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**APT REPORT ON**

**APPROACHES TO SPECTRUM HARMONIZATION FOR 5G**

**IN SATRC COUNTRIES**

**Edition: October 2023**

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# CHAPTER I – INTRODUCTION

## **BACKGROUND**

Access to several key radio-frequency bands, which have been identified internationally, is fundamental to the development of the world’s mobile industry. Meeting the rapid growth in demand for mobile voice and data services requires significant additional spectrum to be allocated to mobile services.

IMT-2020 systems are mobile systems that include the new capabilities of IMT that go beyond those of IMT-Advanced as described in Recommendation ITU-R M.2083, called IMT-2020 Vision. IMT-2020 systems support low to high mobility applications and a wide range of data rates in accordance with user and service demands in multiple user environments. IMT-2020 has capabilities for high quality multimedia applications also, within a wide range of services and platforms, providing a significant improvement in performance and quality of service.

5G, which is considered an IMT-2020 services, supports significantly faster mobile broadband speeds and increasingly extensive mobile data usage - as well as enables the full potential of the Internet of Things. The speed, reach and quality of 5G services will be heavily dependent on Regulatory policies supporting and enabling timely access to the right amount and type of spectrum, and under the right regulatory terms and conditions.

The success of 5G globally is dependent on harmonized mobile spectrum. Spectrum harmonization of internationally identified frequency bands offers many advantages such as:

1. Lower costs for consumers, as device manufacturers can mass-produce devices that function in multiple countries on a single band,
2. Availability of a wider portfolio of devices, driven by a larger, international market,
3. Roaming or the ability to use one’s mobile device abroad,
4. Fewer issues of cross-border interference

As of June 2023, some of the SATRC countries have already launched IMT-2020 (5G) services and others are expected to launch in the near future. The timings of the first implementation are different in each country but it is a common challenge for all SATRC members to deploy IMT-2020 (5G) nationwide smoothly. It is therefore beneficial to adopt the approaches to harmonize IMT-2020 (5G) in the SATRC sub-region in order to derive the various advantages of 5G spectrum harmonization. The regulators in the SATRC sub-region should also work towards aligning with globally harmonized 5G bands to achieve the greatest benefits for consumers and to avoid interference along their borders.

## **OBJECTIVES AND SCOPE OF STUDY**

This Report covers aspects related to the approaches for harmonization of 5G frequency bands in the SATRC sub-region. The main scope and objective of the study include the following but not limited to:

1. Review the existing users of spectrum in potential 5G bands and identify how best to meet the increasing demands for spectrum for mobile services,
2. Identify key 5G spectrum bands (e.g., 3.5 GHz and mm wave bands) that can be potentially harmonized for South Asian region,
3. Discuss as to how best utilize the 5G spectrum bands to benefit from international harmonization with better economies of scale.

## **METHODOLOGY**

This study report is prepared following methodology initiated with literature reviews on 5G, its use cases, global propositions on 5G, spectrum requirements for 5G, need for spectrum harmonization, 5G spectrum harmonization, globally harmonized spectrum bands for 5G and global 5G spectrum allocation plans for 5G. Then a study on the current practices and plans for 5G spectrum in SATRC member countries was conducted through a questionnaire in consultation with SATRC spectrum experts. Based on the responses received from SATRC member countries, the scenario was analyzed and way forward to harmonize the 5G spectrum in SATRC countries was recommended.

## **FORMAT OF THE REPORT**

The report is divided into chapters, based on the nature of the content of each chapter. Chapter I provides the general background of the report. Chapter II provides general information on the 5G services and its requirement of radio frequencies. Chapter III provides the information on the responses received from the member SATRC countries and its analysis thereof. Chapter IV provides the conclusion and recommendations of the report.

# CHAPTER II - IMT-2020 (5G) AND ITS FREQUENCIES

## **IMT-2020 (5G)**

Wireless technology development is at a rapid pace due to continued research and innovations. The world has already jumped into the deployment and the use of recent wireless technology called IMT 2020 which is the fifth generation of mobile technology (5G) even when the fourth generation (4G LTE) is yet to be fully connected throughout the world. The innovation and development of the fifth generation mobile technology has been triggered due to the genuine needs of the services characteristics such as increased data rates, increased capacities, reduced latencies and most importantly the improved Quality of Services (QoS).

The 5G has not only the advantages to enhance the existing mobile broadband and mobile user experiences but also has the potential to revolutionize the capacity and efficiency of numerous sectors such as manufacturing, automotive, health care, energy, transportation, industrial sector, education, agriculture, mining etc.

## **5G APPLICATIONS/USE CASES**

Based on the technical capability characteristics of 5G technology, mainly through the enhanced data rates, enhanced capacities and the reduced latency capabilities, the use cases of the 5G services are mainly categorized into three major application classifications which are;

1. Enhanced Mobile Broadband (eMBB),
2. Massive Machine Type Communication (mMTC),
3. Ultra-Reliable Low Latency Communication (uRLLC)

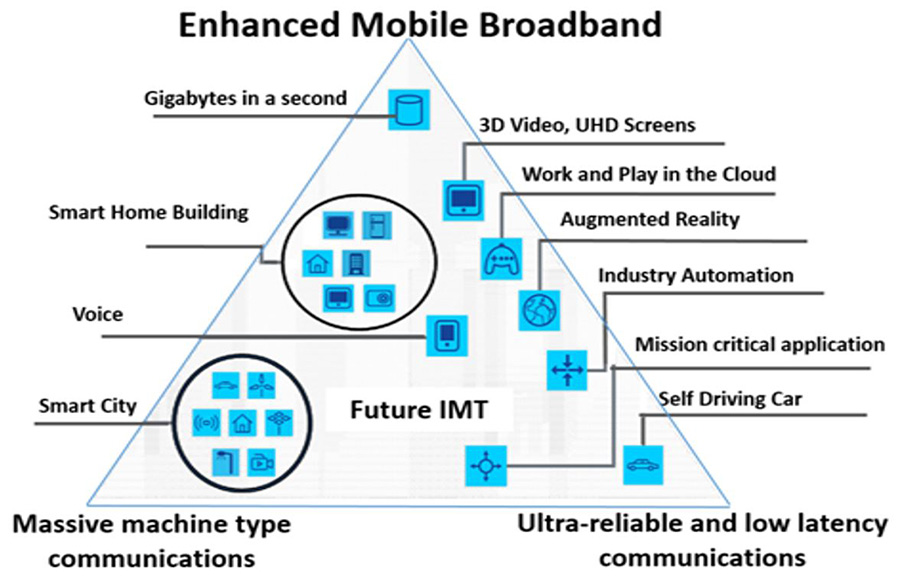


Figure 1: 5G use cases

### **Enhanced Mobile Broadband (eMBB)**

The eMBB, as highlighted by the name enhanced mobile broadband, is mainly aimed at delivering higher quality of service (QoS) internet access to the general public allowing bigger data quantities and a better user experience. The eMBB provides higher bandwidth and data rates with better latency for applications such as augmented reality (AR), virtual reality (VR), and 4K media, Cloud gaming, real-time simulation and training etc. Its user experience data rate is almost 10 times higher than the previous generation of mobile broadband technology as shown in the Figure 2.

### **Massive Machine Type Communication (mMTC)**

The mMTC refers to the ability to support a large device population within a certain area enabling extremely high connection density of connected devices. When compared to the previous generations of mobile broadband technology, especially the fourth generation mobile services, the 5G has ten times more connection density (devices/sq. km) than 4G in which the 5G can almost support a million devices per square km. mMTC can be useful in applications such as implementing IoT services in smart agriculture, smart city, remote sensors, equipment monitoring devices, near real-time data collection and response.

### **Ultra-Reliable Low Latency Communication (URLLC)**

URLLC is applicable to the services which require high network reliability and extremely low latency data transmission. The 5G can support about approximately 1 millisecond latency which is 10 times better than the 4G service as shown in the Figure 2. The applications are most useful to support the mission critical communications for applications such as autonomous cars and remote surgery. It is very relevant to supporting the industry 4.0 service automation and control.

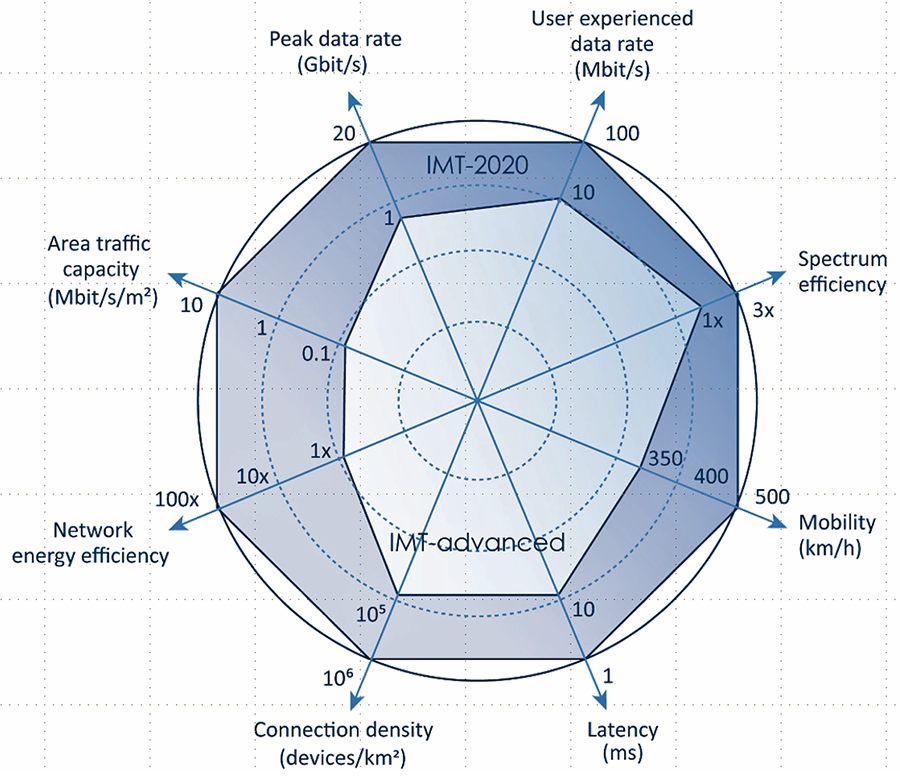


Figure 2: Comparison of IMT-advanced and 5G characteristics

## **GLOBAL PROPOSITION FOR 5G FREQUENCIES**

While the 5G technology and services are critical to modern mobile broadband demands and have immense benefits to the users, its implementation will mainly rely on the timely availability of spectrum in those frequency bands which can be deployed for the 5G technology and services. It is important that there is timely access to the right amount and type of affordable spectrum with the right regulatory conditions.

Numerous entities such as GSMA, 3GPP and other associations including the manufacturers and mobile operators have shared their recommendations on the propositions of the frequencies that are suitable for the implementation of 5G technology and services.

As per the GSMA 5G Spectrum Guide, the low, mid and high band spectrum are all required to support 5G use cases. The 5G can make use of frequencies across all the three bands to realize its best possible performance and can also use the multiple frequencies in the form of carrier aggregation at the same time. Therefore, 5G is more flexible than previous cellular mobile broadband generations and can improve both coverage and reliability.

### **Low band**

The sub-1 GHz, owing to its propagation characteristics to cover longer distances, is suitable to build coverage in sparsely populated areas and penetrate indoor to enable indoor coverage in built-up areas. The low band frequencies for 5G usually ranges from 600MHz to 1GHz and some sources also say that the low band frequencies can cover up to 2.3GHz. Being at the lower end of the 5G spectrum, it has an ability to reach wider coverage and are not easily affected by obstacles.

GSMA report on Vision 2030: Low band Spectrum for 5G recommends that sub-1GHz spectrum is essential to build coverage in thinly populated areas and provide indoor coverage in built-up and hard to reach urban areas. The reports estimate that adding 600MHz to existing low bands will raise download speeds by 30-50% in rural areas. Therefore, 5G network using sub-1 GHz frequency bands will provide wider coverage but lower capacities.

### **Mid Band**

The mid-band spectrum ranging from 1 GHz to 6 GHz is suitable for both coverage and capacity and it is ideal for 5G services since it can carry more capacity data and at the same time could travel certain significant distances. The mid-band spectrum is also further classified into lower and upper mid-band frequencies and based on the GSMA the frequency range from 3.3 GHz to 3.8 GHz is in fact most appropriate for the implementation of 5G services in mid-band.

The GSMA report on Vision 2030: 5G Mid-Band Spectrum Needs, recommends that the government and regulators plan to make 2GHz of mid-band spectrum available per country for IMT-2020 in the 2025-2030 time frame. The report also recommends to carefully consider 5G spectrum demands when 5G usage will be reaching its peak, and advanced uses cases will carry additional needs. Moreover it has recommended that there is a need to support harmonization in the mid-band within 3.5GHz, 4.8GHz and 6GHz ranges.

Therefore, 5G network using mid-band frequencies will provide moderate coverage and better capacities and that is why, the mid-band is called coverage and capacity band. Globally, highest number of 5G commercial launch have taken place in mid-band spectrum.

### **High Band or mmWave Band**

These frequencies range from 24GHz to 40GHz which are suitable for ultra-high, gigabit speeds and low latencies 5G networks. They deliver large quantities of spectrum and capacity over the shortest distances. It complements low and mid-band spectrum implementations in dense urban areas and provides fiber-like connectivity through 5G fixed wireless access (FWA) technologies. These frequencies can provide almost 1Gbps speeds and also can reach up to 10 Gbps under the optimal conditions.

The GSMA Report on Vision 2030: mmWave Spectrum Needs recommends that by 2030, an average of 5GHz of mmWave spectrum per market will be needed to satisfy demand for different 5G use cases including eMBB, FWA and enterprise networks. For this, bands such as 26GHz, 28GHz and 40GHz are recommended as the coverage is very short in these bands whereas the capacities are very high and therefore useful for low latency and high capacity use cases.

## **SPECTRUM REQUIREMENTS FOR 5G**

The implementation of 5G technology and services need significant harmonized spectrum and it is recommended that the regulators should aim to provide at least the following amount of spectrum in different frequency bands to each network operator to meet market demand. For example:

1. It is essential to make available at least 100 MHz of contiguous mid-band spectrum per operator for 5G launch. The spectrum can preferably be provided in in the C Band frequency range from 3.3 GHz to 3.8 GHz. Spectrum in the other mid-bands, such as 2.3 GHz and 2.6 GHz are also quite suitable for 5G deployment. The experience form the 5G deployed countries shows that the mid-band spectrum is the most important spectrum for the consumer 5G experience and therefore MNOs are globally interested to have more spectrum for IMT in mid-band ranging from 2 GHz to 7 GHz. Some of the bands in this range are already under consideration of WRC-23. The wish of MNOs is to have around 2000 MHz of spectrum allocated for IMT services in mid-band.
2. Spectrum in Sub-1 GHz bands are also required for providing indoor coverage and rural coverage for 5G network. The best 5G ecosystem in Sub-1 GHz is gaining momentum around 700 MHz band. However, the other available bands such as 800 MHz and 900 MHz have also been declared as NR bands and will be gradually used for 5G NR deployments. Besides, it is also important to increase the low-band spectrum capacity by assigning all available bands (including 600 MHz). The lower frequencies below 2GHz already licensed for mobile use (e.g., 1800 and 2100 MHz) may also be utilized in combination with mid band spectrum to be assigned to the network operators.
3. In order to enhance the capacities in the dense urban settings, the spectrum in mmWave provides larger capacities with shorter coverage. The spectrum should be made available by the Regulators in 24.25 – 27.5 GHz band. An initial assignment of 800 MHz per network operator in mmWave is desirable. As demand grows upwards, further spectrum can be made available in mmWave bands. The 24.25 – 27.5 GHz and the 37 – 43.5 GHz bands are the most promising bands for 5G deployments requiring coordinated efforts from all regions and countries to reach a global harmonization for 5G use.

## **NEED FOR SPECTRUM HARMONIZATION**

Spectrum harmonization refers to the uniform allocation of radio frequency bands across regions. This is not based on countries, because radio waves do not stop at country boundaries. Spectrum harmonization reduces radio interference along borders and helps in international roaming and interoperability, thus reducing the prices of telecommunication equipment and devices on a global level.

The spectrum harmonization process is critical for the operators among neighboring countries to roll out 5G as it brings together a bunch of airwaves within a band into one contiguous block. With spectrum harmonization, regulators and network operators can get better efficiencies in service operations. This is because radio-wave holdings in one band are brought together with the agreement of all the potential players. The optimum and shared usage of the spectrum within network operators within the country and among the countries can be realized only through the harmonized usage.

Regulators should start planning a clear roadmap for additional spectrum assignments that will deliver enough capacity for 5G services to scale, following the initial launch. 5G needs significant new harmonized spectrum and therefore clearing of prime bands should be prioritized to meet the growing market demand.

## **GLOBALLY HARMONISED SPECTRUM BANDS FOR 5G**

The global harmonization of spectrum bands for 5G is a widely discussed subject. The use of band 3.3-4.2 GHz for mobile broadband has been the subject of harmonization activity at various points in the past fifteen years, both at the ITU and within regional groups. And according to the GSMA’s report titled “3.5GHz in the 5G era - Preparing for New Series in 3.3 - 4.2GHz”, October 2021, there has been the global harmonization of 200 MHz spectrum from 3.4GHz to 3.6GHz at ITU.

It is observed that the discussion to harmonize the spectrum between 3.3-4.2 GHz within the ITU has been put forward during multiple WRC Agenda Items. It started in 2003 and with the upcoming WRC-23, it is expected to be extensively discussed. The frequency range between 3.3-4.2 GHz for IMT had also been discussed during the WRC-07 where some regional harmonization was achieved. The band was also discussed during the WRC-15 where some near-global harmonization was realized in the band 3.4-3.6 GHz, only this 200 MHz piece was widely identified for IMT.

Meanwhile, the endeavors to increase the part of the band which was harmonized at the ITU were unsuccessful ahead of the launch of 5G but the countries moved beyond the Radio Regulations and some regional activity has spurred harmonization outside of the WRC process. For instance, the Arab countries have moved to make the band 3.3-3.8 GHz available for IMT immediately and seek further harmonization at the ITU at a later stage. This echoes pan-European activity through CEPT which has worked to make sufficient spectrum available for the first phase of 5G at launch in the 3.4-3.8 GHz range.

On top of this, 5G services using other parts of the 3.5 GHz range are sometimes the subject of agreements at the ITU. Footnotes for 3.3-3.4 GHz and 3.6-3.7 GHz were also agreed at WRC-15. However, the identification to IMT is not harmonized globally beyond the first 200 MHz segment, 3.4-3.6 GHz, and some recent regional decisions to introduce IMT in parts of the 3.5 GHz range are not yet reflected in the Radio Regulations.

While in high bands, especially the mmWave frequency bands, the WRC-19 had identified the frequency bands in 24.25-27.5 GHz, 37-43.5 GHz, 45.5-47 GHz, 47.2-48.2 and 66-71 GHz for the deployment of 5G networks.

Moreover, in the 600 MHz band, APT (Region 3) has adopted and proposed APT 600 MHz band having 40 MHz paired spectrum in FDD mode with the following frequency pairs:

612-652 MHz – Downlink

663-703 MHz – Uplink

3GPP has also adopted the APT 600 MHz band for 5G NR and defined this band as n105 Band. India has already adopted this band for IMT.

Meanwhile, the WRC-23 is an opportunity to discuss harmonizing the larger frequency band for 5G services. WRC-23 has the following agenda items related to IMT spectrum:

**Agenda Item 1.1**

To consider, based on the results of ITU-R studies, possible measures to address, in the frequency band 4800-4990 MHz, protection of stations of the aeronautical and maritime mobile services located in international airspace and waters from other stations located within national territories, and to review the power flux-density criteria in No. 5.441B in accordance with Resolution 223 (Rev.WRC-19);

**Agenda Item 1.2**

To consider identification of the frequency bands 3 300-3 400 MHz, 3 600-3 800 MHz, 6 425-7 025 MHz, 7 025-7 125 MHz and 10.0-10.5 GHz for International Mobile Telecommunications (IMT), including possible additional allocations to the mobile service on a primary basis, in accordance with Resolution 245 (WRC-19);

**Agenda Item 1.3**

To consider primary allocation of the frequency band 3600-3800 MHz to the mobile service in Region 1 and take appropriate regulatory actions, in accordance with Resolution 246 (WRC-19);

**Agenda Item 1.4**

To consider, in accordance with Resolution 247 (WRC-19), the use of high-altitude platform stations as IMT base stations (HIBS) in the mobile service in certain frequency bands below 2.7 GHz already identified for IMT, on a global or regional level;

**Agenda Item 1.5**

To review the spectrum use and spectrum needs of existing services in the frequency band 470-960 MHz in Region 1 and consider possible regulatory actions in the frequency band 470-694 MHz in Region 1 on the basis of the review, in accordance with Resolution 235 (WRC-15);

## **GLOBAL FREQUENCY ALLOCATION PLAN FOR 5G SERVICES**

Globally, many countries have launched the 5G services and have opted or planned the numerous frequency bands for implementing 5G services.

For instance, the China has identified the following frequencies for the 5G service implementation:

1. 700MHz,
2. 2.5/2.6GHz (B41.n41),
3. 3.3-3.6GHz,
4. 4.8-5GHz,
5. 24.75-27.5GHz,
6. 37-42.5GHz

Note: Recently China has identified and included in its NFAP the IMT band 6425 MHz - 7125 MHz for 5G

India has identified the following frequencies for the 5G service implementation:

1. 600 MHz (APT 600 MHz Band)
2. 700 MHz,
3. 3.3-3.67GHz,
4. 24.25-27.5GHz,
5. 37-43.5GHz

South Korea has identified the following frequencies for the 5G implementation:

1. 3.42-3.7GHz,
2. 26.5-28.9GHz,

Japan has identified the following frequencies for 5G implementation:

1. 3.6-4.1GHz,
2. 4.5-4.9GHz and 4.9-5GHz
3. 26.6-27GHz and 27-29.5GHz,
4. 39-43.5GHz

Australia has identified the following frequencies for 5G implementation:

1. 3.4-3.7GHz,
2. 24.25-27.5GHz,
3. 39GHz

In March 2022, the Independent Communications Authority of South Africa (ICASA) completed a delayed 5G auction, selling spectrum across 700MHz, 800MHz, 2.6GHz, 3.5GHz bands. The MNOs have undertaken to use the acquired spectrum to improve the quality of their existing 4G services and to offer their customers 5G services that require frequency spectrum in 700MHz to 3.5GHz.

The Arab Spectrum Management Group – a forum for regulators across the Arab world had agreed to use spectrum in the range 3.3 – 3.8GHz bands for initial deployments of 5G across the Arab region. Operators in the region are also using spectrum in the 2.6GHz band for 5G deployments.

In UAE, 300 MHz (3300 MHz to 3600 MHz) of n78 frequency band is allocated to Etisalat by e& and 200 MHz (3600 MHz to 3800 MHz) to Du, while in the n41 frequency band, 100 MHz (2496 MHz to 2596 MHz) is allocated to Du, and 94 MHz (2596 MHz to 2690 MHz) to Etisalat by e&. In 2021 both Etisalat by e& and Du were allocated 1 GHz each of mmWave spectrum in 25.5-27.5 GHz to support eMBB applications.

Similarly, many countries have already auctioned and deployed the frequencies for 5G services and others carrying out trial deployment.

# CHAPTER III - QUESTIONNAIRES AND ANALYSIS OF RESPONSES

## 

## **QUESTIONNAIRES DEVELOPED**

The following questionnaires were developed and sent to the SATRC member countries to study the information on the preparation, planning and assignment of the frequency spectrum for 5G technology and service implementations. All the SATRC members provided responses to the questionnaires except Maldives.

* + - 1. **Current Status of Mobile Broadband in your country**

**Question 1:** What are the allocated frequency bands that have been identified for IMT in your country?

**Question 2:** Which of the frequency bands identified for IMT have been assigned in your country?

**Question 3:** What is the roadmap/current status of remaining frequency bands already identified for IMT?

1. **Current Status of technology neutrality in frequency assignment**

**Question 4:** Are the frequency bands assigned in your country technology neutral? If not which of the bands are technology specific and which of the bands are technology neutral? Please state the reasons.

1. **Current Status of 4G in your country**

**Question 5:** What is the scenario of penetration rate and/or number of subscriptions of 4G technologies, such as LTE/LTE-Advanced, in your country? (Percentage of 4G subscribers to total subscribers)

**Question 6:** Is there any rollout obligation for 4G implementation in your country? If yes, please provide details. And how much geographical area/population has been covered by 4G?

1. **Current status of 5G in your country**

**Question 7:** What are the spectrum bands identified in your country supporting 5G? Please provide details.

**Question 8:** Have 5G services been launched in your country? If yes, please provide details of frequency bands in which 5G has been deployed.

**Question 9:** Whether the 5G services have been planned/deployed in the bands used for 2G/3G/4G? If yes, please provide details.

1. **5G spectrum plan**

**Question 10:** Is there any spectrum roadmap for a 5G plan in your country? If yes, please provide details.

**Question 11:** Is there any high capacity wireless backhaul plan for 5G? If yes, please provide the details of frequency bands?

**Question 12:** Is there any plan for the coexistence of IMT services with satellite services? If yes please specify the bands and provide the details.

## **ANALYSIS OF CURRENT STATUS OF SPECTRUM FOR MOBILE BROADBAND IN SATRC COUNTRIES**

### **Status of Frequency Allocations for IMT in SATRC Countries**

Based on the responses received to the questionnaires, the following frequency IMT bands mentioned Radio Regulations for Region 3 are found to be allocated for IMT in SATRC Countries.

Table 1: Status of Frequency Allocations for IMT in SATRC Countries

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Region 3 Bands as mentioned in RR** | **Afghanistan** | **Bangladesh** | **Bhutan** | **India** | **Iran** | **Nepal** | **Pakistan** | **Sri Lanka** |
| 450-455 MHz | 450-470 MHz |  |  | 450-455 MHz |  |  |  | 450 MHz (Band 31) |
| 455-456 MHz |  |  | 455-456 MHz |  |  |  |
| 456-459 MHz |  |  | 456-459 MHz |  |  |  |
| 459-460 MHz |  |  | 459-460 MHz |  |  |  |  |
| 460-470 MHz |  |  | 460-470 MHz |  |  |  | 450 MHz (Band 31) |
| 470-585 MHz |  |  |  | 470-585 MHz |  |  |  |  |
| 585-610 MHz |  |  |  | 585-610 MHz |  |  |  |  |
| 610-890 MHz | 694-862 MHz 880-960 MHz | 703-748 MHz 758-803 MHz 880-915 MHz 925-960 MHz | 700 MHz 850 MHz | 610-890 MHz | 694-862 MHz 876-960 MHz | 700 MHz 800 MHz 900 MHz | 700 MHz 850 MHz 900 MHz | 850 MHz (Band 5) 900 MHz (Band 8) |
| 890-942 MHz | 900 MHz | 890-942 MHz |
| 942-960 MHz | 942-960 MHz |
| 1427-1429 MHz |  |  |  | 1427-1429 MHz | 1427-1518 MHz |  |  |  |
| 1429-1452 MHz |  |  |  | 1429-1452 MHz |  |  |  |  |
| 1452-1492 MHz |  |  |  | 1452-1492 MHz |  |  |  |  |
| 1492-1518 MHz |  |  |  | 1492-1518 MHz |  |  |  |  |
| 1710-1930 MHz | 1710-1880 MHz 1880-1920 MHz 1920-2110 MHz 2110-2200 MHz | 1710-1785 MHz 1805-1880 MHz 1920-1980 MHz | 1700  MHz  1800 MHz 2100 MHz | 1710-1930 MHz | 1710-2025 MHz | 1800 MHz 2100 MHz | 1800 MHz 2100 MHz | 1800 MHz (Band 3) 2100 MHz (Band 1) |
| 1930-1970 MHz | 1930-1970 MHz |
| 1970-1980 MHz | 1970-1980 MHz |
| 1980-2010 MHz |  |  | 1980-2010 MHz |  |  |  |
| 2010-2025 MHz |  |  | 2010-2025 MHz |  |  |  |
| 2025-2110 MHz |  |  | 2025-2110 MHz |  |  |  |  |
| 2110-2120 MHz | 2110-2170 MHz | 2100 MHz | 2110-2120 MHz | 2110-2200 MHz | 2100 MHz | 2100 MHz | 2100 MHz |
| 2120-2160 MHz | 2120-2160 MHz |
| 2160-2170 MHz | 2160-2170 MHz |
| 2170-2200 MHz |  |  | 2170-2200 MHz |  |  |  |
| 2300-2450 MHz | 2300-2400 MHz | 2300-2400 MHz | 2300 MHz | 2300-2450 MHz | 2300-2400 MHz | 2300 MHz | 2300 MHz | 2300 MHz (Band 40) 2600 MHz (Band 41) |
| 2500-2520 MHz | 2500-2690 MHz | 2500-2690 MHz | 2500-2690 MHz | 2500-2520 MHz | 2500-2690 MHz | 2600 MHz | 2600 MHz |
| 2520-2535 MHz | 2520-2535 MHz |
| 2535-2655 MHz | 2535-2655 MHz |
| 2655-2670 MHz | 2655-2670 MHz |
| 2670-2690 MHz | 2670-2690 MHz |
| 3300-3400 MHz |  | 3300-3800 MHz | 3400-3600 MHz | 3300-3400 MHz |  | 3300 MHz | 3500 MHz |  |
| 3400-3500 MHz | 3400-3600 MHz | 3400-3500 MHz | 3400-3500 MHz | 3400 MHz | 3400 MHz (Band 42) |
| 3500-3600 MHz | 3500-3670 MHz | 3500-3600 MHz |
| 3600-3700 MHz |  | 3600-3800 MHz | 3600 MHz |  |
| 3700-4200 MHz |  |  |  |
| 24.25-24.45 GHz |  |  |  | 26GHz (24.25-27.5 GHz) | 26GHz (24.25-27.5 GHz) |  | 26 GHz (24250-24549 MHz, 24633-25557 MHz, 25641-27500 MHz) |  |
| 24.45-24.65 GHz |  |  |  |  |  |
| 24.65-24.75 GHz |  |  |  |  |  |
| 24.75-25.25 GHz |  |  |  |  |  |
| 25.25-25.5 GHz |  |  |  |  |  |
| 25.5-27 GHz |  |  |  |  |  |
| 27-27.5 |  |  |  |  |  |
| 27.5-28.5 |  |  |  | 27.5 GHz-28.5 GHz |  |  |  |  |
| 39 GHz |  |  |  |  |  |  |  |  |
| 37-37.5 |  |  |  | 37-40 GHz |  |  |  |  |
| 37.5-38 |  |  |  |  |  |  |  |
| 38-39.5 |  |  |  |  |  |  |  |
| 39.5-40 |  |  |  |  |  | 39 GHz (39.5 – 43.5 GHz) |  |
| 40-40.5 |  |  |  | 42.5-43.5 GHz |  |  |  |
| 40.5-41 |  |  |  |  |  |  |
| 41-42.5 |  |  |  |  |  |  |
| 42.5-43.5 |  |  |  |  |  |  |

### **STATUS OF FREQUENCY ASSIGNMENTS FOR IMT IN SATRC COUNTRIES**

Among the above allocated IMT frequency bands, the following bands have been assigned in SATRC Countries.

Table 2: Status of Frequency Assignments for IMT in SATRC Countries

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Region 3 Bands as mentioned in RR** | **Afghanistan** | **Bangladesh** | **Bhutan** | **India** | **Iran** | **Nepal** | **Pakistan** | **Sri Lanka** |
| 450-455 MHz |  |  |  |  |  |  |  | 450 MHz (Band 31) |
| 455-456 MHz |  |  |  |  |  |  |  |
| 456-459 MHz |  |  |  |  |  |  |  |
| 459-460 MHz |  |  |  |  |  |  |  |  |
| 460-470 MHz |  |  |  |  |  |  |  | 450 MHz (Band 31) |
| 470-585 MHz |  |  |  |  |  |  |  |  |
| 585-610 MHz |  |  |  |  |  |  |  |  |
| 610-890 MHz | 880-890 MHz |  | 700 MHz 850 MHz | 700 MHz 850 MHz | 900 MHz (885-912.450 MHz/ 925-957.450 MHz) | 800 MHz 850 MHz (CDMA) 900 MHz | 850 MHz 900 MHz | 850 MHz (Band 5) 900 MHz (Band 8) |
| 890-942 MHz |  | 900 MHz | 900 MHz | 900 MHz |
| 942-960 MHz | 942-960 MHz |  |  |
| 1427-1429 MHz |  |  |  |  |  |  |  |  |
| 1429-1452 MHz |  |  |  |  |  |  |  |  |
| 1452-1492 MHz |  |  |  |  |  |  |  |  |
| 1492-1518 MHz |  |  |  |  |  |  |  |  |
| 1710-1930 MHz | 1710-1930 MHz | 1800 MHz 2100 MHz | 1800 MHz 2100 MHz | 1800 MHz (1710-1765 MHz/1805-1860 MHz) 2100 MHz (1939-1979 MHz) | 1800 MHz (1722.5-1855 MHz / 1750-1880 MHz) 2100 MHz (1920-1960 MHz) | 1800 MHz 2100 MHz | 1800 MHz 2100 MHz | 1800 MHz (Band 3) 2100 MHz (Band 1) |
| 1930-1970 MHz | 1930-1970 MHz |
| 1970-1980 MHz |  |
| 1980-2010 MHz |  |  |  |  |  |  |  |
| 2010-2025 MHz |  |  |  |  |  |  |  |
| 2025-2110 MHz |  |  |  |  |  |  |  |  |
| 2110-2120 MHz | 2110-2200 MHz (only first 2x50 MHz) | 2100 MHz | 2100 MHz |  |  | 2100 MHz | 2100 MHz | 2100 MHz |
| 2120-2160 MHz | 2100 MHz (2129-2169 MHz) | 2100 MHz (2110-2170 MHz) |
| 2160-2170 MHz |  |
| 2170-2200 MHz |  |  |  |  |  |  |  |
| 2300-2450 MHz |  | 2300 MHz | 2300 MHz | 2300 MHz (2300-2380 MHz) | 2300 MHz (2300-2380 MHz) | 2300 MHz |  | 2300 MHz (Band 40) 2600 MHz (Band 41) |
| 2500-2520 MHz |  | 2600 MHz |  |  | 2500 MHz (2500-2560 MHz / 2620-2680 MHz) | 2600 MHz (Trial) |  |
| 2520-2535 MHz |  |  |  |
| 2535-2655 MHz |  |  | 2600 MHz (2535-2555 MHz, 2635-2655 MHz) |
| 2655-2670 MHz |  |  |
| 2670-2690 MHz |  |  |  |
| 3300-3400 MHz |  | 3500 MHz | 3400-3600 MHz | 3500 MHz (3300-3670 MHz) |  |  | 3500 MHz (WLL) |  |
| 3400-3500 MHz | 3400-3420 MHz | 3400-3600 MHz |  |  |
| 3500-3600 MHz |  |  |
| 3600-3700 MHz |  |  |  |  |
| 3700-4200 MHz |  |  |  |  |  |
| 24.25-24.45 |  |  |  | 26 GHz (24.25-27.5 GHz) |  |  |  |  |
| 24.45-24.65 |  |  |  |  |  |  |  |
| 24.65-24.75 |  |  |  |  |  |  |  |
| 24.75-25.25 |  |  |  |  |  |  |  |
| 25.25-25.5 |  |  |  |  |  |  |  |
| 25.5-27 |  |  |  |  |  |  |  |
| 27-27.5 |  |  |  |  |  |  |  |
| 37-37.5 |  |  |  |  |  |  |  |  |
| 37.5-38 |  |  |  |  |  |  |  |  |
| 38-39.5 |  |  |  |  |  |  |  |  |
| 39.5-40 |  |  |  |  |  |  |  |  |
| 40-40.5 |  |  |  |  |  |  |  |  |
| 40.5-41 |  |  |  |  |  |  |  |  |
| 41-42.5 |  |  |  |  |  |  |  |  |
| 42.5-43.5 |  |  |  |  |  |  |  |  |

### **ANALYSIS OF STATUS OF SPECTRUM ROADMAP FOR IMT IN SATRC COUNTRIES**

The current status/roadmap of remaining frequency bands already identified for IMT in SATRC countries are found as follows.

* Currently, Afghanistan does not have a specific (written) spectrum roadmap available. However, decisions for the spectrum roadmap will be taken in the future.
* Bangladesh is under active consideration of frequency assignment of 700 MHz. 20% of 900 MHz Band, 30% of 2300 MHz Band, 37% of 2600 MHz Band spectrum assignment is to be done. Also, 90% of 3500 MHz band spectrum shall be assigned based on market demand as 10% of 3500 MHz Band spectrum has been assigned for trial.
* Bhutan plans future assignment of IMT frequency bands those not mentioned above, based on demand from operators. Bhutan will also look into re-farming the spectrum if the legacy technologies does not see much demand.
* India is under study of the coexistence of IMT with various other users in the 526-582 MHz, 37 – 43.5 / 47.2 – 48.2 GHz and 66-71 GHz band.
* Iran is under consideration of frequency bands 45.5-47, 66-71 GHz and 37-43.5, 47.2-48.2 GHz to be used in the mobile service.
* Nepal plans for auction of 700, 2300 and 2600 MHz bands in near future. Although 3300, 3400, 3600 MHz bands are assigned for IMT, broadcasting services are utilizing the C-band. Nepal is thus under study of the possibility of sharing the band for both services. Further decisions regarding C-band are planned to be taken after WRC-23. Furthermore, CDMA service is expected to be shut down soon.
* Pakistan has made available additional spectrum in 1800 and 2100 MHz bands over and above the existing allocations. Further, new spectrum bands have been approved for future spectrum auctions i.e. 2300 MHz, 2600 MHz, 3500 MHz, 24 GHz and 39 GHZ spectrum bands.
* Sri Lanka is under a refarming process of 3500MHz (n78) to remove all existing services. The part of the band is ready for the assignment through a competitive bidding process in 2024.

## **ANALYSIS OF CURRENT STATUS OF TECHNOLOGY NEUTRALITY SPECTRUM IN SATRC COUNTRIES**

Most of the IMT frequency bands assigned in SATRC countries except Sri Lanka are found technology neutral. The adoption of technology neutral spectrum bands in SATRC countries is depicted in the table below.

Table 3: Current Status of technology neutrality in frequency assignment in SATRC Countries

|  |  |
| --- | --- |
| **SATRC Member Country** | **Current Status of technology neutrality in frequency assignment** |
| Afghanistan | The Licenses given to all MNOs are technology neutral |
| Bangladesh | All the IMT frequency bands assigned are technology neutral. |
| Bhutan | The frequency bands assigned are all technology neutral. However, approval for the assignment for services needs to be discussed and sought from the Authority. |
| India | All spectrum assigned through auctions are technology neutral. However, the spectrum assigned administratively prior to 2012, in the 800 MHz, 900 MHz and 1800 MHz bands for GSM/CDMA services were not technology neutral. The operators having administratively assigned spectrum have an option to liberalise (convert to technology neutral) by paying market determined price on a pro-rata basis. |
| Iran | All bands that are assigned, are tech. neutral. However, because of market’s status, consumed payload and other factors, the operators can decide which bands may use what technology |
| Nepal | All spectrum bands are technology neutral. For the bands that were assigned before the technology neutrality regime was introduced, service providers are allowed to submit their rollout plan for technology neutral services and get it approved by the Authority. |
| Pakistan | All bands are technology neutral |
| Sri Lanka | All bands assigned are technology specific. |

## 

## **ANALYSIS OF CURRENT STATUS OF 4G IN SATRC COUNTRIES**

### **Status of 4G subscribers in SATRC Countries**

The scenario of penetration rate and/or number of subscriptions of 4G technologies, such as LTE/LTE-Advanced in SATRC Countries is summarized in Table 4.

Table 4: Status of 4G Subscribers in SATRC Countries

|  |  |  |  |
| --- | --- | --- | --- |
| **SATRC Member Country** | **4G Penetration**  **(Percentage of 4G subscribers to total subscribers)** | **4G Subscribers** | **Data Reference** |
| Afghanistan | 12.5% | 77.60 Million | December 2022 |
| Bhutan | 80.45% | 0.788 Million | September 2022 |
| Bangladesh | 42% |  | October 2022 |
| India | 66.49% | 763.95 Million | October 2022 |
| Iran | - | 86 Million | October 2022 |
| Nepal | 48.42% | 11.27 Million | October 2022 |
| Pakistan | 61% |  | September 2022 |
| Sri Lanka | |  |  | | --- | --- | | *Bharti Airtel Lanka (Pvt) Ltd* | *57%* | | *Dialog (DAP)* | *61%* | | *Hutchison Telecommunications Lanka (Pvt) Ltd* | *39%* | | *Mobitel Private Limited* | *54%* | |  | October 2022 |

### **4G ROLLOUT OBLIGATION AND 4G COVERAGE IN SATRC COUNTRIES**

Most of the SATRC member countries are found to have 4G spectrum Rollout Obligation for spectrum assignment. The summary of roll out obligations for 4G spectrum and the 4G coverage in SATRC member countries is summarized in table 5.

Table 5: 4G rollout obligations and 4G coverage in SATRC Member Countries

|  |  |  |
| --- | --- | --- |
| **SATRC Country** | **4G Rollout obligation** | **4G Coverage** |
| Afghanistan | 34 provinces in 4 categories   1. 95% outdoor coverage in provincial center of each province in 18 months, 2. 90% outdoor coverage in provincial center of each province in 18 months, 3. 90% of the cities in 2 years 4. covering 80% of district centres in 5 years | 15% area coverage  32% population coverage |
| Bangladesh | 3 Phases   1. Services in all Divisional Headquarters in 9 Months 2. Services in another 30% of district Headquarters in 18 months 3. Services in all District Headquarters in 36 months   Other obligations   1. Services in major cities/ locations as per direction from Commission 2. Services in Upazila/ National Highway /railway track upon fulfilment of 3rd Phase Work 3. Services in all over the country upon fulfilment of 3rd Phase Work | 90% |
| Bhutan | No obligation for 4G implementation in the country, however all the uncovered rural areas have been prioritized to cover through the Rural Communication Program. | More than 99% of the population is covered by the 4G network but the older generations still sticks to the 2G and 3G services. |
| India | The roll out obligations are governed by the respective provisions in the NIA issued before each auctions, as available in DoT website. Further, the roll out obligations are frequency band speciﬁc and not technology speciﬁc. | More than 95% of the population is covered by 4G network. |
| Iran | Regulation that defined obligations for all of technology, includes parameters for 4G implementation, such as RSRP Idle Mode, RSRQ Idle Mode, MOS, LTE Service Request Success Rate , LTE eRAB Drop Rate | 15,604 sites covering 1,329 cities |
| Nepal | 1. The operator shall ensure that it shall provide National 4G coverage (in all 7 provinces and 77 district headquarters) by end of 2020. 2. 4G coverage in urban area shall be 95% (by population) by end of 2022. 3. 4G coverage in rural areas of municipalities and rural municipalities shall be 90% (by population) by the end of 2022. 4. 4G coverage in Tourist Areas/Specified National Parks/HighWay shall be 95% by the end of 2022. 5. User Experience (Download Speed) shall be of minimum 20 Mbps in Urban and 10 Mbps in rural areas. |  |
| Pakistan | 3 % population increase every year | Approx. 60% |
| Sri Lanka | The assignments specific rollout obligations are applied for some assignments for 4G implementations.  Rollout obligations are applied based on the investments in terms of number of base stations to be deployed within a period in all districts. | All operators have island wide coverage. |

## **ANALYSIS OF CURRENT STATUS OF 5G IN SATRC COUNTRIES**

### **Identified 5G Spectrum Band in SATRC Countries**

Most of the SATRC Countries except Afghanistan have identified 5G spectrum bands. The following SATRC countries have identified 5G spectrum in following frequency bands as depicted in Table 6.

Table 6: Identified 5G Spectrum band in SATRC Countries

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Frequency Band** | **Bangladesh** | **Bhutan** | **India** | **Iran** | **Nepal** | **Pakistan** | **Sri Lanka** |
| 700 MHz |  |  | All spectrum bands are under technology neutrality regime |  | All spectrum bands are under technology neutrality regime | **√** |  |
| 800 MHz |  |  |  |  |  |
| 900 MHz | **√** |  |  |  |  |
| 1800 MHz | **√** |  |  | **√** |  |
| 2100 MHz |  |  |  | **√** |  |
| 2300 MHz | **√** |  |  | **√** |  |
| 2600 MHz | **√** |  |  | **√** |  |
| 3300 MHz |  |  |  |  |  |
| 3500 MHz | **√** | **√** | 3400-3800 MHz | **√** | **√** |
| 4800 MHz |  |  | 4800-4990 MHz |  |  |  |
| 26 GHz |  |  | 27.5 GHz-28.5 GHz |  | 26 GHz (24250-24549 MHz, 24633-25557 MHz, 25641-27500 MHz) | **√** |
| 39 GHz |  |  |  | 37-40 GHz,  42.5-43.5 GHz |  | 39 GHz (39.5 – 43.5 GHz) |  |
| mmwave |  | Under consideration |  |  |  |  |  |

### **5G launch and plan for 5G in existing 2G/3G/4G bands in SATRC Countries**

### 

Some of the SATRC member countries have launched 5G. Some SATRC members have undergone a 5G trial. The following table 7 depicts the summary of 5G launch and plan for 5G in existing 2G/3G/4G bands in SATRC Countries.

Table 7: 5G launch and plan for 5G in existing 2G/3G/4G bands in SATRC Countries

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **SATRC Country** | **5G Launch** | **5G Trial** | **5G Launch/Trial Frequency Bands** | **5G Plans in existing 2G/3G/4G bands** |
| Afghanistan | No |  |  | No |
| Bangladesh | No | Yes |  | All the IMT frequency bands assigned are technology neutral. Hence, operators are allowed to deploy 5G services in any of their assigned IMT spectrum depending on their strategy. |
| Bhutan | Yes | Done | 3.5 GHz (3.4 - 3.6 GHz) | No, as of now. However, it may be possible in future through spectrum refarming. All the spectrum bands are applicable for technology neutral regime. |
| India | Yes | Done | 700 MHz, 3300 - 3670 MHz and 26 GHz bands | The TSPs can deploy any technology in the spectrum acquired through auctions or liberalized which includes 2G/3G/4G bands. |
| Iran | Yes |  | 3500 MHz | Yes (Tehran City) 3500 MHz frequency bands has been using for 4G as TD-LTE, and reset of the spectrum has been planned for 5G services) |
| Nepal | No | Yes | 2600 MHz | If appropriate and necessary, service providers can plan/deploy 5G services in bands used for 2G, 3G and 4G. |
| Pakistan | No | Yes |  | To be decided. However, no restriction as all the bands are Technology Neutral. |
| Sri Lanka | No | Yes |  | Not yet planed. It will be decided based on the future demands market requirement. |

## **ANALYSIS OF 5G SPECTRUM IN SATRC COUNTRIES**

Some SATRC countries have a 5G roadmap and some SATRC countries are developing a 5G Spectrum roadmap. The following Table 8 depicts the status of the 5G roadmap in SATRC Countries.

Table 8: 5G Spectrum Roadmap in SATRC Countries

|  |  |  |
| --- | --- | --- |
| **SATRC Country** | **5G Roadmap** | **Remarks** |
| Afghanistan | No |  |
| Bangladesh | No documented roadmap for 5G. | Although spectrum is assigned on a technology-neutral basis, spectrum in 2300 MHz and 2600 MHz band had been assigned to operators with the view to introduce 5G services in the country. Spectrum in 700 MHz and 3.5 GHz bands will also be assigned soon keeping 5G in consideration. |
| Bhutan | Yes | 1. Regulatory framework for 5G deployment 2019,  2. Consultations documents and  3. 3.5 GHz frequency band plan 2021. |
| India | No | Under study of the coexistence of IMT with various other users in the 526-582 MHz , 37 – 43.5 / 47.2 – 48.2GHz and 66-71 GHz band |
| Iran | Yes | 4 year Spectrum Roadmap for 5G with 700 MHz and mmWave spectrum |
| Nepal | A road map is being prepared. | The roadmap being developed is and not only for 5G, but also for all cellular frequencies and services, |
| Pakistan | Yes | 1800 MHz, 2100 MHz, 2300 MHz, 2600 MHz, 3500 MHz, 24 GHz and 39 GHz |
| Sri Lanka | Under preparation with the consultation of ITU. |  |

Most of the SATRC countries have high capacity wireless backhaul plans for 5G. Afghanistan and Sri Lanka do not have high capacity wireless backhaul plans for 5G. The following table 9 depicts the status of 5G Spectrum Roadmap in SATRC Countries.

Table 9: High Capacity Backhaul plan for 5G in SATRC Countries

|  |  |  |
| --- | --- | --- |
| **SATRC Country** | **High capacity wireless backhaul plan for 5G** | **Remarks** |
| Afghanistan | No |  |
| Bangladesh | Yes | 60 GHz (50 MHz channel plan) and 70 GHz Band (250 MHz channel plan) |
| Bhutan | Yes | Channel plan for Fixed point to point services 2019 with the band plans for 32GHz, 42 GHz , E- band and V-band. |
| India | Yes | The E band (71-76/81-86 GHz ) has been provisionally made available to the TSPs. |
| Iran | Yes | Frequency bands 55.78-57/64-61 GHz, 71-76 GHz and 81-86 GHz are considered. |
| Nepal | Yes | V-band and E-band are planned. |
| Pakistan | To be decided | E band is being made available on case to case basis |
| Sri Lanka | No | Not yet |

Most of the SATRC Member Countries have not planned for the coexistence of IMT services with satellite services. Only Pakistan has plans for the coexistence of IMT services with satellite services, subject to ecosystem development and supporting studies in C & Ka bands. The following table 10 depicts the status of the coexistence plan of IMT services with satellite services.

Table 10: Coexistence plan of IMT services with satellite services in SATRC Countries

|  |  |  |
| --- | --- | --- |
| **SATRC Country** | **Coexistence plan of IMT services with satellite service** | **Remarks** |
| Afghanistan | No |  |
| Bangladesh |  | If the coexistence of IMT services with satellite services is feasible as per the Radio Regulation of ITU-R then BTRC may consider it in future. |
| Bhutan | No | Under consideration of the coexistence of  IMT and Satellite services in future. |
| India |  | Under Examination |
| Iran | No | license issued for each of IMT and satellite services separately |
| Nepal | No | Awaiting for more concrete results and recommendations to proceed |
| Pakistan | Yes | subject to Ecosystem development and supporting studies in C & Ka bands |
| Sri Lanka | No |  |

# CHAPTER IV – CONCLUSION AND RECOMMENDATIONS

## **CONCLUSION**

Based on the questionnaire responses of the study, the status of spectrum allocation, assignment, adoption of technology neutrality, 5G band identification, 5G readiness, roadmap, high capacity backhaul plans and coexistence of IMT band with other services are summarized as follows.

1. SATRC member countries have allocated 850 MHz Band, 900 MHz Band, 1800 MHz Band, 2100 MHz Band, 2300 MHz Band, 2600 MHz Band and 3500 MHz Bands for IMT. SATRC member countries except Sri Lanka have allocated 700 MHz Band for IMT.
2. Among these allocated IMT bands, SATRC member countries have assigned 900 MHz, 1800 MHz Band and 2100 MHz Bands. SATRC members except Afghanistan and Pakistan have assigned 2300 MHz Band. Similarly, 2600 MHz band has been assigned by SATRC members except Afghanistan, Bhutan, Nepal and Pakistan. Bangladesh, Bhutan, India and Pakistan have assigned 3.5 GHz Band. Nepal, Pakistan and Sri Lanka have assigned 850 MHz band. Similarly, 700 MHz Band have been assigned by India and Bhutan.
3. SATRC members except Sri Lanka have adopted technology neutral in the assigned radio spectrum bands.
4. SATRC member countries have identified 3.5 GHz Band as 5G Band. 26 GHz Band has been identified as 5G Band by India, Iran, Nepal, Pakistan and Srilanka. 2300 MHz and 2600 MHz Bands have been identified as 5G Bands by Bangladesh, India, Nepal and Pakistan. Similarly, 700 MHz Band, 1800 MHz Band and 2100 MHz Band have been identified as 5G band by India, Pakistan and Nepal. Moreover, 900 MHz Bands have been identified as 5G Bands by Bangladesh, Nepal and India. In addition to this, 800 MHz has been identified as 5G band from India and Nepal. Besides, India and Iran have identified 4800 MHz Band as 5G band. Also, Iran and Pakistan have identified 39 GHz Band as 5G Band.
5. Bhutan, India, Maldives and Iran have launched 5G services whereas Bangladesh, Pakistan, Nepal and Sri Lanka have undergone 5G trials.
6. Bhutan, Pakistan and India have spectrum roadmap whereas Bangladesh, Nepal and Sri Lanka are developing spectrum roadmaps.
7. SATRC member countries have high capacity backhaul plans except Sri Lanka.
8. SATRC member countries are not having co-existence of IMT bands with other services and studies are under consideration.

Based on this study, SATRC member countries are already in a situation to harmonize 3.5 GHz Band. There is growing possibility to harmonize 700 MHz Band, 2.3 GHz Band and 2.6 GHz bands and 26 GHz Bands for 5G . Moreover, with adoption of technology neutral, the existing spectrum bands, 1800 MHz Band and 2100 MHz Band, SATRC members have high potential for 5G spectrum harmonization.

## **RECOMMENDATIONS**

As highlighted in the report that the harmonization of spectrum in the region towards the implementation of 5G services has numerous benefits such as deriving the economies of scale benefits, minimization of radio interference especially along the borders, facilitating the international roaming in the 5G services, reducing the cost of mobile devices and radio equipment, facilitating the easy exchange of human resources and information, it is essential that the regional countries especially the SATRC member countries work towards spectrum harmonization in 5G implementation.

Nevertheless, from the information collected through questionnaires, it has been found that most of the SATRC countries have required strategies and implementation plans in place towards the deployment of 5G services. For instance, most of the countries that have been assigning the spectrum with technology neutral approach towards implementation of IMT services, have almost the same set of frequencies allocated for 5G deployment.

In order to enable proper spectrum harmonization among the SATRC countries, the respective member countries are recommended to adopt the following approaches.

1. Develop a proper 5G Implementation policy, framework and strategies in the country,
2. Enable spectrum technology neutral policies in the country,
3. Develop a detailed and clear spectrum allocations for IMT services so that the operators are well informed with the spectrum availability and allocations for their future IMT deployment including the 5G services.
4. As most of the countries have explored on the usage of mid band frequency (3.5GHz) for the implementation of 5G services, it may be followed by the rest of the countries to implement the 5G services primarily in these frequencies ranging from 3.3GHz to 3.8GHz,
5. As the higher band in mmWave is also essential to provide high capacity 5G services, the frequencies in 24.25 – 27.5 GHz may be harmonized and deployed for 5G services by the SATRC countries,
6. The SATRC countries are recommended to support on the global spectrum harmonization on respective WRC-23 agenda items on IMT frequencies.

Moreover, SATRC member countries are recommended to ensure the deployment for 5G services in their respective countries considering following approaches.

1. To make available at least 100 MHz of contiguous mid-band spectrum per operator for 5G launch. The spectrum can preferably be provided in in the C Band frequency range from 3.3 GHz to 3.8 GHz. Spectrum in the other mid-bands, such as 2.3 GHz and 2.6 GHz may also be considered for 5G deployment.
2. Spectrum in Sub-1 GHz bands which is gaining momentum is 700 MHz band and the same should be considered for 5G deployment. However, the other available bands such as 800 MHz and 900 MHz may also be used for 5G NR deployments. Besides, it is also important to increase the low-band spectrum capacity by assigning all available bands (including 600 MHz). The lower frequencies below 2GHz already licensed for mobile use (e.g., 1800 and 2100 MHz) may also be utilized in combination with mid band spectrum to be assigned to the network operators.

In the 600 MHz band, APT (Region 3) has adopted and proposed APT 600 MHz band having 40 MHz paired spectrum in FDD mode with the following frequency pairs:

612-652 MHz – Downlink

663-703 MHz – Uplink

3GPP has also adopted the APT 600 MHz band for 5G NR and defined this band as n105 Band. For use of harmonized spectrum, SATRC member countries may strive to adopt APT 600 MHz band. India has already adopted this band for IMT.

1. To support ultra-reliable, low latency, high speed 5G use cases, SATRC member administrations should make the spectrum available in mm Wave band in the frequency range 24.25 - 27.5 GHz, which is defined as n258 band by 3GPP. An initial assignment of 800 MHz per network operator in mmWave is desirable. As demand grows upwards, further spectrum can be made available in mmWave bands.

# ANNEX - I (AFGHANISTAN RESPONSES TO QUESTIONNAIRES)

1. **Current Status of Mobile Broadband in your country**

**Question 1:** What are the allocated frequency bands that have been identified for IMT in your country?

**Answer:** 450-470 MHz, 694-862 MHz, 880-960 MHz, 1710-1880 MHz, 1880-1920 MHz, 1920-2110 MHz, 2110-2200 MHz, 2300-2400 MHz, 2500-2690 MHz, 3400-3600 MHz

**Question 2:** Which of the frequency bands identified for IMT have been assigned in your country?

**Answer:** 2110-2200 MHz (only the first 2x50 MHz assigned)

**Question 3:** What is the roadmap/current status of remaining frequency bands already identified for IMT?

**Answer:** Currently No specific (written) roadmap available, they are idle now, decision will be taken in the future.

1. **Current Status of technology neutrality in frequency assignment**

Are the frequency bands assigned in your country technology neutral? If not which of the bands are technology specific and which of the bands are technology neutral? Please state the reasons.

**Answer:** The Licenses given to all MNOs are technology neutral.

1. **Current Status of 4G in your country**

**Question 6:** What is the scenario of penetration rate and/or number of subscriptions of 4G technologies, such as LTE/LTE-Advanced, in your country? (Percentage of 4G subscribers to total subscribers)

**Answer:** 12.5%

**Question 7:** Is there any rollout obligation for 4G implementation in your country? If yes, please provide details. And how much geographical area/population has been covered by 4G?

**Answer:** Yes, there is a rollout obligation for 4G in Afghanistan which is already shared with the MNOs, all the 34 provinces of Afghanistan are divided into 4 categories, the first category are to have 95% outdoor coverage in provincial center of each province in 18 months, the second category are to have 70% outdoor coverage in provincial center of each province in two years, the third category are to have 5 base station in one year and ten base station in two years. Currently in Afghanistan there is 15% area coverage and 32% population coverage of 4G.

1. **Current status of 5G in your country**

**Question 7:** What ere the spectrum bands identified in your country supporting 5G? Please provide details.

**Answer:** No spectrum band is officially identified for 5G yet.

**Question 8:** Have 5G services been launched in your country? If yes, please provide details of frequency bands in which 5G has been deployed.

**Answer:** No

**Question 9:** Whether the 5G services has been planned/deployed in the bands used for 2G/3G/4G? If yes, please provide details

**Answer:** No

1. **5G spectrum plan**

**Question 12:** Is there any spectrum roadmap for 5G plan in your country? If yes, please provide details.

**Answer:** No

**Question 13:** Is there any high capacity wireless backhaul plan for 5G? If yes, please provide the details of frequency bands?

**Answer:** No

**Question 14:** Is there any plan for the coexistence of IMT services with satellite services? If yes please specify the bands and provide the details.

**Answer:** No

# ANNEX - I (BANGLADESH RESPONSES TO QUESTIONNAIRES)

1. ***Current Status of Mobile Broadband in your country***

***Question 1:*** *What are the allocated frequency bands that have been identified for IMT in your country?*

**Answer:** Frequency bands that have been identified for IMT are as follows:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Band** | **Duplex Mode** | **Freq (MHz)** | **Uplink (MHz)** | **Downlink (MHz)** | |
| n1 | FDD | **2100** | 1920–1980 | 2110 – 2170 | |
| n3 | FDD | **1800** | 1710 – 1785 | 1805 – 1880 | |
| n8 | FDD | **900** | 880 – 915 | 925 – 960 | |
| n28 | FDD | **700** | 703 – 748 | 758 – 803 | |
|  |  |  |  |  |  |
| **Band** | **Duplex Mode** | **Freq (MHz)** | **Uplink / Downlink (MHz)** | |  |
| n40 | TDD | **2300** | 2300 – 2400 | |  |
| n41 | TDD | **2500** | 2500 – 2690 | |  |
| n78 | TDD | **3500** | 3300 – 3800 | |  |

***Question 2:*** *Which of the frequency bands identified for IMT have been assigned in your country?*

**Answer:** Following frequency bands identified for IMT have already been assigned for IMT till date:

* 900 MHz
* 1800 MHz
* 2100 MHz
* 2300 MHz
* 2600 MHz
* 3500 MHz

***Question 3:*** *What is the roadmap/current status of remaining frequency bands already identified for IMT?*

**Answer:** Current status of remaining frequency bands already identified for IMT are as follows:

|  |  |
| --- | --- |
| **Frequency (MHz)** | **Status** |
| 700 | Not yet assigned. Active consideration is given for assignment. |
| 900 | Around 80% assigned |
| 1800 | Fully assigned |
| 2100 | Fully assigned |
| 2300 | 70% assigned |
| 2600 | Around 63% assigned. Remaining spectrum will be assigned very shortly. |
| 3500 | Around 10% assigned for trial. Remaining spectrum will be assigned based on market demand. |

1. ***Current Status of technology neutrality in frequency assignment***

*Are the frequency bands assigned in your country technology neutral? If not which of the bands are technology specific and which of the bands are technology neutral? Please state the reasons.*

**Answer**: All the IMT frequency bands assigned in our country are technology neutral.

1. ***Current Status of 4G in your country***

***Question 6:*** *What is the scenario of penetration rate and/or number of subscriptions of 4G technologies, such as LTE/LTE-Advanced, in your country? (Percentage of 4G subscribers to total subscribers)*

**Answer:** Number of subscriptions 4G/LTE=77.60 million;

Percentage of 4G subscribers to total subscribers=42%

***Question 7:*** *Is there any rollout obligation for 4G implementation in your country? If yes, please provide details. And how much geographical area/population has been covered by 4G?*

**Answer:** Yes, there is specified rollout obligation for 4G implementation. Rollout obligation is as follows:

|  |  |  |
| --- | --- | --- |
| **Phase** | **Description/Responsibility** | **Duration**  **/Criteria** |
| 1st phase | Services in all Divisional Headquarters | 9 Months |
| 2nd phase | Services in another 30% of district Headquarters | 18 Months |
| 3rd phase | Services in all District Headquarters | 36 Months |
| Other obligation | Services in major cities/ locations | As per direction from Commission |
| Services in Upazila/ National Highway /railway track | Upon fulfillment of 3rd phase work |
| Services in all over the country | Upon fulfillment of 3rd phase work |

Currently the 4G Coverage is around 90%.

1. ***Current status of 5G in your country***

***Question 7:*** *What are the spectrum bands identified in your country supporting 5G? Please provide details.*

**Answer:** Identified spectrum bands for 5G are as follows:

|  |  |  |  |
| --- | --- | --- | --- |
| **Band** | **Duplex Mode** | **Frequency(MHz)** | **Uplink / Downlink (MHz)** |
| n40 | TDD | **2300** | 2300 – 2400 |
| n41 | TDD | **2500** | 2500 – 2690 |
| n78 | TDD | **3500** | 3300 – 3800 |

***Question 8:*** *Have 5G services been launched in your country? If yes, please provide details of frequency bands in which 5G has been deployed.*

**Answer:** In Bangladesh, 5G services have not been commercially launched yet. However, mobile operators are conducting 5G trial and possible 5G business cases are being determined.

***Question 9:*** *Whether the 5G services has been planned/deployed in the bands used for 2G/3G/4G? If yes, please provide details*

**Answer:** All the IMT frequency bands assigned in our country are technology neutral. Hence, operators are allowed to deploy 5G services in any of their assigned IMT spectrum depending on their strategy.

1. ***5G spectrum plan***

***Question 12:*** *Is there any spectrum roadmap for 5G plan in your country? If yes, please provide details.*

**Answer:** Bangladesh does not have any documented roadmap for 5G. Although spectrum is assignment on a technology-neutral basis, spectrum in 2300 MHz and 2600 MHz band had been assigned to operators with the view to introduce 5G services in the country. Spectrum in 700 MHz and 3.5 GHz bands will also be assigned soon keeping 5G in consideration.

***Question 13:*** *Is there any high-capacity wireless backhaul plan for 5G? If yes, please provide the details of frequency bands?*

**Answer:** Yes. In 60 GHz (50 MHz channel plan) and 70 GHz Band (250 MHz channel plan) is planned for high-capacity wireless backhaul.

***Question 14:*** *Is there any plan for the coexistence of IMT services with satellite services? If yes please specify the bands and provide the details.*

**Answer**: If the coexistence of IMT services with satellite services is feasible as per the Radio Regulation of ITU-R then BTRC may consider it in future.

# ANNEX - I (BHUTAN RESPONSES TO QUESTIONNAIRES)

**1. Current Status of Mobile Broadband in your country**

**Question 1:** What are the allocated frequency bands that have been identified for IMT in your country?

Answer=

GSM= 900MHz

UMTS= band 5(850MHz) and band 1 (2100MHz)

LTE= band 28(700MHz), band 3 (1800MHz), band 40 (2300MHz) and 850

MHz and 2100MHz

5G= N78 (3500MHz)

**Question 2:** Which of the frequency bands identified for IMT have been assigned in your

country?

Answer= GSM= 900MHz

UMTS= band 5(850MHz) and band I (2100MHz)

LTE= band 28(700MHz), band III (1800MHz) and band 40 (2300MHz)

5G= N78 (3500MHz)

**Question 3:** What is the roadmap/current status of remaining frequency bands already

identified for IMT?

Answer= Future assignment for IMT based on demand from operators

**2. Current Status of technology neutrality in frequency assignment**

Are the frequency bands assigned in your country technology neutral? If not which of

the bands are technology specific and which of the bands are technology neutral? Please

state the reasons.

Answer= The frequency bands assigned in our country are all technology neutral,

however approval for the assignment needs to be discussed and sought from the

Authority.

**3. Current Status of 4G in your country**

**Question 6:** What is the scenario of penetration rate and/or number of subscriptions of 4G

technologies, such as LTE/LTE-Advanced, in your country? (Percentage of 4G

subscribers to total subscribers)

Answer=

**Question 7:** Is there any rollout obligation for 4G implementation in your country? If

yes, please provide details. And how much geographical area/population has been

covered by 4G?

Answer= No obligation for 4G implementation in the country, however all the uncovered

rural areas have been prioritized to cover through the Rural Communication

Program.

**Question 7:** What are the spectrum bands identified in your country supporting 5G?

Please provide details.

Answer= N78 (3500 MHz), and also we are exploring the mmWaves for 5G.

**Question 8:** Have 5G services been launched in your country? If yes, please provide

details of frequency bands in which 5G has been deployed.

Answer= Yes, commercially deployed on December 2021 in the 3.5 GHz (3.4 - 3.6 GHz)

**Question 9:** Whether the 5G services have been planned/deployed in the bands used for

2G/3G/4G? If yes, please provide details

Answer= No, as of now. However, maybe possible in spectrum refarming.

**4. 5G spectrum plan**

**Question 12:** Is there any spectrum roadmap for a 5G plan in your country? If yes, please

provide details.

Answer= Yes, they are:

1. Regulatory framework for 5G deployment 2019,

2. Consultations documents and

3. 3.5 GHz frequency band plan 2021.

**Question 13:** Is there any high capacity wireless backhaul plan for 5G? If yes, please

provide the details of frequency bands?

Answer= Yes, the Channel plan for Fixed point to point services 2019,

The band plans for 32 GHz, 42GHz, E- band and V-band.

**Question 14:** Is there any plan for the coexistence of IMT services with satellite

services? If yes please specify the bands and provide the details.

Answer = Currently No plan as such and we may have to consider the coexistence of

IMT and Satellite services in future.

Table for SATRC Questionnaire

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sl.** | **Band Name** | **Bandwidth** | **Technology Neutral/ Technology Specific** | **Included**  **for 5G** | **Any future**  **coexistence**  **plan** |
| 1 | N78 | 200 MHz | 5G Technology | Yes | No |

**ANNEX - I (INDIA RESPONSES TO QUESTIONNAIRES)**

# Current Status of Mobile Broadband in your country

**Question 1:** What are the allocated frequency bands that have been identified for IMT in your country?

**Response:** The bands identiﬁed for IMT based on NFAP 2018 and later additions as part of the spectrum Auction conducted in July – August 2022 are as tabulated below.

| **Sl. No.** | **Band as mentioned in RR** |
| --- | --- |
| 1 | 450-455 MHz |
| 2 | 455-456 MHz |
| 3 | 456-459 MHz |
| 4 | 459-460 MHz |
| 5 | 460-470 MHz |
| 6 | 470-585 MHz |
| 7 | 585-610 MHz |
| 8 | 610-890 MHz |
| 9 | 890-942 MHz |
| 10 | 942-960 MHz |
| 11 | 1427-1429 MHz |
| 12 | 1429-1452 MHz |
| 13 | 1452-1492 MHz |
| 14 | 1492-1518 MHz |
| 15 | 1710-1930 MHz |
| 16 | 1930-1970 MHz |
| 17 | 1970-1980 MHz |
| 18 | 1980-2010 MHz |
| 19 | 2010-2025 MHz |
| 20 | 2025-2110 MHz |
| 21 | 2110-2120 MHz |
| 22 | 2120-2160 MHz |
| 23 | 2160-2170 MHz |
| 24 | 2170-2200 MHz |
| 25 | 2300-2450 MHz |
| 26 | 2500-2520 MHz |
| 27 | 2520-2535 MHz |
| 28 | 2535-2655 MHz |
| 29 | 2655-2670 MHz |
| 30 | 2670-2690 MHz |
| 31 | 3300-3400 MHz |
| 32 | 3400-3500 MHz |
| 33 | 3500-3670 |

**Question 2:** Which of the frequency bands identiﬁed for IMT have been assigned in your country?

**Response:** The frequency bands identiﬁed for IMT and assigned in the country are as tabulated below.

|  |  |  |  |
| --- | --- | --- | --- |
| Details of Frequency Band | Type of IMT Service | Type of Duplexing | Band details as allocated for IMT in India |
| 700 MHz | Access | FDD | 713-748/  768-803 |
| 800 MHz | Access | FDD | 824-844/  869-889 |
| 900 MHz | Access | FDD | 890-915/  935-960 |
| 1800 MHz | Access | FDD | 1710-1765/  1805-1860 |
| 2100 MHz | Access | FDD | 1939-1979/  2129-2169 |
| 2300 MHz | Access | TDD | 2300-2380 |
| 2500 MHz | Access | TDD | 2535-2555,  2635-2655 |
| 3400 MHz | Access | TDD | 3300-3670 |
| 26 GHz | Access | TDD | 24250 -27500 |

**Question 3:** What is the roadmap/current status of remaining frequency bands already identified for IMT?

**Response:** The Indian Governmenthas constituted committees for studying the coexistence of IMT with various other users in the 526-582 MHz, 37 – 43.5 / 47.2 – 48.2GHz and 66-71 GHz band

# Current Status of technology neutrality in frequency assignment

**Question 4:** Are the frequency bands assigned in your country technology neutral? If not which of the bands are technology speciﬁc and which of the bands are technology neutral? Please state the reasons.

**Response:** All spectrum assigned through auctions are technology neutral. However, the spectrum assigned administratively prior to 2012, in the 800 MHz, 900 MHz and 1800 MHz bands for GSM/CDMA services are not technology neutral. The operators having administratively assigned spectrum have an option to liberalise (convert to technology neutral) by paying market determined price on pro-rata basis.

# Current Status of 4G in your country

**Question 5:** What is the scenario of penetration rate and/or number of subscriptions of 4G technologies, such as LTE/LTE-Advanced, in your country? (Percentage of 4G subscribers to total subscribers)

**Response:** As on Aug 2022

|  |  |  |  |
| --- | --- | --- | --- |
| Total Wireless subscribers (including 2G, 3G, 4G): | | | 1,149 million |
| Data users: | 2G | 3G | 4G |
| (in million) | 35.20 | 18.52 | 763.95 |

**Question 6:** Is there any rollout obligation for 4G implementation in your country? If yes, please provide details. And how much geographical area/population has been covered by 4G?

**Response:** Yes, The roll out obligations are governed by the respective provisions in the NIA issued before each auctions, as available in DoT website. Further, the roll out obligations are frequency band speciﬁc and not technology speciﬁc. Coverage information is not available.

# Current status of 5G in your country

**Question 7:** What are the spectrum bands identiﬁed in your country supporting 5G? Please provide details.

**Response:** In the 700 MHz, 800 MHz, 900 MHz, 1800 MHz , 2100 MHz ,2300 MHz, 2500 MHz, 3300 MHz and 26 GHz bands where the spectrum has been assigned through auctions services using any technology including 5G can be provided based on the available ecosystem and use cases.

**Question 8:** Have 5G services been launched in your country? If yes, please provide details of frequency bands in which 5G has been deployed.

**Response:** Yes, the 5G services were inaugurated in India on 01.10.2022. TSPs have been assigned spectrum in 700 MHz, 3300 MHz and 26 GHz bands among other bands to roll out their 5G services.

**Question 9:** Whether the 5G services has been planned/deployed in the bands used for 2G/3G/4G? If yes, please provide details

**Response:** The TSPs can deploy any technology in the spectrum acquired through auctions or liberalized.

# 5G spectrum plan

**Question 12:** Is there any spectrum roadmap for 5G plan in your country? If yes, please provide details.

**Response:** Please refer Part 1 , Question 3

**Question 13:** Is there any high capacity wireless backhaul plan for 5G? If yes, please provide the details of frequency bands?

**Response:** The E band (71-76/81-86 MHz) has been provisionally made available to the TSPs for high capacity wireless backhaul.

**Question 14:** Is there any plan for the coexistence of IMT services with satellite services? If yes please specify the bands and provide the details.

**Response:** The matter is under examination.

# ANNEX - I (IRAN RESPONSES TO QUESTIONNAIRES)

# Current Status of Mobile Broadband in your country

**Question 1:** What are the allocated frequency bands that have been identified for IMT in your country?

**Answer**: The allocated frequency bands that have been identified for IMT in our country are following in below table:

|  |  |
| --- | --- |
| 694-862 MHz | 2300-2400 MHz |
| 876-960 MHz | 2500-2690 MHz |
| 1427-1518 MHz | 3400-3500 MHz |
| 1710-2025 MHz | 3500-3600 MHz |
| 2110-2200 MHz | 3600-3800 MHz |
| 4800-4990 MHz | 24.250-27.5 GHz |

**Question 2:** Which of the frequency bands identified for IMT have been assigned in your country?

**Answer**: The frequency bands identified for IMT have been assigned in our country include in the below table:

|  |  |  |
| --- | --- | --- |
| Bands (MHz) | Frequency bands /UP | Frequency bands/DL |
| 900 | 885-912.450 MHz | 925-957.450 MHz |
| 1800 | 1722.5-1855 | 1750-1880 |
| 2100 | 1930-2150 | 1945-2165 |
| 2300 | 2300-2380 | 2300-2380 |
| 2600 | 2500-2560 | 2620-2680 |
| 3500 | 3400-3600 MHz (TDD) | |

**Question 3:** What is the roadmap/current status of remaining frequency bands already identified for IMT?

**Answer**: Frequency bands 45/5-47, 66-71 GHz and 37-43/5, 47/2-48/2 GHz is being considered for use by the mobile service in order to Implementation of International Mobile Communications (IMT).

# Current Status of technology neutrality in frequency assignment

**Question 4:** Are the frequency bands assigned in your country technology neutral? If not which of the bands are technology specific and which of the bands are technology neutral? Please state the reasons.

**Answer**: All bands that are assigned, are tech. neutral. However, because of market’s status, consumed payload and other factors, the operators can decide which bands may use what technology.

# Current Status of 4G in your country

**Question 5:** What is the scenario of penetration rate and/or number of subscriptions of 4G technologies, such as LTE/LTE-Advanced, in your country? (Percentage of 4G subscribers to total subscribers)

**Answer**: The number of subscriptions of 4G technologies, such as LTE/LTE-Advanced, in our country in all of operators are 86 M subscribers.

**Question 7:** Is there any rollout obligation for 4G implementation in your country? If yes, please provide details. And how much geographical area/population has been

**covered b** **Answer**: we have a regulation that defined obligations for all of technology in our country, This Rule is including parameters for 4G implementation, such as RSRP Idle Mode, RSRQ Idle Mode, MOS, LTE Service Request Success Rate , LTE eRAB Drop Rate y **4G?**

|  |  |
| --- | --- |
| **4G** | |
| **Number of city** | **Number of site** |
| **1,329** | **15,604** |

1. **Current status of 5G in your country**

**Question 7:** What are the spectrum bands identified in your country supporting 5G? Please provide details.

**Answer:**

The frequency band have been assigned for developing 5G tech. is including:

- 3400-3800 MHz

The frequency bands have been identified for developing 5G tech. are including:

4800-4990 MHz

- 24.25-27.5 (26GHz)

**Question 8:** Have 5G services been launched in your country? If yes, please provide details of frequency bands in which 5G has been deployed.

* **Answer**: 5G services have been launched as a pilot in Tehran city. In 3500 frequency band

**Question 9:** Whether the 5G services has been planned/deployed in the bands used for 2G/3G/4G? If yes, please provide details

* **Answer:** Yes, in the bands 3500 MHz frequency bands have been using for 4G as TD-LTE, and reset of the spectrum has been planned for 5G services

1. **5G spectrum plan**

**Question 12:** Is there any spectrum roadmap for 5G plan in your country? If yes, please provide details.

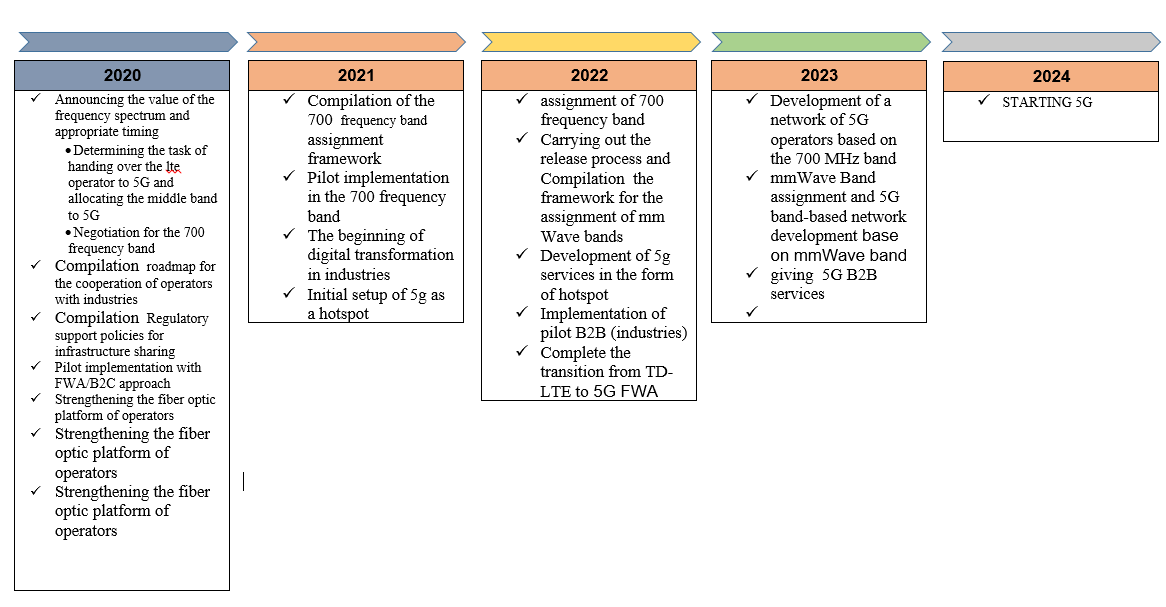
**Answer**: you can see the answer at the end of the page.

**Question 13:** Is there any high capacity wireless backhaul plan for 5G? If yes, please provide the details of frequency bands?

**Answer**: yes, frequency bands 55.78-57/64-61 GHz, 71-76 GHz and 81-86 GHz are consider for high capacity wireless backhaul.

**Question 14:** Is there any plan for the coexistence of IMT services with satellite services? If yes please specify the bands and provide the details.

**Answer**: No, but we issue the license for each of them separately.



**ANNEX - I (NEPAL RESPONSES TO QUESTIONNAIRES)**

**1. Current Status of Mobile Broadband in your country**

**Question 1:** What are the allocated frequency bands that have been identified for IMT in your country?

**R:** Frequency Bands allocated in Nepal: 700, 800, 850, 900, 1800, 2100, 2300, 2600, 3300, 3400, 3600 MHz.

**Question 2:** Which of the frequency bands identified for IMT have been assigned in your country?

**R:** Frequency Bands assigned in Nepal: 800, 850 (for CDMA service), 900, 1800, 2100, 2300 and 2600 MHz (only for 5G Trial purpose).

**Question 3:** What is the roadmap/current status of remaining frequency bands already identified for IMT?

**R:** 700, 2300 and 2600 MHz bands are expected to be auctioned in near future. Even though 3300, 3400, 3600 MHz bands are assigned for IMT, broadcasting services are utilizing the C-band. We are studying the possibility of the sharing the band for both services. Further decision regarding C-band is planned to be taken after WRC-23. Furthermore, CDMA service is expected to be shut down soon.

**2. Current Status of technology neutrality in frequency assignment**

Are the frequency bands assigned in your country technology neutral? If not which of the bands are technology specific and which of the bands are technology neutral? Please state the reasons.

**R**: Yes, all spectrum bands are technology neutral. For the bands that were assigned before the technology neutrality regime was introduced, service providers can submit their rollout plan for technology neutral services and get it approved from the Authority.

**3. Current Status of 4G in your country**

**Question 6:** What is the scenario of penetration rate and/or number of subscriptions of 4G technologies, such as LTE/LTE-Advanced, in your country? (Percentage of 4G subscribers to total subscribers)

**R:** As per the data of June, 2022, the penetration of LTE/LTE-A (data users) is 48.42%. The total numbers of subscribers of 4G services (LTE/LTE-A) is 11,268,663.

**Question 7:** Is there any rollout obligation for 4G implementation in your country? If yes, please provide details. And how much geographical area/population has been covered by 4G?

**R:** Yes. The detailed rollout obligation are as follows:

(a) The operator shall ensure that it shall provide National 4G coverage (in all 7 provinces and 77 district headquarters) by end of 2020.

(b) 4G coverage in urban area shall be 95% (by population) by end of 2022.

(c) 4G coverage in rural areas of municipalities and rural municipalities shall be 90% (by population) by end of 2022.

(d) 4G coverage in Tourist Areas/Specified National Parks/High Way shall be 95% by end of 2022.

(e) User Experience (Download Speed) shall be of minimum of 20 Mbps in Urban and 10 Mbps in rural areas.

**4. Current status of 5G in your country**

**Question 7:** What are the spectrum bands identified in your country supporting 5G? Please provide details.

**R:** All spectrum bands are under technology neutrality regime and the operators can choose any technologies/services for the spectrum assigned to them.

**Question 8:** Have 5G services been launched in your country? If yes, please provide details of frequency bands in which 5G has been deployed.

**R:** No. But one operator is preparing for trial of 5G services. Frequency in 2600 MHz band (TDD) has been assigned for trial.

**Question 9:** Whether the 5G services has been planned/deployed in the bands used for 2G/3G/4G? If yes, please provide details

**R:** If appropriate and necessary, service providers can plan/deploy 5G services in bands used for 2G, 3G and 4G. No other plans are made in this regard.

**5. 5G spectrum plan**

**Question 12:** Is there any spectrum roadmap for 5G plan in your country? If yes, please provide details.

**R:** Roadmap is being prepared. It is the roadmap for all cellular frequencies and services, and not only for 5G.

**Question 13:** Is there any high capacity wireless backhaul plan for 5G? If yes, please provide the details of frequency bands?

**R:** Yes. V-band and E-band are planned for high capacity wireless backhauling.

**Question 14:** Is there any plan for the coexistence of IMT services with satellite services? If yes please specify the bands and provide the details.

**R:** No, not planned yet. We are waiting for more concrete results and recommendations to proceed in this regard.

**ANNEX - I (PAKISTAN RESPONSES TO QUESTIONNAIRES)**

1. **Current Status of Mobile Broadband in your country**

**Question 1:** What are the allocated frequency bands that have been identified for IMT in your country?

**700, 850,900,1800, 2100,2300, 2600,3500 MHz bands & 24, 39 GHz**

**Question 2:** Which of the frequency bands identified for IMT have been assigned in your country?

**850, 900, 1800, 2100 MHz bands have been assigned for IMT. However, 3500 is currently in use of Wireless local loop operators**

**Question 3:** What is the roadmap/current status of remaining frequency bands already identified for IMT?

**700 Refarming in process**

**2600 Refarming in process**

**3500 3300-3400 MHz Vacant, 3415-3600 will be vacated in 2024**

1. **Current Status of technology neutrality in frequency assignment**

Are the frequency bands assigned in your country technology neutral? If not which of the bands are technology specific and which of the bands are technology neutral? Please state the reasons.

**All bands are technology neutral**

1. **Current Status of 4G in your country**

**Question 6:** What is the scenario of penetration rate and/or number of subscriptions of 4G technologies, such as LTE/LTE-Advanced, in your country? (Percentage of 4G subscribers to total subscribers)

**LTE penetration is approx. 55%**

**Percentage of 4G subscribers 61%**

**Question 7:** Is there any rollout obligation for 4G implementation in your country? If yes, please provide details. And how much geographical area/population has been covered by 4G?

**Yes, 3 % population increase every year**

**Approx. 60%**

1. **Current status of 5G in your country**

**Question 7:** What ere the spectrum bands identified in your country supporting 5G? Please provide details.

**700MHz, 1800MHz, 2100MHz, 2300 MHz, 2600MHz, 3500 MHz, 24GHz, 39 GHz**

**Question 8:** Have 5G services been launched in your country? If yes, please provide details of frequency bands in which 5G has been deployed.

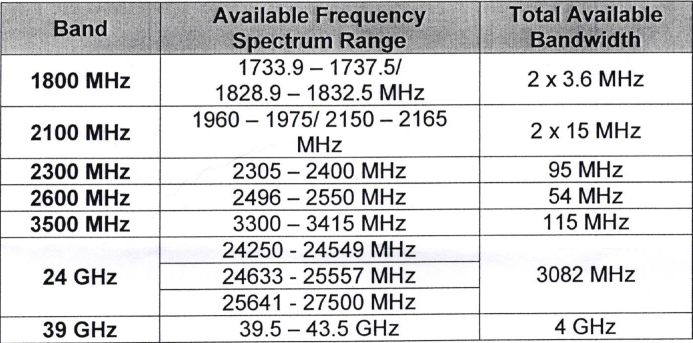
**No**

**Question 9:** Whether the 5G services has been planned/deployed in the bands used for 2G/3G/4G? If yes, please provide details

**TBD However no restriction as all the bands are TN.**

1. **5G spectrum plan**

**Question 12:** Is there any spectrum roadmap for 5G plan in your country? If yes, please provide details. **Yes**

****

**Question 13:** Is there any high capacity wireless backhaul plan for 5G? If yes, please provide the details of frequency bands?

**TBD however, E band is being made available on case to case basis**

**Question 14:** Is there any plan for the coexistence of IMT services with satellite

Services? If yes please specify the bands and provide the details.

**Yes, subject to Ecosystem development and supporting studies in C & Ka bands**

**ANNEX - I (SRI LANKA RESPONSES TO QUESTIONNAIRES)**

1. **Current Status of Mobile Broadband in your country**

**Question 1:** What are the allocated frequency bands that have been identified for IMT in your country?

***Answer: 450MHz (Band 31), 850MHz (Band 5), 900MHz (Band 8), 1800MHz (Band 3), 2100MHz (Band 1), 2300MHz (Band 40), 2600MHz (Band 41), 3500MHz (Band 42)***

**Question 2:** Which of the frequency bands identified for IMT have been assigned in your country?

***Answer: 450MHz (Band 31), 850MHz (Band 5), 900MHz (Band 8), 1800MHz (Band 3), 2100MHz (Band 1), 2300MHz (Band 40), 2600MHz (Band 41)***

**Question 3:** What is the roadmap/current status of remaining frequency bands already identified for IMT?

***Answer: 3500MHz (Band 42) – The re-farming process was started and remove all existing services and band is ready for the assignment through competitive bidding process in year 2023***.

1. **Current Status of technology neutrality in frequency assignment**

Are the frequency bands assigned in your country technology neutral? If not which of the bands are technology specific and which of the bands are technology neutral? Please state the reasons.

***Answer: All bands assigned are technology specific.***

1. **Current Status of 4G in your country**

**Question 6:** What is the scenario of penetration rate and/or number of subscriptions of 4G technologies, such as LTE/LTE-Advanced, in your country? (Percentage of 4G subscribers to total subscribers)

***Answer 6:***

|  |  |
| --- | --- |
| ***Name of the operator*** | ***Percentage of 4G subscribers to total subscribers*** |
| ***Bharti Airtel Lanka (Pvt) Ltd*** | ***57%*** |
| ***Dialog (DAP)*** | ***61%*** |
| ***Hutchison Telecommunications Lanka (Pvt) Ltd*** | ***39%*** |
| ***Mobitel Private Limited*** | ***54%*** |

**Question 7:** Is there any rollout obligation for 4G implementation in your country? If yes, please provide details. And how much geographical area/population has been covered by 4G?

***Answer 7:***

***The assignments specific rollout obligations are applied for some assignments for 4G implementations.***

***Rollout obligations are applied based on the investments in terms of number of base stations to be deployed within a period in all districts.***

***All operators have island wide coverage.***

1. **Current status of 5G in your country**

**Question 7:** What ere the spectrum bands identified in your country supporting 5G? Please provide details.

***Answer: 3500MHz and 26GHz***

**Question 8:** Have 5G services been launched in your country? If yes, please provide details of frequency bands in which 5G has been deployed.

***Answer: Not yet.***

**Question 9:** Whether the 5G services has been planned/deployed in the bands used for 2G/3G/4G? If yes, please provide details

***Answer: Not yet planed. It will be decided based on the future demands market requirement.***

1. **5G spectrum plan**

**Question 12:** Is there any spectrum roadmap for 5G plan in your country? If yes, please provide details. .

***Answer: Under preparation with the consultation of ITU.***

**Question 13:** Is there any high capacity wireless backhaul plan for 5G? If yes, please provide the details of frequency bands?

***Answer: Not yet.***

**Question 14:** Is there any plan for the coexistence of IMT services with satellite services? If yes please specify the bands and provide the details.

***Answer: Not yet***

# REFERENCES

* + - 1. APT report on "Current status and future plan of implementation and deployment of IMT-2020 (5G) in Asia-Pacific region" 28th Meeting of APT Wireless Group, 6 – 14 September 2021
      2. GSMA, Vision 2030: Low-Band Spectrum for 5G, June 2022
      3. 5G Spectrum GSMA Public Policy Position, June 2022, GSMA
      4. Recommendations on Auction of Spectrum in frequency bands identified for IMT/5G, Telecommunication Regulatory Authority of India, 11th April 2022
      5. Spectrum for 5G and Beyond, AMTA Policy Position Paper, Nov 2021, Australian Mobile Telecommunications Association
      6. Radio Regulations, Edition of 2020, International Telecommunication Union
      7. 3.5 GHz in the 5G Era, Preparing for New Services in 3.3 GHz - 2.8GHz, GSMA, October 2021
      8. <https://www.qualcomm.com/content/dam/qcomm-martech/dm-assets/documents/spectrum-for-4g-and-5g.pdf>
      9. 5G Spectrum Public Policy Position, GSMA, March 2022
      10. [WRC-19 identifies additional frequency bands for 5G, ITU, 24 Jan 2020](https://www.itu.int/hub/2020/01/wrc-19-identifies-additional-frequency-bands-for-5g/)
      11. Vision 2030: Insights for Mid-band Spectrum Needs, GSMA, July 2021
      12. Vision 2030: mmWave Spectrum Needs, GSMA, June 2022
      13. Roadmaps for 5G Spectrum: Sub-Saharan Africa, GSMA, August 2021