsights.com/20200827/channels/news/67-local-licences-in-10-months-5g-in-the-home-of-industry-40

5 https://pts.se/contentassets/430b8fbfa510476d8d70bc2c7ff73da3/spectrum-orientation-plan-200505.pdf

6 https://www.federalregister.gov/documents/2020/05/26/2020-11236/unlicensed-use-of-the-6-ghz-band