Empowering Africa: An Agenda of Significance

December 2023

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At this year's 2023 World Radiocommunications Conference (WRC-23), in addition to the issues that are being considered by the Conference, we shift focus to the agenda that will guide the next four years of planning and preparation i.e. issues that would be addressed by WRC-27 in 2027. We do this because African countries need to have their voices heard on the issues that directly impact their future socio-economic development. Under Agenda Item 10 (AI 10) of WRCs, the African Telecommunications Union (ATU) has proposed six topics for the future WRC agenda. Here, we highlight those topics, outlining their importance to African countries and the potential benefits of their inclusion in the WRC-27 agenda.

FSS Equitable Access

Recently, in their efforts to meet growing consumer demand, some satellite operators have increasingly shifted to Q and V bands – away from stiffer competition for the highly sought-after lower frequency bands. Specifically, these are the 37.5-42.5 GHz (space-to-Earth), 42.5-43.5 GHz (Earth-to-space), 47.2-50.2 GHz (Earth-to-space), and 50.4-51.4 GHz (Earth-to-space) frequency bands. There are benefits to this shift: the Q and V bands have a plethora of available spectrum, the nature of the bands allows for significantly higher data throughput, and the shift could reduce interference. Further, companies shifting their commercial operations in these bands would also free additional spectrum in the lower Ka band.

However, developing countries risk being shut out from the resources under the current first-come-first-served process. For example, in November 2021 alone, the US Federal Communications Commission (FCC) offered licences in the V band and nine companies applied for authorisation for more than 38,000 NGSO communication satellites. , While the ITU's anti-warehousing rules apply, developing countries risk losing out entirely given the lack of economic leverages to exploit the resources. The ITU has taken similar action in the past with respect to GSO Fixed Satellite Services (FSS) and Broadcast Satellite Services (BSS) access in the 4/6/10/11/12/13/14/17/20 GHz ranges. Considering the growing space and satellite sectors in Africa, as well as consumer demand for spectrum and clear use cases for FSS, countries in Africa would benefit from access to key frequencies in the Q and V bands if a portion thereof is reserved for them on a-priori arrangement akin to Appendix 30, 30A and 30B plans of the ITU. From the ATU perspective, the principle of equity to satellite resources should be balanced with that of efficiency as per the ITU Constitution.

NGSO Networks for Connectivity

The ITU has long noted the need for additional FSS spectrum in the 50 GHz frequency range, dating back to Resolution 162 (WRC-15) and its subsequent follow-up with Report ITU-R S.2461, published in 2019. The report effectively outlined the need for an additional 1 GHz FSS allocation, focusing on the growing possibility of satellite-based connectivity services and their utility. These studies included satellites in both

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[1] Kratos Defense Crowded Spectrum Pushing Satcom Operators into Q/V Band.
[2] Ibid.
[3] FCC Memorandum Opinion, Theia Authorization.
[4] FCC Fact Sheet, ViaSat Authorization.
[5] African Common Proposals, Proposals for the Work of the Conference.
[6] ITU Report, Spectrum needs for the fixed-satellite-service in the 51.4-52.4 GHz band.

geostationary orbit (GSO) and non-geostationary orbit (NGSO). The spectrum needs for GSO were addressed at WRC-19. However, the need for broadband connectivity has only increased in the intervening years, pointing to the potential need to expand the use of FSS frequency band 51.4-52.4 GHz to address the growing spectrum needs of NGSO networks. Expanding the frequency band could help address outstanding issues with Internet connectivity, especially in rural areas and the world's least developed countries. There are several reasons why NGSO networks represent an appealing option to expand broadband connectivity: these networks (through high-gain narrow spot beams, frequency re-use, and other advanced communication techniques, such as phased-array antenna designs) can deliver high data rate communication services. Further, due to the low-Earth orbit of NGSO networks, they can deliver connectivity with low latency. ITU analysis shows that implementing FSS in the 51.4-52.5 GHz band is not substantially different from existing efforts in the 40/50 GHz bands.

Supplementing existing networks and connectivity efforts with additional spectrum allocations for FSS in the target bands could make broadband connectivity more accessible and affordable to Africa as a whole. A 2022 World Bank report highlighted that, despite recent efforts and improvements, only 36 percent of the continent's population had broadband Internet access. Additionally, according to the ITU, Africa has one of the world's largest digital gender gaps. Affordability continues to be a major barrier towards digitalisation efforts, with average prices across the continent generally exceeding the international target metric. Africa's large rural populations and variable geography make traditional broadband efforts difficult to achieve. A 2019 report from the Broadband Commission estimated that it would cost USD 100 billion to achieve universal broadband connectivity by 2030. This figure covered the estimated construction of 250,000 new 4G base stations and at least 250,000 km of new fibre.

Expanding MSS Coverage

The international ICT community is making efforts to connect the unconnected. Despite the steady deployment of terrestrial networks, there remain large areas and vast populations without cellular coverage particularly in Africa where much of the areas are rural. Further, traditional terrestrial networks have increasingly been impacted by natural disasters, interrupting life-saving services in critical times. These factors, coupled with recent technological developments in semiconductor design that have allowed for the integration of mobile-satellite connectivity into consumer cellular equipment, have led countries to increasingly look to mobile-satellite services (MSS) for coverage. MSS capabilities and range have expanded significantly since the last MSS allocations were made at the WARC-92 and WRC 95. For example, an increasing number of mobile phone and chip manufacturers, as well as MNOs, have partnered with existing satellite system operators to provide Direct-to-Device (D2D) communication services when end users are out of terrestrial IMT and/or Wi-Fi coverage. However, despite growing

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[7] Ibid.
[8] Ibid.
[9] World Bank, From Connectivity to Services: Digital Transformation in Africa.
[10] ITU, the gender digital divide.
[11] World Bank, From Connectivity to Services: Digital Transformation in Africa.
[12] ITU, The State of Broadband 2019.
[13] Ibid.

demand, a D2D service typically requires a satellite network integrated with earth stations that operate in lower frequency bands to transmit to handsets.

D2D services are currently limited to attending emergencies, but more sophisticated services could be offered by using the MSS spectrum to complement existing terrestrial IMT and Wi-Fi coverage. However, the current MSS allocations are insufficient to meet these demands. Further, as the consumer demand for MSS continues to grow (both in total users and the proliferation of smartphones with satellite capabilities), the traffic increases will result in a need for additional spectrum. A new MSS allocation would enable satellite communication service providers to offer more sophisticated communication services. These new services would be uniquely beneficial to many ATU Member States. A 2020 World Bank report states that around 60 percent of the population of Sub-Saharan Africa lives in rural areas. Africa has a large land mass of 30.37 million square km with extremely variable geography. This makes the deployment of terrestrial networks challenging, particularly in rural and remote areas. Rather than relying on terrestrial options alone, MSS could play a complementarily vital role in bringing mobile coverage and Internet connectivity to rural communities in Africa.

FSS Earth Station Sharing Conditions

The proliferation of FSS satellites in recent decades, coupled with the increased use of smaller FSS earth stations in the 10-15 GHz range, has significantly taxed the available spectrum in the Ku band. Across all three ITU regions, there is only 500 MHz of spectrum available for uplink, while the downlink bandwidth ranges from 750 MHz in Region 1 to 1,050 MHz in Region 3. While the technology around satellite equipment has evolved to meet new customer demands for higher data transmission rates, smaller user terminals, and more flexible products, the regulations have not kept pace. Footnotes 5.502 and 5.503 limit the minimum size of earth station antennas and the power flux density (pfd) limitations at sea. These were last modified at WRC-03. Given the significant changes to FSS networks and applications in the last 20 years, a review of the regulations governing the 13.75-14 GHz frequency band is necessary.

This proposal is especially relevant to ATU Member States, as the continent stands poised to benefit from the new applications for FSS networks. However, outdated regulations could restrict development. For example, the pfd limitations at sea would prevent the deployment of earth stations in certain locations. As African countries turn to FSS to provide services such as broadband connectivity, these restrictions could hinder positive development. Smaller earth station antennas and identification of possible alternative sharing conditions for the band could allow for more efficient spectrum allocation, meeting new demands for satellite applications in the FSS.

Earth Stations in Motion

As Africa considers creative methods to address its outstanding connectivity issues, one such solution could be found in earth stations in motion (ESIM). There are three distinct classes of ESIM: aeronautical, maritime, and land. All three are vital for providing ubiquitous connectivity in Africa. Historically, ESIMs have communicated with satellites in the MSS in relatively low-frequency bands. These ranges limited

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[14] World Bank Data, https://data.worldbank.org/indicator/SP.RUR.TOTL.ZS?locations=ZG.
[15] GSOA, Agenda Item 10.
[16] African Common Proposals, Proposals for the Work of the Conference.
[17] ITU, Satellite issues: Earth stations in motion (ESIM).

the achievable data rates. Regulatory changes in the most recent WRCs have opened higher bands, such as the 17.7-19.7 GHz and 27.5-29.5 GHz bands to ESIMs, enabling much better data rates. Most recently, Resolution 176 (WRC-19) resolved to study the possibility of aeronautical and maritime ESIMs operating within GSO FSS allocations in the 37.5-39.5 GHz (space-to-Earth), 40.5-42.5 GHz (space-to-Earth), 47.2-50.2 GHz (Earth-to-space), and 50.4-51.4 GHz (Earth-to-space) frequency bands. This was an important step towards improving the capabilities of ESIMs.

However, as was noted in the African Common Proposals, recent advances in antenna and terminal technology have enabled the use of those target bands for both GSO and NGSO FSS systems. A modification to this Resolution stands not just to benefit African nations but countries across the globe that could utilise ESIMs, which can provide connectivity to remote areas unreachable by traditional broadband efforts. This is a very applicable use case for Africa. Further, ESIM applications exist for governments and aid organisations that require connectivity; for example, in the event of a natural disaster that interrupts terrestrial networks. By expanding the study to cover NGSOs, the ITU would be opening additional options, especially for developing nations that may be disproportionately reliant on these services or in need of cost-saving opportunities.

ATU Radio Quiet Zones

In recent years, radio astronomers have warned about the proliferation of satellites and the possible unintended consequences of dozens of new low-earth orbit satellite launches each year. The growing popularity of satellite-based connectivity services, which primarily utilise low earth orbit (LEO) satellites, has led to the creation of "mega-constellations". Among other risks, astronomers have warned that the light emitted by the estimated 400,000 satellites projected to occupy the LEO space in coming years will significantly impact their studies. Concern for this potential problem has been echoed by major administrations globally as well as international bodies, spearheaded by the United Nations Committee on Peaceful Uses of Outer Space (UN COPOUS) under the mantra "Dark and Quiet Skies"

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"Radio Quiet Zones" (RQZs) are generally defined as any recognised geographic area within which the usual spectrum management procedures are modified for the specific purpose of reducing or avoiding interference to radio telescopes, thereby maintaining the required standards for quality and availability of observational data. However, as the ATU notes, the ITU does not have a formal definition for the term. Regulations for RQZs have largely been left to individual countries. Having the ITU develop a common regulatory framework would benefit the growing African astronomy industry. Ongoing projects, such as the Development in Africa with Radio Astronomy (DARA) and the South African Radio Astronomy Observatory (SARAO), are contributing to growing investment in human capital on the continent. Further, the construction of the USD 25 million Africa Millimetre Telescope in Namibia is hugely important, not only for the development of radio astronomy in Africa but also for the larger scientific community. By introducing this topic, the ATU is effectively signalling that Africa is capable of both looking to lead on the

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[18] Ibid.
[19] ITU, Resolution 176 (WRC-19).
[20] African Common Proposals, Proposals for the Work of the Conference.
[21] Space: Science & Technology, LEO Mega Constellations.
[22] UNOOSA website.
[23] Africa Millimetre Telescope, Scientific American.

benefits of increased satellite coverage and using and addressing the negative consequences of satellite proliferation to protect the bourgeoning industry.

Path forward

As AI 10 discussions are ongoing at WRC-23, the ATU underscores the importance of addressing key issues that will shape the future of radiocommunications beyond this WRC cycle. By proposing the study of possible spectrum allocation and regulatory measures concerning the protection of Radio Quiet Zones, expanding FSS spectrum, updating regulations for FSS operations, regulating ESIM, and securing additional spectrum for MSS, the ATU aims to ensure that African countries not only benefit from the advantages of advanced radiocommunication technologies but also actively contribute to shaping global regulations.

As we embark on the next phase of planning and preparation beyond WRC-23, it is imperative that the international community collaborates to bridge the connectivity gap, foster technological innovation, and empower nations, especially those in Africa, to harness the full potential of radiocommunications for socioeconomic empowerment. The ATU stands committed to fostering a future where the benefits of radiocommunications are shared inclusively, leaving no one behind in the digital transformation journey.

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