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BHUTAN INFOCOMM AND MEDIA AUTHORITY
ROYAL GOVERNMENT OF BHUTAN



Frequency Band Plan in 26GHz for Bhutan

February 2024



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1. Background

With the increase in the demand for mobile broadband services, issues of degrading Quality of Service (QoS) delivered to the subscribers are increasing. The network densification, through deploying more mobile network infrastructure is one of the solutions to enhancing the mobile broadband QoS. However, owing to the limited land space and Right of Ways issues, especially in the urban areas, has significantly posed challenges to the telecom operators in expanding their mobile broadband networks and ensuring the mobile QoS.

An alternative to solving such issues is through enhancing the network capacity by making available the frequency spectrum and issuing more frequency spectrum to the telecom operators. The telecom operators in Bhutan have deployed mid 3.5GHz (n78) for 5G Non-Standalone (NSA) and may require additional spectrum in near future for the expansion of 5G services and enhancing its QoS. Globally, most of the regulators have released the spectrum to deploy 5G and they have released spectrum mostly in mid 3.5GHz, 700MHz and mmWave frequency bands. The spectrum in 26GHz (n258 band) which is generally a part of the mmWave frequencies, is also considered suitable for deploying the 5G services globally. Being able to deploy 5G in the n258 band may enhance the network capacity of mobile broadband services in the country. However, in order to deploy the n258 band for IMT services especially for 5G services, there is a requirement to formulate the frequency band plan, the methods of assignment and limitations if applicable.

In this regard, the Authority has identified a spectrum band in mmWave frequency for potential use for the IMT services, in particular, the 5G services.

2. Legal Basis

This frequency band plan is prepared as per the:

- a. Section 165 and 166 of the Information, Communication and Media Act of Bhutan 2018, which requires the Authority, from time to time, prepare a frequency band plan in respect of any part of radio frequency spectrum,
- b. Subsection 1.2(a) of the chapter I of the National Radio Rules and Regulations 2021 (NRRR 2021) which requires the Authority to prepare frequency band plans.

This band plan shall be the part of Schedule A of National Radio Rules and Regulations (NRRR 2021).

3. Title and Commencement

This band plan shall come into force on the 21st February 2024, corresponding to the 12th day of the 1st Month of Bhutanese Wood Male Dragon Year.



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4. Scope of Application

This band plan shall apply to:

- a. Any individuals, entity and organizations involved in the use and management of radio frequencies in Bhutan, and
- b. All matters by any individuals, entities and organizations related to the radiocommunication within or from the territory of Bhutan, its atmosphere and its outer space, to stations and devices using radio spectrum.

And shall be read in conjunction with all other existing codes of practice, Rules and Regulations established by the Authority.

5. mmWave

Millimeter wave (mmWave), also known as millimeter band, is the band of spectrum whose wavelength ranges between 10 millimeters and 1 millimeter. In terms of frequency, the spectrum band ranges from 30 GHz to 300 GHz. However for cellular mobile networks, mmWave's frequency spectrum is considered to be ranging from 24 GHz to 100 GHz.

mmWave delivers large quantities of spectrum and capacity over the shortest distances. Spectrum allocations for mmWave are often extremely wide, with most recommending 800 MHz or more frequencies per service provider. This enables the provision of high capacity delivery and improved handling of peak data rates. Wide radio carriers are defined for the high band to be used within wide spectrum allocations. These wide carriers enable shorter transmission time intervals and lower radio-interface latency to facilitate the introduction of and support for low-latency-sensitive applications.

The expected capabilities of deploying 5G in mmWave are as follows:

- a. Peak throughput per sector is of the order of 5 Gbit/s,
- b. Single user peak throughput of the order of 2-3 Gbit/s,
- c. Average throughput per sector is expected of the order of 1 Gbit/s,
- d. These throughput can be reached with Carrier Aggregation of multiple bandwidths,
- e. 8 x 100 MHz contiguous channels to get 5 Gbit/s,
- f. Such channel bandwidths can be reached only in mmWave bands,



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- g. High modulation schemes both in upload and download.

6. 26 GHz band Spectrum Allocation as per National Frequency Allocation Table

The spectrum for the n258 band ranges from 24.25 GHz to 27.50 GHz. Likewise, the National Radio Frequency Allocation Plan of Bhutan 2021 also allows the spectrum for 24.25 GHz to 27.50 GHz to be used for IMT considering that following conditions are applied:

- a. Existing EESS, SRS and FSS earth stations functioning in the band shall not be disturbed,
- b. Take practical measures to ensure the transmitting antennas of outdoor base stations are normally pointing below the horizon, when deploying IMT base stations within the frequency band 24.25-27.5 GHz; the mechanical pointing needs to be at or below the horizon,
- c. As far as practicable, sites for IMT base stations within the frequency band 24.45-27.5 GHz employing the values of 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,
- d. That protection of EESS/space research service (SRS) earth stations in the frequency band 25.5-27 GHz and radio astronomy service (RAS) stations in the frequency band 23.6-24 GHz and coexistence between FSS earth stations in the frequency bands 24.65-25.25 GHz and 27-27.5 GHz and IMT stations shall be facilitated through bilateral agreements for cross-border coordination as necessary,
- e. That the operation of IMT within the frequency band 24.25-27.5 GHz shall protect existing and future EESS (passive) systems in the frequency band 23.6-24 GHz,
- f. The antenna pattern of IMT base stations within the limits of the approximation envelope according to Recommendation ITU-R M.2101,
- g. The spurious emission limits of Recommendation ITU-R SM.329 Category B for the frequency bands 50.2-50.4 GHz and 52.6-54.25 GHz shall be applied for the 24.25-27.5 GHz band;

The table below shows the allocation of frequency spectrum for Bhutan and the rest of the world (3 Regions) in the n258 band.



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24.25-24.45 FIXED MOBILE except aeronautical mobile 5.338A 5.532AB	24.25-24.45 FIXED 5.532AA MOBILE except aeronautical mobile 5.338A 5.532AB	24.25-24.45 FIXED MOBILE 5.338A 5.532AB RADIONAVIGATION	24.25-24.45 FIXED MOBILE 5.338A 5.532AB RADIONAVIGATION
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24.45-24.65 FIXED INTER-SATELLITE MOBILE except aeronautical mobile 5.338A 5.532AB	24.45-24.65 FIXED 5.532AA INTER-SATELLITE MOBILE except aeronautical mobile 5.338A 5.532AB RADIONAVIGATION 5.533	24.45-24.65 FIXED INTER-SATELLITE MOBILE RADIONAVIGATION 5.533	24.45-24.65 FIXED INTER-SATELLITE MOBILE RADIONAVIGATION 5.533
24.65-24.75 FIXED FIXED-SATELLITE (Earth-to-space) 5.532B INTER-SATELLITE MOBILE except aeronautical mobile 5.338A 5.532AB	24.65-24.75 FIXED 5.532AA INTER-SATELLITE MOBILE except aeronautical mobile 5.338A 5.532AB RADIOLOCATION SATELLITE (Earth-to-space)	24.65-24.75 FIXED FIXED-SATELLITE (Earth-to-space) 5.532B INTER-SATELLITE MOBILE 5.338A 5.532AB	24.65-24.75 FIXED FIXED-SATELLITE (Earth-to-space) 5.532B INTER-SATELLITE MOBILE 5.338A 5.532AB



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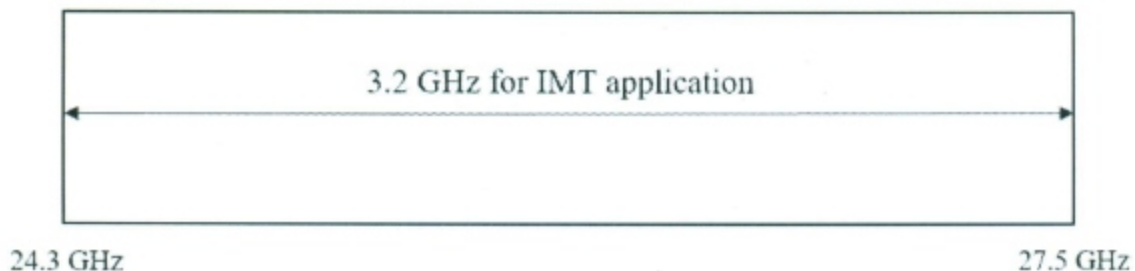
Region 1	Region 2	Region 3	Bhutan
24.75-25.25 FIXED FIXED-SATELLITE (Earth-to-space) 5.532B MOBILE except aeronautical mobile 5.338A 5.532AB	24.75-25.25 FIXED-SATELLITE (Earth-to-space) 5.535 MOBILE except aeronautical mobile 5.338A 5.532AB	24.75-25.25 FIXED FIXED- SATELLITE (Earth-to-space) 5.535 MOBILE 5.338A 5.532AB	24.75-25.25 FIXED FIXED-SATELLITE (Earth-to-space) 5.535 MOBILE 5.338A 5.532AB
25.25-25.5	FIXED 5.534A INTER-SATELLITE 5.536 MOBILE 5.338A 5.532AB Standard frequency and time signal-satellite (Earth-to-space)		25.25-25.5 FIXED 5.534A INTER-SATELLITE 5.536 MOBILE 5.338A 5.532AB Standard frequency and time signal-satellite (Earth-to-space)
25.25-25.5	EARTH EXPLORATION-SATELLITE (space- to Earth) 5.536B FIXED 5.534A INTER-SATELLITE 5.536 MOBILE 5.338A 5.532AB SPACE RESEARCH (space-to-Earth) 5.536C Standard frequency and time signal-satellite (Earth-to-space) 5.536A		25.5-27 EARTH EXPLORATION-SATELLITE (space to Earth) 5.536B FIXED 5.534A INTER-SATELLITE 5.536 MOBILE 5.338A 5.532AB SPACE RESEARCH (space-to-Earth) 5.536C Standard frequency and time signal-satellite (Earth-to-space) 5.536A
27-27.5 FIXED INTER-SATELLITE 5.536 MOBILE 5.338A 5.532AB	27-27.5 FIXED FIXED-SATELLITE (Earth-to-space) INTER-SATELLITE 5.536 5.537 MOBILE 5.338A 5.532AB	27-27.5 FIXED FIXED-SATELLITE (Earth-to-space) INTER-SATELLITE 5.536 5.537 MOBILE 5.338A 5.532AB	



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7. Frequency band plan for the band n258 (26GHz band)

The frequency band plan for n258 is as shown below where the total bandwidth of 3200MHz shall be allocated to the IMT services in Bhutan. The starting frequency for 26GHz is considered as 24.3GHz instead of 24.25GHz, unlike the 3GPP 26GHz band plan, with an objective to keep the bandwidth separation from the 24GHz EESS services. The band plan is formulated taking into consideration that, on both upper and lower end of the n258 band, there are also frequencies allocated for the use of satellite/stations.



8. Restrictions for IMT Infrastructures in 26GHz

The IMT services which use the n258 mmWave frequency spectrum shall be subject to comply with the following power limitations and other conditions;

- a. To limit the out-of-band emission from base stations to the maximum of -39 dBW/200 MHz,
- b. Existing EESS, SRS and FSS earth stations functioning in the band shall not be disturbed,
- c. Take practical measures to ensure the transmitting antennas of outdoor base stations are normally pointing below the horizon, when deploying IMT base stations within the frequency band 24.3-27.5 GHz; the mechanical pointing needs to be at or below the horizon,
- d. That the operation of IMT within the frequency band 24.3-27.5 GHz shall protect existing and future EESS (passive) systems in the frequency band 23.6-24 GHz,



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9. Proposed Method of Frequency Assignment

The method of allocations will be based on the provisions of the ICM Act 2018 and the National Radio Rules and Regulations 2021.

The Authority will assign these frequencies based on the administrative method or auction method wherever applicable and the auction will be allowed to even non-telecom companies in Bhutan which may be interested in providing or utilizing the private captive networks or enterprise networks.



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