Consultation Paper No. 4/ 2024

भारतीय दूरसंचार विनियामक प्राधिकरण

Telecom Regulatory Authority of India

Consultation Paper on

Auction of Frequency Spectrum in 37-37.5 GHz, 37.5-40 GHz, and 42.5-43.5 GHz bands Identified for IMT

New Delhi, India

4th April 2024

Mahanagar Doorsanchar Bhawan, Jawaharlal Nehru Marg, New Delhi-110002

Written Comments on the Consultation Paper are invited from the stakeholders by 2nd May 2024 and counter-comments by 16th May 2024. Comments and counter-comments will be posted on the TRAI's website www.trai.gov.in. Comments and counter-comments may be sent, preferably in electronic form, to Shri Akhilesh Kumar Trivedi, Advisor (Networks, Spectrum and Licensing), TRAI on the email ID advmn@trai.gov.in.

For any clarification/ information, Shri Akhilesh Kumar Trivedi, Advisor (Networks, Spectrum and Licensing), TRAI may be contacted on Telephone No. +91-11-23210481.

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CHAPTER I: INTRODUCTION

A. DoT's Reference Dated 02.08.2023

1.1 The Department of Telecommunications (DoT), Ministry of Communications, Government of India, through the letter No. L-14006/01/2023-IMT dated 02.08.2023 (**Annexure-1.1**) sent a reference under the terms of clause 11(1)(a) of TRAI Act, 1997 (as amended) and requested the Telecom Regulatory Authority of India (hereinafter, also referred to as "TRAI", or "the Authority") to provide recommendations for the auction of spectrum in the frequency bands identified for International Mobile Telecommunications (IMT). The afore-mentioned letter dated 02.08.2023 is reproduced below:

"In response to DoT's reference dated 13.09.2021, TRAI had provided its recommendations dated 11.04.2022 on various issues involved in the auction of spectrum in the 600 MHz, 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz, 2500 MHz, 3300 MHz and 26 GHz bands. Based on the TRAI recommendations dated 11.04.2022 and its subsequent response dated 09.05.2022 on DoT's back-reference, Government conducted auction of spectrum in the above frequency bands during July-August, 2022.

(i) A total of 72097.85 MHz spectrum in different band-LSA combinations worth Rs. 4,31,605 crores (at Reserve Price) were made available for bidding. A quantum of 51236.2 MHz worth Rs. 150173.3 crores were sold in the auction. However, no bids were received in the 600 MHz and 2300 MHz bands during the auction. As per the TRAI recommendations, a comprehensive report (Annexure-I) analysing the outcomes of the above auction was also communicated on 14.12.2022 to the TRAI.

2. Further, the following developments took place after the completion of the spectrum auctions held during July-August 2022:

(i) Indian Railways surrendered 1.6 MHz of paired spectrum in the 900 MHz band in the Jammu & Kashmir LSA, which can be included in the next auction.

(ii) Based on the recommendations of TRAI on Spectrum Requirements of National Capital Region Transport Corporation (NCRTC) for Train Control System for RRTS Corridors dated 28.12.2022, 5 MHz of paired spectrum has been assigned to NCRTC on provisional basis in the 700 MHz band. The same will be regularised after the final decision is taken on the above TRAI Recommendations.

(iii) Recently, as per the decision taken by the Union Cabinet in its meeting held on 07.06.2023, the Department has reserved for BSNL's 5G purpose, 10 MHz (paired) spectrum in the 700 MHz band in all 22 LSAs in lieu of the 10 MHz (paired) spectrum previously reserved in the 600 MHz band, additional 30 MHz spectrum to the already reserved 40 MHz in the 3300 MHz band in all 22 LSAs, additional 400 MHz to the already reserved 400 MHz in the 26 GHz band in all but Kerala LSA. In Kerala LSA, 250 MHz in addition to already reserved 400 MHz in 26 GHz band is being kept reserved for 5G services of BSNL.

(iv) Further, the Cabinet in its above meeting, has also decided to allot additional 20 MHz of spectrum in the Andhra Pradesh, Karnataka, Kolkata, Tamil Nadu, Delhi and Mumbai LSAs and 10 MHz of spectrum in Gujarat and Maharashtra LSAs to BSNL in the 2500 MHz band for the roll out of 4G services, in addition to already reserved spectrum in various bands for them for 4G services through the Cabinet decision of 2019.

These additional spectrum provisions for BSNL need to be kept out of the next auction.

2.1 In addition to above, Department of Telecommunications (DoT) has decided to make available the following new frequency bands as detailed

below for IMT, which can be made available for bidding in the next auction.

Sl. No	*Applications/ Services*	*Frequency bands*
1.	*IMT*	*37 - 37.5 GHz*
2.	*IMT (to share with Satellite Gateway Earth Stations with suitable protection)*	*37.5 - 40 GHz, 42.5 - 43.5 GHz*

2.2 The LSA-wise quantum available with the Government in the existing bands after the auction, taking into consideration the facts mentioned in the paras 2 (i) to (iv) and 2.1 above is given in Annexure-II.

2.3 Moreover, part of the administratively assigned spectrum to various TSPs, including that of BSNL, will be expiring during the year 2024; the same may also be included in the next auction. The LSA-wise details of such spectrum (2024 expiring) is placed at Annexure-III.

2.4 Further, as part of the reforms in the telecom sector, the Government has decided to hold spectrum auctions in the last quarter of every financial year.

3. Considering the above, the competent authority has decided that the spectrum mentioned at Para 2.2 and 2.3 above (Annexure-II and Annexure-III respectively) may be made available for bidding in the next auction for IMT. Any other spectrum, which might be available due to any re-farming etc. in these bands before the start of the auction, will also be made part of the auction process.

4. In view of the above, under the terms of clause 11 (1)(a) of TRAI Act, 1997, as amended by TRAI Amendment Act 2000, TRAI is requested to:

(a) provide recommendations on applicable reserve price, band plan, block size, quantum of spectrum to be auctioned and associated conditions for auction of spectrum in 600 MHz, 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz, 2500 MHz, 3300 MHz, 26 GHz, 37 - 37.5 GHz, 37.5 - 40 GHz and 42.5 - 43.5 GHz bands for IMT.

(b) provide any other recommendations deemed fit for the purpose of spectrum auction in these frequency bands, including the regulatory/ technical requirements as enunciated in the relevant provisions of the latest NFAP/Radio Regulations of the ITU."

B. TRAI's response dated 01.09.2023 to the DoT's reference dated 02.08.2023

1.2 Earlier, the Authority in its recommendations on 'Auction of Spectrum in frequency bands identified for IMT/5G' dated 11.04.2022, had recommended, *inter-alia*, as below:

"6.42 As there will be regular conduct of spectrum auctions on annual basis (or at shorter intervals), the Authority recommends that

(I) For existing bands (including for the bands being put to auction for the first time in the forthcoming auction), a fresh spectrum valuation exercise be conducted once every three years; a suitable reference be made to the Authority by Government for this purpose.

(II) For auctions conducted in the interim period between periodic valuation exercises conducted once every three years,

(1) for LSAs where the spectrum put to auction in a previous auction is sold, the auction determined prices (duly indexed using applicable MCLR if more than one year has elapsed since the previous auction) should be used for arriving at the reserve prices for the next auction;

(2) for LSAs, where spectrum remains unsold in previous auctions, past recommended reserve price (without indexation) should be used.

(III) For new spectrum bands, to be put to auction for first time, a reference be sent to the Authority, as per established procedure as and when these bands are proposed to be put to auction.

(IV) However, if required, DoT may seek fresh reserve prices from the Authority for the existing bands, providing a full and reasoned justification for the same."

1.3 Subsequently, DoT, through a back reference dated 29.04.2022, mentioned, *inter-alia*, as below:

"DoT is of the view that given the fast-changing techno-commercial ecosystem, spectrum valuation at shorter intervals may be desirable. For instance, in LSAs/ bands where spectrum remains unsold, there could be a case for reduction in reserve prices. Alternatively, there could be a spectrum band which may become more valuable due to a technological breakthrough. Hence, it is proposed that recommendations of TRAI on spectrum pricing would be sought before conduct of every auction."

1.4 With respect to the DoT's back-reference dated 29.04.2022, TRAI provided its response to DoT on 09.05.2022 and mentioned, *inter-alia*, as below:

"DoT, in its letter dated 23.09.2021, inter alia, conveyed the Government's decision regarding the regular conduct of spectrum auction on annual basis, normally in the last quarter of every financial year and at shorter intervals whenever necessary. The Authority has, in this context, factored in this Government decision while making the recommendation at paragraph 6.42. The detailed rationale for this recommendation is given at paragraph 3.39 of the Authority's Recommendations dated 11.04.2022. As stated therein, the Authority undertakes spectrum valuation exercises using various models/ approaches that use different datasets of technical, market and economic data, updated periodically. These parameters do not change much in a short time span. At the same time, the Authority had

noted that there is a need to evaluate the techno-economic context at regular intervals to reckon for changes. The Authority had also noted in this context that annual valuation exercises may not be necessary.

As such, the Authority does not agree with DoT's proposal to seek the Authority's recommendations before conduct of every (annual/ shorter interval) auction, as this would not be necessary unless DoT comes to a conclusion that the changes in the techno-commercial ecosystem and other factors warrants a fresh valuation. The Authority reiterates its recommendation given at paragraph 6.42 of the Recommendations dated 11.04.2022. As recommended at sub-paragraph (IV) thereof, in case DoT would like to seek the Authority's recommendations for existing spectrum bands in the interim period between periodic valuation exercises conducted once every three years, it may do so with a full and reasoned justification for the same. For new spectrum bands to be put to auction for the first time, the recommendation at subparagraph (III) of paragraph 6.42 would be applicable."

1.5 In view of the above, and in the absence of full and reasoned justification by DoT for seeking fresh reserve prices from the Authority for the existing bands, TRAI through a letter dated 01.09.2023 (**Annexure 1.2**) informed DoT that the recommendations at para 6.42 (II) of the TRAI's recommendations dated 11.04.2022 are applicable for all bands and for all LSAs referred through Annexure-II and Annexure III of the DoT's letter dated 02.08.2023 except for the new referred bands viz. 37-37.5 GHz, 37.5-40 GHz, and 42.5-43.5 GHz. Therefore, for the existing bands viz. 600 MHz, 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz, 2500 MHz, 3300 MHz, and 26 GHz, auction may be conducted as per the recommendations at para 6.42 (II) of the TRAI's Recommendations dated 11.04.2022.

1.6 With regard to band plan, block size, and associated conditions for auction of spectrum in the existing bands viz. 600 MHz, 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz, 2500 MHz, 3300 MHz, and 26 GHz

bands for IMT, it was noted that the Authority's earlier recommendations for auction of spectrum in these bands were made on 11.04.2022, based on which an auction of spectrum was conducted during July-August 2022. The Authority opined that in such a short span of time since the previous recommendations, no technological developments or market changes have occurred that warrant any change in the band plan, block size, and associated conditions for auction of spectrum in the existing bands.

1.7 In view of the above, TRAI, through its response letter dated 01.09.2023, informed DoT the following:

"10. In light of the above, ***the Authority reiterates its recommendation at para 6.42 (II) of the Recommendations on 'Auction of Spectrum in frequency bands identified for IMT/5G' dated 11.04.2022 on the reserve price. All available spectrum in the existing bands viz. 600 MHz, 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz, 2500 MHz, 3300 MHz, and 26 GHz in the referred LSAs may be put to auction with the same band plan, block size and associated conditions.***

11. As per the para 6.42 (III) of the TRAI's Recommendations dated 11.04.2022, the Authority will initiate a consultation process for providing recommendations for the new referred bands viz. 37-37.5 GHz, 37.5-40 GHz, and 42.5-43.5 GHz.

12. ***The Government may put to auction the spectrum in the existing bands viz. 600 MHz, 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz, 2500 MHz, 3300 MHz, and 26 GHz without waiting for the Authority's recommendations for the new bands viz. 37-37.5 GHz, 37.5-40 GHz, and 42.5-43.5 GHz."***

1.8 Keeping in view the DoT's reference dated 02.08.2023, and the TRAI's response dated 01.09.2023, the Authority has decided to initiate a

consultation process for providing recommendations for the new referred bands viz. 37-37.5 GHz, 37.5-40 GHz, and 42.5-43.5 GHz bands.

1.9 Considering that the frequency range 40-42.5 GHz is not a part of the frequency ranges identified by DoT for IMT, TRAI through its letter dated 20.02.2024 requested DoT to inform as to whether the frequency range 40-42.5 GHz has been identified for some other application(s) in India. In response, DoT, through its letter dated 13.03.2024, has informed that the Government has decided the following apportionment/ sharing of the spectrum in the frequency range from 37-43.5 GHz between IMT and space based services:

Sl. No.	Application/ Service	Frequency Bands
1.	IMT	37-37.5 GHz
2.	IMT and Satellite Gateway links	37.5-40 GHz
3.	Satellite User/ Gateway links	40-42.5 GHz*
4.	IMT and Satellite Gateway links	42.5-43.5 GHz

** The frequency band 40.0-42.5 GHz (Space to Earth) is predominantly for satellite user links. However, this frequency band may also be used for Satellite Gateway links without causing any harmful interference to the satellite user links operating in these bands.*

C. The Present Consultation Paper

1.10 In this background, this consultation paper is being issued for soliciting comments of stakeholders on auction of spectrum in 37-37.5 GHz, 37.5-40 GHz, and 42.5-43.5 GHz frequency bands identified for IMT. This chapter provides background information on the reference received from DoT. Chapter II examines the issues related to auction of spectrum in 37-37.5 GHz, 37.5-40 GHz, and 42.5-43.5 GHz frequency bands identified for IMT. Chapter III summarizes the issues for consultation.

CHAPTER II: EXAMINATION OF ISSUES

A. Background

2.1 The socio-technical evolution in the last few decades has been significantly driven by the evolution of mobile communications. Mobile communication has become closely integrated in the daily life of the whole society. In the future, however, it is foreseen that new demands, such as more traffic volume, many more devices with diverse service requirements, better quality of user experience (QoE) and better affordability by further reducing costs, will require an increasing number of innovative solutions.

2.2 In the year 2015, International Telecommunication Union (ITU) issued Recommendation[1] on 'IMT Vision-Framework and overall objectives of the future development of IMT for 2020 and beyond'. The Recommendation states that *"[f]uture IMT[2] systems should support emerging new use cases, including applications requiring very high data rate communications, a large number of connected devices, and ultra-low latency and high reliability applications".* The Recommendation envisages 'utilization of large blocks of spectrum in higher frequency bands' as a key technique for achieving higher data rates and improvement in capacity.

2.3 In the World Radiocommunications Conference 2019 (WRC-19), additional globally harmonized frequency bands were identified for IMT, including IMT-2020, facilitating diverse usage scenarios for enhanced mobile broadband, massive machine-type communications, and ultra-reliable and low-latency communications. New resolutions approved at WRC-19

[1] ITU's Recommendation No. ITU-R M.2083-0 (09/2015)
Source: https://www.itu.int/dms_pubrec/itu-r/rec/m/R-REC-M.2083-0-201509-I!!PDF-E.pdf

[2] IMT stands for "International Mobile Telecommunications'. The term International Mobile Telecommunications (IMT) is the generic term used by the ITU community to designate broadband mobile systems. It encompasses IMT-2000, IMT- Advanced and IMT-2020 collectively. The ITU-R develops and adopts the international regulations and global standards which, through their worldwide application, enable the harmonization and implementation of broadband mobile networks (3G, 4G and now 5G) throughout the World. Source: https://www.itu.int/en/ITU-R/Documents/ITU-R-FAQ-IMT.pdf

pointed out that ultra-low latency and very high bit-rate applications of IMT will require larger contiguous blocks of spectrum than those available in frequency bands that had previously been identified for use by administrations wishing to implement IMT.

2.4 In accordance with the Resolutions 241-244 of WRC-19, frequency bands 24.25-27.5 GHz, 37-43.5 GHz, 45.5-47 GHz, 47.2-48.2, and 66-71 GHz, have been identified for IMT. Out of these bands, frequency spectrum in 26 GHz band (24.25-27.5 GHz) was put to auction in July/ August 2022 in India, wherein about 72% of the frequency spectrum in 26 GHz got sold.

2.5 In its recommendations on 'Auction of Spectrum in frequency bands identified for IMT/5G' dated 11.04.2022, the Authority had noted and recommended, *inter-alia*, as below:

"In addition to the spectrum bands earmarked for IMT in India, there are certain additional bands which are already identified by ITU for IMT services. Further, few additional bands are under consideration in WRC-23 for IMT identification. Details are given below:

(i) Bands already been identified by ITU for IMT services, which should be explored for its early availability to the service providers in India.

- *4800-4990 MHz*
- *37-43.5 GHz*
- *45.5-47 GHz*
- *47.2-48.2 GHz*
- *66-71 GHz*

(ii) Frequency bands under consideration in WRC-23 for IMT identification

- *3600-3800 MHz*
- *6425-7125 MHz*
- *10-10.5 GHz*

In view of the above, ***considering that there are certain additional bands which are already identified by ITU for IMT services and few additional bands are under consideration in WRC-23 for IMT identification, the Authority recommends that DoT should explore the possibility to make these bands available for IMT services at the earliest and come out with a spectrum roadmap for opening up of new bands for IMT to meet the future demand. At least a 5-year roadmap on spectrum likely to be made available for IMT in each year and likely date/month of auction should be made public. Such a spectrum roadmap will provide certainty, enable the bidders to take informed decisions and may also encourage new entrants."***

2.6 Through the instant reference letter dated 02.08.2023, DoT has conveyed that it *"has decided to make available the following new frequency bands as detailed below for IMT, which can be made available for bidding in the next auction:*

Sl. No.	*Applications/ Services*	*Frequency bands*
1.	*IMT*	*37 - 37.5 GHz*
2.	*IMT (to share with Satellite Gateway Earth Stations with suitable protection)*	*37.5 - 40 GHz, 42.5 - 43.5 GHz"*

2.7 In total, 4,000 MHz of frequency spectrum will be available in each licensed service area (LSA) in the afore-mentioned frequency ranges as tabulated below:

Sl. No.	Frequency range	Quantum of spectrum available in each LSA (in MHz)
1.	37 - 37.5 GHz	500
2.	37.5 - 40 GHz	2,500
3.	42.5 - 43.5 GHz	1,000
	Total	**4,000**

Table 2.2: Quantum of spectrum available in the frequency ranges under consideration

2.8 As per the band plans identified by 3GPP[3], there is no single band plan, which covers all the frequency ranges referred by DoT (viz. 37-37.5 GHz, 37.5-40 GHz, and 42.5-43.5 GHz). However, there are two band plans i.e., n259 (39.5 to 43.5 GHz) and n260 (37 to 40 GHz) in the frequency ranges referred by DoT. Both the band plans defined by 3GPP viz. n259 and n260 are based on Time Division Duplexing (TDD) configuration. The frequency range 39.5-40 GHz is covered under both the band plans. The following figure depicts the band definition in the frequency range 37-43.5 GHz and frequency ranges identified for IMT in India in this range.

[3] 3GPP TS 38.101-2 V17.11.0 (2023-09)
Source:
https://portal.3gpp.org/desktopmodules/Specifications/SpecificationDetails.aspx?specificationId=3284

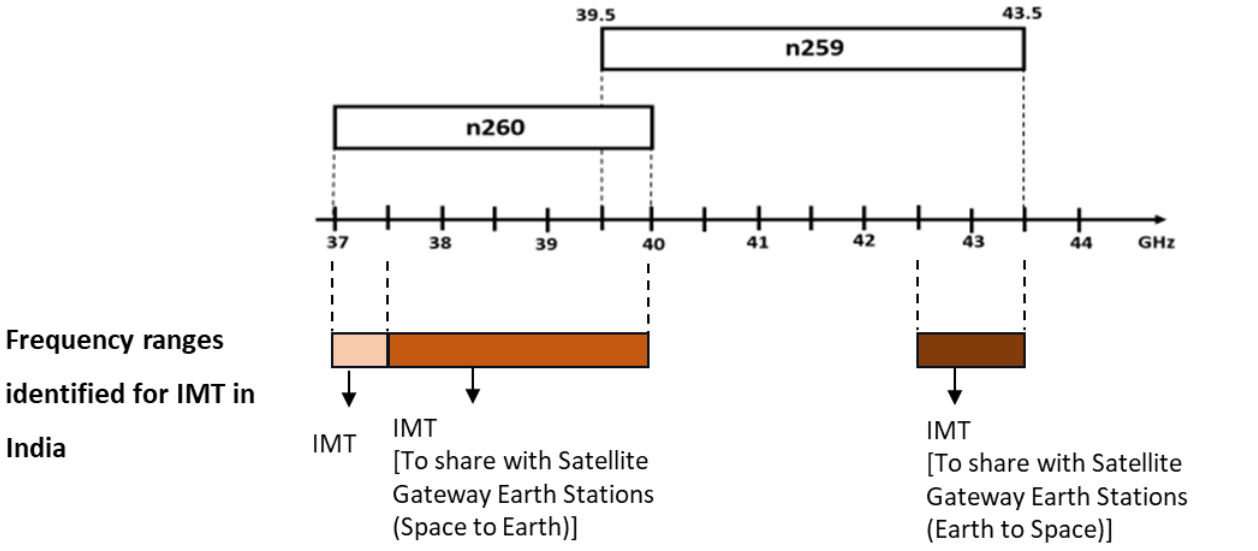

Figure 2.1: Band definitions in the 37-43.5 GHz frequency range

2.9 From the study of international scenario regarding adoption of the frequency range under consideration, it has been observed that only Federal Communication Commission (FCC), USA has auctioned spectrum in these frequency ranges so far. Innovation, Science and Economic Development (ISED), Canada has released a consultation paper and OFCOM, UK has issued a statement after due consultation process. The details of these developments are given below:

(a) FCC, USA

2.10 In May 2019[4], the Federal Communications Commission (FCC), USA decided to permit non-Federal fixed and mobile terrestrial operation throughout 37 GHz band (37.0 GHz - 38.6 GHz). It divided the band into two segments - Lower 37 GHz band (37.0–37.6 GHz) and Upper 37 GHz band (37.6 - 38.6 GHz). The Lower 37 GHz band is available for coordinated co-primary sharing between Federal and non-Federal users, while Upper 37 GHz band is licensed geographically by Partial Economic

[4] Use of Spectrum Bands Above 24 GHz for Mobile Radio Services (https://www.govinfo.gov/content/pkg/FR-2019-05-13/pdf/2019-09426.pdf)

Areas (PEA) basis. Further, FCC established coordination zones for 37 GHz band for military sites and scientific sites identified by National Telecommunications and Information Administration (NTIA).

2.11 In 2020, FCC concluded auction (Auction 103[5]) of Upper 37 GHz Band (37.6-38.6 GHz), 39 GHz Band (38.6-40 GHz) and 47 GHz band (47.2-48.2 GHz) in the blocks of 100 MHz each. In this auction, 28 bidders won 14,142 licenses. The auction offered Upper Microwave Flexible Use Service (UMFUS) licenses for all available spectrum in the Upper 37 GHz (37.6–38.6 GHz), 39 GHz (38.6–40 GHz), and 47 GHz (47.2–48.2 GHz) bands. The services provided by UMFUS licensees are limited only by the Fixed, Mobile, and co-primary Fixed Satellite Service (FSS) and Federal use designation of the spectrum allocated for UMFUS, and the services rules adopted for those specific frequency bands.

(b) ISED, Canada

2.12 In year 2019, the Innovation, Science and Economic Development (ISED), Canada in its decision[6] on 'Releasing Millimetre Wave Spectrum to Support 5G' adopted a band plan consisting of 24 unpaired 100 MHz blocks for the 37.6-40.0 GHz band. Through the said decision, ISED mentioned, *inter-alia*, as below:

"ISED is adopting a flexible use licensing model for fixed and mobile services in the 37-40 GHz frequency band. Under this model, a licensee would be permitted to deploy mobile, fixed or a combination of both services using a single spectrum licence. These bands will continue to be shared with other co-primary satellite services, as per the Canadian Table of Frequency Allocations.

..

[5] Auction 103: Spectrum Frontiers – Upper 37 GHz, 39 GHz, and 47 GHz (https://www.fcc.gov/auction/103)
[6] Decision on Releasing Millimetre Wave Spectrum to Support 5G (canada.ca)

ISED is adopting a band plan consisting of 24 unpaired 100 MHz blocks (…) for the frequency band 37.6-40 GHz. ISED is deferring the development of a band plan in the 37-37.6 GHz frequency band to a later date. Only TDD systems will be permitted."

2.13 In June 2022, ISED published a consultation paper7 on a Policy and Licensing Framework for Spectrum in the 26, 28 and 38 GHz Bands for the auction of millimetre wave (mmWave) spectrum licences in the bands 26.5-27.5 GHz (26 GHz band), 27.5-28.35 GHz (28 GHz band), and 37.6-40.0 GHz (38 GHz band).

(c) OFCOM, UK

2.14 The Office of Communications (OFCOM), UK through a statement on 'Enabling mmWave spectrum for new uses'[8] in September 2023 has decided (i) to make 40.5-43.5 GHz band (40 GHz band) available for auctioned aggregated citywide Spectrum Access licences covering 68 designated High Density areas, where highest volume of mmWave deployment is expected, and, (ii) in the rest of the country, to make the whole band available for local first come, first served licences from June 2028, using Shared Access licensing framework. In UK, there are three existing licensees in the 40 GHz band which hold block assigned national licenses to provide fixed services. OFCOM has completed the statutory process for revoking existing licenses in the 40 GHz band with effect from 01.06.2028.

2.15 Regarding the availability of ecosystem, based on information available on the frequency check website[9], over 280 devices of over 11 brands currently support n260 band. Charts depicting the number of operators

[7] Consultation on a Policy and Licensing Framework for Spectrum in the 26, 28 and 38 GHz Bands (https://ised-isde.canada.ca/site/spectrum-management-telecommunications/en/learn-more/key-documents/consultations/consultation-policy-and-licensing-framework-spectrum-26-28-and-38-ghz-bands)

[8] https://www.ofcom.org.uk/__data/assets/pdf_file/0033/268656/Statement-Enabling-mmWave-spectrum-for-new-uses.pdf#page=50&zoom=100,0,1009

[9] FrequencyCheck - Mobile Network Compatibility Search for Unlocked Phones and Devices

investing in key 5G spectrum bands (end of February 2024) and the number of devices announced/ available at the end of February 2024, as published in the GSA report on 5G Market Snapshot (March 2024)[10], are given below:

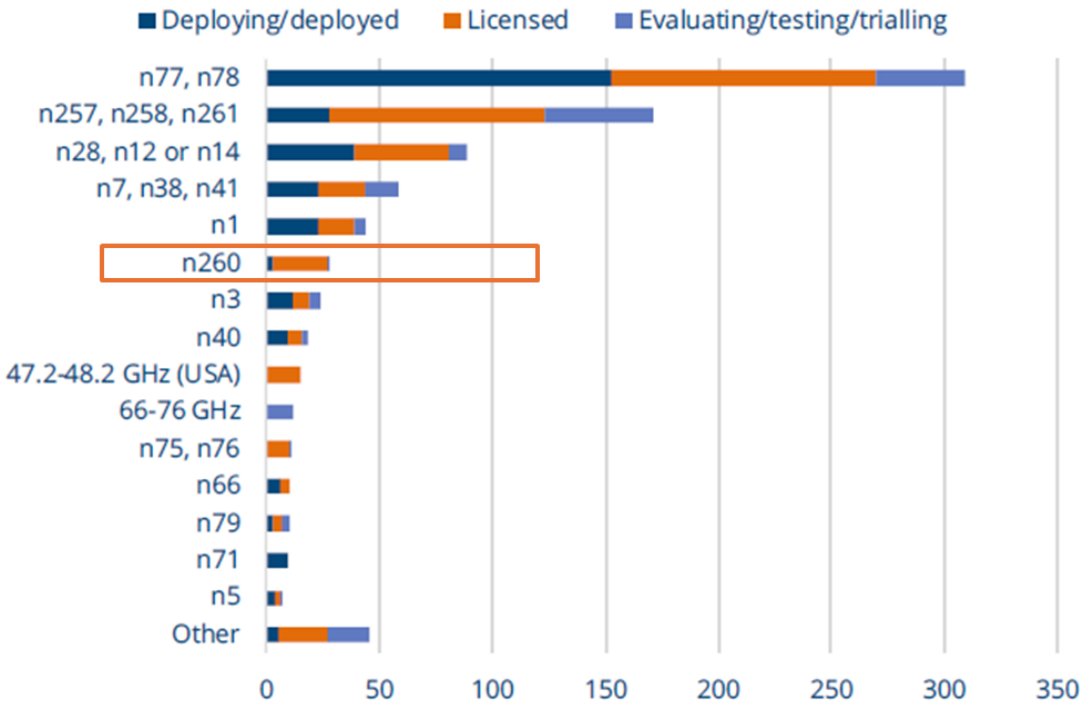

Figure 2.2: Operators investing in key 5G spectrum bands (end of Feb-2024), Source: GSA[11]

[10] 5G Market Snapshot March 2024 released by GSA
[11] GSA Report on 5G Market Snapshot, March 2024 (https://gsacom.com/paper/gsa-market-snapshot-march-2024/)

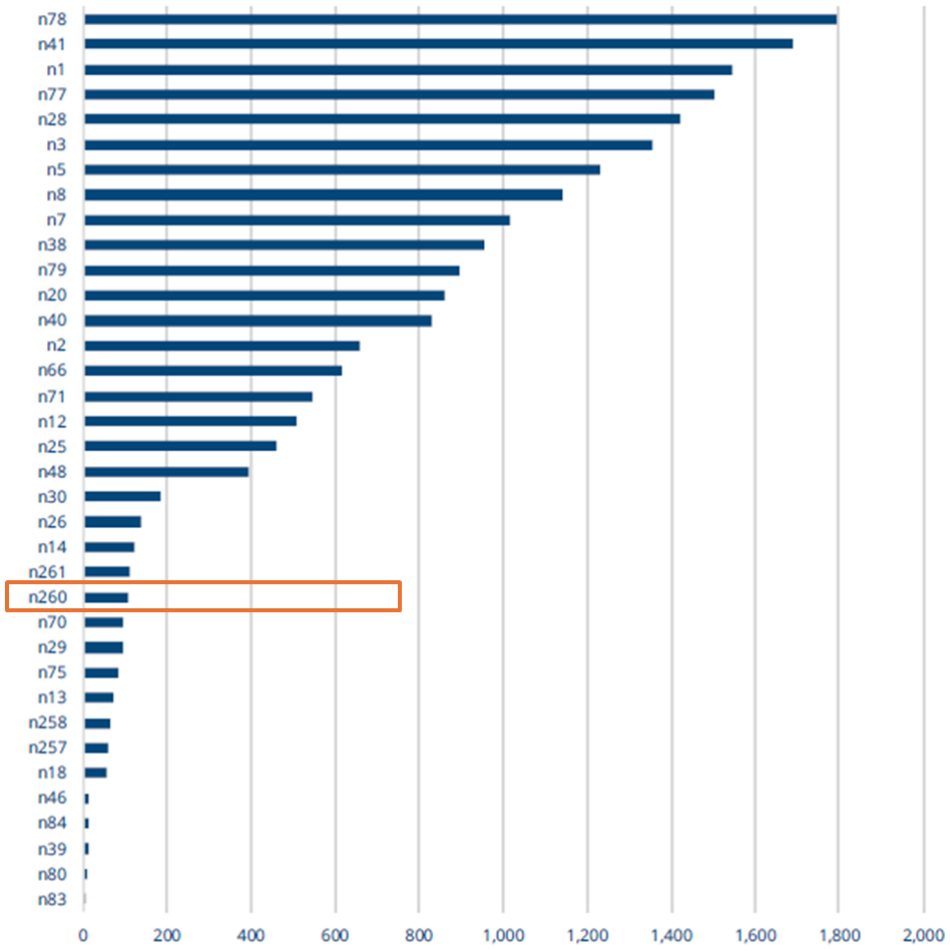

Figure 2.3: Announced 5G device models supporting key 5G spectrum bands (end of Feb-2024), Source: GSA[12]

2.16 As per the GSA report[13] on 'mmWave Bands: Global Licensing and Usage for 5G' of November 2020, Band n260, covering 37-40 GHz is also used with 32 companies in six countries/ territories investing in licenses for, or networks using this spectrum. 31 of these companies hold licenses. The majority of these companies are based in the USA and its territories. Three operators in the USA have launched 5G using n260 band.

2.17 As can be seen from the above, while a device ecosystem is available in the n260 band (37-40 GHz), it does not seem to be readily available in the n259 band (39.5-43.5 GHz). However, once frequency spectrum in

[12] GSA report on 5G Market Snapshot (March 2024)
[13] https://gsacom.com/paper/mmwave-bands-global-licensing-and-usage-for-5g-2/

the n259 band is assigned to service providers, there is a strong likelihood that the device ecosystem in this band will also develop soon. In this regard, OFCOM, UK has mentioned in its consultation paper[14] on 'Enabling mmWave spectrum for new uses' released in May 2022 that the availability of mobile technology equipment and devices in the adjacent 39 GHz band, which has similar technical properties to the 42.5-43.5 GHz band, may facilitate the development of 42.5-43.5 GHz equipment for new uses.

2.18 In this background, the Authority solicits views of stakeholders on the following set of questions:

Issues for Consultation:

Q1. Whether the entire available spectrum in each of the frequency ranges (a) 37-37.5 GHz, (b) 37.5-40 GHz, and (c) 42.5-43.5 GHz, should be put to auction for IMT? If no, please specify the quantum of spectrum in each frequency range to be put to auction. Kindly justify your response.

Q2. In case you are of the opinion that any of the frequency ranges viz. 37-37.5 GHz, 37.5-40 GHz, and 42.5-43.5 GHz should be put to auction at a later date, what should be the timelines for auctioning of such frequency bands for IMT? Kindly justify your response.

Q3. Do you agree that TDD-based duplexing configuration should be adopted in the country for the frequency ranges under consideration viz. (a) 37 - 37.5 GHz, (b) 37.5 - 40 GHz, and (c) 42.5 - 43.5 GHz, for IMT? If yes, considering that there is an overlap of frequencies in the band plans n260 (37-40 GHz) and n259 (39.5-43.5 GHz), how should the band

[14] https://www.ofcom.org.uk/__data/assets/pdf_file/0027/237258/mmwave-spectrum-condoc.pdf

plan(s) along with its frequency range be adopted? Kindly justify your response.

B. Validity period and licensed service area

2.19 As per the existing licensing and regulatory framework in India, access spectrum is assigned to access service licensees with a validity period of 20 years. Considering that the new spectrum bands being identified for IMT, particularly the higher spectrum bands, where ecosystem is not fully developed and such frequency bands are yet to find adequate use cases, there could be difficulty in assessing the true value of spectrum in such frequency bands. Therefore, the aspect of the period of validity for such spectrum bands requires examination.

2.20 From the study of international scenario, it is observed that in some countries, validity period of spectrum has been shortened for mmWave bands. For example-

(a) FCC, USA auctioned the spectrum in 28 GHz, 37 GHz, 39 GHz, and 47 GHz bands with an initial authorization term of 10 years.

(b) OFCOM, UK in its statement on 'Enabling mmWave spectrum for new uses' dated 27.09.2023, while deciding to award fixed term licenses in 26 GHz and 40 GHz bands with a 15-year duration mentioned as below:

"We acknowledge that a 20-year duration would be more in line with both previous licences awarded by Ofcom and the preferences expressed by stakeholders in response to the March 2023 Statement and Consultation. However, for the reasons set out below, we consider that a 15-year duration is long enough to provide investment certainty for licensees to invest in and deploy mmWave spectrum, despite the concerns raised by some respondents around (i) its shorter duration compared to other auctioned licences, (ii) the current status of equipment ecosystems

and (iii) the existence of fixed links in some parts of both mmWave bands."

(c) In South Korea, the spectrum in 28 GHz band was auctioned with a validity period of five years.

2.21 Considering that the mmWave spectrum is typically used for meeting the very high-capacity and ultra-low latency requirements, deployment of mmWave spectrum for IMT is not likely to be ubiquitous. It may be noted that the USA has been auctioning spectrum in higher bands (including upper 37 and 39 GHz bands) based on Partial Economic Areas (PEAs).

2.22 In November 2023, OFCOM, UK released a consultation on 'Enabling mmWave spectrum for new uses - Auction design'[15]. According to this consultation, the geographic scope of licences through auction will be sub-national, with each licence authorizing the licensee to use the relevant spectrum in all the major cities and towns ("high density areas") in which high volume of deployment of mmWave spectrum is expected. OFCOM has also decided to award subnational licences, that is, for aggregation of all 68 high density areas. However, local licenses are proposed to be issued in both low-density and high-density areas on a first come, first served basis using Shared Access licensing framework.

2.23 For the auction of mmWave spectrum, ISED, Canada has proposed the smallest service area (viz. Tier 5 service area). In this regard, ISED, Canada has stated as below in in its consultation on a Policy and Licensing Framework for Spectrum in the 26, 28 and 38 GHz Bands[16]:

"As different wireless services and applications are best suited to different sizes of service areas, five tiers of service areas have been established.

Tier 1 is a single national service area

[15] Enabling mmWave spectrum for new uses - Auction design, : 8 November 2023 (https://www.ofcom.org.uk/__data/assets/pdf_file/0022/271129/consultation-statement-mmwave-auction-design.pdf)

[16] https://ised-isde.canada.ca/site/spectrum-management-telecommunications/en/learn-more/key-documents/consultations/consultation-policy-and-licensing-framework-spectrum-26-28-and-38-ghz-bands

Tier 2 consists of 14 large service areas covering all of Canada

eight Tier 2 service areas that have provincial/territorial boundaries

six Tier 2 service areas that are sub-provincial within Ontario and Quebec

Tier 3 contains 59 smaller regional service areas

Tier 4 consists of 172 localized service areas

Tier 5 contains the smallest licensing areas and includes 654 service areas, further categorized into 4 broader groups: metropolitan, urban, rural, and remote

In order to determine the appropriate licensing area, ISED takes into consideration the potential uses for the spectrum and the characteristics of the spectrum, including propagation characteristics and potential for interference coordination challenges. The limited range of mmWave signals lowers the potential for interference, and makes mmWave suitable for licensing using smaller tier sizes. Licensing based on smaller tier sizes, such as Tier 5, also provides additional flexibility to licensees by allowing them to concentrate on the geographic markets of most interest and/or to aggregate smaller service areas into larger regions that correspond to their business needs. In particular, Tier 5 further separates metropolitan, urban, rural, and remote areas allowing wireless providers to target their areas of interest with greater specificity. In ISED's view, Tier 5 service areas would be appropriate for the proposed mmWave auction. As such, ISED is proposing to use Tier 5 service areas for the proposed mmWave auction."

2.24 In this background, the Authority solicits comments of stakeholders on the following set of questions:

Issues for Consultation:

Q4. Whether the spectrum in the frequency ranges under consideration viz. (a) 37-37.5 GHz, (b) 37.5-40 GHz, and (c) 42.5-43.5 GHz should be assigned for a validity period of 20 years, as prevalent in the existing frequency bands, or for a shorter validity period? In case you are of the opinion that a shorter validity period should be adopted, please suggest the validity period? Kindly provide your response with detailed justifications.

Q5. Whether the spectrum in (a) 37-37.5 GHz, (b) 37.5-40 GHz, and (c) 42.5-43.5 GHz frequency ranges should be assigned for the existing licensed service areas (LSAs) for Access Service (i.e. Telecom Circles/ Metros), or it should be assigned for smaller service areas? In case you are of the opinion that the spectrum in these bands should be assigned for smaller service areas, please suggest the criteria for defining such service areas? Kindly provide your response with detailed justifications.

C. Block Size

2.25 Block size is the lowest unit of quantum of spectrum, in multiples of which, the spectrum is auctioned/ assigned. In other words, block size works as building blocks and while bidding, the bidders decide the number of blocks to bid in each spectrum band. In some cases, the minimum amount of spectrum (in multiples of minimum number of blocks) that a bidder is required to bid is also prescribed.

2.26 The spectrum in 37-37.5 GHz, 37.5-40 GHz, and 42.5-43.5 GHz bands will be auctioned for the first time in India. The spectrum is likely to be used for provision of 5G use cases/ applications. As per the 3GPP[17] standard for 5G NR bands n259 and n260, the supported channel bandwidth is 50 MHz, 100 MHz, 200 MHz, and 400 MHz.

2.27 From the study of international scenario, it has been observed that the USA conducted an auction in upper 37, 39 and 47 GHz band for next generation wireless services and with a minimum block size of 100 MHz. Canada has issued a consultation paper, wherein it has proposed to auction 38 GHz band with block size of 100 MHz. OFCOM, UK in its statement and consultation on 'Enabling mmWave spectrum for new uses-Auction design'[18] dated 08.11.2023, has mentioned that it has decided to adopt a lot size of 200 MHz for 40 GHz band.

2.28 During the previous spectrum auction conducted in July-August 2022 by DoT, the mmWave band (24.25-27.5 GHz) was auctioned with a block size of 50 MHz. During the stakeholders' consultation held by the Authority in the year 2021-22, most of the stakeholders had suggested a block size of 100 MHz while some stakeholders had suggested a block size of 50 MHz. At that point of time, it was observed that the total spectrum available in 26 GHz band (3250 MHz) was in the multiples of 50 MHz, and if 100 MHz block size was prescribed for 26 GHz band, 50 MHz would not have been put to auction. At the same time, it was felt that 50 MHz block size would give flexibility to the service providers and may also encourage new entrants. It was also noted that considering that 24.25-27.5 GHz band is likely to be used for 5G services, the bidders may like to acquire a larger chunk of spectrum in this band. Therefore, to avoid fragmentation, it was recommended that in case a service provider acquires more than one

[17] ETSI TS 138 101-2 V17.11.0 (2023-10) URL: https://www.etsi.org/deliver/etsi_ts/138100_138199/13810102/17.11.00_60/ts_13810102v171100p.pdf

[18] https://www.ofcom.org.uk/__data/assets/pdf_file/0022/271129/consultation-statement-mmwave-auction-design.pdf

block of spectrum in 26 GHz band, the assignment of spectrum should be done in a contiguous manner.

2.29 In the frequency ranges under consideration viz. (i) 37-37.5 GHz, (ii) 37.5-40 GHz and (iii) 42.5-43.5 GHz, the available spectrum is in the multiples of 50 as well as 100. It requires to be examined as to what should be the optimal block size and minimum quantity for bidding for the frequency ranges under consideration.

2.30 In this background, the Authority solicits comments of stakeholders on the following question:

Issues for consultation:

Q6. What should be the block size, and the minimum quantity for bidding in (a) 37-37.5 GHz, (b) 37.5-40 GHz, and (c) 42.5-43.5 GHz frequency ranges? Kindly justify your response.

D. Spectrum Cap

2.31 The spectrum cap is the limit of access spectrum a telecom operator can hold in a licensed service area. The objective of prescribing spectrum cap is to prevent large holdings of spectrum by one or a few service providers, which otherwise may create concerns for the competition in the market. In the Notice Inviting Application (NIA), 2024 dated 08.03.2024, the spectrum cap has been defined as below:

"Spectrum Cap shall be as follows:

a) A Cap of 40% on the combined spectrum holding in the sub-1 GHz bands i.e. 700 MHz, 800 MHz and 900 MHz bands, including existing spectrum holding of TSPs in these bands.

b) A Cap of 40% on the combined spectrum holding in 1800 MHz, 2100 MHz, 2300 MHz and 2500 MHz bands, including existing spectrum holding of TSPs in these bands.

c) *A Cap of 40% on the spectrum holding in 3300 MHz band including existing spectrum holding of TSPs (rounded off considering the block size in this band).*

d) *A Cap of 40% on the total spectrum holding in 26 GHz band including existing spectrum holding of TSPs (rounded off considering the block size in this band).*

Note:

The blocks/spectrum that are expiring in 2024 and are being put to auction (including those which are not available for assignment immediately after the auction, but at a later date) are not included in the spectrum holding of the existing licensees, for the purpose of spectrum holding cap rules.

The following principles will be applied for the calculation of various spectrum caps for an LSA.

a) *All spectrum assigned to TSPs, including quantity of spectrum whose rights to use were put to auction but remained unsold, spectrum whose rights to use were assigned but subsequently surrendered by the TSPs or taken back by the licensor and quantity of spectrum whose rights to use are being put to auction would be counted for the purpose of the spectrum cap.*

b) *The spectrum which may become available to DoT for commercial use after its refarming from other uses (such as defence) at different points of time would not be counted for determining the spectrum caps until its rights to use are put to auction.*

c) *In case a situation arises where due to any subsequent assignment of spectrum to defence/ non-commercial usage, spectrum cap is affected adversely, no TSP would be asked to surrender right to use of any spectrum which it already holds.*

d) *For the sake of level playing field among Telecom Service Providers (TSPs), the same spectrum cap shall be made applicable for all the telecom service providers in that Licensed Service Area."*

2.32 The 37-37.5 GHz, 37.5-40 GHz, and 42.5-43.5 GHz frequency bands are being considered for auction for the first time in India. As mentioned above, for 26 GHz band spectrum, a band-specific spectrum cap of 40% has been prescribed. One may contend that considering the propagation characteristics of mmWave bands, a combined spectrum cap should be prescribed for all mmWave bands. However, a counter argument to the above view could be that with a combined spectrum cap, there could be a possibility of a service provider monopolizing one of the spectrum bands, particularly in the case of new spectrum bands because different ranges of spectrum under consideration will be subjected to different ITU RR provisions.

2.33 In this background, the Authority solicits comments of stakeholders on the following question:

Issues for consultation:

Q7. What provisions with respect to the spectrum cap per service provider in a licensed service area (LSA) should be made applicable for the frequency ranges under consideration viz. (i) 37-37.5 GHz, (ii) 37.5-40 GHz, and (iii) 42.5-43.5 GHz for IMT? Specifically, -

(a) Whether there is a case for a combined spectrum cap for 26 GHz band (24.25-27.5 GHz) and the frequency ranges under consideration? If yes, what should be the spectrum cap? Kindly justify your response.

(b) In case your response to (a) above is in the negative, whether spectrum cap should be prescribed separately for each frequency range viz. (i) 37-37.5 GHz, (ii) 37.5-40 GHz, and (iii) 42.5-43.5 GHz, or these frequency ranges should be combined for applicability of spectrum cap? What should be the spectrum cap(s)? Kindly justify your response.

E. Rollout Obligations

2.34 Roll-out obligations are mandated for the spectrum assigned to the service providers to ensure that spectrum is used effectively and efficiently in a timely manner.

2.35 In its recommendations on 'Auction of spectrum in frequency bands identified for IMT/5G' dated 11.04.2022, the Authority had noted that mmWave spectrum is typically used for meeting the very high-capacity and ultra-low latency requirement. Deployment of mmWave spectrum for IMT is not likely to be ubiquitous as it is likely to be used for the creation of hotspots and provision of fixed wireless access (FWA) services. Therefore, prescribing band specific coverage-based rollout obligations may not be appropriate. However, nominal network deployment-based rollout obligations may be specified to ensure that the spectrum purchased is put to an efficient use, in a timely manner.

2.36 In the NIA 2024[19] for auction of spectrum, following rollout obligations have been defined for 26 GHz (24.25 - 27.5 GHz) frequency band:

8.3.2 For 26 GHz bands

(a) In LSAs other than Metro LSAs

The following rollout obligations for non-metro LSAs have to be fulfilled by the bidders acquiring spectrum through this auction:

Time Period	*Roll Out Obligations (per LSA)*	*Minimum number of towns to be covered using targeted sites (per LSA)*
Phase-1: *By the end of 1st year*	*Commercial launch of services anywhere in the LSA*	*1*
Phase-2: *By the end of 3rd Year*	*Cumulative number of sites to be deployed:* *Category A LSAs: 240* *Category B LSAs: 150*	*In Category A LSAs: 2* *In Category B LSAs: 1* *In Category C LSAs: 1*

[19] NIA 2024: (https://dot.gov.in/sites/default/files/Notice%20Inviting%20Applications%202023-24.pdf)

	Category C LSAs: 80	
Phase-3: *By the end of 5th Year*	*Cumulative number of sites to be deployed:* *Category A LSAs: 660* *Category B LSAs: 460* *Category C LSAs: 300*	*In Category A LSAs: 7* *In Category B LSAs: 5* *In Category C LSAs: 3*

(b) Metro LSAs

The following rollout obligations for metro LSAs have to be fulfilled by the bidders acquiring spectrum through this auction:

Time Period	*Roll Out Obligations (per LSA)*
Phase-1: *By the end of 1st year*	*Commercial launch of services anywhere in the LSA*
Phase-2: *By the end of 3rd Year*	*Cumulative number of sites to be deployed in each LSA: 90*
Phase-3: *By the end of 5th Year*	*Cumulative number of sites to be deployed in each LSA: 300*

2.37 As already mentioned, the spectrum in 37 - 37.5 GHz, 37.5 - 40 GHz, and 42.5 - 43.5 GHz frequency bands are suitable for very high data rate and ultra-low latency applications. Therefore, successful bidders are likely to deploy spectrum in these frequency ranges in the geographies having demand for such applications.

2.38 Based on the examination of the international scenario, the rollout obligations specified by USA, Canada and UK are given below:

(a) USA

2.39 In 2020, FCC concluded auction (Auction 103), which offered 14,144 Upper Microwave Flexible Use Service licenses in the Upper 37 GHz (37.6-38.6 GHz), 39 GHz (38.6-40 GHz), and 47 GHz (47.2-48.2 GHz) bands,

and the licenses were based on Partial Economic Areas (PEAs). In this auction, construction requirements[20] were prescribed as follows:

Upper Microwave Flexible Use Service (UMFUS) licensees must make a buildout showing as part of their renewal applications. Licensees relying on mobile or point-to-multipoint service must show that they are providing reliable signal coverage and service to at least 40% of the population within the service area of the licensee, and that they are using facilities to provide service in that area either to customers or for internal use. Licensees relying on point-to-point service must demonstrate that they have four links operating and providing service, either to customers or for internal use, if the population within the license area is equal to or less than 268,000. If the population within the license area is greater than 268,000, a licensee relying on point-to-point service must demonstrate that it has at least one link in operation and is providing service for each 67,000 population within the license area. In order to be eligible to be counted under the point-to-point buildout standard, a point-to-point link must operate with a transmit power greater than +43 dBm.

In the alternative, a licensee may make its buildout showing on the basis of geographic area coverage. To satisfy the requirements of using this metric, licensees relying on mobile or point-to-multipoint service must show that they are providing reliable signal coverage and service to at least 25% of the geographic area of the license. The geographic area of the license shall be determined by the total land area of the county or counties covered by the license. Licensees relying on fixed point-to-point links or other, low-power point-to-point connections must show that they have deployed at least one transmitter or receiver in at least 25% of the census tracts within the license area. All equipment relied upon in the showing, whatever type of service or connection it provides, must be

[20] https://www.fcc.gov/auction/103

operational and providing service, either to customers or for internal use, as of the date of the filing.

If a licensee in this service is also a Fixed-Satellite Service licensee and uses the spectrum covered under its UMFUS license in connection with a satellite earth station, it can demonstrate compliance with the requirements of this section by demonstrating that the earth station in question is in service, operational, and using the spectrum associated with the license. This provision can only be used to demonstrate compliance for the county in which the earth station is located.

Licensees may fulfill their performance requirement by showing that they meet their choice of any one of the above standards, or a combination thereof, but they may not combine population-based showings with geographic area-based showings. Showings that rely on a combination of multiple types of service will be evaluated on a case-by-case basis. Licensees must make their showing by the end of their initial license terms in these bands – there is no interim benchmark.

Failure to meet this requirement will result in automatic cancellation of the license. In bands licensed on a Partial Economic Area basis, licensees will have the option of partitioning a license on a county basis in order to reduce the population within the license area to a level where the licensee's buildout would meet one of the applicable performance metrics.

(b) Canada

2.40 ISED, Canada[21] in their consultation on a Policy and Licensing Framework for Spectrum in the 26, 28 and 38 GHz Bands, mentioned that the licensee will be required to demonstrate the spectrum use to actively offer service with number of stations in each Tier 5 service area as specified

[21] Consultation on a Policy and Licensing Framework for Spectrum in the 26, 28 and 38 GHz Bands (https://ised-isde.canada.ca/site/spectrum-management-telecommunications/en/learn-more/key-documents/consultations/consultation-policy-and-licensing-framework-spectrum-26-28-and-38-ghz-bands)

in annexure D[22], at 5 and 9.5 years following the initial licence issuance date. The ISED is proposing two options - Option 1 has deployment requirements with a lower number of stations to take into account the uncertainty of the business models for the mmWave bands while Option 2 has higher deployment requirements between three to five times the number of stations of Option 1 to encourage greater use of the spectrum. The sample requirement as per Annexure D of the ISED consultation is as follows:

Proposed deployment requirements per Tier 5 service area				
Service area	Option #1		Option 2	
	No. of stations / 100 MHz block at year 5	No. of stations / 100 MHz block at year 9.5	No. of stations / 100 MHz block at year 5	No. of stations / 100 MHz block at year 9.5
Remote (Hottah Lake)	1	2	5	10
Rural (Harbour Grace)	2	4	10	20
Urban (St. John's)	3	11	15	51
Metro (Vancouver)	80	101	400	505

Table 2.4: Proposed (sample) deployment requirements, ISED, Canada

(c) OFCOM, UK

2.41 In March 2023, OFCOM, UK, through 'Statement and further consultation: Enabling mmWave spectrum for new uses'[23] proposed that the roll-out obligations and/ or a 'use it or lose it' condition would require licensees to make use of the relevant spectrum within a specified time period, or risk revocation of the licenses if these obligations are not met (i.e. 'use-it-or-lose-it'). OFCOM viewed that spectrum hoarding, and other spectrum allocation inefficiencies, can be resolved without the need for 'use it or

[22] Annex D: Proposed deployment requirements per Tier 5 service area (https://ised-isde.canada.ca/site/spectrum-management-telecommunications/en/learn-more/key-documents/consultations/consultation-policy-and-licensing-framework-spectrum-26-28-and-38-ghz-bands-annexes#tD1)

[23] https://www.ofcom.org.uk/__data/assets/pdf_file/0015/255030/03-23-statement-and-consultation-mmwave.pdf

lose it' conditions. However, OFCOM acknowledged that in theory such conditions could help to ensure efficient use of spectrum, but proposed not to include such conditions in the award licenses for the following reasons specific to the current case:

(a) there may be entirely legitimate reasons for spectrum remaining unused;

(b) imposing such an obligation has the potential to distort and/ or chill the incentives to invest in the spectrum, and so reduce the benefits for consumers and citizens which the award would otherwise create; and

(c) such conditions might also be difficult to make workable in practice because of the problem of defining what constitutes 'use' and therefore what the trigger for a licence revocation would be.

OFCOM in its statement of September 2023 on 'Enabling mmWave spectrum for new uses'[24] decided not to include any roll-out obligations in the award licences, cited the following reasons:

(a) it will be possible to trade award licences to a third party;

(b) if spectrum remains unused and there are no immediate plans to use it in certain areas, if there is demand, OFCOM will be able to issue licences under Local Access licensing framework; and

(c) fixed term licences with a 15-year term will support efficient use of the spectrum.

[24] https://www.ofcom.org.uk/__data/assets/pdf_file/0033/268656/Statement-Enabling-mmWave-spectrum-for-new-uses.pdf

2.42 In this background, the Authority solicits comments of stakeholders on the following question:

Issues for consultation:

Q8. What should be the roll-out obligations for the assignment of spectrum in (a) 37-37.5 GHz, (b) 37.5-40 GHz, and (c) 42.5-43.5 GHz frequency bands for IMT? Kindly justify your response.

F. Eligibility Conditions for Participation in Auction

2.43 Eligibility conditions for participation in the auction are specified in the relevant NIA. The eligibility conditions prescribed in the NIA 2024[25], are reproduced below:

"3.1 Eligibility criteria to participate in the Auction

(i) Any licensee that holds a UASL/ UL with authorization for Access Services for that LSA; or

(ii) Any licensee that fulfils the eligibility criteria for obtaining a Unified License with authorization for Access Services, and gives an undertaking to obtain a Unified License with authorization for Access Services and an undertaking regarding compliance to FDI guidelines; or

(iii) Any entity that gives an undertaking to obtain a Unified License with authorization for Access Services through a New Entrant Nominee as per the DoT guidelines/ license conditions, and an undertaking regarding compliance to FDI guidelines, can bid for the Spectrum in 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz, 2500 MHz, 3300 MHz, and 26 GHz Bands subject to other provisions of the Notice.

[25] https://dot.gov.in/sites/default/files/Notice%20Inviting%20Applications%202023-24.pdf

A Unified License can only be awarded to an Indian Company. Hence, any foreign applicants will need to form or acquire an Indian company, to obtain a Unified License. However, they are allowed to participate in the auctions directly and apply for a Unified License subsequently through an Indian company, where they hold equity stake, with a maximum foreign equity up to 100% under Automatic route subject to restrictions on investments from land border sharing countries as per extant guidelines. …"

2.44 The associated eligibility conditions prescribed in the NIA 2024 stipulate 'Net Worth' requirements on bidders. The key requirement is reproduced below:

"A Bidder is required to show a net worth of Rs.100 Crore per License Service Area (Rs. 50 Crore each for Jammu & Kashmir and North East Service Areas), in which the bidder wants to submit bids. The net worth requirement is applicable in case of 'New Entrants' and the same is not applicable in case of existing licensees. However, this condition of net worth requirement will be applicable on new entrants only in those LSAs where they do not hold any spectrum in any of the bands (i.e., any of the 700/800/900/1800/2100/2300/2500/3300 MHz & 26 GHz bands)."

2.45 In this background, the Authority solicits comments of stakeholders on the following question:

Issues for consultation:

Q9. Whether the eligibility conditions and associated eligibility conditions for participation in the auction for 37-37.5 GHz, 37.5-40 GHz, and 42.5-43.5 GHz should be kept analogous to the eligibility conditions and associated eligibility conditions for participation in the auction for spectrum for IMT, as defined in NIA 2024? In case your response is in the negative, suggestions may kindly be made with detailed justification.

G. Interference mitigation in TDD bands

2.46 It is a well-known fact that when more than one time division multiplexing (TDD) network operates in the same band and the same geographical area, interference may occur if the networks are uncoordinated i.e., if some base stations (BSs) are transmitting while others are receiving. Synchronization is one of the techniques to avoid uplink/ downlink interference, and thereby, obviate the need for reserving a chunk of frequency spectrum as a guard band. A synchronized operation of TDD networks prevents simultaneous uplink and downlink. It can be implemented by (a) starting the frame at the same time and (b) configuring compatible frame structures (length of the frame, and uplink/downlink ratio) so that all transmitters stop before any receiver starts.

2.47 In the recommendations on 'Auction of spectrum in frequency bands identified for IMT/5G' dated 11.04.222, the authority examined this issue in detail and noted as below:

"To cater to the different 5G use cases, the TSPs may like to implement Dynamic TDD, wherein each cell in the network can adapt its uplink-downlink ratio depending on the traffic requirement. Prescribing a frame structure with a downlink and uplink configuration could come in way of implementation of dynamic TDD.

However, in case of multiple service providers environment and spectrum is assigned on LSA basis, possibility of interference on border areas cannot be ruled out. Therefore, there may be a need to synchronize outdoor networks or adjacent frequencies of different TSPs.

Considering the global trend, 3300-3670 MHz and 24.25-28.5 GHz bands are likely to be used for 5G deployment, and TSPs may like to acquire larger chunk of spectrum in each of these bands. As already recommended that in case a TSP acquires more than one block, the entire

spectrum should be assigned in a contiguous manner. Thus, contiguous spectrum assignment will reduce the chances of interference to a large extent. Further, since spectrum is assigned on LSA basis, cross border interference issues could still be there if the overlapping frequency spots have been assigned to different TSPs in neighboring LSAs. This can also be avoided if a TSP is assigned same frequency spots across different LSAs, to the extent possible. Further interference mitigation be left to the mutual coordination between the TSPs."

2.48 It needs to be deliberated whether the above-mentioned approach adopted for 3300-3670 MHz and 26 GHz bands should also be made applicable for the frequency ranges under consideration viz. 37-37.5 GHz, 37.5-40 GHz, and 42.5-43.5 GHz, or some other provisions need to be created.

2.49 In this background, the Authority solicits comments from stakeholders on the following question:

Issues for Consultation:

Q10. To mitigate inter-operator interference due to TDD-based configuration, whether the approach adopted for 3300-3670 MHz and 26 GHz bands should also be made applicable for the frequency ranges under consideration viz. 37-37.5 GHz, 37.5-40 GHz, and 42.5-43.5 GHz, or some other provisions need to be created? In case you are of the opinion that some other provisions are required to be created, suggestions may be made with detailed justification.

H. Coexistence of IMT and Satellite Earth Station Gateways

2.50 As per the DoT's reference dated 02.08.2023, 37-37.5 GHz, 37.5-40 GHz, and 42.5-43.5 GHz bands have been identified for IMT; however, 37.5-40 GHz and 42.5-43.5 GHz frequency bands will also be shared with satellite gateway Earth Stations with suitable protection.

2.51 In the terrestrial networks, the deployment of mmWave networks is primarily intended to address the growing demand for capacity across different geographic areas. Due to significant propagation loss, achieving seamless coverage poses a challenge, however, it provides an opportunity for sharing of the same spectrum with the satellite gateway earth stations.

2.52 According to the National Frequency Allocation Plan (NFAP) 2022 issued by DoT, India, allocation of services in the given frequency ranges is as shown below:

Allocation to Radiocommunication Services (NFAP 2022)		
Band	**Rgion1, Region 2 & Region 3**	**India**
37-37.5	FIXED MOBILE except aeronautical mobile 5.550B SPACE RESEARCH (space-to-Earth) 5.547	37-37.5 FIXED MOBILE except aeronautical mobile 5.550B IND 16 SPACE RESEARCH (space-to-Earth) 5.547
37.5-38	FIXED FIXED-SATELLITE (space-to-Earth) 5.550C MOBILE except aeronautical mobile 5.550B SPACE RESEARCH (space-to-Earth) Earth Exploration-Satellite (Space-to-Earth) 5.547	37.5-38 FIXED FIXED-SATELLITE (space-to-Earth) 5.550C MOBILE except aeronautical mobile 5.550B IND 16 SPACE RESEARCH (space-to-Earth) Earth Exploration-Satellite (Space-to-Earth) 5.547
38-39.5	FIXED 5.550D FIXED-SATELLITE (space-to-Earth) 5.550C MOBILE 5.550B Earth Exploration-Satellite (space-to-Earth) 5.547	38-39.5 FIXED 5.550D FIXED-SATELLITE (space-to-Earth) 5.550C MOBILE 5.550B IND 16 Earth Exploration-Satellite (Space-to-Earth) 5.547

39.5-40	FIXED FIXED-SATELLITE (space-to-Earth) 5.516B 5.550C MOBILE 5.550B MOBILE-SATELLITE (space-to-earth) Earth Exploration-Satellite (space-to-Earth) 5.547 5.550E	39.5-40 FIXED FIXED-SATELLITE (space-to-Earth) 5.516B 5.550C MOBILE 5.550B IND16 MOBILE-SATELLITE (space-to-earth) Earth Exploration-Satellite (space-to-Earth) 5.547 5.550E
42.5-43.5	FIXED FIXED-SATELLITE (Earth-to-space) 5.552 MOBILE except aeronautical mobile 5.550B RADIO ASTRONOMY 5.149 5.547	42.5-43.5 FIXED FIXED-SATELLITE (Earth-to-space) 5.552 MOBILE except aeronautical mobile 5.550B IND16 RADIO ASTRONOMY 5.149 5.547

Table 2.5: Frequency Allocation in NFAP 2022

2.53 As can be seen from the above, apart from mobile service, the frequency range from 37.5 to 40 GHz has been allocated for FSS (Space to Earth) and frequency range from 42.5 to 43.5 GHz has been allocated for FSS (Earth to Space). It is also noted that as per ITU Resolution 243 titled "Terrestrial component of International Mobile Telecommunications in the frequency bands 37-43.5 GHz and 47.2-48.2 GHz" passed in WRC 2019, resolved:

"1. that administrations wishing to implement IMT consider use of the frequency band 37- 43.5 GHz, or portions thereof, and the frequency band 47.2-48.2 GHz, identified for IMT in No. 5.550B and No. 5.553B, and the benefits of harmonized utilization of the spectrum for the terrestrial component of IMT taking into account the latest relevant ITU-R Recommendations.

2. that, in order to ensure coexistence between IMT in the frequency bands 37-43.5 GHz and 47.2-48.2 GHz as identified in WRC-2019 conference in Article 5 and other services to which the frequency band is allocated, including the protection of these other services, administrations shall apply the following condition(s):

2.1 in order to protect the Earth exploration satellite service (EESS) (passive) in the frequency band 36-37 GHz should be protected. The unwanted emissions of IMT stations operating in the frequency band 37-40.5 GHz apply as specified in Table 1 below.

Frequency band for the EESS (passive)	***Frequency band for IMT stations***	***Unwanted emission mean power for IMT stations[1]***	***Recommended limits for IMT stations[1]***
36-37 GHz	*37-40.5 GHz*	*−43 dB(W/MHz) and −23 dB(W/GHz) within the frequency band 36-37 GHz*	*−30 dB(W/GHz)*

[1] The unwanted emission power level is considered in terms of total radiated power (TRP). The TRP is to be understood here as the integral of the power transmitted from all antenna elements in different directions over the entire radiation sphere.

2.2 protection of space research service (SRS) earth stations in the frequency band 37-38 GHz and RAS stations in the frequency band 42.5-43.5 GHz from IMT stations should be facilitated through bilateral agreements for cross-border coordination as necessary.

2.3 protection of and coexistence with fixed-satellite service (FSS) earth stations within the frequency ranges 37.5-43.5 GHz and 47.2-48.2 GHz should be facilitated through bilateral agreements for cross-border coordination as necessary.

2.4 take practical measures should be taken to ensure the transmitting antennas of outdoor base stations are normally pointing below the horizon, when deploying IMT base stations within the frequency bands 42.5-43.5 GHz and 47.2-48.2 GHz; the mechanical pointing needs to be at or below the horizon;

2.5 as far as practicable, sites for IMT base stations in the frequency bands 42.5-43.5 GHz and 47.2-48.2 GHz employing values of equivalent

isotropically radiated power (e.i.r.p.) per beam exceeding 30 dB(W/200 MHz) should be selected so that the direction of maximum radiation of any antenna will be separated from the geostationary-satellite orbit, within line-of-sight of the IMT base station, by ±7.5 degrees;

3. that IMT stations within the frequency ranges 37-43.5 GHz and 47.2-48.2 GHz are used for applications of the land mobile service,"

2.54 Regarding protection of wireless broadband electronic communications services (WBB ECS) from the fixed satellite service (FSS) transmitting earth station emissions in the band 42.5-43.5 GHz, The European Conference of Postal and Telecommunications Administrations (CEPT) report[26] dated 18.11.2023 submitted to the European Commission mentions as below:

"Based on results of the WRC-19 sharing studies, coexistence issues in terms of protection of WBB ECS from FSS earth station emissions can be managed at national level, with the LRTC developed in this Report.

Regarding interference from FSS ESs into WBB ECS, studies showed separation distances between WBB ECS base stations and FSS earth stations are from 160 m to 4 km. Where FSS earth stations and WBB ECS stations are in the same geographical area sharing could be dealt with on a case-by-case basis."

2.55 It may be noted that for the spectrum in 27.5-28.5 GHz frequency range, TRAI in its recommendations on 'Auction of spectrum in frequency bands identified for IMT/5G' dated 11.04.2022, had recommended, *inter-alia*, as below:

a) As mmWave spectrum is going to be used for capacity requirement, its deployment is not likely to be ubiquitous rather it is more likely to be kind of hotspots or urban micro cells. Therefore, IMT Stations and

[26] CEPT Report 82

Satellite Earth Stations Gateway (Earth to Space) can co-exist in 27.5-28.5 GHz frequency range. The Satellite Earth Station Gateway should be permitted to be established in frequency range 27.5-28.5 GHz at uninhabited or remote locations on case-to-case basis, where there is less likelihood of 5G IMT services to come up.

b) *DoT should prescribe the exclusion zone requirement for co-existence of IMT and satellite earth stations (Earth to space) in 27.5-28.5 GHz frequency range.*

c) *DoT should create a software defined automated process on a portal having database of coordinates of the IMT base stations in mmWave. The geofencing coordinates of the proposed earth station in 27.5-28.5 GHz can provide the feasibility results through the portal for establishing the earth station.*

d) *Spectrum dues for 27.5-28.5 GHz frequency range can be revised on pro-rata basis for the mobile operator holding spectrum in the LSA, in which the permission for establishing earth station is given in the same frequency range, on account of creation of exclusion zone.*

2.56 It needs to be examined as to what protection criteria need to be adopted for the coexistence of IMT and satellite earth state gateways in 37.5-40 GHz and 42.5-43.5 GHz bands.

2.57 In this background, the Authority solicits comments from stakeholders on the following set of questions:

Issues for Consultation:

Q11. Whether there could be any challenges in sharing of 37.5-40 GHz and 42.5-43.5 GHz spectrum frequency ranges between IMT and Satellite Gateway links? If yes, what challenges do you foresee and what measures could be

adopted to mitigate such challenges? Kindly justify your response.

Q12. In case it is decided to share (i) 37.5-40 GHz, and (ii) 42.5-43.5 GHz spectrum frequency ranges between IMT and Satellite Gateway links, -

(i) Whether there is a need to prescribe a protection/ keep-off distance between IMT stations and Satellite Earth Station Gateways? If yes, what should be the protection distance?

(ii) What other parameters should be prescribed for the coexistence of IMT and Satellite Gateway links?

Suggestions may kindly be made with detailed justification.

I. Valuation of Spectrum

2.58 In the past, the Authority for the purpose of valuation and fixation of reserve price has used various models such as production function model, producer surplus model, revenue surplus model, Multiple regression model etc. These models rely on an extensive dataset regarding certain market and financial parameters related to a particular band, previous spectrum holding of the band etc. However, the 37–37.5 GHz, 37.5–40 GHz and 42.5–43.5 GHz frequency bands are being contemplated for auction in India for the first time. There is no historical auction data available to conduct comparative analysis involving auction determined prices in India. Hence, all the valuation methodologies used in IMT recommendations cannot be used for valuation of 37–37.5 GHz, 37.5–40 GHz and 42.5–43.5 GHz frequency bands due to lack of data related to the spectrum bands being put to auction. Some possible methodologies for the valuation of these bands could be:

(a) Technical/ Spectral efficiency approach

(b) International benchmarking

Technical/ Spectral efficiency approach

2.59 One of the approaches for valuation of these bands could be based on comparative values that can be achieved by using relative spectral efficiency approach where characteristics like capacity of a particular spectrum band can be compared with the same characteristics of another spectrum band and a spectral efficiency factor can be derived as a ratio.

2.60 The Authority in the past has used spectral efficiency factor for valuation of spectrum in other bands. It can be explored if the same is available in respect of 37–37.5 GHz, 37.5–40 GHz and 42.5–43.5 GHz frequency bands also and can be utilized as a basis for valuation of these bands.

2.61 Moreover, the auction determined prices of 26 GHz band (24.25-27.5 GHz range) is available across all the 22 licensed service areas from the recently concluded July/ August 2022 auction. It can be explored whether these auction-determined prices can be used as a basis for the valuation of 37–37.5 GHz, 37.5–40 GHz and 42.5–43.5 GHz frequency bands.

International benchmarking

2.62 Another alternative approach such as international benchmarking can also be explored for these bands. It can be examined if the international available auction determined prices/ reserve prices can serve as a basis for valuation of 37-37.5 GHz, 37.5-40 GHz and 42.5-43.5 GHz spectrum bands.

2.63 It may be mentioned that when using international benchmarking, there are cross-country differences in GDP, population, subscriber base etc. which need to be normalized for use in the context of valuation of

spectrum for a particular country. To handle this problem, the Authority in its Recommendations on Auction of Spectrum in frequency bands identified for IMT|5G dated 11.04.2022, used the international average auction price ratio between two bands, that is 26 GHz band and 3.3-3.67 GHz band, to arrive at the valuation of 26 GHz band. Since the ratio used was between auction prices of the two bands in the same country, it avoided the problem of cross-country divergences, and thereby no further normalization was required. It can be explored if a similar international benchmarking approach may be used for valuation of 37-37.5 GHz, 37.5-40 GHz and 42.5-43.5 GHz spectrum bands.

2.64 A brief information regarding international spectrum pricing in respect of some of the countries, for the frequency bands under consideration, is given below.

USA[27]

The 37 GHz band (37.6 – 38.6 GHz) and 39 GHz band (38.6 – 40 GHz) was auctioned as 24*100 MHz blocks in 2019.

Spectrum license duration was 10 years.

Total proceeds from auctioning these two bands came to $ 7.22 billion[28].

UK[29]

Ofcom has plans for the auction of licences for spectrum in the 26 GHz and 40 GHz bands.

Ofcom has decided to offer the frequencies in 200 MHz lots. There are total of 15 lots in the 40 GHz (40.5-43.5 GHz) spectrum band.

[27] https://www.fcc.gov/auction/103
[28] GSA Gambod database
[29] https://www.commsupdate.com/articles/2023/11/09/ofcom-firms-up-auction-plans-for-26ghz-40ghz-spectrum/

Reserve prices are being set at GBP 1 million for each lot (Lot size =200 MHz) of the 40 GHz spectrum band.[30]

2.65 In this background, the Authority solicits comments from stakeholders on the following question:

Issues for consultation:

Q13. Whether the value of spectrum in 37–37.5 GHz, 37.5–40 GHz and 42.5–43.5 GHz spectrum bands be derived by relating it to the auction determined price/value of spectrum in any other band by using spectral efficiency factor? If yes, with which spectrum band, should these bands be related and what efficiency factor or formula should be used? Please justify your suggestions.

Q14. Should international spectrum prices i.e. the auction determined price/ reserve price of other countries in 37 – 37.5 GHz, 37.5 – 40 GHz and 42.5 – 43.5 GHz spectrum bands serve as a basis for the purpose of valuation of these bands? If yes, what methodology can be followed in this regard? Please provide detailed information.

Q15. Apart from the approaches highlighted above which other valuation approaches should be adopted for the valuation of 37 – 37.5 GHz, 37.5 – 40 GHz and 42.5 – 43.5 GHz spectrum bands? Please support your suggestions with detailed methodology, related assumptions and other relevant factors, etc.

[30] https://www.ofcom.org.uk/news-centre/2023/paving-the-way-for-improved-5g-and-innovative-new-wireless-services#:~:text=Reserve%20prices%20will%20be%20%C2%A3,each%20bidder%20will%20be%20allocated.

J. Single vs. Multiple approaches

2.66 Further, the Authority, since September 2013, has taken a consistent view that instead of depending on the valuation arrived at using any single approach, it would be better to rely on a number of such approaches to arrive at a final reasonable valuation and then determine reserve price based on such valuation. Accordingly, the Authority has been using various approaches to arrive at the valuation of different spectrums bands and to determine the reserve price of different spectrum bands for the auction of various bands of spectrum from time to time. All of these valuation approaches have their merits as well as demerits and it would be appropriate to rely on a number of such approaches to arrive at a final reasonable valuation rather than depending on the valuation arrived at using any one approach. The Authority in its spectrum valuation exercises has used probabilistic average valuation (simple mean) of the valuations obtained through the different approaches attempted for valuation of a particular spectrum band. Taking into account the principle of equal probability of occurrence of each valuation, 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, as adopted by the Authority since September 2013 recommendations or some other methodology be used for valuation exercise.

2.67 In this background, the Authority solicits comments from stakeholders on the following set of questions:

Issues for consultation:

Q16. 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 support your answer with detailed justification.

Q17. 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 etc. should be followed? Please support your answer with detailed justification.

K. Reserve price estimation

2.68 A reserve price is the starting point for an ascending price auction and bidding is the means to true price discovery. It ensures a minimum guaranteed amount for the owner/ seller of goods and prevents excessive bargaining in the auction process. The reserve price set at a too low level is inefficient in deterring collusion and if set at a too high level, it can negatively impact participation in the auction. Thus, to ensure efficiency of the auction process, setting the reserve price at an optimal level is a prerequisite.

2.69 For arriving at the reserve prices, the Authority in its recommendation dated 11.04.2022 had primarily set reserve price equal to 70% of the mean of value derived from all possible approaches. Accordingly, the following issue arise for consultation:

Issues for consultation:

Q18. What ratio should be adopted between the reserve price for the auction and the valuation of the spectrum in these spectrum bands and why? Please support your answer with detailed justification.

L. Payment Terms

2.70 The following payment terms have been prescribed as per Notice Inviting Applications (NIA) for auction of spectrum in 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz, 2500 MHz, 3300 MHz, and 26 GHz Bands dated 08.03.2024, in which spectrum is to be assigned for a duration of 20 years:

i. *Successful Bidders shall make the payment (in Indian Rupees) in accordance with any of the following two options:*

Option 1: Full or part upfront payment of the bid amount within 10 days of declaration of final price. Where part upfront payment has been made, which can be a multiple of complete years with a minimum of two years, the buyer shall have the option of availing moratorium for the corresponding number of years for which the upfront payment has been made and the balance amount shall be payable in equal annual instalments over the remaining period, payable in advance at the beginning of each year, after the period of moratorium if any, duly protecting the Net Present Value (NPV) of the bid amount at the applicable rate of interest.

Option 2: Payment of 20 equal annual instalments of the bid amount, duly protecting the NPV of the bid amount at the applicable rate of interest, in advance at the beginning of the year, the first instalment becoming payable within 10 days of declaration of final price. The balance 19 instalments shall become due and payable on the Effective Date anniversary of each following year…..

ii. Prepayment option: - Pre-payment of one or more instalments has been allowed on any date, provided that the NPV of the due amount is protected at the applicable interest rate.

iii. Number of instalments: For the case of deferred payments, the balance amount is to be paid in equal annual instalments over the

remaining period, payable in advance at the beginning of each year, after the period of moratorium if any, duly protecting the Net Present Value (NPV) of the bid amount at the applicable rate of interest.

iv. Rate of Discount: The applicable interest rate for protecting the NPV of the bid amount has been taken as 8.65%.

2.71 In this regard, the following questions arise for consultation: -

Issues for consultation:

Q19. What should the payment terms and associated conditions for the assignment of 37 – 37.5 GHz, 37.5 – 40 GHz and 42.5 – 43.5 GHz spectrum bands relating to:

i. Upfront payment
ii. Moratorium period
iii. Total number of installments to recover deferred payments
iv. Rate of discount in respect of deferred payment and prepayment

Please support your answer with detailed justification.

Q20. Any other suggestion relevant to the subject, may be submitted with detailed justification.

2.72 The following chapter lists the issues for consultation.

CHAPTER III: ISSUES FOR CONSULTATION

Stakeholders are requested to provide their inputs on the following questions with detailed justifications:

Q1. Whether the entire available spectrum in each of the frequency ranges (a) 37-37.5 GHz, (b) 37.5-40 GHz, and (c) 42.5-43.5 GHz, should be put to auction for IMT? If no, please specify the quantum of spectrum in each frequency range to be put to auction. Kindly justify your response.

Q2. In case you are of the opinion that any of the frequency ranges viz. 37-37.5 GHz, 37.5-40 GHz, and 42.5-43.5 GHz should be put to auction at a later date, what should be the timelines for auctioning of such frequency bands for IMT? Kindly justify your response.

Q3. Do you agree that TDD-based duplexing configuration should be adopted in the country for the frequency ranges under consideration viz. (a) 37 - 37.5 GHz, (b) 37.5 - 40 GHz, and (c) 42.5 - 43.5 GHz, for IMT? If yes, considering that there is an overlap of frequencies in the band plans n260 (37-40 GHz) and n259 (39.5-43.5 GHz), how should the band plan(s) along with its frequency range be adopted? Kindly justify your response.

Q4. Whether the spectrum in the frequency ranges under consideration viz. (a) 37-37.5 GHz, (b) 37.5-40 GHz, and (c) 42.5-43.5 GHz should be assigned for a validity period of 20 years, as prevalent in the existing frequency bands, or for a shorter validity period? In case you are of the opinion that a shorter validity period should be adopted, please suggest the validity period? Kindly provide your response with detailed justifications.

Q5. Whether the spectrum in (a) 37-37.5 GHz, (b) 37.5-40 GHz, and (c) 42.5-43.5 GHz frequency ranges should be assigned for the existing licensed service areas (LSAs) for Access Service (i.e. Telecom Circles/ Metros), or it should be assigned for smaller service areas? In case you are of the opinion that the spectrum in these bands should be assigned for smaller service areas, please suggest the criteria for defining such service areas? Kindly provide your response with detailed justifications.

Q6. What should be the block size, and the minimum quantity for bidding in (a) 37-37.5 GHz, (b) 37.5-40 GHz, and (c) 42.5-43.5 GHz frequency ranges? Kindly justify your response.

Q7. What provisions with respect to the spectrum cap per service provider in a licensed service area (LSA) should be made applicable for the frequency ranges under consideration viz. (i) 37-37.5 GHz, (ii) 37.5-40 GHz, and (iii) 42.5-43.5 GHz for IMT? Specifically, -

(a) Whether there is a case for a combined spectrum cap for 26 GHz band (24.25-27.5 GHz) and the frequency ranges under consideration? If yes, what should be the spectrum cap? Kindly justify your response.

(b) In case your response to (a) above is in the negative, whether spectrum cap should be prescribed separately for each frequency range viz. (i) 37-37.5 GHz, (ii) 37.5-40 GHz, and (iii) 42.5-43.5 GHz, or these frequency ranges should be combined for applicability of spectrum cap? What should be the spectrum cap(s)? Kindly justify your response.

Q8. What should be the roll-out obligations for the assignment of spectrum in (a) 37-37.5 GHz, (b) 37.5-40 GHz, and (c) 42.5-43.5 GHz frequency bands for IMT? Kindly justify your response.

Q9. Whether the eligibility conditions and associated eligibility conditions for participation in the auction for 37-37.5 GHz, 37.5-40 GHz, and 42.5-43.5 GHz should be kept analogous to the eligibility conditions and associated eligibility conditions for participation in the auction for spectrum for IMT, as defined in NIA 2024? In case your response is in the negative, suggestions may kindly be made with detailed justification.

Q10. To mitigate inter-operator interference due to TDD-based configuration, whether the approach adopted for 3300-3670 MHz and 26 GHz bands should also be made applicable for the frequency ranges under consideration viz. 37-37.5 GHz, 37.5-40 GHz, and 42.5-43.5 GHz, or some other provisions need to be created? In case you are of the opinion that some other provisions are required to be created, suggestions may be made with detailed justification.

Q11. Whether there could be any challenges in sharing of 37.5-40 GHz and 42.5-43.5 GHz spectrum frequency ranges between IMT and Satellite Gateway links? If yes, what challenges do you foresee and what measures could be adopted to mitigate such challenges? Kindly justify your response.

Q12. In case it is decided to share (i) 37.5-40 GHz, and (ii) 42.5-43.5 GHz spectrum frequency ranges between IMT and Satellite Gateway links, -

(i) **Whether there is a need to prescribe a protection/ keep-off distance between IMT stations and Satellite Earth Station Gateways? If yes, what should be the protection distance?**

(ii) **What other parameters should be prescribed for the coexistence of IMT and Satellite Gateway links?**

Suggestions may kindly be made with detailed justification.

Q13. Whether the value of spectrum in 37–37.5 GHz, 37.5–40 GHz and 42.5–43.5 GHz spectrum bands be derived by relating it to the auction determined price/value of spectrum in any other band by using spectral efficiency factor? If yes, with which spectrum band, should these bands be related and what efficiency factor or formula should be used? Please justify your suggestions.

Q14. Should international spectrum prices i.e. the auction determined price/ reserve price of other countries in 37 – 37.5 GHz, 37.5 – 40 GHz and 42.5 – 43.5 GHz spectrum bands serve as a basis for the purpose of valuation of these bands? If yes, what methodology can be followed in this regard? Please provide detailed information.

Q15. Apart from the approaches highlighted above which other valuation approaches should be adopted for the valuation of 37 – 37.5 GHz, 37.5 – 40 GHz and 42.5 – 43.5 GHz spectrum bands? Please support your suggestions with detailed methodology, related assumptions and other relevant factors, etc.

Q16. 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 support your answer with detailed justification.

Q17. 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 etc. should be followed? Please support your answer with detailed justification

Q18. What ratio should be adopted between the reserve price for the auction and the valuation of the spectrum in these spectrum bands and why? Please support your answer with detailed justification.

Q19. What should the payment terms and associated conditions for the assignment of 37 – 37.5 GHz, 37.5 – 40 GHz and 42.5 – 43.5 GHz spectrum bands relating to:

- **i. Upfront payment**
- **ii. Moratorium period**
- **iii. Total number of installments to recover deferred payments**
- **iv. Rate of discount in respect of deferred payment and prepayment**

Please support your answer with detailed justification.

Q20. Any other suggestion relevant to the subject, may be submitted with detailed justification.

ANNEXURES

Annexure - 1.1: DoT letter No. L-14006/01/2023-IMT dated 02.08.2023

(Without Annexures)

Government of India
Ministry of Communications
Department of Telecommunications
Wireless Planning & Coordination (WPC) Wing

6th floor, Sanchar Bhawan,
20, Ashoka Road, New Delhi – 110001.

No.: L-14006/01/2023-IMT Date: 02.08.2023

To,

The Secretary
Telecom Regulatory Authority of India
Mahanagar Doorsanchar Bhawan
Jawahar Lal Nehru Marg (Old Minto Road)
New Delhi-110002.

Subject: Seeking TRAI recommendations for the auction of spectrum in the frequency bands identified for International Mobile Telecommunications (IMT).

Sir,

In response to DoT's reference dated 13.09.2021, TRAI had provided its recommendations dated 11.04.2022 on various issues involved in the auction of spectrum in the 600 MHz, 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz, 2500 MHz, 3300 MHz and 26 GHz bands. Based on the TRAI recommendations dated 11.04.2022 and its subsequent response dated 09.05.2022 on DoT's back-reference, Government conducted auction of spectrum in the above frequency bands during July-August, 2022.

(i) A total of 72097.85 MHz spectrum in different band-LSA combinations worth Rs. 4,31,605 crores (at Reserve Price) were made available for bidding. A quantum of 51236.2 MHz worth Rs. 150173.3 crores were sold in the auction. However, no bids were received in the 600 MHz and 2300 MHz bands during the auction. As per the TRAI recommendations, a comprehensive report (***Annexure – I***) analysing the outcomes of the above auction was also communicated on 14.12.2022 to the TRAI.

2. Further, the following developments took place after the completion of the spectrum auctions held during July-August 2022:

(i) Indian Railways surrendered 1.6 MHz of paired spectrum in the 900 MHz band in the Jammu & Kashmir LSA, which can be included in the next auction.

(ii) Based on the recommendations of TRAI on Spectrum Requirements of National Capital Region Transport Corporation (NCRTC) for Train Control System for RRTS Corridors dated 28.12.2022, 5 MHz of paired spectrum has been assigned to NCRTC on provisional basis in the 700 MHz band. The same will be regularised after the final decision is taken on the above TRAI Recommendations.

1

(iii) Recently, as per the decision taken by the Union Cabinet in its meeting held on 07.06.2023, the Department has reserved for BSNL's 5G purpose, 10 MHz (paired) spectrum in the 700 MHz band in all 22 LSAs in lieu of the 10 MHz (paired) spectrum previously reserved in the 600 MHz band, additional 30 MHz spectrum to the already reserved 40 MHz in the 3300 MHz band in all 22 LSAs, additional 400 MHz to the already reserved 400 MHz in the 26 GHz band in all but Kerala LSA. In Kerala LSA, 250 MHz in addition to already reserved 400 MHz in 26 GHz band is being kept reserved for 5G services of BSNL.

(iv) Further, the Cabinet in its above meeting, has also decided to allot additional 20 MHz of spectrum in the Andhra Pradesh, Karnataka, Kolkata, Tamil Nadu, Delhi and Mumbai LSAs and 10 MHz of spectrum in Gujarat and Maharashtra LSAs to BSNL in the 2500 MHz band for the roll out of 4G services, in addition to already reserved spectrum in various bands for them for 4G services through the Cabinet decision of 2019.

These additional spectrum provisions for BSNL need to be kept out of the next auction.

2.1 In addition to above, Department of Telecommunications (DoT) has decided to make available the following new frequency bands as detailed below for IMT, which can be made available for bidding in the next auction.

Sl No	Applications/Services	Frequency bands
1.	IMT	37-37.5 GHz
2.	IMT (to share with Satellite Gateway Earth Stations with suitable protection)	37.5 – 40 GHz, 42.5-43.5 GHz

2.2 The LSA-wise quantum available with the Government in the existing bands after the auction, taking into consideration the facts mentioned in the paras 2 (i) to (iv) and 2.1 above is given in **Annexure-II**

2.3 Moreover, part of the administratively assigned spectrum to various TSPs, including that of BSNL, will be expiring during the year 2024; the same may also be included in the next auction. The LSA-wise details of such spectrum (2024 expiring) is placed at **Annexure-III.**

2.4 Further, as part of the reforms in the telecom sector, the Government has decided to hold spectrum auctions in the last quarter of every financial year.

3. Considering the above, the competent authority has decided that the spectrum mentioned at Para 2.2 and 2.3 above (**Annexure-II** and **Annexure-III** respectively) may be made available for bidding in the next auction for IMT. Any other spectrum, which might be available due to any re-farming etc. in these bands before the start of the auction, will also be made part of the auction process.

4. In view of the above, under the terms of clause 11 (1)(a) of TRAI Act, 1997, as amended by TRAI Amendment Act 2000, TRAI is requested to:

(a) provide recommendations on applicable reserve price, band plan, block size, quantum of spectrum to be auctioned and associated conditions for auction of

spectrum in 600 MHz, 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz, 2500 MHz, 3300 MHz, 26 GHz, 37 – 37.5 GHz, 37.5 – 40 GHz and 42.5 – 43.5 GHz bands for IMT.

(b) provide any other recommendations deemed fit for the purpose of spectrum auction in these frequency bands, including the regulatory/ technical requirements as enunciated in the relevant provisions of the latest NFAP/Radio Regulations of the ITU.

This issues with the approval of the competent authority.

(Gulab Chand)
Joint Wireless Adviser

Enclosures:

i) ***Annexure I***: A comprehensive report analysing the outcomes of the auction held during July/August 2022.

ii) ***Annexure-II***: LSA-wise quantum available with the Government in the 600 MHz, 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz, 2500 MHz, 3300 MHz, 26 GHz after July-August, 2022 auction and new 40 GHz bands (37-43.5 GHz range); taking into account the spectrum surrendered by Indian Railway, taking out the spectrum reserved/ proposed to be assigned to BSNL/MTNL and Railways/ NCRTC.

iii) ***Annexure-III***: LSA-wise quantum of the administratively assigned spectrum which is due for expiry during 2024.

Annexure - 1.2: TRAI letter No. C-15/2/(2)/2023-NSL-II dated 01.09.2023

(Without Annexures)

भारतीय दूरसंचार विनियामक प्राधिकरण
TELECOM REGULATORY AUTHORITY OF INDIA
भारत सरकार / Government of India

सत्यमेव जयते

No. C-15/2/(2)/2023-NSL-II
Date: 01.09.2023

To,

The Secretary,
Department of Telecommunications,
Sanchar Bhawan, 20 Ashoka Road, New Delhi - 110 001.

Subject: DoT's letter dated 02.08.2023 seeking TRAI's Recommendations for the auction of spectrum in the frequency bands identified for International Mobile Telecommunications (IMT) - reg.

Kindly refer to the DoT's letter No. L-14006/01/2023-IMT dated 02.08.2023, on the subject - 'seeking recommendations for the auction of spectrum in the frequency bands identified for International Mobile Telecommunications (IMT)'. A copy of the said letter is enclosed.

2. As mentioned in the above-referred letter, in response to the DoT's reference dated 13.09.2021, TRAI had provided its recommendations dated 11.04.2022 on various issues involved in the auction of spectrum in the 600 MHz, 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz, 2500 MHz, 3300 MHz and 26 GHz bands; based on the TRAI's recommendations dated 11.04.2022 and its subsequent response dated 09.05.2022 on DoT's backreference, the Government conducted auction of spectrum in the above frequency bands during July-August 2022.

3. Through the said letter dated 02.08.2023, DoT has mentioned the developments that took place after the completion of spectrum auctions held during July-August 2022. It has also been mentioned that DoT has decided to make available the new frequency bands viz. 37-37.5 GHz, 37.5-40 GHz, and 42.5-43.5 GHz for IMT, which can be made available for bidding in the next auction. DoT has also provided the LSA-wise quantum of spectrum available with the Government for auction of spectrum and details of the administratively assigned spectrum which will be expiring in the year 2024, which may also be included in the next auction.

Cont'd

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आज़ादी का अमृत महोत्सव

4. With this background, under the terms of clause 11 (1)(a) of TRAI Act, 1997, (as amended), DoT has requested TRAI to -

a) provide recommendations on applicable reserve price, band plan, block size, quantum of spectrum to be auctioned and associated conditions for auction of spectrum in 600 MHz, 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz, 2500 MHz, 3300 MHz, 26 GHz, 37- 37.5 GHz, 37.5- 40 GHz and 42.5-43.5 GHz bands for IMT.

b) provide any other recommendations deemed fit for the purpose of spectrum auction in these frequency bands, including the regulatory/technical requirements as enunciated in the relevant provisions of the latest NFAP/Radio Regulations of the ITU.

5. It may be noted that, TRAI through the recommendations dated 11.04.2022 on 'Auction of spectrum in the frequency bands identified for IMT/5G', provided, *inter-alia*, recommendations in the matter of regular conduct of spectrum auctions on annual basis (or at shorter intervals). The recommendations made at Para 6.42 of the TRAI's recommendations dated 11.04.2022 are reproduced below:

6.42 As there will be regular conduct of spectrum auctions on annual basis (or shorter intervals), the Authority recommends that

(I) For existing bands (including for the bands being put to auction for the first time in the forthcoming auction), a fresh spectrum valuation exercise be conducted once every three years; a suitable reference be made to the Authority by Government for this purpose.

(II) For auctions conducted in the interim period between periodic valuation exercises conducted once every three years,

(1) for LSAs where the spectrum put to auction in a previous auction is sold, the auction determined prices (duly indexed using applicable MCLR if more than one year has elapsed since the previous auction) should be used for arriving at the reserve prices for the next auction;

(2) for LSAs, where spectrum remains unsold in previous auctions, past recommended reserve price (without indexation) should be used.

(III) For new spectrum bands, to be put to auction for first time, a reference be sent to the Authority, as per established procedure as and when these bands are proposed to be put to auction.

6. Subsequently, DoT, through its letter dated 29.04.2022, referred back some of the recommendations made through the TRAI's recommendations dated 11.04.2022 on 'Auction of spectrum in the frequency bands identified for IMT/5G'. With respect to the recommendation made at para 6.42 (as mentioned in the para above), through the back-reference dated 29.04.2022, DoT mentioned that:

> *"DoT is of the view that given the fast-changing techno-commercial ecosystem, spectrum valuation at shorter intervals may be desirable. For instance, in LSAs/bands where spectrum remains unsold, there could be a case for reduction in reserve prices. Alternatively, there could be a spectrum band which may become more valuable due to a technological break-through.*
>
> *Hence, it is proposed that recommendations of TRAI on spectrum pricing would be sought before conduct of every auction."*

7. TRAI in its response dated 09.05.2022 to the DoT's back-reference dated 29.04.2022, concluded that:

> *"..the Authority does not agree with DoT's proposal to seek the Authority's recommendations before conduct of every (annual/ shorter interval) auction, as this would not be necessary unless DoT comes to a conclusion that the changes in the techno-commercial ecosystem and other factors warrants a fresh valuation. The Authority reiterates its recommendation given at paragraph 6.42 of the Recommendations dated 11.04.2022. As recommended at sub-paragraph (IV) thereof, in case DoT would like to seek the Authority's recommendations for existing spectrum bands in the interim period between periodic valuation exercises conducted once every three years, it may do so with a full and reasoned justification for the same. For new spectrum bands to be put to auction for the first time, the recommendation at sub-paragraph (III) of paragraph 6.42 would be applicable."*

8. In view of the above, and in the absence of full and reasoned justification by DoT for seeking fresh reserve prices from the Authority for the existing bands, recommendations at para 6.42 (II) of the TRAI's recommendations dated 11.04.2022 are applicable for all bands and for all LSAs referred through Annexure-II and Annexure III of the DoT's letter dated 02.08.2023 except for the new referred bands viz. 37-37.5 GHz, 37.5-40 GHz and 42.5-43.5 GHz. Therefore, for the existing bands viz. 600 MHz, 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz, 2500 MHz, 3300 MHz, and 26 GHz, auction may be conducted as per the recommendations at para 6.42 (II) of the TRAI's Recommendations dated 11.04.2022.

9. With regard to band plan, block size, and associated conditions for auction of spectrum in the existing bands viz. 600 MHz, 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz, 2500 MHz, 3300 MHz, and 26 GHz bands for IMT, it may be noted that the previous recommendations for auction of spectrum in these bands were made on 11.04.2022, based on which the auction was conducted during July-August 2022. The Authority is of the view that in such a short span of time since the previous recommendations, no technological developments or market changes have occurred that warrant any change in the band plan, block size, and associated conditions for auction of spectrum in the existing bands. The Authority also notes the changes made by the Government in the roll-out obligations in the Auctions of 2022. As regards the quantum of spectrum to be auctioned, the Authority maintains its position that all available spectrum should be put to auction.

10. In light of the above, **the Authority reiterates its recommendation at para 6.42 (II) of the Recommendations on 'Auction of Spectrum in frequency bands identified for IMT/5G' dated 11.04.2022 on the reserve price. All available spectrum in the existing bands viz. 600 MHz, 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz, 2500 MHz, 3300 MHz, and 26 GHz in the referred LSAs may be put to auction with the same band plan, block size and associated conditions.**

11. As per the para 6.42 (III) of the TRAI's Recommendations dated 11.04.2022, the Authority will initiate a consultation process for providing recommendations for the new referred bands viz. 37- 37.5 GHz, 37.5- 40 GHz, and 42.5-43.5 GHz.

12. **The Government may put to auction the spectrum in the existing bands viz. 600 MHz, 700 MHz, 800 MHz, 900 MHz, 1800 MHz, 2100 MHz, 2300 MHz, 2500 MHz, 3300 MHz, and 26 GHz without waiting for the Authority's recommendations for the new bands viz. 37-37.5 GHz, 37.5-40 GHz, and 42.5-43.5 GHz.**

This is issued with the approval of the Competent Authority.

Enclosure: As above

V. Raghunandan

(V. Raghunandan)
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LIST OF ACRONYMS

3GPP	3rd Generation Partnership Project
4G	Fourth Generation
5G	Fifth Generation
BS	Base Station
BSNL	Bharat Sanchar Nigam Limited
CEPT	European Conference of Postal and Telecommunications Administrations
DoT	Department of Telecommunications
EESS	Earth Exploration Satellite Service
EIRP	Equivalent Isotropic Radiated Power
ETSI	European Telecommunication Standards Institute
FCC	Federal Communications Commission
FCFS	First Come First Serve
FSS	Fixed Satellite Service
GHz	Giga Hertz
GSA	Global mobile Suppliers Association
IMT	International Mobile Telecommunications
ISED	Innovation, Science and Economic Development
ITU	International Telecommunication Union
ITU-R	International Telecommunication Union Radiocommunication
LSA	Licensed Service Area
LTE	Long Term Evolution
MCLR	Marginal Cost of Landing Rate
MHz	Mega Hertz
mmWave	millimeter Wave
NCRTC	National Capital Region Transport Corporation
NFAP	National Frequency Allocation Plan
NIA	Notice Inviting Applications

NTIA	National Telecommunications and Information Administration
NR	New Radio
OFCOM	Office of Communications
PEA	Partial Economic Areas
RR	Radio Regulation
SRS	Space Research Service
TDD	Time Division Duplexing
TRAI	Telecom Regulatory Authority of India
TRP	Total Radiated Power
TSP	Telecom Service Provider
UASL	Unified Access Service License
UL	Unified License
UK	United Kingdom
UMFUS	Upper Microwave Flexible Use Service
USA	United States of America
WBB ECS	Wireless Broadband Electronic Communications Services
WRC	World Radiocommunication Conference