

**APT REPORT ON**

**CROSS-BORDER COORDINATION FOR INTERFERENCE IN SATRC COUNTRIES**

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# 1. Introduction

**1.1** All administrations have sovereign right to use the spectrum on the whole territory of their countries. However, radio waves do not stop at the border of the country. One of the major components influencing the legal aspect of spectrum management is cross border coordination of telecommunication, which is vital to avoid interference and ensure optimum network conditions near international border. It is a continuous process with the aim of ensuring the smooth operation of various (or the same) telecommunications networks between two or more neighboring countries.

**1.2** Frequency management in most countries is harmonized, meaning that the national frequency allocation tables comply with international tables. But in some cases, due to historical reasons or different policies in different countries, the same frequency band can be allocated to incompliant services, which may cause complications in coordination procedure. Cross-border coordination has become more challenging with the introduction of 5G technologies and infrastructure since new sharing or coexistence requirements need to be incorporated into already-existing international agreements or other pertinent papers.

**1.3** The main objective of this report is to address the common issues faced by SATRC countries related to cross border interference, discuss prominent examples and agreements made by other countries and regional intergovernmental organizations and provide recommendations for coordination to address these issues. The lead expert had developed questionnaire and was circulated to all the nominated experts from the member countries to get feedback. The responses of the questionnaire reveal that almost all of the SATRC countries have faced cross border frequency interference issues. Therefore, a defined framework is required to handle cross border interference issues.

# 2. Radio Frequency Interference

**2.1** Radio interference is defined by No. 1.166 of the ITU Radio Regulations (RR) as "*the effect of unwanted energy due to one or a combination of emissions, radiations, or inductions upon reception in a radio communication system, manifested by any performance degradation, misinterpretation or loss of information which could be extracted in the absence of such unwanted energy“.* Any signal received from Transmitter different than the intended one may be called as interference.

**2.2** Interference impact can vary from being tolerable (without any performance degradation) to severe, resulting in partial degradation to complete loss of information. Interference has been classified by ITU Radio Regulations (RR 1.166 to RR 1.169) on the basis of their impact as:

a) **Permissible Interference** - Observed or predicted interference which complies with quantitative interference and sharing criteria contained in ITU-R Regulations or Recommendations or in special agreements.

b) **Accepted Interference** - Interference at a higher level than that defined as permissible interference and which has been agreed upon between two or more administrations without prejudice to other administrations.

c) **Harmful Interference** - Interference which endangers the functioning of a radio navigation service or of other safety services or seriously degrades, obstructs, or repeatedly interrupts a radio communication service operating in accordance with Radio Regulations/ ITU Recommendations.

# 3. Cross Border Interference

**3.1** Harmful interference across international border can take place for a wide range of reasons, which can be either accidental or intentional. Both commercial services as well as critical safety-of-life applications may be degraded and affected. The impact of the interference can vary considerably and in the worst case may lead to network deployments and services being limited, of poorer quality, or even unavailable in localized areas. Interference may be the result of co-channel (where the transmit channel overlaps the receive channel) or adjacent channel (where there is no overlap between transmit and receive channel) deployments on either side of the border.

**3.2** The problem can vary over time as frequencies are redeployed (‘re-farmed’) to support the introduction of new services and technologies on a per-country or per-operator basis. There are a number of reasons why interference occurs. Geographic proximity of the networks, strong transmitter emission levels (such as high-power and high-altitude transmitter masts), imperfect transmitter and receiver characteristics (like poor masking and poor filtering) and propagation effects (such as ‘ducting’ of signals during high-pressure weather conditions). Interference may still be an issue even if the frequency use either side of a border is for the same services and utilizes the same technologies. Unsynchronized time-division duplex (TDD) deployments can lead to high levels of interference. Synchronization of mobile broadband networks between operators is becoming an accepted solution although it limits an operator’s flexibility to modify the uplink and downlink ratio based on real time traffic.

# 4. Cross Border Coordination

**4.1** Cross border coordination is the first step to resolve cross border interference issues. Each country has to develop and modify its spectrum policy in a way that is compatible with its neighboring countries. Factors such as border type, population near border, vegetation type, climatic conditions etc. effect the possibility of interference between countries. The greater the level of radio usage across the border area, the more likely it will be that the spectrum management authority will require dialogue with neighboring countries and the international radio community. Each country is obliged to take account of other BTS stations across the border before putting its own into operation. Even with technically similar systems from different sides of the border, there could be different deployments goals in which one country may pursue more flexibility in system roll-out in the border area and other country would seek interference protection of existing stations.

**4.2** It is a government responsibility to develop spectrum management policies that conform to the international treaty obligations of the Radio Regulations while meeting national spectrum needs. Within the national legal framework for telecommunications, a spectrum management organisation has the delegated authority to prepare spectrum plans that meet government policies. National spectrum plans should be reviewed regularly and, when necessary, be updated to keep pace with technology and changing demands. One of the most important tools for effective spectrum management is the National Table of Frequency Allocation (NTFA). This shows how the spectrum can be used in the country. The NTFA is normally developed by the National Administration/ National Regulatory Authority.

**4.3** The Regulator would normally establish working groups to undertake the detailed technical and regulatory work and provide the expertise in frequency assignment, spectrum engineering, monitoring and standardisation. Representatives from relevant government departments would be group members to provide detailed advice on government spectrum use and requirements. It is also beneficial to invite experts and practitioners from major non-government spectrum stakeholders to participate.

**4.4** The importance of interference has been recognized to support efficient spectrum planning in terms of frequency assignments for the different radio communication services and for cross border radio frequency coordination. Cross border bilateral or multilateral agreements help to optimize spectrum usage by accurate interference field strength calculations. It also helps to harmonize parameters, resulting in objectively predictable and transparent decisions. Relevant authorities of countries can assign frequencies quickly and smoothly if there are such agreements.

**4.5** Despise all the advantages, these agreements result in increased administrative work and costs due to complex procedures, longer turnaround times and topographical database. This also requires a detailed and extensive data from the operators including geographical parameters and antenna details. Making a mutually beneficial agreement also requires complex operational conditions assignments subject to diverging conditions. This can result in poor costumer service as they can be affected by usage rights.

**4.6** In the agreements, there are certain categories of frequencies that are defined. These categories are:

a) **Frequencies requiring coordination**: Frequencies which Administrations are required to coordinate with the other Administrations affected before a station is put into service.

b) **Preferential frequencies:** Frequencies which the Administrations concerned may assign, without prior co-ordination, on the basis of bi- or multilateral agreements under the terms laid down therein;

c) **Shared frequencies**: Frequencies which may be shared without prior coordination, on the basis of bi- or multilateral agreements under the terms laid down therein.

# 5. Process for Cross Border Coordination

**5.1** The most efficient method for resolving interference in a border region is frequency assignment planning, when neighbouring country has entire information regarding parameters of planned and operational BTS sites of the affected country. In such a case the impact of harmful interference can be calculated during bilateral/multilateral discussions of the planned BTS sites. Although the situation described above is not typical in cross-border discussions between administrations, such approach shows the idealized course of action process providing maximum efficiency at minimum probability of neglected harmful interference. This approach has no difference between determination of technical conditions and the calculation to determine the mutual impact of a new or modified frequency assignment of requesting administration to stations of the affected administrations.

**5.2** The following steps provides useful guidance to resolve interference issues in the border area:

a) Definition of the technical parameters which may be considered as a sufficient condition for starting the process of bilateral/multilateral discussions between administrations.

(i) Development of the interference scenario to be considered between administrations when the conditions of the defined technical parameters precipitate review by affected administrations. Determination of the necessity and the extent of radio propagation, relief and the other details to be considered while considering specific interference scenario.

(ii) Forming the BTS parameters list which may be needed for solving the sharing/compatibility issues

b) Discussions between administrations on a method to determine whether the above specified criterion is exceeded.

c) Definition of possible technical and operational interference mitigation technique.

d) Analysis and identification of actions considering the mitigation technique defined at (c) above.

**5.3** To calculate the effect of harmful interference during bilateral/multilateral discussions of a planned station, a parameter for permissible harmful interference needs to be determined. While defining the parameter for permissible impact of harmful interference on receiving station, it is recommended to use condition of protection of the receiving station from “long-term” harmful interference at a minimum (threshold) signal level. “Long-term” interference is defined as harmful interference with permissible level exceeded more than 1% of time. During bilateral/multilateral discussions on harmonization of planned frequency assignments to stations, it is recommended to use the requirement for protection from “long-term” interference not exceeded more than 20% of time.

**5.4** Two-step procedure for defining necessity of bilateral/multilateral discussion is a simple in use and simultaneously providing high practical accuracy method for calculation of conditional area around a station, using combination of the above-mentioned methods. The procedure consists of the following two steps:

a) **First step** of the procedure uses the parameter of conditional distance, presented as a table of maximum conditional distances for specified frequency bands which correspond to notifying frequency assignments, and derived for conservative system parameters of stations and using conservative initial data for the interference propagation path. If the resulting use of the conditional distance criterion shows that station bilateral/multilateral review isn’t required, then the two-step procedure is completed. If the resulting use of the parameter shows that bilateral/multilateral review may be required, the procedure goes to its second step. The first step of the procedure will select stations for which bilateral/multilateral review isn’t required in 99% of cases.

b) **Second step** of the procedure uses the parameter based on the conditional area for stations for which conditional distance parameter confirmed necessity of bilateral/multilateral review. Calculation of conditional area at the second step of the procedure uses known parameters of the planned station, system parameters of unknown station and conservative initial data (simplified calculation of losses), or known parameters of planned station, system parameters of unknown station and known initial data for propagation path (detailed calculation of losses).

# 6. Global Trends and Initiatives

6.1 Broadly, there are three types of cross border agreements. These includes:

1. Global Frameworks
2. Regional Frameworks
3. Bilateral/Multilateral/Sub Regional Frameworks

## **a) Global Frameworks**

##

These include treaties and international laws that provide basic framework or frequency coordination between countries. ITU Radio Regulations (RR) is one such framework. It is a basic document of the [International Telecommunication Union](https://en.wikipedia.org/wiki/International_Telecommunication_Union) (ITU) that regulates [radio communication services](https://en.wikipedia.org/wiki/Radiocommunication_service) and the utilization of [radio frequencies](https://en.wikipedia.org/wiki/Radio_frequency). It is the supplementation to the [ITU Constitution and Convention](https://en.wikipedia.org/wiki/Constitution_and_Convention_of_the_International_Telecommunication_Union) and in line with the ITU [International Telecommunication Regulations](https://en.wikipedia.org/wiki/International_Telecommunication_Regulations) (ITR). The ITU RR comprise and regulate the part of the allocated [electromagnetic spectrum](https://en.wikipedia.org/wiki/Electromagnetic_spectrum) (also: [radio frequency spectrum](https://en.wikipedia.org/wiki/Radio_frequency_spectrum)) from 9 KHz to 275 GHz. The *Radio Regulations* define:

1. the allocation of different frequency bands to different radio services;
2. the mandatory technical parameters to be observed by radio stations, especially transmitters;
3. procedures for the coordination (ensuring technical compatibility) and notification (formal recording and protection in the Master International Frequency Register) of frequency assignments made to radio stations by national governments;
4. Other procedures and operational provisions.

ITU Radio Regulations (RR) is an International Treaty, elaborated and revised by administrations and membership, during World Radio Conferences (WRC). RR has a binding nature for ITU Member States. Global frameworks are important because they are easier to implement with global backing of multiple administrations. Once agreed, these frameworks are easier to implement and follow. However, it is difficult to provide a detailed framework that countries of various conditions and backgrounds can agree to, so the global frameworks are mostly generalized.

## **b) Regional Frameworks**

Regional frameworks prepare common positions to be presented to regional, then global instances. These are important for exchange of information and experiences to foster the harmonization of spectrum management rules. They allow neighboring countries to manage interference by establishment of a common framework and coordinating the use of technical standards across regions. Examples of Regional frameworks include:

1. Asia-Pacific Telecommunity (APT): APT serves as the organization for information and communications technology (ICT) in the region. Throughout the past years, APT has been able to assist members in the preparation of Global conferences such as ITU Plenipotentiary Conference (PP), World Telecommunication Development Conference (WTDC), World Radio communication Conference (WRC), and World Summit on the Information Society (WSIS), World Telecommunication Standardization Assembly (WTSA), and the ITU meetings. APT is also involved in promoting regional harmonization of their programs and activities in the region.
2. Arab Spectrum Management Group (ASMG) was established in 1997 to cooperate in the field of Spectrum Management by sharing and exchanging views on the emerging radio communication aspects as well as to manage and coordinate all issues related to Spectrum Management, World Radio communications Conferences and other spectrum matters between Arab States. ASMG helps to harmonizing spectrum use between Arab countries, negotiating and developing common Arab proposals for the agenda items of World Radio Conference (WRC) held every four years at the ITU and assessing the progress of the studies pertaining to the agenda items of World Radio Conferences.

(iii) The European Telecommunications Standards Institute (ETSI) is an independent, not-for-profit, [standardization](https://en.wikipedia.org/wiki/Standardization) organization in the field of [information and communications](https://en.wikipedia.org/wiki/Information_and_communications_technology). ETSI supports the development and testing of global technical standards for ICT-enabled systems, applications and services. ETSI develops standards in key global technologies such as:  [GSM](https://en.wikipedia.org/wiki/GSM)™, [3G](https://en.wikipedia.org/wiki/3G), [4G](https://en.wikipedia.org/wiki/4G), and [5G](https://en.wikipedia.org/wiki/5G). A significant part of ETSI’s work is to identify new potential areas for [standardization](https://en.wikipedia.org/wiki/Standardization) at an early stage in order to monitor the technologies that may influence the future of [digital economy](https://en.wikipedia.org/wiki/Digital_economy).

## **c) Bilateral/Multilateral Arrangements**

These are cross border coordination between two or more neighboring countries. These treaties and arrangements provide specific solutions to particular problems. The examples of bilateral/multilateral includes:

1. The European Conference of Postal and Telecommunications Administrations (CEPT) and the Regional Commonwealth in the field of Communications (RCC) played a crucial role for cross border coordination between European countries. Hungary became the first European country to take advantage of the CEPT-RCC framework agreement and signed a ARNS coordination agreement with Ukraine in July 2011. Under the agreement, mobile phone base stations can be situated up to 20km from the Ukrainian border. After finishing further compatibility tests, this limit may decrease to 10 km from the border.
2. In August 2011, Russia, Lithuania, Latvia and Estonia agreed to a 2013 deadline for 790–862 MHz to be used in the border areas and signed a memorandum of understanding on roaming tariffs. Later that month, a coordination agreement was also signed by Russia and Finland.
3. Trilateral Coordination Meeting between Singapore, Malaysia and Indonesia; and Border Communication Coordination Meeting (BCCM) between Singapore and Indonesia. The Trilateral Coordination Meeting and Border Communication Coordination Meeting were set up to provide a forum for discussion of technical matters relating to telecommunications in the participating countries. Both meetings are held annually to discuss matters relating to:
4. Radio frequency coordination along bordering areas;
5. Coordination of future planned radio-communication services; and
6. Resolution of radio frequency interference along bordering areas.
7. Cambodia and Vietnam have held multiple Meetings on Frequency Management and Cross-Border Frequency Coordination. The focal of the meetings are bilateral cooperation such as bands for broadband systems, deployment of digital TV, frequency control activities and development of satellite services. The two sides agreed to continue to strengthen international cooperation, training and sharing of experiences on frequency management; to organize meetings on cross-border frequency coordination and satellite coordination; to exchange views on the agenda of 2019 World Radio communication Conference and to promote cooperation between TV, mobile operators in order to improve spectrum efficiency.
8. In May 2017, administrations of Belgium, Germany, France, Luxembourg and the Netherlands signed agreement on the Harmonization of 1452-1492 MHz frequency bands for terrestrial systems. This is done in order to improve the LTE systems deployed at the border area.

# 7. Current condition in SATRC countries

**7.1** Rapid growth of telecommunication and ICT technology worldwide offer a variety of new telecom products, services and technologies. Considering these issues, a questionnaire on cross border coordination (attached as Annex A) was provided and shared with all member countries. All SATRC countries except Maldives responded to the questionnaire. The responses of all the countries are attached as Annex-B to Annex-I. Based on these responses, this report presents the survey’s results of cross border coordination among the SATRC countries; conclusion and recommendations for further actions.

**7.2** At the time of this report, working group on spectrum has received responses to the questionnaire from SATRC member countries except Maldives.

The table below shows an overview of spectrum usage in SATRC countries:

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Frequency Bands | **Afghanistan** | **Bangladesh**  | **Bhutan**  | **Iran** | **India** | **Nepal** | **Pakistan** | **Sri Lanka** |
|
| 450 MHz |   |   |   |   |   |   |   |   |
| 600 MHz |   |   |   |   |   |   |   |   |
| 700 MHz |   |   |   |   |   |   |   |   |
| 800 MHz  |   |   |   |   |   |   |   |   |
| 850 MHz |   |   |   |   |   |   |   |   |
| 900 MHz  |   |   |   |   |   |   |   |   |
| 1500 MHz |   |   |   |   |   |   |   |   |
| 1800 MHz  |   |   |   |   |   |   |   |   |
| 2100 MHz  |   |   |   |   |   |   |   |   |
| 2300 MHz  |   |   |   |   |   |   |   |   |
| 2600 MHz  |   |   |   |   |   |   |   |   |
| 3300 MHz  |   |   |   |   |   |   |   |   |
| 3400 MHz  |   |   |   |   |   |   |   |   |
| 3500 MHz |   |   |   |   |   |   |   |   |
| 3600 MHz  |   |   |   |   |   |   |   |   |
| 26 GHz |   |   |   |   |   |   |   |   |
| 39 GHz |   |   |   |   |   |   |   |   |

|  |  |
| --- | --- |
|   | Bands assigned for IMT  |
|   | Bands identified for IMT but not assigned  |
|   | Bands identified for 5G  |

1. First two questions in the questionnaire are about the incidents of harmful interference faced by SATRC countries. The table below gives the overview of cross border interference incidents:

| **Country A** | **Afghanistan** | **Bangladesh** | **Bhutan** | **India** | **Iran** | **Nepal** | **Pakistan** | **Sri Lanka** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| a) | **Country B** | IranPakistan | India | India | Nepal | Pakistan, Afghanistan | India | India | India |
| b) | **Technology used in country A** | 2G, 3G | GSM | 3G UTMS | LTE | 2G, 3G, 4G | WiMAX | GSM | Fixed LTE |
| c) | **Technology used in country B** | 2G, 3G | GSM | IMT Services | WiMAX | 2G, 3G, 4G | LTE | GSM, LTE | 4G LTE |
| d) | **Border type** | Plain and uneven | Plain and uneven  | Plain and Hilly | Hilly | Plain | Plain hilly | Plain and Hilly | Sea |
| e) | **Year of Interference** | Since several years | 2016 and 2022 | 2022 | 2018 | \_ | 2016 | 2007 | 2010 |
| f) | **Reason for interference** | Signal Overspill | Ducting effect | Downlink | Signal Over-spill | Downlink | - | Downlink | Ducting effect |

1. Harmful cross border interference is faced by all of the SATRC countries. Five out of eight countries faced cross border interference with India as they share common border and also the border of India is too long and has both hilly and plain portions, so the chances of interference are high.
2. Question three is about the processes followed by SATRC countries to reduce cross border interference. Bangladesh, India, Iran and Pakistan conduct routine exercises to eliminate spillover signals. The figure below shows the answers:

Actions taken by member countries to mitigate cross border inference are summarized below;

* 1. In Bangladesh, within the country, spillovers are being eliminated by limiting TA value of sites near the border areas. Drive tests are also conducted and establishment of sites near the border areas are also controlled. However, no routine exercises are conducted jointly in collaboration with neighboring countries.
	2. India conducts detailed drive tests in case the interference is observed. After this, coordination through the Ministry of External Affairs with the concerned administration is usually carried out.
	3. Iran conducts drive tests near border every six months.
	4. In Pakistan, Timing Advance Filters optimization, Physical parameter optimization, frequency retuning and regular drive test & frequency scanning are conducted to eliminate interference.
	5. Another factor that can limit the cross border interference is defining a buffer zone across border where no site can be installed. Except of Bangladesh and Pakistan, who have defined this buffer zone of 3 km, no other SATRC country has defined a limit.
1. The next question is regarding cross border coordination measures taken by SATRC countries. Only Iran has signed a bilateral agreement with Gulf countries regarding cross border frequency coordination. Azerbaijan and IRAN signed an agreement for harmonized and coordinated use of GSM networks in the border areas of two countries. Two sides agreed to use the GSM frequency bands with the equitable access in the border areas.
2. In Pakistan, agreements were discussed and finalized at regulatory authority level but could not be signed due to diplomatic channels.
3. The member countries were also asked about the status of registering BTS sites in Master International Frequency Register (MIFR). India, Nepal and Pakistan are in the process of registering all BTS sites in MIFR. Most of the member countries have not yet considered this process.
4. Member countries are also asked about any assistance received from ITU regarding cross border agreements. Responses of Question 3-8 are summarized in the table below:

| **Country** | **Distance of BTS sites from border** | **Bi-lateral agreement signed with neighboring countries** | **Registration of BTS sites in MIFR** | **Help received from ITU regarding cross border agreement** |
| --- | --- | --- | --- | --- |
| **Afghanistan** | Not defined | None | Not considered | None |
| **Bangladesh** | 3 km from border | None | Not considered | None |
| **Bhutan** | Not defined | None | Not considered | None |
| **India** | Not defined | None | In process | ITU conducted Bilateral Agreement |
| **Iran** | Not defined | Signed with Gulf countries | Not considered | ITU conducted Bilateral Agreement |
| **Nepal** | Not defined | None | In process | ITU advised registration of MIFR |
| **Pakistan** | 3 km from border | None | Under Consideration | None |
| **Sri Lanka** | Not defined | None | Not considered | None |

1. Question No 9 was related to the current status of 5G in SATRC countries and steps taken by each country to avoid interference in 5G bands. The question was about coexistence of satellite services with the 5G bands. India has ensured the synchronization of satellites and 5G. Pakistan and Nepal are in process of research and development for 5G and has not yet reached the step of live satellite and 5G network coexistence.
2. In last question member countries were requested to provide recommendations for agreement between SATRC countries on resolving cross border interference issues, following recommendations are received:
	1. MoU between neighboring countries
	2. General treaty between all SATRC countries
	3. Agreement between member countries
	4. Bilateral level talks at the administration level
	5. Determining the limit of signal level and BTS site distance on the border
	6. A team involving regulators and operators of bordering countries should be formed that works in close coordination
	7. A single platform for SATRC countries to be developed to raise and coordinate for resolving cross-border interference issues

# 8. Challenges in Cross-border coordination

**8.1** Cross-border coordination to resolve cross-border interference can face several challenges. Here are some common problems encountered in this process.

**a) Regulatory Differences**. Each country may have its own regulatory framework and spectrum allocation plans. These variations can make it difficult to align the frequencies and technical parameters necessary to address cross-border interference. Harmonizing regulations and coordinating spectrum usage between countries can help overcome this challenge.

**b) Limited Coordination Mechanisms.** In some cases, there may be a lack of established mechanisms for cross-border coordination. Without proper communication channels or coordination agreements, resolving interference issues becomes more challenging. Establishing bilateral or multilateral agreements, creating joint working groups, or leveraging international organizations can facilitate coordination efforts.

**c) Disputes Resolution**. Disputes may arise between neighboring countries regarding interference incidents or the allocation of frequencies. These disputes can hinder the resolution process and delay the implementation of mitigation measures. Establishing dispute resolution mechanisms, such as arbitration or mediation processes, can help address conflicts and reach mutually acceptable solutions.

**d) Technical Complexity.** Resolving cross-border interference often requires technical expertise and thorough analysis. Identifying the sources of interference, assessing its impact, and implementing appropriate mitigation measures can be technically complex, especially when multiple technologies and services are involved. Collaborative technical studies and sharing of measurement data can assist in overcoming these challenges.

**e) Time and Resource Constraints.** Resolving cross-border interference issues can be time-consuming and resource-intensive. It requires coordination among multiple stakeholders, including regulatory bodies, network operators, and satellite service providers. The process may involve conducting joint studies, coordinating frequency assignments, implementing technical solutions, and ensuring compliance with regulatory requirements. Adequate resources, including funding, personnel and expertise are essential to address these challenges effectively.

**f) Political Considerations.** Cross-border coordination can be influenced by political factors, including national interests and geopolitical dynamics. These considerations may impact the willingness of countries to collaborate, share information, or reach consensus on interference mitigation measures. Overcoming political barriers requires diplomatic efforts, trust-building and recognizing the mutual benefits of resolving interference issues.

**g) Technological Limitations.** In some cases, existing technologies may have limitations in mitigating cross-border interference effectively. Advanced interference mitigation techniques, such as dynamic frequency assignment, adaptive filtering or interference cancellation may be required to address complex interference scenarios. Continued research and development in these areas can help overcome technological limitations. Addressing these challenges requires close collaboration, open communication and a willingness to find common solutions among neighboring countries. International organizations, such as the International Telecommunication Union (ITU), play a crucial role in facilitating cross-border coordination efforts and providing guidelines for interference resolution.

# 9. Regulatory issues that need to be addressed by SATRC countries

**9.1** From the results shown above, it is clear that there is a requirement for cross border coordination / agreement between the SATRC countries for frequency harmonization to avoid cross border interference issues. Mostly, international borders in SATRC countries are of varying characteristics, posing multiple issues for different countries. To avoid cross border interference, individual countries like Pakistan and Bangladesh have identified specific distance for installation of towers near border; other SATRC countries may also consider the same.

**9.2** Bilateral agreement between countries effectively addresses the common cross border interference issues. However, the signing of such agreements involves diplomatic channels which makes the process tedious and time consuming often leading to delayed or no results on the efforts made to finalize the agreements. Such agreements would also help to expedite the process of network optimization and provide signals to population near border. In this regard, a draft technical agreement is attached herewith as Annex-J which could be adopted by SATRC countries with necessary modifications based on the requirements of technology and interference type.

**9.3** ITU has defined MIFR **(Master International Frequency Register) which contains** frequency assignments together with their particulars as notified to the ITU in accordance with Article 11 of the Radio Regulations (RR). This is one of the most important systems established by ITU for efficient use of radio frequency spectrum. It is more useful for countries in planning their future use of spectrum and resolution of cross border interference issues. It is therefore vital that SATRC countries periodically check the entries appearing in the MIFR on their behalf and delete those which no longer reflect their current usage.

**9.4** In the 5G era, cross border coordination will be more important than ever, as 5G can be deployed in both TDD and FDD modes. Cross-border interference can indeed pose challenges for 5G synchronization, it is crucial in 5G networks to ensure accurate timing and coordination between base stations and user devices. It allows for efficient spectrum utilization and enables advanced features like beam forming, coordinated multipoint (CoMP) transmission, and interference management. Cross-border interference occurs when signals from neighboring countries' networks interfere with each other due to proximity or frequency overlap. This interference can disrupt synchronization signals, leading to synchronization issues in 5G networks.

**9.5** Therefore, all the SATRC countries, especially neighboring countries need to have pre-launch synchronization to avoid serious interference problems. The networks have to be designed differently for the 5G deployment in border areas to avoid cross border interference. To mitigate synchronization issues in cross-border interference scenarios, international collaborations and standardization efforts are crucial. Harmonizing frequency allocations, timing references, and synchronization protocols can help minimize synchronization issues and improve overall network performance. Developing synchronization protocols that are robust to cross-border interference is essential. These protocols should account for timing discrepancies and interference scenarios, allowing for efficient synchronization despite neighboring network interferences. Bilateral or multilateral agreements between neighboring countries can also facilitate coordination and mutual understanding of synchronization requirements.

**9.6** Ensuring coexistence of satellite services with 5G bands is another important step for advancement of 5G in SATRC countries. Coexistence of satellite services with 5G bands in cross-border coordination requires careful planning and coordination to avoid interference and ensure both services can operate effectively. One of the key aspects is coordinating the frequency bands used by satellite services and 5G networks. Countries need to collaborate and harmonize their frequency allocations to minimize interference. This coordination ensures that satellite services and 5G networks use non-overlapping or adequately separated frequency bands. Coordinating the placement of satellite ground stations and 5G base stations along the borders can help reduce interference risks. Regular monitoring helps identify any interference issues and enables timely resolution. Countries can establish coordination mechanisms, such as joint working groups or bilateral/multilateral agreements, to exchange information, coordinate actions, and address any interference incidents promptly.

# 10. Recommendations

**10.1** Implementing cross-border interference mitigation requires a comprehensive approach involving technical, regulatory, and collaborative efforts. Following are the recommendations for its successful implementation.

1. **Bilateral or Multilateral Agreements.** Foster agreements between neighboring countries to establish a framework for cross-border interference mitigation. These agreements should address frequency coordination, interference monitoring, notification mechanisms, and dispute resolution procedures. Clear guidelines and mutual commitments help ensure effective coordination and cooperation.
2. **Harmonization of Regulatory Frameworks.** Encourage harmonization of regulatory frameworks related to spectrum management, interference mitigation, and technical standards. This alignment minimizes discrepancies and simplifies coordination efforts. Collaboration with regional and international organizations, such as the ITU, can provide guidance and best practices for regulatory harmonization.
3. **Joint Technical Studies.** Collaborate on technical studies to understand the nature and extent of cross-border interference. This includes analyzing interference sources, measuring interference levels, and assessing the impact on both terrestrial (IMT) and satellite services. Joint studies facilitate a shared understanding of the problem and help identify suitable mitigation techniques.
4. **Interference Mitigation Strategies.** Based on the findings of technical studies, develop interference mitigation strategies that are tailored to the specific cross-border interference scenarios. This may involve implementing power control mechanisms, frequency notching, adaptive filtering, or interference cancellation techniques. Consideration should also be given to advanced antenna systems, beam forming, and smart spectrum management approaches.
5. **Monitoring System Development.** Establish a robust monitoring system to continuously assess interference levels and detect interference incidents. This includes deploying monitoring stations near border regions and implementing remote monitoring tools. The collected data can be shared between countries to facilitate timely interference detection and resolution.
6. **Foster Information Exchange and Collaboration.** Promote regular information exchange and collaboration among regulatory authorities, network operators, and satellite service providers. This includes sharing interference-related data, best practices, and lessons learned. Collaboration platforms, workshops, and technical working groups can facilitate effective communication and knowledge sharing.
7. **Enhance Cross-border Coordination Mechanisms.** Strengthen coordination mechanisms between neighboring countries to address interference incidents promptly. This involves establishing contact points, notification mechanisms, and coordination procedures for reporting and resolving interference issues. Quick response and effective coordination minimize the impact of interference and foster a cooperative environment.
8. **Awareness and Education.** Educate stakeholders, including network operators, satellite service providers, and end-users, about the importance of cross-border interference mitigation. Awareness programs and training initiatives can help ensure compliance with mitigation strategies, regulations, and good practices.
9. **Monitoring.** Continuously monitor the effectiveness of implemented mitigation measures and adapt them as necessary. Regularly evaluate the performance of interference mitigation strategies, address emerging challenges, and leverage technological advancements to improve efficiency and effectiveness.
10. **Synchronization frameworks & cross-border coordination.** The synchronized operation is the strongly recommended operating mode for Macro-cellular networks operating in the same area. Spectrum licensees are in the best position to select the most appropriate frame structure for them and to conduct negotiations with other licensees to reach agreement on a common frame structure. It is recommended that administrations initiate effective cross-border coordination discussions with neighboring countries considering the need for cross-border synchronization while assessing the most suitable frame structure at national level. In addition, agreeing on a common phase clock reference is an important first step for a successful cross-border coordination.

**10.2** By implementing these recommendations, SATRC countries can enhance cross-border interference mitigation, foster efficient spectrum utilization, and ensure the successful coexistence of terrestrial (IMT) and satellite services. Collaboration, coordination, and a shared commitment to resolving interference issues are essential for achieving these objectives.

**10.3** A Sample Technical Agreement is also recommended and attached as **Annex-J** which could be adopted by SATRC member countries with necessary modifications based on the requirements of technology and interference type.

# ANNEX A

**QUESTIONNAIRE**

**QUESTIONNAIRE ON WORK ITEM**

**CROSS-BORDER COORDINATION FOR INTERFERENCE IN SATRC COUNTRIES**

**Section 2: Questionnaire Part**

***Q1.*** *Did your country ever face any harmful interference in any network’s operation from any other SATRC/ other countries?*

**Ans:**

***Q2.*** *If yes, then provide following details;*

**Ans:**

**(a)** Country Name

**Ans:**

***(b)*** *Technology used in your country*

**Ans:**

***(c)*** *Technology used in other Country*

**Ans:**

***(d)*** *Spectrum Band*

**Ans:**

***(e)*** *Nature of interference*

**Ans:**

***(f)*** *Operator Name*

**Ans:**

***(g)*** *State geographical type of the border that faces cross border interference?*

**Ans**:

***(h)*** *Year of origin of interference?*

**Ans**:

**(i)** Are you able to identify the reason of interference?

**Ans**:

***Q3.*** *Do your country conduct routine exercises for eliminating spillover near border area?*

**Ans:**

**(a)** If yes what is the activity/ coordination mechanism

**Ans:**

***Q4.*** *What distance is permissible for a site installation near border area?*

**Ans:**

***Q5.*** *Did your country ever sign an agreement with any other country on cross border interference cases?*

**Ans:**

**(a)** If yes, which country?

**Ans:**

***(b)*** *What benefits you gained through this agreement*

 **Ans:**

 ***(c)*** *if not, what are the reasons?*

**Ans:**

 ***(d)*** *What difficulties do you face to sign an agreement?*

**Ans:**

***Q6.*** *Have your country registered all the transmitting stations in Master International Frequency Register (MIFR)?*

**Ans:**

***Q7.*** *Any success story you have on resolving cross border interference case?*

**Ans:**

***Q8.*** *Did you ever report about cross border interference to ITU?*

**Ans:**

**(a)** If yes, what facilitation did you get from ITU?

**Ans**:

***(b)*** *If not, why?*

**Ans:**

***Q9.*** *With the launch of 5G network in SATRC countries, cross border synchronization/ coordination will be of keen importance. What precautionary steps / plans are made by your country?*

**Ans:**

**(a)** Currently, which bands are identified for 5G launch in your country?

**Ans:**

***(b)*** *Is there any coexistence with satellite services in identified bands?*

**Ans:**

***Q10.*** *Your country’s recommendations for agreement between SATRC countries on resolving cross border interference issues?*

**Ans:**

# ANNEX B

**AFGHANISTAN RESPONSE**

**Q1** *Did your country ever face any harmful interference in any network’s operation from any other SATRC/ other countries?*

**Ans** NO

**Q2** *If yes, then provide following details;*

**Ans** -------------------------------------------------------------------------------------------------

**(a)** Country Name

Ans --------------------------------

**(b)** *Technology used in your country*

Ans --------------------------------

**(c)** *Technology used in other Country*

Ans --------------------------------

**(d)** *Spectrum Band*

Ans --------------------------------

**(e)** *Nature of interference*

Ans --------------------------------

**(f)** *Operator Name*

Ans --------------------------------

**(g)** *State geographical type of the border that faces cross border interference?*

Ans --------------------------------

**(h)** *Year of origin of interference?*

Ans --------------------------------

**(i)** Are you able to identify the reason of interference?

Ans --------------------------------

(Ducting effect, Uplink / Downlink etc.)

**Q3** *Do your country conduct routine exercises for eliminating spillover near border area?*

**Ans** No, very rare, communication is through ministry of foreign affairs.

**(a)** If yes what is the activity/ coordination mechanism

 **Ans** we are collecting the data and proofs that there is a strong signal spillover across the shared border, then sending them to the neighbor country through ministry of foreign affairs.

**Q4** *What distance is permissible for a site installation near border area?*

**Ans** Inside the country territory with no sector/cell toward the neighbor country.

**Q5** *Did your country ever sign an agreement with any other country on cross border interference cases?*

**Ans No**

**(a)** If yes, which country?

Ans --------------------------------

 **(b)** *What benefits you gained through this agreement*

 Ans --------------------------------

 **(c)** *if not, what are the reasons?*

Ans --------------------------------

  **(d)** *What difficulties do you face to sign an agreement?*

Ans --------------------------------

**Q6** *Have your country registered all the transmitting stations in Master International Frequency Register (MIFR)?*

**Ans** No

**Q7** *Any success story you have on resolving cross border interference case?*

**Ans** Not yet.

**Q8** *Did you ever report about cross border interference to ITU?*

**Ans** No

 **(a)** If yes, what facilitation did you get from ITU?

Ans --------------------------------

 **(b)** *If not, why?*

Ans --------------------------------

**Q9** *With the launch of 5G network in SATRC countries, cross border synchronization / coordination will be of keen importance. What precautionary steps / plans are made by your country?*

**Ans W**e don’t have 5G in our plan yet and not taken any step for it.

**(a)** Currently, which bands are identified for 5G launch in your country?

Ans --------------------------------

**(b)** *Is there any coexistence with satellite services in identified bands?*

Ans --------------------------------

**Q10** *Your country’s recommendations for agreement between SATRC countries on resolving cross border interference issues?*

**Ans** The regulatory of every SATRC country is better to have regular communication with all its neighboring countries for cooperation and exchange of information and experience. If some interference is observed from any neighboring country, initially they have to communicate and agree on the existence of the problem, then raise officially (paper base communication) it through proper channel between the governments of two countries to come to conclusion and solution, after agreeing upon a solution, both countries have to document it as an MoU and set a deadline for implementing it and have regular communication and cooperation for implementing the MoU.

# ANNEX-C

**BANGLADESH RESPONSE**

***Q1.*** *Did your country ever face any harmful interference in any network’s operation from any other SATRC/ other countries?*

**Ans:** Yes

***Q2.*** *If yes, then provide following details;*

**Ans:**

**(a)** Country Name

**Ans:** INDIA

***(b)*** *Technology used in your country*

**Ans:** GSM

***(c)*** *Technology used in other Country*

**Ans:** GSM

***(d)*** *Spectrum Band*

**Ans:** 900MHz, 1800MHz and 2600MHz

***(e)*** *Nature of interference*

**Ans:** Co-Channel Interference

***(f)*** *Operator Name*

**Ans:** Grameenphone Ltd; Robi Axiata Ltd; and Banglalink Digital Communications Ltd.

***(g)*** *State geographical type of the border that faces cross border interference?*

**Ans**: International border between Bangladesh and India is not straight line. Rather it is zig-zag line.

***(h)*** *Year of origin of interference?*

**Ans**: 2016 and 2022

**(i)** Are you able to identify the reason of interference?

**Ans**: Ducting effect; Uplink/Downlink. Also due the zig-zag nature of the international border line.

***Q3.*** *Do your country conduct routine exercises for eliminating spillover near border area?*

**Ans:** Yes

**(a)** If yes what is the activity/ coordination mechanism

**Ans:** Within the country, spillovers are being eliminated by limiting TA value of sites near the border areas. Drive tests are also conducted and establishment of sites near the border areas are also controlled. However, no routine exercises are conducted jointly in collaboration with neighboring countries.

***Q4.*** *What distance is permissible for a site installation near border area?*

**Ans:** The usual permissible distance for the site installation is beyond 3 Km from the border line. But, under special circumstances, sites may also be established near the border line (~0 Km from the border line). However, in such cases, concerned operator has to ensure that no spillover happens across the border by technical means.

***Q5.*** *Did your country ever sign an agreement with any other country on cross border interference cases?*

**Ans:** No

**(a)** If yes, which country?

**Ans:** N/A

 ***(c)*** *What benefits you gained through this agreement*

 **Ans:** N/A

 ***(c)*** *if not, what are the reasons?*

**Ans:** The problem was resolved bilaterally.

  ***(d)*** *What difficulties do you face to sign an agreement?*

**Ans:** N/A

***Q6.*** *Have your country registered all the transmitting stations in Master International Frequency Register (MIFR)?*

**Ans:** Not yet.

***Q7.*** *Any success story you have on resolving cross border interference case?*

**Ans:** Yes. The cross-border interference issue that occurred in 2016 was resolved bilaterally with the concerned authority of India.

***Q8.*** *Did you ever report about cross border interference to ITU?*

**Ans:** No

**(a)** If yes, what facilitation did you get from ITU?

**Ans**: N/A

***(b)*** *If not, why?*

**Ans:** The issue was resolved bilaterally. Hence was not required to report to ITU.

***Q9.*** *With the launch of 5G network in SATRC countries, cross border synchronization / coordination will be of keen importance. What precautionary steps / plans are made by your country?*

**Ans:** We are planning to take necessary precautionary measures.

**(a)** Currently, which bands are identified for 5G launch in your country?

**Ans:** 3.5 GHz Band

***(b)*** *Is there any coexistence with satellite services in identified bands?*

**Ans:** No

***Q10.*** *Your country’s recommendations for agreement between SATRC countries on resolving cross border interference issues?*

**Ans:** A general treaty may be signed between all SATRC countries on resolving cross-border interference issues.

# ANNEX-D

**BHUTAN RESPONSE**

**Q1**. *Did your country ever face any harmful interference in any network’s operation
from any other SATRC/ other countries?*

**Ans** Yes, but only recently (August 2022)

**Q2** *If yes, then provide following details;*
**(a)** *Country Name* **Ans** India  **(b)** *Technology used in your country* **Ans** 3G UMTS **(c)** *Technology used in other Country* **Ans** IMT services  **(d)** *Spectrum Band* **Ans** 850 MHz and 2100 MHz  **(e)** *Nature of interference* **Ans** External interference (disruption in the services by unwanted signal)  **(f)** *Operator Name* **Ans** Tashi Infocomm Limited  **(g)** *State geographical type of the border that faces cross border interference?* **Ans** Both hill and plain areas (near border)  **(h)** *Year of origin of interference?* **Ans** 2022

**(i)** Are you able to identify the reason for interference? (Ducting effect, Uplink / Downlink etc.)

**Ans** Downlink

**Q3** *Does your country conduct routine exercises for eliminating spillover near the
border area?*

**Ans** We do when there is issues but we don't conduct a routine monitoring in border
Areas. **(a)** *If yes what is the activity/ coordination mechanism.*

**Ans** Using spectrum analyzers we measure and detect from where the unwanted
frequencies come. However, we have not yet informed the neighboring country
for coordination.

**Q4** *What distance is permissible for a site installation near the border area?*

**Ans** No established standards as of now.

**Q5** *Did your country ever sign an agreement with any other country on cross border interference cases?*

**Ans** So far not done with any countries.

 **(a)** If yes, which country?

 **Ans --------------------------------**

 **(b)** *What benefits you gained through this agreement*

 **Ans --------------------------------**

 **(c)** *if not, what are the reasons?*

 **Ans --------------------------------**

 **(d)** *What difficulties do you face to sign an agreement?*

 **Ans --------------------------------**

**Q6** *Has your country registered all the transmitting stations in the Master International Frequency Register (MIFR)?*

**Ans** Not done.

**Q7** *Any success story you have on resolving cross border interference cases?*

**Ans** Not so far.

**Q8** *Did you ever report about cross border interference to ITU?*

**Ans** Not so far.

 **(a)** *If yes, what facilitation did you get from ITU?* **Ans --------------------------------
 (b)** *If not, why?* **Ans** Haven’t received any interference before August 2022.

**Q9** *With the launch of the 5G network in SATRC countries, cross border synchronization / coordination will be of keen importance. What precautionary steps / plans are made by your country?*

**Ans** We have decided on the 5G frequency band based on the GSMA spectrum
harmonization for 5G. This will help for synchronization/coordination for implementing 5G.

 **(a)** Currently, which bands are identified for 5G launch in your country?

 **Ans** 3.4 - 3.6 GHz

 **(b)** *Is there any coexistence with satellite services in identified bands?*

 **Ans** No

**Q10** *Your country’s recommendations for agreement between SATRC countries on
resolving cross border interference issues?*

**Ans** Especially in the IMT services there needs an agreement in terms of distance where one country’s Signal can travel to another country. Also a distance for the Locations of BTS in border areas. ITU or any other relevant agencies should be Assist if there are any interference issues in border areas. The cross border interference issues can be solved only through involving high level diplomatic agencies from the two countries rather than involving only the two regulators and operators. It is because the numerous protocols have to be followed.

# ANNEX-E

**INDIA RESPONSE**

**Q1** *Did your country ever face any harmful interference in any network’s operation from any other SATRC/ other countries?*

**Ans** Yes

**Q2** *If yes, then provide following details;*

**Ans**

1. *Country Name*

Ans Nepal

1. *Technology used in your country*

Ans LTE

1. *Technology used in other Country*

Ans WIMAX

1. *Spectrum Band*

Ans 2300 MHz

1. *Nature of interference*

Ans Signal degradation

1. *Operator Name*

Ans Reliance Jio

1. *State geographical type of the border that faces cross border interference?*

**Ans** Mountain terrain

1. *Year of origin of interference?*

**Ans** 2018

1. *Are you able to identify the reason of interference (Ducting effect, Uplink / Downlink etc.)?*

**Ans** Spillage of signal across border

**Q3** *Do your country conduct routine exercises for eliminating spillover near border area?*

**Ans** No

a. *If yes what is the activity/ coordination mechanism*

**Ans** India conducts detailed drive tests in case the interference is observed. After t coordination through Ministry of External Affairs with the concerned administration usually carried out.

**Q4** *What distance is permissible for a site installation near border area?*

**Ans** No such restrictions are imposed as on date.

**Q5** *Did your country ever sign an agreement with any other country on cross border interference cases?*

**Ans** No agreement has been signed recently.

1. *If yes, which country?*

*Ans --------------------------------*

1. *What benefits you gained through this agreement?*

*Ans -------------------------------*

1. *If not, what are the reasons?*

*Ans -------------------------------*

1. *What difficulties do you face to sign an agreement?*

*Ans --------------------------*

**Q6** *Have your country registered all the transmitting stations in Master International Frequency Register (MIFR)?*

**Ans** Indian administration is registering satellite as well as Terrestrial transmitting stations in MIFR.

**Q7** *Any success story you have on resolving cross border interference case?*

**Ans** 3G interference case in the 2100 MHz band along the Border States were resolved subsequent to bilateral meetings between administrations.

**Q8** *Did you ever report about cross border interference to ITU?*

**Ans** Yes

(a) *If yes, what facilitation did you get from ITU?*

**Ans** Necessary support in conducting bilateral meetings

(b)*If not, why?*

**Ans NA**

**Q9** *With the launch of 5G network in SATRC countries, cross border synchronization/ coordination will be of keen importance. What precautionary steps / plans are made by your country?*

**Ans** India has ensured the synchronization of satellites and 5G.

1. *Currently, which bands are identified for 5G launch in your country?*

**Ans** TSPs has been assigned spectrum in 700 MHz, 3300 MHz and 26 GHz bands among other bands to roll out their 5G services.

1. *Is there any coexistence with satellite services in identified bands?*

 **Ans** No

**Q10** *Your country’s recommendations for agreement between SATRC countries on resolving cross border interference issues?*

**Ans** Bilateral level talks at the administration level will be useful for resolution of interference.

# ANNEX-F

**I.R. of iran Response**

**Q1** *Did your country ever face any harmful interference in any network’s operation from any other SATRC/ other countries?*

**Ans Yes**

**Q2** *If yes, then provide following details;*

Ans -------------------------------------------------------------------------------------------------

**(a)** *Country Name*

Ans Pakistan, Afghanistan,

**(b)** Technology used in your country

Ans 2G, 3G, 4G

**(c)** Technology used in other Country

Ans 2G, 3G, 4G

**(d)** *Spectrum Band*

Ans 900 MHz, 1800 MHz, 2100 MHz

**(e)** Nature of interference

Ans Harmful------------------------

**(f)** *Operator Name*

Ans Mobilink, ZONG, UFONE PAKTEL, Telenor - Afghan Wireless, Roshan, Etesalat, Afghan Telecom

**(g)** *State geographical type of the border that faces cross border interference?*

Ans Land border

**(h)** *Year of origin of interference?*

Ans ---------------------

**(i)** Are you able to identify the reason of interference?

Ans ------Co-channel interference (Overshoot) --------------------------

(Ducting effect, Uplink / Downlink etc.)

**Q3** *Do your country conduct routine exercises for eliminating spillover near border area?*

**Ans** YES----------------------------------------------------------------

**(a)** If yes what is the activity/ coordination mechanism

**Ans** Drive test in the border are every 6 month

**Q4** *What distance is permissible for a site installation near border area?*

**Ans** There is no specific distance limitation

**Q5** *Did your country ever sign an agreement with any other country on cross border interference cases?*

**(a)** If yes, which country?

Ans Azerbaijan/ Neighboring countries in Persian Gulf and Oman Sea

**(c)** What benefits you gained through this agreement?

Ans *The signal level of the mobile operators in the territory of neighboring country decreased.*

 **(c)** if not, what are the reasons?

Ans --------------------------------

 **(d)** What difficulties do you face to sign an agreement?

Ans --------------------------------

**Q6** *Have your country registered all the transmitting stations in Master International Frequency Register (MIFR)?*

**Ans** No

**Q7** *Any success story you have on resolving cross border interference case?*

**Ans** --To Control the signal overshoot of the mobile networks through the borders----------------------------------------------------------------------------------------------

**Q8** *Did you ever report about cross border interference to ITU?*

**Ans** Yes

**(a)** If yes, what facilitation did you get from ITU?

Ans -----ITU assist to communicate with some administrations to inform them of the interference report---------------------------

 **(b)** If not, why?

Ans --------------------------------

**Q9** *With the launch of 5G network in SATRC countries, cross border synchronization / coordination will be of keen importance. What precautionary steps / plans are made by your country?*

**Ans** *There are not successful experience with some neighboring countries which have significant distance between their Base stations.*

**(a)** Currently, which bands are identified for 5G launch in your country?

**Ans** The frequency bands have been assigned for developing 5G tech. are including:

- Partial of 3400-3800 MHz

- Partial of 24.25-27.5 (26 GHz)

**(b)** *Is there any coexistence with satellite services in identified bands?*

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

**Q10** *Your country’s recommendations for agreement between SATRC countries on resolving cross border interference issues?*

**Ans** Determining the limit of signal level on the border and also at a certain distance from the border is suggested based on ITU recommendations and European recommendations (such as ERC/REC/(01)01, ECC/REC/(05)08, ECC/REC/(08)02, ECC/REC/(11)04, ECC/REC/(11)05, ECC/REC/(14)04, ...)

# ANNEX-G

**NEPAL RESPONSE**

**Q1.** *Did your country ever face any harmful interference in any network’s operation from any other SATRC/ other countries?*

**Ans:** Yes

**Q2** *If yes, then provide following details;*

|  |  |  |
| --- | --- | --- |
| **Ser.** | ***Country Name***  | **India** |
|  | *Technology used in your country* | WiMAX |
|  | *Technology used in other country* | LTE |
|  | *Spectrum Band* | 2300 |
|  | *Nature of Interference*  | Interference  |
|  | *Operator Name* | Nepal Telecom |
|  | *Type of geographical border that faced interference.* | Plain border as well as hilly regions far away from border |
|  | *Year in which interference occurred* | 2016 |
|  | *Were you able to identify the reason of interference?* | - |

**Q3** *Do your country conduct routine exercises for eliminating spillover near border area?*
**Ans**: No. It is recommended to formulate a joint coordination mechanism among neighbor

member states.

**(a)** If yes what is the activity/ coordination mechanism

**Ans:** Not Applicable (as of now).

**Q4** *What distance is permissible for a site installation near border area?*
**Ans:** Not Applicable (as of now).

**Q5** *Did your country ever sign an agreement with any other country on cross border interference cases?*
**(a)** *If yes, which country?*

**Ans**: No.

**(b)** What benefits you gained through this agreement

**Ans:** Not Applicable (as of now).

**(c)** if not, what are the reasons?

**Ans:** For occasional problems, we had attempted to find solutions to cross border interference issues in close coordination and cooperation with corresponding neighboring countries.

**(d)** What difficulties do you face to sign an agreement?

**Ans:** Not Applicable.

**Q6** *Have your country registered all the transmitting stations in Master International Frequency Register (MIFR)?*

**Ans**: No. However, the registration procedure is underway.

**Q7** *Any success story you have on resolving cross border interference case?*

**Ans:** Not Applicable.

**Q8** *Did you ever report about cross border interference to ITU?*

**(a)** If yes, what facilitation did you get from ITU?

**Ans: Not Applicable. (**We had not informed ITU about any cross-border interference.)

**(b)** *If not, why?*

**Ans:** In close coordination and cooperation with neighboring countries, we had attempted to find solutions for the cross-border interference issues.

**Q9** *With the launch of 5G network in SATRC countries, cross border synchronization/ coordination will be of keen importance. What precautionary steps/plans are made by your country?*

**Ans:** No specific plan is made, as of now.

**(a)** Currently, which bands are identified for 5G launch in your country?

**Ans**: All spectrum bands are permitted to be used for 5G (under technology neutrality regime). But we expect the 5G services to be rolled out in 2600, 2300, and C band together with 700 and 800 MHz bands.

**(b)** Is there any coexistence with satellite services in identified bands?

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

**Q10** *Your country’s recommendations for agreement between SATRC countries on resolving cross border interference issues?*

**Ans:** A team involving regulators and operators of bordering countries should be formed that works in close coordination to prevent and/or minimize cross border interferences. The team can cooperate for not only the mitigation and minimization of the cross-border interferences, it should also coordinate during the planning phases for spectrum and service harmonization.

# ANNEX-H

**PAKISAN RESPONSE**

***Q1.*** *Did your country ever face any harmful interference in any network’s operation from any other SATRC/ other countries?*

**Ans:** Yes

**Q2.** If yes, then provide following details;

**Ans:**

***(a)*** *Country Name*

**Ans:** India, Afghanistan and Iran (Spillover Signals)

**(b)** Technology used in your country

**Ans:** GSM

**(c)** Technology used in other Country

**Ans:** GSM, LTE

***(d)*** *Spectrum Band*

**Ans:** 900MHz (EGSM Band)

***(e)*** *Nature of interference*

**Ans:** Harmful Interference

***(f)*** *Operator Name*

**Ans:** Various Operators

***(g)*** *State geographical type of the border that faces cross border interference?*

**Ans**: International border between Pakistan and India is very long with different geographical terrain.

**(h)** Year of origin of interference?

**Ans**: 2007 till date

**(i)** Are you able to identify the reason of interference?

**Ans**: Same frequency bands are being used for same and different technologies

***Q3.*** *Do your country conduct routine exercises for eliminating spillover near border area?*

**Ans:** Yes

**(a)** If yes what is the activity/ coordination mechanism

**Ans:** Timing Advance Filters optimization, Physical parameter optimization, frequency retuning and regular drive test & frequency scanning etc.

***Q4.*** *What distance is permissible for a site installation near border area?*

**Ans:** The permissible distance for the site installation is 3 Km from international borders.

***Q5.*** *Did your country ever sign an agreement with any other country on cross border interference cases?*

**Ans:** No

***(a)*** *If yes, which country?*

**Ans:** N/A

**(b)** What benefits you gained through this agreement

**Ans:** N/A

***(c)*** *if not, what are the reasons?*

**Ans:** N/A

 **(d)** What difficulties do you face to sign an agreement?

**Ans:** Agreements were discussed and finalized at regulatory level but could not be signed due to diplomatic channels.

***Q6.*** *Have your country registered all the transmitting stations in Master International Frequency Register (MIFR)?*

**Ans:** BTS sites are being registered in MFR maintained by Frequency Allocation Board in Pakistan. However, MIFR registration is under consideration.

***Q7.*** *Any success story you have on resolving cross border interference case?*

**Ans:** Yes, with Oman. The issue was resolved through spectrum re-farming.

***Q8.*** *Did you ever report about cross border interference to ITU?*

**Ans:** Yes

**(a)** If yes, what facilitation did you get from ITU?

**Ans**: ITU wrote to the corresponding country administration but issue could not be solved

***(b)*** *If not, why?*

**Ans:** N/A

***Q9.*** *With the launch of 5G network in SATRC countries, cross border synchronization / coordination will be of keen importance. What precautionary steps / plans are made by your country?*

**Ans:** Necessary precautionary measures are being taken by Pakistan and different studies and analysis are ongoing to avoid cross border interference and synchronization in 5G

**(a)** Currently, which bands are identified for 5G launch in your country?

**Ans:** 2.1 GHz, 2.3GHz, 2.6GHz, 3.5 GHz, 24 GHz, 39 GHz

**(b)** Is there any coexistence with satellite services in identified bands?

**Ans:** Not yet, as 5G services have not yet started.

***Q10.*** *Your country’s recommendations for agreement between SATRC countries on resolving cross border interference issues?*

**Ans:** There should be single platform for SATRC countries to raise and coordinate for resolving cross-border interference issues. It will lead to speedy resolution of external interference cases and form a source of information for other SATRC members**.**

# ANNEX I

**SRILANKA RESPONSE**

**Q1** *Did your country ever face any harmful interference in any network’s operation from any other SATRC/ other countries?*

**Ans Yes**

***Q2*** *If yes, then provide following details;*

**Ans** -------------------------------------------------------------------------------------------------

***(a)*** *Country Name*

Ans India

***(b)*** *Technology used in your country*

**Ans** Fixed LTE

**(c)** Technology used in other Country

**Ans** 4G LTE

***(d)*** *Spectrum Band*

**Ans** 2300MHz (Band 40)

***(e)*** *Nature of interference*

**Ans** Co-channel Interference

***(f)*** *Operator Name*

**Ans** Dialog Broadband Networks (Pvt) Ltd

***(g)*** *State geographical type of the border that faces cross border interference?*

**Ans** Sea Border

***(h)*** *Year of origin of interference?*

**Ans** Intermittent from 2010

**(i)** Are you able to identify the reason of interference?

**Ans** Ducting Effect

*(Ducting effect, Uplink / Downlink etc.)*

***Q3*** *Do your country conduct routine exercises for eliminating spillover near border area?*

**Ans** No

**(a)** If yes what is the activity/ coordination mechanism

***Ans*** *------------------------------------------------------------------------------------------------*

***Q4*** *What distance is permissible for a site installation near border area?*

**Ans** No such requirement is essential as the minimum distance between two counties is 20 Miles.

**Q5** Did your country ever sign an agreement with any other country on cross border interference cases?

***Ans*** No

***(a)*** *If yes, which country?*

*Ans --------------------------------*

***b)*** *What benefits you gained through this agreement*

Ans --------------------------------

***(c)*** *if not, what are the reasons?*

*Ans Distance between the countries is high but we are planning to initiate.*

**(d)** What difficulties do you face to sign an agreement?

*Ans Not yet notice*

***Q6*** *Have your country registered all the transmitting stations in Master International Frequency Register (MIFR)?*

**Ans** No

***Q7*** *Any success story you have on resolving cross border interference case?*

**Ans** No

***Q8*** *Did you ever report about cross border interference to ITU?*

**Ans Yes**

**(a)** If yes, what facilitation did you get from ITU?

**Ans** ITU advised to initiate the Notification in MIFR

***(b)*** *If not, why?*

**Ans** --------------------------------

***Q9*** *With the launch of 5G network in SATRC countries, cross border synchronization / coordination will be of keen importance. What precautionary steps / plans are made by your country?*

**Ans** None

**(a)** Currently, which bands are identified for 5G launch in your country?

**Ans** 3500 MHz (Band 42)

**(b)** Is there any coexistence with satellite services in identified bands?

**Ans No**

***Q10*** *Your country’s recommendations for agreement between SATRC countries on resolving cross border interference issues?*

***Ans*** It is better to have cross boarder agreements with neighboring countries even though, the border distances are high because some interferences due to ducting effect will travel far than what we expected.

#  ANNEX-J

**Sample Agreement**

**Arrangement to Control Cross Border Spillover and Harmful Interference for Telecommunication Service between**

**Regulatory Authority A**

**And**

**Regulatory Authority B**

**Date:**

Disclaimer: This is a sample agreement for resolution of cross border spillover and harmful interference for telecommunication services which could be modified in terms of definitions and other parameters depending on nature of service(s) which causes observed interference.

## **Introduction**

The administrations *of A and B Authority* have made arrangements to prevent and/or solve spillover and harmful interference to the telecommunication service and optimizing the use of the frequency spectrum by both administrations.

Both the parties recognize that radio frequency propagation is not restricted by international borders and that not even the best techniques available can avoid incidental spillover from occurring across international borders. Both the parties also recognize that reasonable allowance has to be made for spillover to occur, provided that the transmissions of affected operators do not suffer harmful interference and results in making calls. Therefore, technical and administrative measures should be adopted to resolve the interference and cross border issues in frequency bands for radio services.

## **Definitions**

**Administration** means Regulatory Authority A and Regulatory Authority B

**Absolute Radio Frequency Channel Number** (ARFCN) means a unique number given to each radio channel in GSM. The ARFCN can be used to calculate the exact frequency of the radio channel.

**CDMA** means Code Division Multiple Access

**Cell Global Identity** (CGI) means a standard identifier for mobile phone cells, providing means to geographically locate connected mobile phones. If a cell phone is connected to a GSM network, then the position of that particular cell phone can be determined using CGI of the cell which is covering that cell phone. It is also applicable for other technologies.

**Evolved Absolute Radio Frequency Channel Number** (EARFCN) means a unique number given to each radio channel within the frequency band.

**GSM** means Global system for mobile communication.

**LTE** means Long Term Evolution.

**PCI** means Physical Cell identity which is mainly used by UE to decode physical layer data being transmitted by eNodeB.

**Resource Block** means the smallest block of resource that can be allocated to UE by eNB; it is 12 subcarriers for 7 symbols.

**UMTS** means Universal Mobile Telecommunications Service.

**UTRA Absolute Radio Frequency Channel Number** (UARFCN) means a unique number given to each radio channel within the frequency bands used by the [UMTS](http://www.telecomabc.com/u/umts.html) [UTRA](http://www.telecomabc.com/u/utra.html). The UARFCN can be used to calculate the carrier frequency.

**WCDMA** means Wideband Code Division Multiple Access

## **SECTION ONE**

**Purpose and Applicability**

The purpose of this arrangement is to efficiently and effectively resolve the cross border spillover and harmful interference in relation to terrestrial telecommunication services, namely 2G, 3G, 4G and WLL in the bands 450, 479, 900, 1800, 1900, 2100 and 3500 MHz in the following Administrations of *Regulatory Authority A and Regulatory Authority B.*

Any terms, definition and/or expirations used through this document are merely limited to the implementation of the arrangement mentioned in this document, and shall not be construed to have any implication, to the countries party to this arrangement, outside the scope of this document.

##

## **SECTION TWO**

**Arrangement to Eliminate Spillover**

1) The following technical criteria shall be followed by all operators:

(a) The received outdoor signal level shall not exceed -102 dBm referenced to 200 kHz bandwidth on the surface of the earth of the neighboring country for 2G networks.

(b) The received outdoor signal level shall not exceed -110 dBm referenced to 5 MHz bandwidth on the surface of the earth of the neighboring country for 3G networks.

(c) The received outdoor signal level shall not exceed -117.5 dBm referenced to 5 MHz bandwidth on the surface of the earth of the neighboring country for CDMA 2000 WLL networks.

(d) The received outdoor signal level shall not exceed -110 dBm referenced to 5 MHz bandwidth on the surface of the earth of the neighboring country for LTE (4G) networks.

2) In case of spillover, technical reports and measurement actual log files indicating the technical specifications of the spillover coverage and stations causing this spillover will be exchanged between Regulators on both sides. The technical report shall include the following details:

1. CGI causing the spillover coverage.
2. Cell ID and ARFCN for GSM (2G) networks.
3. Scrambling Code (SC), UARFCN for UMTS (3G) networks.
4. EARFCN and PCI for LTE (4G) networks.
5. Received signal level.
6. Geographical coordinates of field measurements.
7. Images for the routes showing the spillover coverage.
8. Any other necessary details (dates and times, etc.).

3) To resolve any spillover coverage case, the following action shall be taken:

* 1. Operators shall take all necessary actions to resolve any spillover cases as soon as possible by direct coordination.
	2. Subsequently concerned Administration shall take all necessary actions to resolve any Cross-border Spillover cases as soon as possible by direct coordination.
	3. The affected Administration then send a spillover correspondence including Technical
	Report (as described in item 2 of this Section).
	4. The acknowledgment of receipt of the Spillover correspondence and report should be sent by the concerned administration within four working days from the date of receiving the Spillover correspondence and Report.
	5. After 15 working days from the date of acknowledgment of receipt of the spillover correspondence and Report, except if a reasonable different delay is requested by the concerned administration for not more than 15 calendar days, if spillover is still not resolved and there has been no major progress to resolve Spillover, the affected Administration could inform the ITU requesting to provide assistance in resolving the spillover, including the possibility of holding bilateral/multilateral meeting.
	6. In case of no acknowledgement after four working days from the date of sending the Spillover correspondence and Report, the affected Administration may send a reminder to the concerned Administration. If no acknowledgement is received after four working days from the date of sending the reminder, the affected Administration could inform ITU with the request to provide assistance in resolving the Spillover, including the possibility of holding bilateral/multilateral meeting.

## **SECTION THREE**

**Arrangement for Eliminating Harmful Interferences**

1. In case of spillover resulting in harmful interference, technical reports and actual measurement log files indicating the details of the interference and network causing this harmful interference are exchanged between Operators with copy to the corresponding administration. The technical report shall include the following details as per Appendix-10 of Article 15 of Radio Regulations:
2. **Interfering stations**
	* 1. CGI causing the harmful interference.
		2. Cell ID and ARFCN for GSM (2G) networks.
		3. Scrambling Code (SC), UARFCN for UMTS (3G) networks.
		4. EARFCN and PCI for LTE (4G) networks.
		5. Received signal level.
		6. Geographical coordinates of field measurements.
		7. Images for the routes showing the interference.
		8. Any other necessary details (dates and times, etc.).
3. **Affected stations**
	1. KPI degradation report, as well as field test report if available.
	2. CGI of affected stations.
	3. Cell ID and ARFCN for GSM (2G) networks.
	4. Scrambling Code (SC), UARFCN for UMTS (3G) networks.
	5. EARFCN and PCI for LTE (4G) networks.
	6. Geographical coordinates of field measurements.
	7. Any other information related to the identification of the affected stations (dates
	and times, etc.).

2) To resolve any harmful interference case, the following action shall be taken:

* 1. The affected operator should send a correspondence including Technical Report (as described in item 1) of this Section about the harmful Interference case with a copy to the corresponding administration.
	2. Operators shall take all necessary actions to resolve any harmful interference cases as soon as possible by direct coordination.
	3. Acknowledgment of receipt of the harmful interference correspondence and report should be sent by the intended operator causing the interference within four working days from the date of sending the correspondence and Report.
	4. After 7 working days from the date of acknowledgment of receipt of the correspondence and Report, if harmful interference still does not stop, the affected operator shall raise the issue to its own administration.
	5. After having been informed by its operator that the harmful interference was not resolved between operators, the affected administration shall contact the interfering administration requesting to cease the harmful interference within five working days with a copy to ITU along with report desired at item I. These five working days count as from the date of receipt of the correspondence and Report by the affecting Administration.
	6. In case of no acknowledgement after two working days from the date of sending the harmful interference correspondence and Report, the affected Administration may send a reminder to the concerned Administration. If no acknowledgement is received after one working day from the date of sending the reminder, the affected Administration could inform ITU of the harmful interference correspondence with the request to provide assistance in resolving the harmful interference, including the possibility of holding bilateral/multilateral meeting.
	7. If after all the process mentioned above, the harmful interference has not ceased, the affected administration may call for a bilateral/multilateral meeting through ITU to find a suitable solution for the Harmful interference.

## **SECTION FOUR**

**Drive Tests' Arrangement**

When drive tests are carried out in the border areas between the two countries to measure the harmful interference or spillover of 2G/3G/4G and WLL network signals, the following guidelines should be adhered to:

1. Drive test technical tools should be used for the signals measurement.
2. Idle mode shall be used in the survey operations.
3. Results of the drive tests shall be analyzed based on the technical criteria set out in
section two.
4. The measurements should be in such statistics and quantity to reflect an experience
of permanent spillover or harmful interference at least 50 samples for each CGI.

## **SECTION FIVE**

**Correspondence Follow up and Point of Contact**

1. All correspondence shall be sent between the focal points, from operators or administrations, as the case may be, via a fax and/or email including scanned copy of correspondence and reports. Details at Annex –A.
2. Administrations shall notify immediately of any change to the other administrations in the list of the focal points or new spectrum introduced.

## **SECTION SIX**

**Implementation of this Arrangement**

1. This Arrangement shall be in line with Article 42 of the ITU Constitution relating to
Special Arrangements, which stipulates the following:

*Member States reserve for themselves, for the operating agencies recognized by them and for other agencies duly authorized to do so, the right to make special arrangements on telecommunication matters which do not concern Member States in general. Such arrangements, however, shall not be in conflict with the terms of this Constitution, of the Convention or of the Administrative Regulations, so far as concerns the harmful interference which their operation might cause to the radio services of other Member States, and in general so far as concerns the technical harm which their operation might cause to the operation of other telecommunication services of other Member States,"*

1. This Arrangement signed in {place} on {date} and shall enter into force form date of signing.
2. This arrangement may be reviewed and revised if necessary, after two years.
3. This arrangement will expire after five years of signing unless extended by both the parties through mutual consent.

## **SECTION SEVEN**

**Point of Contact:**

**Regulatory Authority A Focal Point:**

**Administration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Name** | **Organization** | **Designation** | **Email Address** | **Phone No.** | **Fax** |
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|  |  |  |  |  |  |

**Operators**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Name** | **Organization** | **Designation** | **Email Address** | **Phone No.** | **Fax** |
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**Regulatory Authority B Focal Point:**

**Administration**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Name** | **Organization** | **Designation** | **Email Address** | **Phone No.** | **Fax** |
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**Operators**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Name** | **Organization** | **Designation** | **Email Address** | **Phone No.** | **Fax** |
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#  ANNEX - K

 **Focal Departments for Cross Border Coordination in SATRC Countries**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Country** | **ICT Regulator** | **Spectrum Management Body** | **Organization Responsible for Receiving Cross Border Interference Complaints** | **Incase of any cross border interference complaint, please contact on following details (email ID, Telephone, Fax, Address)** |
| Bangladesh |  Bangladesh |  Spectrum Division, BTRC |  Spectrum Division, BTRC |  Director GeneralSpectrum Division, BTRCEmail: dgsm@btrc.gov.bd |
| Bhutan |  BICMA | Spectrum and Technology Division, BICMA |  Spectrum and Technology Division, BICMA |  Spectrum and Technology Division, BICMA,spectrum@bicma.bt |
| **India** |  TRAI | Department of Telecommunications, Ministry of Communications, Government of India | Wireless Planning & Coordination (WPC) Wing,Department of Telecommunications (DoT) | Wireless Advisor,Wireless Planning & Coordination (WPC) Wing,Department of Telecommunications (DoT),Sanchar Bhawan,20-Ashoka Road, New Delhi-110001, India.Office Tel: +91-11-23755444Email: wawpc@nic.in |
| Iran | CRA |  CRA |  CRA |  irnadm@cra.ir​+982189662205+98218966221317th Entrance, ICT Buildings, Shariati Ave. Tehran Iran |
| Pakistan |  PTA | Frequency Allocation Board (FAB) | Spectrum Monitoring Wing, FAB | Director General, Spectrum Monitoring, FAB HQs, Plot No. 112, Sector H-10/4, IslamabadEmail: dgnfmms@fab.gov.pk+92 51 9257747 |
| Nepal | NTA | NTA | Monitoring Division, NTA | DirectorMonitoring Division NTAEmail: bkroy@nta.gov.np |