



VIL/PB/RCA/2023/033

November 29, 2023

Advisor (Networks, Spectrum and Licensing)
Telecom Regulatory Authority of India,
Mahanagar Doorsanchar Bhawan,
Jawaharlal Nehru Marg (Old Minto Road),
New Delhi – 110002

Kind Attn: Shri Akhilesh Kumar Trivedi

Subject: Comments on the TRAI's Consultation Paper on "Open and De-licensed use of Unused or Limited Used Spectrum Bands for Demand Generation for Limited Period in Tera Hertz Range" dated September 27, 2023

Dear Sir,

This is in reference to the TRAI's Consultation Paper on "Open and De-licensed use of Unused or Limited Used Spectrum Bands for Demand Generation for Limited Period in Tera Hertz Range" dated September 27, 2023.

In this regard, kindly find enclosed herewith comments from Vodafone Idea Limited on the above-said consultation paper.

We hope our comments will merit your kind consideration please.

Thanking you,
Yours sincerely,

For **Vodafone Idea Limited**

P. Balaji
Chief Regulatory & Corporate Affairs Officer

Enclosed: As stated above



VIL Comments to the TRAI's Consultation Paper on Open and De-licensed use of Unused or Limited Used Spectrum Bands for Demand Generation for Limited Period in Tera Hertz Range

1. At the outset, we are thankful to the Authority for giving us this opportunity to provide our comments to the Consultation Paper on "Open and De-licensed use of Unused or Limited Used Spectrum Bands for Demand Generation for Limited Period in Tera Hertz Range" dated September 27, 2023.
2. **We would like to highlight that the Government has already put in place a very progressive framework through the guidelines dated July 23, 2019, which provide ample opportunities to companies/start-ups/academic, etc. for their research and development related initiatives.**
3. **The eligibility to acquire license under this guideline, is quite liberal and is open for numerous entities with nominal license fees and no royalty charges for spectrum usage. In certain cases, the guidelines provides the license basis self-declaration whereas in other cases, it provides time bound approval (de facto approval after certain time).**
4. Giving the spectrum through a License under this progressive framework, would provide regulatory certainty and much needed regulatory oversight to the use of any non-commercial spectrum including Tera Hertz Spectrum.
5. **Therefore, we urge the TRAI to recommend that such R&D requirements should be fulfilled under the existing umbrella of Experimental and Trial Licenses and not through delicensing.**
6. In case, there are certain restrictions in the Experimental and Trial License under the said guidelines, a lighter version of the said license can be looked into instead of delicensing. However, no commercial services or sale of devices should be allowed under such license.

In addition to above, kindly find below our question-wise for Authority's kind consideration:

Question-wise Comments

Q1. Whether there is a need for permitting license-exempt operations in 116-123 GHz, 174.8-182 GHz, 185-190 GHz, and 244-246 GHz frequency ranges? Please provide a detailed response with justification.

And



Q2. In case it is decided to permit license-exempt operations in 116-123 GHz, 174.8-182 GHz, 185-190 GHz, and 244-246 GHz frequency ranges, what should be the terms and conditions including technical parameters for permitting license-exempt operations in these bands, while protecting both passive and active services in and around these frequency ranges? Please provide a detailed response with justification.

And

Q3. Whether there is a need for permitting license-exempt operations in any other bands in the 95 GHz to 3 THz frequency range? Please provide a detailed response with justification.

VIL Comments to Q1, Q2 and Q3

A. Tera Hertz required for evolution of IMT services

1. For any sector, continued innovation is the key to strive and thrive in the present competitive world. For this, development of new communications technologies and new services have to be encouraged in the country, through an enabling environment.
2. Spectrum is a national and a finite resource and it should not be assigned without proper considerations and comprehensive assessment. Globally, lot of research and development is going on for using the Tera-Hertz frequency Range, as it will provide large swathes of spectrum chunks, which are crucial for providing enhanced services. While spectrum in Tera-Hertz frequency range comes with its own set of challenges, however, world over efforts are being made to utilize the same as a key technology especially for 6G services in 2030 and beyond. In many researches and concept papers¹, the usage of Tera-Hertz, especially lower portion of Tera-Hertz is involved.
3. With large bandwidth being available, THz spectrum would radically improve the performance of common network applications enabling Tera-IoT, Tera-IAB and the smaller frequencies in Tera-Hertz will open door to the new world of nanoscale electromagnetic communications networks such as IoNT and WiNoC.
4. **Advancements in THz spectrum utilization:** Advancements such as improved beamforming, ultra-massive MIMO antennas, reconfigurable intelligent surfaces (RIS), embedded AI/ML, and enhanced energy efficiency are opening the door to spectrum utilization beyond 95 GHz. Ultra-high data rates and low latencies are being targeted by IMT-2030 (6G) which need substantial contiguous spectrum. Frequencies ranging from 95 GHz to 3 THz hold immense potential. W band, D band (110 - 170 GHz) and

¹ <https://www.ericsson.com/en/6g/sub-terahertz-communication#:~:text=6G%20connectivity%20will%20be%20able,300%20GHz%20sub%2DTHz%20range>



H/J band (220 - 330 GHz) are being explored by OEMs for backhaul as these offer significant bandwidth for high throughput, low latency, high-resolution sensing and precise positioning. Also, ongoing research is focusing on innovative backhaul systems, in the D-Band^{2,3,4} with active phase array antennas along with beam-steering.

5. **Backhaul requirements:** With evolution and deployment of 5G on mmWave band, it is expected that the backhaul ecosystem will also evolve and will require large bandwidths to serve the access data requirements in urban and dense urban areas. With more deployments and uptake of 5G technology, the demand for high-speed and high capacity backhaul will continue to witness manifold increase.
6. **Nokia's demonstration - Live D-Band Microwave backhaul connection:** Nokia Bell Labs has successfully demonstrated a live microwave connection using D-Band spectrum (130-175 GHz)⁵. This spectrum offers significantly higher bandwidth compared to existing microwave bands and is expected to serve as an ultra-high-capacity backhaul and front haul solution in dense urban areas.
7. **The Bharat 6G:** The Government is already giving a huge push for India to lead globally in 6G developments and standards formulations. The Bharat 6G vision statements says "Design, develop and deploy 6G network technologies that provide ubiquitous, intelligent and secure connectivity for high quality living experience for the world". One of the functions of Bharat 6G mission is to fine-tune the research and innovation pathways and focus on new technologies such as Terahertz communication. The report from the Task Force formed under the Bharat 6G, also recognize that the New Wireless Technology in the mm-Wave and Tera-Hertz bands is expected to provide multi-gigabit speed akin to optical systems. It also says that a judicious combination of ultra-high-bitrate wireless technology in new mm-Wave and terahertz bands and optical technology, designed to operate seamlessly, can provide India with the flexible and cost-effective solution to take broadband to every home and office within the next 10 years.
8. **IMT services are backbone of Digital revolution:** IMT services serve ~114 crores connections, with ~84 crores consumers relying on wireless medium for their broadband needs. The data consumption increased manifold due to technology evolution i.e. from 3G to 4G and is expected to rise exponentially with increased 5G deployments and uptake. This technology cycle upgrade is expected to take less number of years for moving from 5G to 6G, as compared to time taken to move from 4G to 5G.

² www.graph-x-project.eu/

³ www.h2020-dream.eu

⁴ www.h2020-dragon.eu

⁵ <https://www.nokia.com/about-us/news/releases/2022/04/13/nokia-demonstrates-live-d-band-microwave-backhaul-connection/>



9. With this in background, it would be important that spectrum which is already or which can be in the path of natural evolution of IMT services, is not used for any other purposes.

B. No Delicensing of Spectrum

1. Before deliberation on delicensing, it is imperative for TRAI to seek Report from DoT containing Utilization audit of present delicensed spectrum, demand studies for new frequency range and interested parties, use cases etc.
2. Delicensing is fraught with issues of non-identification of user entity which can lead to national security issues, as well as issue of non-reversibility. Also, delicensing generally leads to deployment of ecosystem in the said bands. It becomes sort of an irreversible process to get the bands vacated once network elements and end devices have been deployed.
3. Therefore, the Tera-Hertz spectrum should neither be delicensed nor made open to use. The purpose of encouraging research and development can be fulfilled by providing the spectrum through Experimental/Demonstration licenses.

C. Progressive Guidelines from DoT

1. The Government has already put in place a very progressive framework through the guidelines dated July 23, 2019, which provide ample opportunities to companies/start-ups/academic, etc. for their research and development related initiatives.
2. The eligibility to acquire license under this guideline, is quite liberal and is open for numerous entities with nominal license fees and no royalty charges for spectrum usage. In certain cases, the guidelines provides the license basis self-declaration whereas in other cases, it provides time bound approval (de facto approval after certain time).
3. Giving the spectrum through a License under this progressive framework, would provide regulatory certainty and much needed regulatory oversight to the use of any non-commercial spectrum including Tera Hertz Spectrum.
4. **Therefore, we urge the TRAI to recommend that such R&D requirements should be fulfilled under the existing umbrella of Experimental and Trial Licenses and not through delicensing.**



5. In case, there are certain restrictions in the Experimental and Trial License under the said guidelines, a lighter version of the said license can be looked into instead of delicensing. However, no commercial services or sale of devices should be allowed under such license.

Q4. Whether there is a need for permitting license-exempt operation in 77-81 GHz band for automotive radar applications? Please provide a detailed response with justification.

And

Q5. In case it is decided to permit license-exempt operations in the 77-81 GHz band for automotive radar applications, what should be the terms and conditions including technical parameters for permitting licensed-exempt operations in this frequency band? Please provide detailed response with justification.

VII Comments to Q4 and Q5

1. The spectrum in 76 GHz - 77 GHz is already delicensed for development of short-range radar systems, however, neither there has been any specific indication of demand from existing group within India nor has any report of utilization audit of such delicensed spectrum been shared.
2. The E-band i.e. 71 GHz - 76 GHz and 81 GHz - 86 GHz is widely recognized for mobile backhaul services for 5G services, and would require it to be free from harmful interference from adjacent frequency ranges including 77 GHz - 81 GHz.
3. It would create a highly uncertain, non-uniform non-level playing policies, if one set of users are provided with specific delicensed spectrum.
4. Before deliberation on delicensing, it is imperative for TRAI to seek Report from DoT containing Utilization audit of present delicensed spectrum, demand studies for new frequency range and interested parties, use cases etc.
5. Delicensing is fraught with issues of non-identification of user entity which can lead to national security issues, as well as issue of non-reversibility. Also, delicensing generally leads to deployment of ecosystem in the said bands. It becomes sort of an irreversible process to get the bands vacated once network elements and end devices have been deployed. Therefore, the spectrum in 77-81 GHz should neither be delicensed nor made open to use.
6. The guidelines dated 23.07.2019 from Department of Telecommunication provides for Experimental and Technology Trial License and would fulfill the needs of companies to do



research and development under this Experimental license. Giving the spectrum through this Experimental License would provide regulatory certainty and much needed Regulatory oversight to the use of Spectrum, its locations and also other aspects.

7. **Therefore, once details against point no. 4 mentioned above is available, we urge the TRAI to recommend that such R&D requirements should be fulfilled under the existing umbrella of Experimental and Trial Licenses and not through delicensing.**

Q6. Whether there is a need to open the frequency spectrum between 95 GHz to 3 THz for experiment and demonstration of equipment designed to operate on any frequency above 95 GHz through a separate experimental license? Please provide a detailed response with justification.

And

Q7. In case it is decided to open the frequency spectrum between 95 GHz to 3 THz for experiment and demonstration of equipment designed to operate on any frequency above 95 GHz through a separate experimental license –

(a) what should be the terms and conditions under such a license? Kindly provide inputs in respect of, inter alia, the following aspects for the proposed separate experimental license:

- i. Purpose of the license;**
- ii. Scope of the license;**
- iii. Eligibility conditions for entities seeking to acquire the license;**
- iv. Mode of applying for the license;**
- v. Duration of the license;**
- vi. Obligation under the license;**
- vii. Financial conditions including the license fees;**
- viii. Technical conditions and other terms and conditions for operations under the license;**
- ix. Mechanism to ensure protection to passive services in the frequency range between 95 GHz to 3 THz; and**
- x. Any other (please specify).**

(b) whether the licensees should be permitted to market experimental devices designed to operate in the frequency range between 95 GHz to 3 THz via direct sale? If yes, what should be the associated terms and conditions?

Please provide a detailed response with justification.

VIL Comments to Q6 and Q7



Please refer our comments to Q1 to Q3 given above. No frequency range should be delicensed. It should be provided on a time-bound basis under DoT's guideline for Experimental and Trial License.

Q8. Whether there are any other issues or inputs in respect of the frequency spectrum in Tera Hertz bands? If yes, please provide detailed comments with justification.

VIL Comments to Q8

No comments.

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