



**BHUTAN INFOCOMM AND MEDIA AUTHORITY**

**700MHz FREQUENCY BAND PLAN FOR  
INTERNATIONAL MOBILE TELECOMMUNICATION  
(IMT) SERVICES IN BHUTAN**

## **Foreword**

In accordance with the Bhutan Information, Communications and Media Act 2006 and the National Radio Rules 2011, the “**Frequency Band plan in the 700MHz Band for use by International Mobile Telecommunication (IMT) Services**” is hereby adopted as of 5<sup>th</sup> November, 2015.

This Band Plan shall be an addendum to the schedule 2, Part IV of the National Radio Rules 2011.

**(DIRECTOR GENERAL)**

**BHUTAN INFOCOMM AND MEDIA AUTHORITY**

## **Part I: Background**

1. The 700MHz frequency band is also called the “Digital dividend”. This radio spectrum band is the result of frequencies being freed up due to the transition from analog to digital television.
2. With the enhanced compression systems of the digital television technology, more number of television channels (up to 6 TV channels depending on the coding and modulation techniques) can be supported in a single band of frequencies in digital system, which otherwise the analog system would have supported only one television channel. Therefore, fewer spectrum is now required for digital television broadcasting than previously required by the analog television broadcasting.
3. The 700MHz band, which was previously used by the television broadcasters are now gradually, freed for other services like wireless broadband services, mobile services and other telecommunications services globally.
4. The demand of 700MHz spectrum is at its peak from the telecommunications sector as the band is most suitable for both International Mobile Telecommunication 2000 (IMT-2000) services (e.g. 2.5G, 3G mobile services etc) and Advanced International Mobile Telecommunication services (IMT-Advanced) (e.g. 4G, LTE, LTE-advanced etc). The band is also suitable for the terrestrial television broadcasting.
5. Similarly, the band has been considered as the important frequency band for deploying the IMT services in Bhutan and the telecommunication sector has expressed their interests to utilize the band.
6. Therefore, in order to encourage and facilitate the implementation of efficient and effective radio services in the band, to enable fair and transparent allocation of the frequency band in Bhutan, and as well as to ensure the regional and global harmonization of services deployed, the Authority formulates the band plan for the 700MHz Frequency Band for Bhutan.

## **Part II: Legal basis**

7. 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.

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

### **Part III. Consultation Undertaken**

9. On 13<sup>th</sup> October 2015, the Authority floated the public consultation paper titled “**700MHz Frequency Band Plan for Use by the International Mobile Telecommunication (IMT) Services in Bhutan**” to seek valuable views and comments on the proposed 700MHz frequency band plan for Bhutan.
10. The Authority received comments and feedback on the consultation paper from the relevant stakeholders, industries and the beneficiaries. **The detailed views and comments received are attached in the Annexure I.**
11. The Authority incorporated the comments and feedbacks received from the stakeholders, industries and the beneficiaries of the radio frequency and hereby formulate and adopt the 700MHz frequency band plan for Bhutan.

### **Part IV: 700MHz Frequency Band Plan for Bhutan**

12. The Authority formulates the frequency band plan of 700MHz deriving from the Asia Pacific Telecommunity (APT) band plan, which extends from 698MHz to 806MHz.
13. The Authority adopts the APT band plan in FDD (Frequency Duplex Technology). This 700MHz frequency band plan in FDD divides the band into contiguous blocks of frequencies that are as large as possible taking account of the need to avoid interference with services in other bands. As a result, the FDD option comprises two large blocks, one of 45MHz for uplink transmission (mobile to network) in the lower band and other also of 45MHz for downlink transmission in the upper part.
14. The FDD schemes include the guard bands of 5MHz and 3MHz at their lower and upper edges, respectively. The guard band serves the purpose of mitigating interference with adjacent bands and its services.

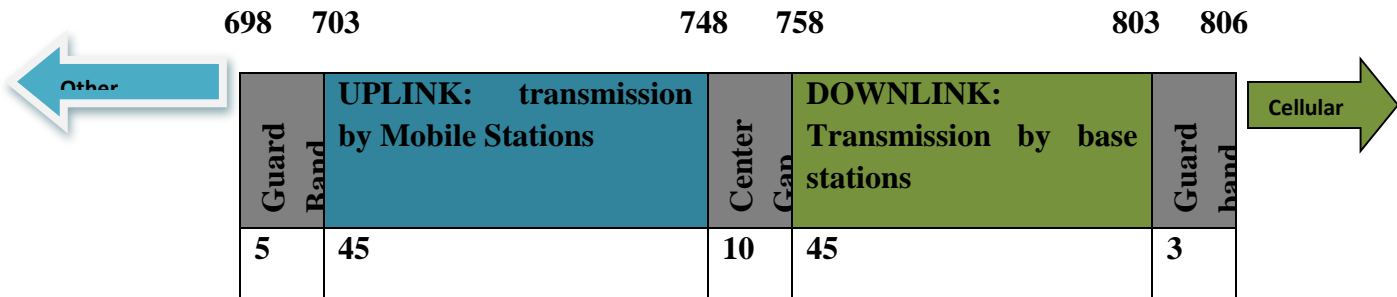
#### ***FDD 700MHz Band Plan***

15. The Figure 1 below shows the FDD 700MHz band plan. The FDD 700MHz band plan divides the following frequency bands 703MHz to 748MHz paired with 758MHz to 803MHz

with the center gap of 10MHz. The centre gap is required to avoid interference between uplink and downlink transmission.

**Figure 1**

**Frequency (MHz)**



**Bandwidth (MHz)**

16. The Table 1 below shows the further segregation of FDD plan with 10MHz band interval derived from the Figure 1 above.

**Table 1 – The FDD 700MHz band plan**

Frequency (MHz)	Band	Item	Sub-band (MHz)	limits	Sub-band (MHz)	limits
703-748 758-806		a)	703-713		758-768	
		b)	713-723		768-778	
		c)	723-733		778-788	
		d)	733-743		788-798	
		e)	743-748		798-803	

**Part V: Service allocations for 700MHz frequency band in Bhutan**

17. With the digital transition, globally, the television broadcasting is recommended to utilize the VHF television band. As the UHF band in 700MHz is gradually freed, it is recommended that the band shall be utilized for the mobile broadband services and the other IMT-2000 and IMT-advanced services.

18. Considering the regional harmonization of the frequency usage and the service implementation, the SATRC and other South Asian nations are intending to deploy the digital dividend for relevant IMT-2000 and IMT-advanced services. To derive the advantages of the economics of scale, the Bhutan can also allocate the 700MHz band for the similar services.
19. As per the ITU-R Resolutions 224 (Rev.WRC-07) and 749 (WRC-07), those parts of the band 790-960 MHz in Regions 1 and 3 (Bhutan falls in region 3) which are allocated to the mobile service on a primary basis are identified for use by administrations wishing to implement International Mobile Telecommunications (IMT) services.
20. The National Frequency Allocations Table for Bhutan from the Part IV National Radio Rules also states that the frequency band 610MHz – 876MHz are allocated primarily for the Fixed Mobile services.
21. Therefore, the 700MHz frequency band will be allocated to deploy the IMT-2000 and IMT-advanced services in the Bhutan.

#### **Part VI: Power Radiation Limit for the Services deploying 700MHz**

22. All broadband Wireless Access equipment operating in 700MHz band must adhere to the following minimum technical standards;
  - a) Base station - 30dBW
  - b) Fixed and Mobile - 14.8dBW
  - c) Portable (Handheld) Station - 4.89dBW

## Annexure 1

The table below shows comments received on the 700MHz Frequency Band consultation paper

Questions	Comments received from	Comments
<b>1) Do you agree with the proposed frequency band plan?</b>	<i>Coleago Consulting Limited, INDIA</i>	<p>The frequency ranges shown in the consultation document are consistent with the internationally harmonised band. Yes, the frequency band plan should be adopted.</p> <p>As regards block sizing, the document shows the FDD band plan in 2x5MHz blocks. Splitting the band into nine 2x5MHz blocks gives flexibility in the allocation process. However, it is relatively uneconomic to deploy the 700MHz spectrum in less than 2x10MHz.</p>
	<i>Tashi InfoComm Limited (TICL), BHUTAN</i>	<p>The proposed band plan is acceptable to TICL. However, we are concerned about the reservation of 2x10MHz for future use. If this reservation is adopted, the existing two operators will be left with only 2x35MHz to share. Since the full potential of LTE can be achieved only with 2x20MHz bandwidth, TICL would like to propose the following allocation:</p> <ul style="list-style-type: none"> <li>a) Initially, allocate 2x20MHz frequencies each to the existing two operators with the condition that the operators will have to give up 2x5MHz of spectrum in case the third operator enters the market in future, which will result in fair allocation of 2x15MHz for each of the three operators.</li> <li>b) In case the operators, after the entry of 3<sup>rd</sup> operator, are not able to meet the LTE data capacity demand using 2x15MHz of APT 700 spectrum in future, the operators have the option to migrate their network to LTE-advanced and use its Carrier Aggregation feature wherein the frequencies from different bands can be combined to offer higher data capacity. In case of Bhutan the operators can aggregate APT 700 (3GPP and band 28) and 1800 (3GPP and band 3) to offer higher data speed. Such aggregation will ensure that operators have wider coverage using APT 700 band and higher capacity using 1800MHz band.</li> <li>c) However, it must be noted that due to huge difference in the cost of deployment between LTE and LTE-</li> </ul>

		<p>advanced networks and very low compatibility of devices that support carrier aggregation, it is not commercially viable for the operators to deploy LTE-advanced network at present. Therefore, it is necessary for the existing operators to have 2x20MHz spectrum in APT 700 band to provide excellent coverage and high-capacity LTE services in cost-effective manner.</p>
	<p><i>Bhutan Telecom Limited (BTL), BHUTAN</i></p>	<p>Yes, we agree with the proposed frequency band plan because by very nature of being lower frequency band it has higher and better penetration power through materials such as buildings than any higher frequency band and more importantly, to meet to mobile data usage explosion many will prefer to 700Mhz band.</p>
	<p><i>Ministry of Information and Communications (MoIC), BHUTAN</i></p>	<p>The MoIC agrees with the proposed frequency band plan. Considering the benefits of the band, we foresee better coverage and services with the use of this band. Better penetration could be achieved in urban areas with dense population and better coverage in rural areas with sparse settlement.</p>
	<p><i>Bhutan Broadcasting Service Corporation (BBSC), BHUTAN</i></p>	<p>In future, if Bhutan migrates to digital terrestrial transmission as whole world is moving towards it, we might need to plan the spectrum requirement for at least two to three multiplexers. Taking into consideration of government’s policy on the digital migration BICMA may allocate the frequency for broadcasters according to the digital migration plan of Bhutan.</p>
<p><b>2) If yes which one should we adopt FDD or TDD? And Why?</b></p>	<p><i>Coleago Consulting Limited, INDIA</i></p>	<p>It would be best to adopt the FDD band plan, i.e. Band 28 rather than the TDD version. The FDD band plan has been widely adopted and services are running some markets. Considering the specific context of Bhutan and the 700MHz eco-system, the following arguments underpin our opinion that it would be best for Bhutan to adopt the FDD 700MHz band plan (Band 28):</p> <ul style="list-style-type: none"> <li>• Band 28 has been deployed and is operational in some markets, including Australia, New Zealand and Japan.</li> <li>• Many other countries have adopted the Band 28 FDD plan, including countries in Asia Pacific and in Latin</li> </ul>



		<p>America.</p> <ul style="list-style-type: none"> <li>• Countries in Region 1 (Europe and Africa) have started the assignment process for FDD 2x30MHz of 700MHz spectrum which overlaps with the lower duplexer of band 28 (see Exhibit 1 below). The Region 1 700MHz band plan is fully harmonized with the APT700 lower duplex. This means that band 28 devices can work in the Region 1 700MHz band. In other words region 1 700MHz and APT band 28 are harmonised. As the GSMA puts it: “The APT band plan 3GPP band 28 is a closeto-global ecosystem opportunity”. Bhutan would benefit by being part of this by adopting the FDD version of the APT 700MHz band plan.</li> <li>• In March 2013, the Telecoms Regulatory Authority of India (TRAI) the announced the adoptions of APT700 FDD band plan. The assignment to mobile may be some time away, but India is not only a very large country in terms of population, but it is also adjacent to Bhutan. Bhutan enjoys close links to India and hence harmonizing the band plan with India would be beneficial.</li> <li>• Band 28 is already included in several handsets.</li> <li>• This means Band 28 offers exceptional harmonisation in terms of the number of countries which will use this band. China has opted for the TDD version (Band 44). While China is a very large market and adjacent to Bhutan, it is so far the only country to have adopted the TDD band plan.</li> </ul>
	<p><i>Tashi InfoComm Limited (TICL), BHUTAN</i></p>	<p>TICL would like to strongly recommend the adoption of FDD over TDD owing to the following reasons:</p> <ol style="list-style-type: none"> <li>a) FDD system provides greater coverage than TDD leading to less number of base station, which in turn leads to lower CAPEX and OPEX to operators and the lower tariff for customers,</li> <li>b) FDD system has lower interference than TDD system, and</li> <li>c) FDD ecosystem is more matured than TDD. Thus, both the operators and consumers can enjoy economies of scale on network equipment and devices.</li> </ol>
	<p><i>Bhutan Telecom</i></p>	<p>We would prefer to adopt FDD as TDD technology is more complicated and availability of devices in market are less.</p>

	<i>Limited (BTL), BHUTAN</i>	Besides that there is enough bandwidth available since there are only two operators currently.
	<i>Ministry of Information and Communications (MoIC), BHUTAN</i>	Though both the technology has its pros and cons, the Ministry believes that the FDD would be better for following reasons: <ul style="list-style-type: none"> <li>a) Bhutan is not facing spectrum shortage at the moment so there is no issue of spectrum being wasted with the adoption of FDD</li> <li>b) FDD allows for the establishment of full duplex communications while the TDD does not</li> <li>c) FDD is widely adopted technology for cellular service deployment</li> <li>d) Using FDD would lead to better avoidance of interference</li> </ul>
	<i>Bhutan Broadcasting Service Corporation (BBSC), BHUTAN</i>	-
<b>3) Do you agree with the proposed type of services (IMT-2000 and IMT-advanced) to be deployed for 700MHz in the country?</b>	<i>Coleago Consulting Limited, INDIA</i>	It is best practice to assign spectrum on a technology neutral basis to IMT-2000 and IMT-advanced services.
	<i>Tashi InfoComm Limited (TICL), BHUTAN</i>	APT 700 frequency has been adopted by both the APT and the SATRC member countries for LTE mobile broadband services due to its excellent RF characteristics like wide coverage and good indoor penetration. This band is also increasingly being adopted by the countries in Latin America and Middle East. Thus APT 700 has the huge potential to become the most harmonized spectrum with the potential market of over 4 billion people. The band has also been officially standardized by 3GPP as Band 28 for FDD-LTE.  Further, in a joint study titled, “Socio-economic impact of allocating 700MHz band to mobile in Asia pacific”, Boston Consulting Group (BCG) and GSMA have found that the economic benefits of allocating 700MHz spectrum to mobile services are far greater than allocating it to any other service like broadcasting.  ( <a href="http://www.bcg.com/documents/file72139.pdf">http://www.bcg.com/documents/file72139.pdf</a> ).

		Therefore, in view of the above points, TICL would like to strongly recommend BICMA to assign APT 700 band for LTE, which is an IMT-advanced service.
	<i>Bhutan Telecom Limited (BTL), BHUTAN</i>	Yes, we do agree with the proposed type of service IMT-advanced (LTE) to be deployed for 700MHz in the country as IMT-2000(3G) is already operating in 850MHz band and moreover data growth in 3G network is ever increasing. Thus, data demand in future will be on rise. We think it is more important to reserve 700MHz in Bhutan IMT-advanced (LTE network) to meet mobile data demand as many citizens prefer to use mobile broadband than any other services. Further it is easier to use wireless broadband connectivity to extend services in every part of Bhutan which otherwise would be difficult due to our rugged geographical terrain.
	<i>Ministry of Information and Communications (MoIC), BHUTAN</i>	The allocation of 700 MHz bands for IMT services is adopted and recommended by APT and ITU, thus the Ministry has no reservation against it. Moreover, considering the benefits, the MoIC supports the allocation.
	<i>Bhutan Broadcasting Service Corporation (BBSC), BHUTAN</i>	-
<b>4) If no, what other services can also be deployed for 700MHz in Bhutan. Please justify.</b>	<i>Coleago Consulting Limited, INDIA</i>	Not Applicable
	<i>Tashi InfoComm Limited (TICL), BHUTAN</i>	None
	<i>Bhutan Telecom</i>	-

	<i>Limited (BTL), BHUTAN</i>	
	<i>Ministry of Information and Communicati ons (MoIC), BHUTAN</i>	Not Applicable
	<i>Bhutan Broadcasting Service Corporation (BBSC), BHUTAN</i>	-
<b>5) Do you have any alternative band plan proposal?</b>	<i>Coleago Consulting Limited, INDIA</i>	No
	<i>Tashi InfoComm Limited (TICL), BHUTAN</i>	Prefer to the answer to question 1
	<i>Bhutan Telecom Limited (BTL), BHUTAN</i>	Not at the moment.
	<i>Ministry of Information and Communicati ons (MoIC), BHUTAN</i>	Not Applicable
	<i>Bhutan Broadcasting Service Corporation</i>	-

	<i>(BBSC), BHUTAN</i>	
<b>6) Any other comments?</b>	<i>Coleago Consulting Limited, INDIA</i>	<p>Allocating the 700MHz spectrum to IMT services is the first step. The value of the spectrum can only be realised after the spectrum is assigned to operators and the 700MHz network is deployed.</p> <p>If the mobile operators were to roll-out LTE in the 700MHz band to a good extent of coverage, this would provide significant benefits to Bhutanese businesses and consumers. The 700MHz band would be the most cost effective solution to deliver broadband connectivity for all. However, Bhutan has a relatively small population which is spread over a wide area. Furthermore, incomes are modest. This means revenues generated from the use of the spectrum are likely to be modest. Therefore the cost of the spectrum itself (licence fees) and the cost of deployment will be important considerations for the mobile operators in Bhutan.</p> <p>Coleago recommends to adopt an assignment process and spectrum licences terms which bring the use of LTE in 700MHz band 28 to as many people as possible as fast as possible. This can be achieved by:</p> <ul style="list-style-type: none"> <li>• Not holding back spectrum and assign the total 2x45MHz as fast as possible.</li> <li>• Setting minimal spectrum licence fees.</li> <li>• Have appropriate coverage roll-out targets to ensure use and discourage spectrum hoarding.</li> <li>• Allow operators to jointly deploy the spectrum if they opt to do so.</li> <li>• Consider an administered process to assign the spectrum to operators.</li> </ul>
	<i>Tashi InfoComm Limited (TICL), BHUTAN</i>	None
	<i>Bhutan Telecom Limited (BTL), BHUTAN</i>	If BICMA decides to allocate the frequency to operators in the 700 MHz band, what is the earliest time frame that the regulator is looking at since we are planning to expand our LTE services in the country? Currently BT is using 1800 MHz band for LTE and if we get 700 MHz band then we would like to discontinue the service in band 3 and proceed

		with 700 MHz band
	<i>Ministry of Information and Communications (MoIC), BHUTAN</i>	Not Applicable
	<i>Bhutan Broadcasting Service Corporation (BBSC), BHUTAN</i>	-