



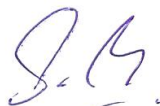
BHUTAN INFOCOMM AND MEDIA AUTHORITY RADIOCOMM DIVISION

FREQUENCY BAND PLAN FOR THE USE OF WORLDWIDE
INTER-OPERABILITY FOR MICROWAVE ACCESS (WIMAX)
TECHNOLOGY IN BHUTAN

Foreword

In accordance with the Bhutan Information, Communications and Media Act 2006 and the National Radio Rules 2011, the "**Frequency Band Plan for the Use of Worldwide Interoperability for Microwave Access (WiMAX) Technology in Bhutan**" is hereby adopted on 30th April, 2013.

This band plan shall be an addendum to the Schedule 2, Part IV of the National Radio Rules 2011.


(DIRECTOR)

Director
Bhutan InfoComm & Media Authority
Thimphu

BHUTAN INFOCOMM AND MEDIA AUTHORITY



Part I: Background and Purpose

1. There is an increase in demand of frequency spectrum for Fixed and Mobile wireless services from the private and public sector in the country for deploying flexible wireless broadband technology to enhance higher capacity, higher data speed and last mile delivery.

The WiMAX technology is one of the most appropriate such wireless broadband technology used worldwide.

In this document, the Authority publishes the spectrum/frequency band plan for deploying WiMAX technology in Bhutan. All private and public sectors intending to implement WiMAX technology in the country shall deploy in the spectrum/frequency mentioned in the published spectrum/frequency plan.

Part II: Consultation Undertaken

2. In March 26, 2013, the Authority floated the consultation paper titled ***"Frequency Band Plan for the Use of Worldwide Interoperability for Microwave Access (WiMAX) Technology in Bhutan"*** for determining the committed band of frequency for WiMAX technology implementation in the country. Incorporating the comments and feedbacks received from telecommunication sector industries, the Authority formulates the spectrum/frequency band plan for WiMAX.

Part III: Legal basis

3. Subsection 25(a) of the Bhutan Information, Communications and Media Act 2006, provides that the Authority shall plan, supervise, regulate and manage the use of radio frequency spectrum. Section 81(1) of the Act also empowers that the Authority may from time to time prepare a Frequency Band Plan in respect of any part of radio frequency spectrum.



4. The subsection 1.2(a) of the chapter III of the National Radio Rules provides that the Authority shall, by written instrument prepare frequency band plans each relating to one or more frequency bands.

Part IV: Introduction on WIMAX

5. What is WIMAX?

WIMAX is short for Worldwide Interoperability for Microwave Access. It is a metropolitan wireless standard created by the companies Intel and Alvarion in 2002 and ratified by the IEEE (*Institute of Electrical and Electronics Engineers*) under the name IEEE-802.16. More precisely, **WIMAX** is the commercial designation that the WIMAX Forum gives to the devices which conform to the IEEE 802.16 standard, in order to ensure a high level of interoperability among them.

In theory, WIMAX provides for speeds around 70 Mbps with a range of 50 kilometers. The WIMAX standard has the advantage of allowing wireless connections between a *base transceiver station* (BTS) and thousands of subscribers without requiring that they be in a direct line of sight (LOS) with that station. This technology is called NLOS for non-line-of-sight. In reality, WIMAX can only bypass small obstructions like trees or a house and cannot cross hills or large buildings. When obstructions are present, actual throughput might be under 20 Mbps

6. WIMAX standards

The revisions of the IEEE 802.16 standard fall into two categories:

- **Fixed WIMAX**, also called *IEEE 802.16-2004*, provides for a fixed-line connection with an antenna mounted on a rooftop, like a TV antenna.



Fixed WIMAX operates in the 2.5 GHz and 3.5 GHz frequency bands (which require a licence), as well as in the licence-free 5.8 GHz band.

- **Mobile WIMAX**, also called *IEEE 802.16e*, allows mobile client machines to be connected to the Internet. Mobile WIMAX opens the doors to mobile phone use over IP, and even high-speed mobile services.

Standard	Frequency	Speed	Range
Fixed WIMAX (802.16-2004)	2-11 GHz (3.5 GHz in Europe)	75 Mbps	10 km
Mobile WIMAX (802.16e)	2-6 GHz	30 Mbps	3.5 km

7. Application

One of WIMAX's potential uses is to cover the so-called "last mile" (or "last kilometer) area, meaning providing high-speed Internet access to areas which normal wired technologies do not cover (such as DSL, cable, or dedicated T1 lines).

Another possibility involves using WIMAX as a *backhaul* between two local wireless networks, such as those using the WiFi standard. WIMAX will ultimately enable two different hotspots to be linked to create a mesh network.

Part V: WIMAX Frequency Band Plan in Bhutan

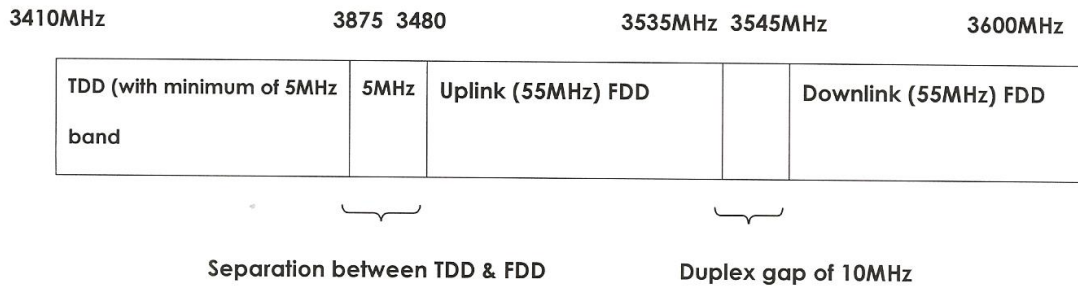
8. The WIMAX band plan for 3.5GHz

The Authority formulates the WiMAX frequency/spectrum in the 3.5GHz band which is in (3410MHz–3600MHz). It is noted that the frequency band plan is



provisioned for both the TDD (Time Division Duplex technology) and FDD (Frequency Division Duplex technology).

The initial 65MHz band from (3410MHz – 3475MHz) in 3.5GHz band is allocated for the TDD WiMAX with the 5MHz separation from the FDD band. The remaining band from (3480MHz – 3600MHz) with the duplex gap separation of 10MHz is allocated for the FDD WiMAX. The diagrammatic WiMAX frequency band allocation in 3.5GHz for Bhutan is given below.



Note: The FDD duplex gap can be allocated for TDD usage.

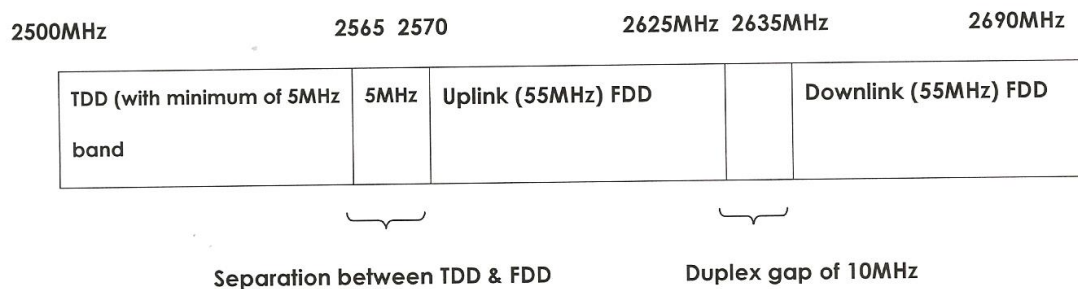
The 3.5GHz band plan with 5MHz interval for FDD

Frequency Band (MHz)	Item	Sub-band limits (MHz)	Sub-band limits (MHz)
(3480-3535)MHz (3545-3600)MHz	1.1	3480-3485	3545-3550
	1.2	3485-3490	3550-3555
	1.3	3490-3495	3555-3560
	1.4	3495-3500	3560-3565
	1.5	3500-3505	3565-3570
	1.6	3505-3510	3570-3575
	1.7	3510-3515	3575-3580
	1.8	3515-3520	3580-3585
	1.9	3520-3525	3585-3590
	2.0	3525-3530	3590-3595

	2.1	3530-3535	3595-3600
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9. The WiMAX band plan for 2.5GHz band

The Authority formulates the WiMAX frequency/spectrum in the 2.5GHz band which is in (2500MHz-2690MHz). The initial 65MHz band from (2500MHz – 2565MHz) in 2.5GHz band is allocated for the TDD WiMAX with the 5MHz separation from the FDD band. The remaining band from (2570MHz – 2690MHz) with the duplex gap separation of 10MHz is allocated for the FDD WiMAX. The diagrammatic WiMAX frequency band allocation in 2.5GHz for Bhutan is given below.



Note: This band can also be allocated for any other services supported by the band with respect to the need of the services.

The 2.5GHz FDD band plan with 5MHz interval

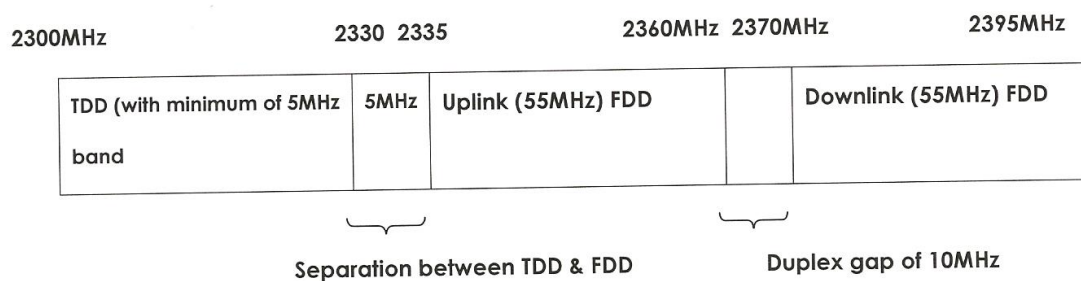
Frequency Band (MHz)	Item	Sub-band limits (MHz)	Sub-band limits (MHz)
(2570-2625)MHz (2635-2690)MHz	1.1	2570-2575	2635-2640
	1.2	2575-2580	2640-2645
	1.3	2580-2585	2645-2650
	1.4	2585-2590	2650-2655
	1.5	2590-2595	2655-2660
	1.6	2595-2600	2660-2665

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	1.7	2600-2605	2665-2670
	1.8	2605-2610	2670-2675
	1.9	2610-2615	2675-2680
	2.0	2615-2620	2680-2685
	2.1	2620-2625	2685-2690

10. The WiMAX band plan for 2.3GHz band

The Authority formulates the WiMAX frequency/spectrum in the 2.3GHz band which is in (2300MHz–2395MHz). The lower 30MHz band from (2300MHz – 2395MHz) in 2.3GHz band is allocated for the TDD WiMAX with the 5MHz separation from the FDD band. The remaining band from (2335MHz – 2395MHz) with the duplex gap separation of 10MHz is allocated for the FDD WiMAX. The diagrammatic WiMAX frequency band allocation in 2.3GHz for Bhutan is given below.



Note: This band can also be allocated for any other services supported by the band with the need of the services.

The 2.3GHz band plan with 5MHz interval for FDD

Frequency Band (MHz)	Item	Sub-band limits (MHz)	Sub-band limits (MHz)
(2335-2360)MHz	1.1	2335-2340	2370-2375
(2370-2395)MHz	1.2	2340-2345	2375-2380

	1.3	2345-2350	2380-2385
	1.4	2350-2355	2385-2390
	1.5	2355-2360	2390-2395

Part VI: Payment of Spectrum Fees

In accordance with the National Radio Rules, the licensee is required to pay initially the one time Spectrum Access Fees and Application fees. In addition, since the frequency being scarce public resource, the use of relevant frequency block is subjected to the payment of the Spectrum Utilization Fee (SUF) annually. Since the WiMAX spectrum is planned and offered for the first time any applicant will be required to pay one time Nu.10000.00 as Spectrum Access Fees.

Part VII: Technical standards and requirements

For deploying the WiMAX services, the radio emissions and power levels emission shall be in line with the international standards.

