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| **The Meeting of the SATRC Working Group** **on Spectrum** | **SAPIX-SPEC1/ OUT-01** |
| 7 – 9 May 2024, Lalitpur, Nepal | 9 May 2024 |

Working Group on Spectrum

**WORK PLAN OF WORKING GROUP ON SPECTRUM FOR**

**SATRC ACTION PLAN PHASE IX**

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| **Work Item** | **Work Item 1: Spectrum Approaches and Regulatory Requirements for NGSO Satellite Constellations for Space-based Communication Services** |
| **Lead Expert** | Mr. Md. Mehfuz Bin Khaled (BTRC) |
| **Proposed by** | Bangladesh Telecommunication Regulatory Commission (BTRC) |
| **Responsible Working Group** | Working Group on Spectrum |
| **Output** | Report |
| **Background and Purpose** | The increasing demand for high-speed internet access, remote sensing, and other space-based communication services has led to a growing interest in Non-Geostationary Satellite Orbit (NGSO) constellations. These constellations, comprising multiple satellites orbiting the Earth at various altitudes and inclinations, offer advantages such as global coverage, low latency, and enhanced capacity compared to traditional geostationary satellites.However, the deployment and operation of NGSO satellite constellations are subject to complex technical, regulatory, and policy challenges. Spectrum allocation, in particular, is a critical issue, as it determines the frequencies at which these satellites can operate without causing harmful interference to other services.The purpose of this study is to conduct a comprehensive assessment of spectrum approaches and regulatory requirements for NGSO satellite constellations, with a focus on supporting space-based communication services. By examining existing literature, engaging with stakeholders, and conducting technical and regulatory analyses, the study aims to:1. Identify the spectrum requirements of NGSO satellite constellations for various communication services, including broadband internet, satellite-based navigation, disaster management communication system, etc.
2. Review prevailing regulations in SATRC countries governing spectrum allocation and coordination for NGSO satellite systems.
3. Study the socio-economic impact of NGSO satellite services over other prevailing services.
4. Develop policy recommendations to optimize spectrum allocation and regulatory frameworks, ensuring the efficient and equitable use of the radio frequency spectrum while promoting innovation and competition in the space-based communication sector.
5. Provide insights and best practices through case studies of existing NGSO satellite constellations, highlighting regulatory challenges and success factors for deployment and operation.
6. Disseminate findings and recommendations to regulatory bodies, policymakers, industry associations of SATRC countries, to facilitate informed decision-making and promote dialogue on spectrum management in the context of NGSO satellite constellations.

Overall, the study aims to contribute to the development of informed policies and regulatory frameworks that balance the interests of stakeholders, promote technological innovation, and maximize the socioeconomic benefits of NGSO satellite constellations for space-based communication services. |
| **Scope** | The scope of this study encompasses a range of technical, regulatory, and policy considerations related to the deployment and operation of NGSO satellite constellations for communication services.The scope of this study includes the following:1. Spectrum Approaches
* Evaluate the spectrum requirements for NGSO satellite constellations, considering various communication services such as broadband internet, satellite-based navigation, and other emerging applications.
* Assess the bandwidth, frequency bands, and any other technical parameters needed to support efficient and reliable communication links within NGSO constellations and between satellites and ground stations.
1. Regulatory Framework Review
* Examine international, regional, and national regulations governing spectrum allocation, coordination, and licensing for NGSO satellite systems.
* Identify key regulatory bodies and stakeholders involved in spectrum management for space-based communication services.
* Analyze regulatory trends and developments, including initiatives aimed at facilitating the deployment of NGSO constellations while ensuring spectrum efficiency and interference avoidance.
1. Policy Recommendations and Best Practices:
* Develop policy recommendations to optimize spectrum allocation and regulatory frameworks for NGSO satellite constellations, balancing the need for spectrum access, innovation, and spectrum efficiency with the protection of incumbent users and spectrum integrity.
* Propose best practices for spectrum sharing, licensing processes, coordination mechanisms, and spectrum monitoring and enforcement to promote fair competition, investment certainty, and regulatory compliance in the space-based communication sector.
1. Case Studies and Comparative Analysis:
* Conduct case studies of existing NGSO satellite constellations, analyzing their regulatory approval processes, spectrum management strategies, and operational performance in different geographical regions and market segments.
* Compare and contrast regulatory approaches and spectrum policies adopted by SATRC countries and international organizations to identify lessons learned, success factors, and areas for improvement in supporting NGSO satellite constellations for space-based communication services.

By addressing these aspects within the scope of this study, stakeholders can gain valuable insights into the spectrum-related challenges and opportunities associated with NGSO satellite constellations and inform evidence-based decision-making for policy development, regulatory reform, and technology innovation in the space communication sector. |
| **How the output will be beneficial for SATRC Members** | The study is expected to offer several benefits to SATRC members involved in the development, deployment, and regulation of NGSO satellite systems. The output will help SATRC countries to adapt appropriate regulations and policies for NGSO satellite constellations. Overall, the study would serve as a valuable resource for policymakers and regulators of SATRC countries. |
| **Time Frame** | * Development of the draft Questionnaire (April 2024)
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 |
| **Utilization of Output** | The output yielded from this study may be utilized by the Governments, Regulators, Industry stakeholders of SATRC countries, in various ways. The output of this study would serve as a valuable resource for stakeholders across the public and private sectors, enabling evidence-based decision-making, stakeholder collaboration, and sustainable development of NGSO satellite constellations for space-based communication services. |

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| **Work Item** | **Work Item 2: Current Practices of Licensing and Spectrum Assignment in Land Mobile Radio Systems Particularly in VHF and UHF Person-to-Person Voice Communication System in SATRC Countries** |
| **Lead Experts** | Mr. Sonam Phuntsho (BICMA) and Mr. Thubten Jamtsho (BICMA) |
| **Proposed by** | Bhutan InfoComm and Media Authority (BICMA) |
| **Responsible Working Group** | Working Group on Spectrum |
| **Output** | Report |
| **Background and Purpose** | Land mobile radio system (also termed as Radio Trunking Services), which is a person-to-person voice communication systems consisting of two-way radio transceivers (an audio transmitter and receiver in one unit) which can be stationary (base station units), mobile (installed in vehicles), or portable (handheld transceivers e.g., “walkie-talkies”), are also one of the important tools of radio-communication. Such communication systems need to be managed effectively and efficiently through proper licensing and frequency allocations to the public or private. It is of the view that few countries might be facing interference within such communications and to other radio services as well. Bhutan has also experienced certain interferences in these communications as reported by the users.As this is also one of the important categories of radiocommunication services, it has to have a proper licensing and frequency assignment framework.Therefore, the objective of the proposed work item is to study the licensing practices, frequency assignment, interference experience and management in SATRC Countries, examine the issues and recommend the best practices for SATRC Members for effective and efficient management of such services. |
| **Scope** | To study the:1. Current licensing regime on land mobile services in SATRC countries,2. Spectrum allocation and assignment for land mobile services in the region,3. All kinds of fees/Charges for Land Mobile services in the region,4. Technical limitations for land mobile services equipment,5. Interference experienced in land mobile radio services in the region,6. Challenges faced by the regulators in managing the land mobile services,7. Current Practices of monitoring Land Mobile Radio Applications8. Different application and services in Land Mobile RadioUpon completion of the study, Experts will provide the best practices in land mobile radio usage. |
| **How the output will be beneficial for SATRC Members** | The output will provide the experiences and best practices in licensing, frequency assignment and monitoring of Land Mobile Radio services to SATRC Members. |
| **Time Frame** | * Development of the draft Questionnaire (April 2024)
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| **Utilization of Output** | Regulators, Governments, Industry Stakeholders. |

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| **Work Item Title** | **Work Item 3: Spectrum Approaches and Regulatory Requirements to Enable Satellite - IMT Integration** |
| **Lead Expert** | Ms. Sonia Madan (TRAI) |
| **Co-Lead Expert** | Ms. Rachna Mathur (TRAI) |
| **Proposed by** | Telecom Regulatory Authority of India (TRAI) |
| **Responsible Working Group** | Working Group on Spectrum |
| **Output** | Report  |
| **Background and Purpose** | Currently, there is increasing interest of the satellite communication industry to explore the market potential for an integrated satellite and terrestrial network infrastructure for making the IMT services available across the geography, irrespective of location and terrain.On one hand, smartphone mobile handsets are incorporating the Satellite frequency bands in the chipsets to communicate with the existing satellite systems. On the other hand, the satellite operators are collaborating with Mobile Network Operators (MNOs) to incorporate the IMT spectrum bands in future satellites for directly communicating with the devices, known as Supplemental Coverage from Space. The concept of Supplemental Coverage from Space is picking up to close coverage gaps in terrestrial service and to make available the emergency service across the geographies.Integration of terrestrial networks with satellite networking technologies can provide coverage in areas that terrestrial networks cannot reach would help to deliver resilient services, bringing significant social and economic benefits.The current step in the development of Mobile Satellite Services (MSS) focuses on the ability to communicate with standard smartphones. 3GPP in its Release 17 has come out with the framework of 5G Non-Terrestrial Network (NTN). With such developments, role of regulators and spectrum managers is to enable the Satellite-IMT integration, permit extra-terrestrial use of IMT spectrum and put to flexible use of the spectrum for maximum efficiency. |
| **Scope** | The scope of the study includes the following: * Satellite - IMT integration – benefits and regulatory issues
* Spectrum approaches to satellite - IMT integration
* Examination of spectrum approaches to satellite - IMT integration in SATRC member countries
* International practices
* Recommendations
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| **How the output will be beneficial for SATRC Members** | The output will assist SATRC members in understanding and identifying spectrum approaches and regulatory requirements to enable Satellite-IMT integration.  |
| **Time Frame** | * Development of the draft Questionnaire (April 2024)
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| **Utilization of Output** | The output will assist SATRC members in formulating appropriate regulatory spectrum policy to enable Satellite-IMT integration. |

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| **Work Item** | **Work Item 4A: Spectrum Outlook in SATRC Countries** |
| **Lead Experts** | Ms. Rita Jalali (CRA-Iran) and Ms. Sedigheh Tadayon (CRA-Iran) |
| **Co-Lead Expert** | Mr. S M Golam Sorwar (BTRC)  |
| **Proposed by** | Communications Regulatory Authority (CRA) of Islamic Republic of Iran |
| **Responsible Working Group** | Working Group on Spectrum |
| **Output** | Report  |
| **Background and Purpose** | The frequency spectrum is one of the national capitals and resources of every country, which has a great socio-economic value due to its use in establishing radio communications.The growing use of radio waves in all types of public and private telecommunication networks is inevitable and even the use of the energy of these waves in industrial, medical and domestic matters has become common and normal. Along with the growth beyond the predictions regarding the various applications and technologies of radio communication, the mobile broadband data traffic has also grown day by day.The emergence of new communication and information technologies and their need for the frequency spectrum has drawn more attention to the issue of frequency spectrum management and short-term and long-term planning for its optimal use; hence, various countries have developed programs known as Spectrum Outlook, which is a kind of structured spectrum roadmap. |
| **Scope** | The scope of the study will include the following:1. Survey of existing documents in developed/developing countries.
2. Collect and study ideas/views from SATRC Member countries.
3. Analyze SATRC member countries experiences as questionnaires.
4. Recommend Spectrum outlook structure and relative content.
 |
| **How the output will be beneficial for SATRC Members** | 1. Efficient use of the scarce frequency spectrum resource for maximum benefit of the frequency spectrum;
2. Adopting comprehensive and up-to-date programs and road map in the field of spectrum management based on national interests and taking into account technical, legal and economic considerations.
 |
| **Time Frame** | * Development of the draft Questionnaire (April 2024)
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| **Utilization of Output** | The Governments and Regulators may utilize the output yielded from this study.  |

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| **Work Item** | **Work Item 4B: Registration of Frequency Assignments in MIFR by SATRC Countries** |
| **Lead Expert** | Mr. Muditha Gunasinghe (TRCSL) |
| **Co-Lead Experts** | Dr. Pradip Paudyal (NTA) and Mr. S M Golam Sorwar (BTRC) |
| **Proposed by** | Nepal Telecommunications Authority (NTA) |
| **Responsible Working Group** | Working Group on Spectrum |
| **Output** | Report  |
| **Background and Purpose** | Spectrum is a scarce natural resource and with growing digitalization and uptake of wireless services, demand for spectrum has been increasing and will continue to rise. The spectrum assignments need to be registered in the Master International Frequency Register (MIFR) or the Master Register, whichcontains frequency assignments together with their particulars, as notified by the ITU in accordance with Article 11 of the Radio Regulations (RR). MIFR helps not only in maintaining the global record of the spectrum assignment but also helps in the spectrum usage right of a member administration in case of cross border interference issues. Some of the SATRC member countries are in process to register the frequency assignments in MIFR, whereas other SATRC member countries’ frequency assignments are yet to be registered or updated in the MIFR. In this context, the objective of the study is to analyse the status of registration of spectrum assignment of SATRC member countries in MIFR and recommend the necessary steps or procedures to be taken by SATRC member countries to register or update the spectrum assignment in MIFR. |
| **Scope** | The scope of the study will include the following:* Benefits of registering the spectrum assignments in MIFR
* Procedures for registering the spectrum assignments in MIFR
* Tools for registering the spectrum assignments in MIFR
* International practices
 |
| **How the output will be beneficial for SATRC Members** | The output will assist SATRC members in updating spectrum assignments in MIFR and to follow the ITU recommendations to update the spectrum assignments in MIFR and reduce cross border interference. |
| **Time Frame** | * Development of the draft Questionnaire (April 2024)
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| **Utilization of Output** | The Governments and Regulators may utilize the output yielded from this study. |

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| **Work Item** | **Work Item 5: Backhaul Infrastructure Readiness and Requirements for 5G Deployment in SATRC Countries** |
| **Lead Experts** | Ms. Syeda Shafaq Karim (PTA) and Mr. Sajid Saeed (PTA) |
| **Co-Lead Expert** | Mr. Kazi Md. Ahasanul Habib Mithun (BTRC) |
| **Proposed by** | Pakistan Telecommunication Authority (PTA) |
| **Responsible Working Group** | Working Group on Spectrum |
| **Output** | Report |
| **Background and Purpose** | High speed backhaul is a critical component of the 5G network infrastructure. 5G networks promise higher speeds, lower latency, and increased capacity compared to previous generations of mobile networks. To deliver on these promises, a robust and efficient backhaul network is essential to connect the 5G cell sites to the core network. It is not just a supporting component but an enabler that ensures the overall success of 5G deployments and delivery of advanced services and applications. As 5G continues to evolve and expand, the importance of a robust and efficient backhaul network will only become more pronounced.Due to limited fiber infrastructure, geographical diversity and other associated challenges, backhaul for 5G can indeed pose challenges for SATRC countries. In this context, the objective of the study is to analyse the status of backhaul infrastructure, backhaul requirements, challenges, available solutions, regulatory and spectrum considerations, mechanism for backhaul spectrum assignment and strategies adopted by SATRC member countries.  |
| **Scope** | The scope of the study will include the following:* Current backhaul infrastructure status in SATRC Countries
* Backhaul requirements for urban, suburban and rural areas
* Adopted solution mix of backhaul technologies for 5G launch
* Challenges and Barriers
* Strategies adopted to overcome challenges
* Regulatory and spectrum considerations
* Mechanism for backhaul spectrum assignment
* Future-Proofing Backhaul Networks
 |
| **How the output will be beneficial for SATRC Members** | The output will assist SATRC members to have a comprehensive understanding of the current state of 5G backhaul in the SATRC countries, identify challenges and opportunities, and propose recommendations for optimizing backhaul networks to support the growing demands of 5G technology.  |
| **Time Frame** | * Development of the draft Questionnaire (April 2024)
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| **Utilization of Output** | Regulators, Operators, Governments |

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| **Work Item** | **Work Item 6: Efficient Valuation and Pricing of Spectrum in SATRC Countries** |
| **Lead Experts**  | Dr. Shahbaz Nasir (PTA) and Ms. Huma Abid (PTA) |
| **Co-Lead Expert** | Mr. Istiaque Arif (BTRC)  |
| **Proposed by** | Pakistan Telecommunication Authority (PTA) |
| **Responsible Working Group** | Working Group on Spectrum |
| **Output** | Report |
| **Background and Purpose** | Spectrum valuation and pricing are essential tools for regulators and policymakers to balance the economic interests of operators, government revenue generation, and the broader public interest. The process of valuing spectrum, whether for regulatory purposes or in the context of spectrum auctions, is a multifaceted endeavor that takes into account several key factors, including market dynamics, technological evolution, use cases, and prevailing economic conditions. Achieving the appropriate valuation may present several challenges, given factors such as demand uncertainties, government revenue targets, and data limitations. Furthermore, the rapid advancements in wireless technologies, such as the transition to 5G and beyond, can introduce additional uncertainties into the spectrum valuation.The adoption of appropriate valuation and pricing strategies by SATRC member countries can encourage the efficient utilization of spectrum resources, spur innovation, and foster the development of new wireless applications. This, in turn, can contribute to economic growth and technological advancement. |
| **Scope** | The scope will include the following:* Valuation and pricing of cellular/IMT spectrum: approaches, models and associated issues
* The prevailing practices in SATRC member countries concerning spectrum valuation, pricing strategies, and cellular spectrum auctions, and the challenges being faced
* Backhaul spectrum pricing /charging mechanism
* Case studies in the context of 5G spectrum valuation
* International best practices
* Guidelines/Recommendations
 |
| **How the output will be beneficial for SATRC Members** | The study will emphasize the challenges encountered in spectrum pricing within SATRC countries, with a specific focus on the context of 5G. The study is expected to come up with guidelines / recommendations for policymakers/governments and regulators to adopt best processes, models and approaches for appropriate economic valuation and efficient/fair pricing of upcoming spectrum bands and to address deficiencies in current practices within the region. |
| **Time Frame** | * Development of the draft Questionnaire (April 2024)
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| **Utilization of Output** | Regulators and Governments may use the output yielded from this study for efficient spectrum valuation and pricing.  |