

Global mobile Suppliers Association

Response for TRAI Consultation Paper on Auction of
Spectrum in frequency bands identified for IMT/5G

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GSA Introduction

GSA (the Global mobile Suppliers Association) is a not-for-profit industry organisation representing companies across the worldwide mobile ecosystem who are engaged in the supply of infrastructure, semiconductors, test equipment, devices, applications and mobile support services.

We actively promote the 3GPP technology road-map – 3G; 4G; 5G – and we are a single source of information for industry reports and market intelligence. Our Members drive the GSA agenda and define the communications and development strategy for the Association.



Our Members post a broad range of industry reports, white papers and presentations that create and expand mobile industry discussions, helping numerous industries and companies better understand how mobile technologies, products and services are contributing to the continued expansion of the mobile industry.

The GSA Spectrum Group develops strategies and plans, and contributes studies and technical analysis to international, regional and individual country policymakers and regulators to facilitate the timely availability of spectrum for use by mobile network operators.

The Spectrum Group is the supplier focus group for technical and regulatory matters of radio spectrum pertaining to the successful evolution of International Mobile Telecommunication (IMT) and associated radiocommunication systems and comprises a

team made up of spectrum and regulatory affairs specialists from our Executive Member and Member companies.

The Spectrum Group is participating in the study work leading up the World Radiocommunication Conference meeting in 2019, (WRC-19).

In addition, our spectrum reports regularly provide updates on global spectrum harmonisation efforts and developments including auctions, assignments, allocations, and re-farming activities.

8 Major Industry Executives are part of the GSA executive board -



A. 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?

GSA Response:

526-617 MHz range is of high importance to IMT services. Region-3 has already identified this for IMT, and Region-1 is considering this for IMT services. 3GPP has also undertaken various studies for suitability of this band for 5G services as part of ongoing Rel.17 and Rel.18 work. This range of spectrum must remain available for IMT services introduction as soon as specification and IMT identification work is completed.

Q.2 If your answer to Q1 above is in affirmative, which band plans and duplexing configuration should be adopted in India?

GSA Response:

We recommend keeping this range available for all possible 3GPP band plan options before deployments are undertaken.

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.

GSA Response:

We recommend keeping this range available for all possible 3GPP band plan options before deployments are undertaken.

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?

GSA Response:

In India, availability of quantum of spectrum in 700MHz is limited due to assignments to government agencies in 700 MHz band hence 600MHz is critical to complement low band 5G requirements. Therefore, GSA support and encourage auction to be undertaken for this band in current proposed auction.

There is an existing 3GPP band plan n71 ranging 617-698MHz (2x35 MHz) [1]. 3GPP has also completed its study on two candidate band options for extended 600MHz in Region 3 in 3GPP TR 38.860 based on AWG request as part of efforts to have a harmonized APT600

MHz band to further expand the available spectrum in this band to 2x40 MHz (612-703 MHz Option B1, 617-703 MHz Option B2).

In view of this GSA suggests TRAI to recommend auctioning of paired blocks of 5MHz in the spectrum range 612-703 MHz.

GSA will work towards supporting in development of ecosystem covering applicable band plan for this spectrum range 612-703 MHz (Option B1, Option B2).

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

GSA Response:

3GPP has multiple bands covering the frequency range between 3300-3670 MHz. Given all the band options, n78 is most suitable as it covers the entire identified band.

As per latest GSA reports [2] over 800 devices already support band n78 which has highest share of all 5G spectrum bands from ecosystem development perspective. Majority of the 3.5GHz auctions undertaken world-wide consider all or portion of frequencies covered through n78 spectrum band.

3GPP has equally defined n77 which covers 3300 – 4200 MHz; when more spectrum becomes available in this range, we recommend TRAI to consider identifying the entire n77 band.

Q.6 Do you agree that TDD based configuration should be adopted for 24.25 to 28.5 GHz frequency range?

GSA Response:

3GPP has defined the NR spectrum bands for frequencies 24.25 – 28.5 GHz for TDD mode operations only [3]. The bands identified in the frequency range 24.25 to 28.5GHz have a TDD duplex mode configuration as depicted in the table below:

NR operating band	Uplink (UL) and Downlink (DL) operating band BS transmit/receive UE transmit/receive FUL,low – FUL,high FDL,low – FDL,high	Duplex mode
n257 (28 GHz)	26500 MHz – 29500 MHz	TDD

n258 (26 GHz)	24250 MHz – 27500 MHz	TDD
n261	27500 MHz – 28350 MHz	TDD

The bands n257, n258 and n261 covers this spectrum range. Moreover, there is no study or developments happening in developing FDD mode in mmWave at 3GPP.

GSA recommends using TDD based configurations for 24.25 to 28.5 GHz frequency range.

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?

GSA Response:

Currently, 3GPP supports carrier bandwidths of 50MHz, 100MHz, 200MHz and 400MHz in both n257 and n258 bands.

NR band / SCS / BS channel bandwidth					
NR Band	SCS kHz	50 MHz	100 MHz	200 MHz	400 MHz
n257	60	Yes	Yes	Yes	
	120	Yes	Yes	Yes	Yes
n258	60	Yes	Yes	Yes	
	120	Yes	Yes	Yes	Yes
n260	60	Yes	Yes	Yes	
	120	Yes	Yes	Yes	Yes
n261	60	Yes	Yes	Yes	
	120	Yes	Yes	Yes	Yes

GSA recommends that multiple blocks (unit) of 50 MHz be assigned contiguously such that it does not overlap between n257 and n258 ranges (i.e., 27.46 – 28.51GHz). An operator may combine multiple blocks to form one or multiple contiguous component carriers.

Q.8 Whether entire available spectrum referred by DoT in each band should be put to auction in the forthcoming auction?**GSA Response:**

GSA recommends that, whenever possible, the maximum spectrum quantity should be made available for deployment of 5G in each frequency range: 600 MHz, 3300 – 3670 MHz and 24.25 – 28.5 GHz bands. For the successful proliferation of 5G use-cases, the combination of all types of spectrum is desirable: low (e.g. 600 MHz, 700 MHz), mid (e.g. 3.3-3.67 GHz) and high bands (e.g. 26/28 GHz) [4].

Q.9 Channel plan of 800 MHz band to revised from 1.25 to 5 MHz?**GSA Response:**

-GSA recommends reconsideration of existing rules for the 800 MHz spectrum band and the removal of the provision on guard band. Globally, the 800 MHz band is being used to deploy LTE services mostly under technology neutral conditions. Sub-GHz spectrum is valuable for mobile network coverage and should be allocated efficiently to allow for flexibility in use under technology agnostic conditions.

-GSA recommends block size of 2x5 MHz (UL/DL) in the 800MHz band to be harmonized with 700MHz and 600MHz plans.

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?**GSA Response:**

We recommend TRAI to consider a harmonised approach for the sub-GHz bands, with the same FDD spectrum blocks of 2x5 MHz (UL/DL) for all three low bands: 600 MHz, 700 MHz and 800 MHz.

Q.12 What should be optimal block size and minimum quantity for bidding in 3300-3670 MHz band?**GSA Response:**

We recommend the block size to be of 10MHz.

GSA recommends operators to have a minimum of 100 MHz contiguous blocks per MNO network by 2021, in C-band for optimal 5G experience.

Q.13 What should be optimal block size and minimum quantity for bidding in 24.25-28.5 GHz?**GSA Response:**

5G NR in mmWave spectrum was envisaged to address extreme mobile broadband use cases. Operators globally have been interested in using 5G NR mmWave to offer FWA services, and with the recent introduction of high-power CPEs (consumer premise equipment), the prospect of mmWave FWA is compelling. 5G NR mmWave services are no longer limited to outdoor deployment scenarios. When deployed indoors, mmWave cell sites can provide good coverage for enterprise use cases.

Currently there are network infrastructure, chipsets and mobile devices that can support eight 100MHz channels (8CC = 800MHz) in the downlink and two 100MHz (2CC) in the uplink direction.

GSA recommends that a unit block size of 50 MHz be used for the mmWave bands.

GSA recommends that at least 800MHz-1000MHz in the mmWave per operator by contiguous spectrum assignment for optimum experience of 5G. Contiguous spectrum blocks should be allocated without splitting them into two bands i.e., n257 and n258.

GSA report on mmWaves [5] provides good insights on quantum of spectrum and co-existence of services between 24.25 – 28.5 GHz.

B. 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.

GSA Response:

Please refer to our more detailed response to Q17.

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.

GSA Response:

Recently, ITU-R WP5D completed its report ITU-R M. [IMT-2020.TDD.SYNCHRONIZATION] to study the issues of network synchronization when IMT-2020 network is deployed in co-channel and adjacent channel in the same band. This can also lead to cross link interference, e.g., DL to UL or UL to DL, may happen if unsynchronised or semi-synchronised operation is used, e.g., by using different DL/UL time slot ratio and/or unaligned transmission frame structures. Synchronised operation can avoid cross link interference and spectrum waste but requires neighbouring operators to coordinate to select a compatible frame structure, and a common phase clock reference (e.g., UTC) with a requirement on the accuracy/performance, and a common understanding about the start of the frame with regards to the common phase clock reference.

Interference issues due to unsynchronized operation between operators in the same or adjacent licensed service areas could be solved through consultation and coordination.

GSMA also published the report “5G TDD Synchronization Guidelines and Recommendations for the Coexistence of TDD Networks in the 3.5 GHz Range”[6], where the operators are recommended to have synchronized network at national level as well as at local levels. The operators may have to coordinate to use different synchronized frame structures to meet the network requirements that may need to vary locally to address special needs from users such as verticals or events.

Refer to ECC report (<https://docdb.cept.org/download/1381>) [7] on interference mitigation methods.

Considering the multiple techniques for TDD interference mitigation available, as summarized above, GSA recommends leaving to the TSPs the management of interferences by mutual coordination without prescribing any guard band.

F. 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.

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?

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.

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

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)?

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.

GSA Combined response of Q 69, 71, 72, 73:

GSA considers that primary focus of TRAI should be the successful auction of spectrum to MNOs to assure that deployment of 5G can commence at national level. Private cellular networks should be considered in parallel.

GSA considers that individual wide area/national licensing is the preferred authorisation regime for 3GPP networks for the delivery of services with a predictable/managed QoS, including for eMBB, URLLC and mMTC.

If there is a justified demand from parties to deploy private 3GPP networks within limited geographic areas, market-led intra-service spectrum sharing should be preferably achieved through leasing of spectrum from the individual wide-area/national 3GPP network licensees.

Nevertheless, some countries have already made spectrum available for local/private use. As the market is still at an early stage there is still time to consider the options and it is important to build in regulatory flexibility to accommodate various scenarios and future developments.

If TRAI decides to reserve spectrum for local/private network, then GSA recommends the following –

- 1) 3GPP has specified comprehensive solutions framework which facilitates deployment of local/private networks in standalone, using tailored solution leveraging public slices

from TSPs, and hybrid mode solutions, for which the 3GPP technologies can be re-used as it is, with some application specific enhancements. Details are available in 3GPP TS.

2) GSA suggests that flexibility may be provided for captive users to deploy 3GPP based technologies for local/private networks using spectrum availed directly from government or leased through private entities TSP Private owners or using tailored solutions from external agencies. A range of entities can apply for local/private licenses such as the mobile operators, building owners, neutral hosts, specific specialized local area network & service providers, etc. Applicants may also lease these licenses to serve different geographic sizes such as a campus, a factory, or a large/complete area of a city under the administrative guidelines.

3) It is important for TRAI to carefully assess whether there is a need for spectrum for use by private local networks in India, and if so, analyse the amount of spectrum bandwidth and the appropriate frequencies – that are not earmarked for wide-area networks – which might be required for short-range communications in such private local networks. To this effect, some limited portion of spectrum within the 3800-4200 MHz, 4500-4990 MHz (n79) mid-band range and within the 28.5-29.5 GHz mm-wave range may be considered for local/private networks, noting that mid-bands frequencies are a precious resource that are essential and optimum for wide-area communications in public cellular networks.

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References

- [1]: Snapshot of National Spectrum Positions: Spectrum from 600 MHz <https://gsacom.com/paper/600-mhz-december-2021-spectrum-update/>
- [2]: 5G Ecosystem Report Member Report: December 2021 <https://gsacom.com/paper/5g-ecosystem-member-report-december-2021>
- [3]: 26, 28 GHz, Snapshot of National Spectrum Positions: Spectrum in the 26 GHz and 28 GHz <https://gsacom.com/paper/26-ghz-28-ghz-december-2021-spectrum-update/>
- [4]: All kinds of 5G spectrum essential: <https://gsacom.com/5g-spectrum/>
- [5]: GSA mmWaves study <https://gsacom.com/paper/mmwave-bands-for-5g-india-october-2020/>
- [6]: ITU-R draft New Report, Synchronization of IMT-2020 TDD Networks, <https://www.itu.int/md/R19-SG05-C-0050/en> <https://www.gsma.com/spectrum/resources/3-5-ghz-5g-tdd-synchronisation/>
- [7]: National synchronization regulatory framework options in 3400-3800 MHz: a toolbox for coexistence of MFCNs unsynchronized, unsynchronized and semi-synchronized operation in 3400-3800 MHz <https://docdb.cept.org/download/1381> Efficient usage of the spectrum at the border of CEPT countries between TDD MFCN in the frequency band 3400-3800 MHz, <https://docdb.cept.org/download/3541>.