Aarti Holla-Maini
Secretary General
sg@gsoasatellite.com

GSOA Feedback on ICASA - Implementation of the Radio Frequency Migration Plan

The Independent Communications Authority of South Africa,
Dr Ivy Matsepe-Casaburri building,
350 Witch-Hazel Avenue, Eco Point Office Park
Eco Park, Centurion
South Africa
Private Bag X10,
Highveld Park 0169
Centurion, Pretoria

GSOA thanks the South African Independent Communications Authority (ICASA) for the opportunity to provide comments on ICASA's position and draft implementation of the Radio frequency migration plan and the international Mobile Telecommunication (IMT) roadmap in terms of Section 34(16) of the Electronic Communications Act (ECA).

GSOA[1] (the Global Satellite Operators Association) is the global platform for collaboration between satellite operators. As the world's only CEO-driven satellite association, GSOA leads the sector's response to global challenges and opportunities. It offers a unified voice for the world's largest operators, important regional operators and other companies that engage in satellite-related activities. GSOA is recognised as the representative body for satellite operators by international, regional, and national bodies including regulators, policymakers, standards-setting organisations such as 3GPP, and international organisations such as the International Telecommunications Union (ITU) and the World Economic Forum (WEF).

GSOA welcomes ICASA's "primary objectives to ensure spectrum efficiency, universal availability of broadband services as well as a vibrant and competitive telecommunications industry and promote investments." These priorities again underline the criticality of satellite communications in the country and elsewhere in Africa in contributing to the availability of broadband services to everyone. This role will further increase as satellite supports the expansion and acceleration of the deployment of 4G and 5G fixed and mobile communications services, as explained below in relation to key satellite bands. Therefore, GSOA is aligned with ICASA's primary driver which is to ensure that it meets Objective (e) "ensure efficient use of the radio frequency spectrum" for all bands being consulted on in this document.

In preparing the national radio frequency plan as contemplated in subsection (4), ICASA took the right approach to ensure that any decision must take into account the ITU's international spectrum allocations for radio frequency spectrum use, in so far as ITU allocations have been adopted or agreed upon by the Republic and give due regard to protect incumbent services using this scarce resource.

[1] The members, activities, and other details about GSOA can be found at www.gsoasatellite.com

Aarti Holla-Maini
Secretary General
sg@gsoasatellite.com

Consideration of Legislation and Public Policy – SA Connect

GSOA would like to raise a very important clarification to the "South Africa Connect" broadband policy (SA Connect) which aims to set out South Africa's national broadband plan. In this plan, it is claimed that at least 80-100 MHz of mid-band spectrum and a further 400 MHz - 1 GHz of spectrum in high bands are needed to enable 5G.

In Africa, unlike other parts of the world such as Europe, the C-Band frequencies are heavily used for broadcasting, aeronautical, backhaul, government services, and mission-critical communications the need for which results from Africa's unique size, weather, topography, and population distribution.

As a fact, C-band frequencies are not unused by satellite services. C-band is a heavily occupied and vital satellite communications band as evidenced by the number of satellites that have C band payloads over Africa (as per the ICASA database, over 30 satellites are authorized to operate in the C-band[2]). A recent report by the GSA and Huawei[3] showed that a number of C-band satellites have a utilization rate of over 80%, without however taking into account transponders which were booked but not in use at the time. These satellites provide essential services, delivering connectivity in areas with heavy rainfall, and essential communications for users such as governments and airports.

GSOA supports the drive for spectrum efficiency, but the arguments being made for contiguous 80-100 MHz blocks of C-band spectrum for 5G are not justified, when compared to the importance of the services which already occupy the band. 100 MHz frequency channels may be desirable for 5G, but this does not imply that it has all to be contiguous and in C-band. If needed, mobile operators (MNOs) can also utilize spectrum from other available frequency bands.

GSA, GSMA and South Africa, in its latest input contribution to ITU-R WP 5D (Doc 5D/996) have acknowledged that mid-band frequencies including C-Band will only be deployed for IMT applications in urban areas.

GSOA, therefore recommends that ICASA review the mid-band frequency requirements for IMT.

The African Telecommunications Union in its paper "Recommendations for the Implementation of 5G (IMT2020) in Africa"[4] recorded that, even though mobile network operators are asking for 80-100 MHz, they may accept less. This is because 100 MHz assignments are uncommon elsewhere (See Appendix A), and they recognise that spectrum constraints are generally unassailable even before considering the cost of mobile spectrum auctions.

The main reasons why IMT operators are demanding 100 MHz of contiguous spectrum in the C-band have been as follows:

- ⇨ 100 MHz is the MNO's ideal situation (and one never argues for a compromise as an opening gambit).

[2] ICASA List of Space Stations https://www.ncc.gov.ng/technical-regulation/space-services
[3] "African C Band Satellite Report: The Systems House" https://gsacom.com/paper/african-c-band-satellite-report-the-systems-house-2021/
[4] Task Group on Emerging Technologies. Draft Recommendations for the Implementation of 5G (IMT2020) in Africa. s.l. : African Telecommunications Union (ATU), 2021.

Aarti Holla-Maini
Secretary General
sg@gsoasatellite.com

⇨ C-band is green-field spectrum in which operators can deploy their networks without needing to re-farm spectrum in other bands, allowing for more rapid deployment and lower roll-out costs.

IMT operators have exposed their arguments arguing for 100 MHz of contiguous spectrum in the C-band as important to ensure 5G headline speeds and to satisfy what they believe their users are expecting. As a result, operators and manufacturers are putting pressure on regional regulators to open up large amount of C-band spectrum for new 5G services.

Disrupting existing C-band services to provide very wide portions of C-band spectrum to IMT operators for 5G is unnecessary. In many African countries, including South Africa, the frequency range 3300 – 3400 MHz has been identified for IMT as well as the 3400 – 3600 MHz, and most African nations have no more than 4 MNOs. With the 2.3 GHz and 2.6 GHz bands, there is ample spectrum to make a total of 100 MHz available to each operator. Figure 1 below makes this clear.

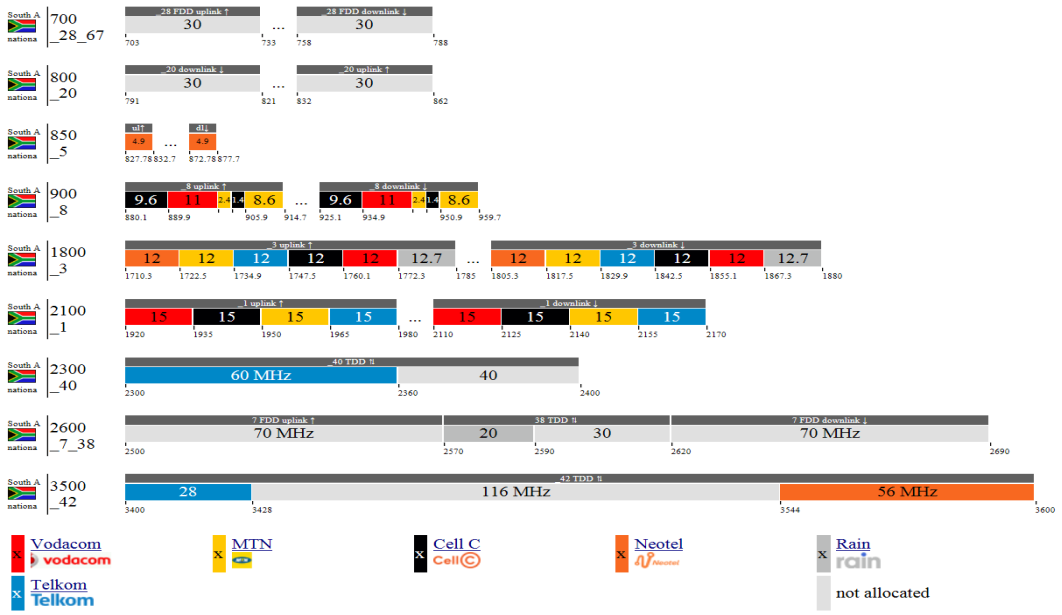


Figure 1: chart showing South Africa Mobile Network operators spectrum use

GSOA actually believes that the arguments used by the mobile operators are fallacious, as exposed in the document "Ten Good Reasons why Mobile operators in Africa do not need 100 MHz of contiguous C-band spectrum each".[5]

There is no evidence that 80-100 MHz of contiguous C-band spectrum per MNO is an absolute requirement to achieve 5G; and in fact, most 5G auctions that have occurred globally did not imply the grant of 100 MHz contiguous spectrum (See Appendix A). GSOA also refers to the UK Ofcom study[6] (see para 1.20). The results suggest that it would be technically feasible for operators to support 5G

[5] Ten Good Reasons why mobile operators in Africa do not need 100MHz of contiguous C-band - GSOA - Global Satellite Operator's Association (gsoasatellite.com)

[6] Source: Ofcom, Figure A7.26, *Award of the 700 MHz and 3.6-3.8 GHz spectrum bands: Annexes*, 13 March 2020

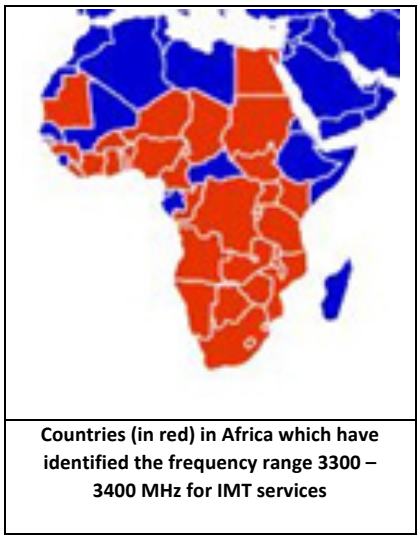
Aarti Holla-Maini
Secretary General
sg@gsoasatellite.com

services with smaller bandwidths than 80 MHz. GSOA notes para 1.35 of the study where Ofcom states that 5G is "technically feasible to be delivered by a network with 40 MHz of spectrum."

In conclusion, MNOs may look for 80-100 MHz of contiguous C-band spectrum and may claim this would optimize their performance, without actually needing 100 MHz of contiguous spectrum to offer high quality services and remain competitive. In other words, most benefits for the economy and consumers will result from MNOs deploying 5G by each using 40 MHz of the C-band spectrum, whilst smaller incremental benefits are expected from the usage of additional spectrum up to 80-100 MHz.

Annex 5: 3300 - 3400 MHz Band: Implementation of the IMT Roadmap 2014 and 2019

It is worth noting that in many African nations, the 3300 – 3400 MHz frequency range is already being considered for IMT services. This is the case in South Africa which has identified this band for the mobile service in its national frequency allocation table. This provides 100 MHz of additional spectrum for 5G and together with other spectrum available in lower bands it should satiate demand for mid-band spectrum for many years. South Africa is planning to implement mobile services in the 3400-3600 MHz, therefore amounting to 300 MHz of contiguous spectrum when considering the 3300-3400 MHz band. This, in addition to spectrum in lower bands, should be more than enough to cover the needs of national operators to meet the demand of their users in urban areas. It is also worthwhile pointing out that current reports[7] indicate that by 2025 only 2% of sub-Saharan population will use 5G versus 58% for 3G and 27% for 4G. This should be taken into account when evaluating spectrum requirements for 5G in the band noting that frequencies below 3GHz remain prime mobile bands.



Countries (in red) in Africa which have identified the frequency range 3300 – 3400 MHz for IMT services

Figure 2: African Countries that have identities IMT in 3.3-3.4 GHz

MNOs, however, are pushing for access to the whole of C-Band, despite the 3300-3400 MHz band which is already allocated to mobile services, not being utilised in most countries and despite the fact that the C-band is already in use for satellite services, fixed links and, in some countries, for fixed wireless access as well.

[7] Source: GSMA, "The Mobile Economy 2020" Report, 2020

Aarti Holla-Maini
Secretary General
sg@gsoasatellite.com

The need for additional C-band spectrum therefore needs to be balanced against the impact it would have on incumbent services, especially considering the argument put across by MNOs that they will not use the C band for rural areas but rather for urbanized areas only[8] which are the only places where infrastructure is available to support such use. The risk of allocating the whole C-band spectrum is that other services helping to bridge the digital divide, FS and FSS, would be driven out of the band. This would lead to accentuating the differences and gaps between rural and urban environments in their access to connectivity.

An auction for 300 MHz of C-Band spectrum for terrestrial use is sufficient to promote the initial deployment of 5G in South Africa. With 300 MHz (between 3.3-3.6 GHz), there is enough spectrum for every MNO to offer high quality 5G services.

In a near future, South Africa might even transition from a five-player MNO market to a four-player MNO market at national level, owing to merger and acquisition activity. If the market is indeed moving to four players, then a likely outcome with 300 MHz is that the four national MNOs will each secure 75 MHz of C-band contiguous spectrum nationwide. Even where there are still five players, the likely outcome is that each operator will secure on average 60 MHz of spectrum.

GSOA observes that, in all cases, the expectation is that every MNO will secure at least 40 MHz of C-band spectrum. This is more than sufficient for every MNO in every region to provide a great 5G service, as demonstrated by research published by UK Ofcom[9]. In response to claims made by some MNOs that they needed access to at least 80 MHz of contiguous spectrum, UK Ofcom concluded that:[10]

"there was no evidence that 5G could not be delivered with smaller [e.g. 40 MHz blocks] or non-contiguous carriers in other frequency bands [i.e. spectrum other than C-band]."

To support its finding that 40 MHz of C-band was sufficient to provide 5G services, UK Ofcom developed a theoretical cell site throughput model to estimate network performance based on various assumptions on the type of antenna used, bandwidth of C-band carrier, and signal strength received by the user. Figure 3 and Figure 4 show the results of UK Ofcom's analysis for both downlink and uplink, respectively. The results clearly demonstrate that MNOs will be able to deliver all the main services anticipated under 5G – including but not limited to connected cars, virtual reality cloud broadband and live 4K streaming – using 40 MHz of spectrum.

[8] Horwitz, Jeremy. The definitive guide to 5G low, mid and high band speeds. [Online] VentureBeat.com, December 2019. https://venturebeat.com/2019/12/10/the-definitive-guide-to-5g-low-mid-and-highband-speeds/.
[9] Source: Ofcom, Figure A7.26, *Award of the 700 MHz and 3.6-3.8 GHz spectrum bands: Annexes*, 13 March 2020
[10] Source: Ofcom, Figure A7.26, *Award of the 700 MHz and 3.6-3.8 GHz spectrum bands: Annexes*, 13 March 2020.

Aarti Holla-Maini
Secretary General
sg@gsoasatellite.com

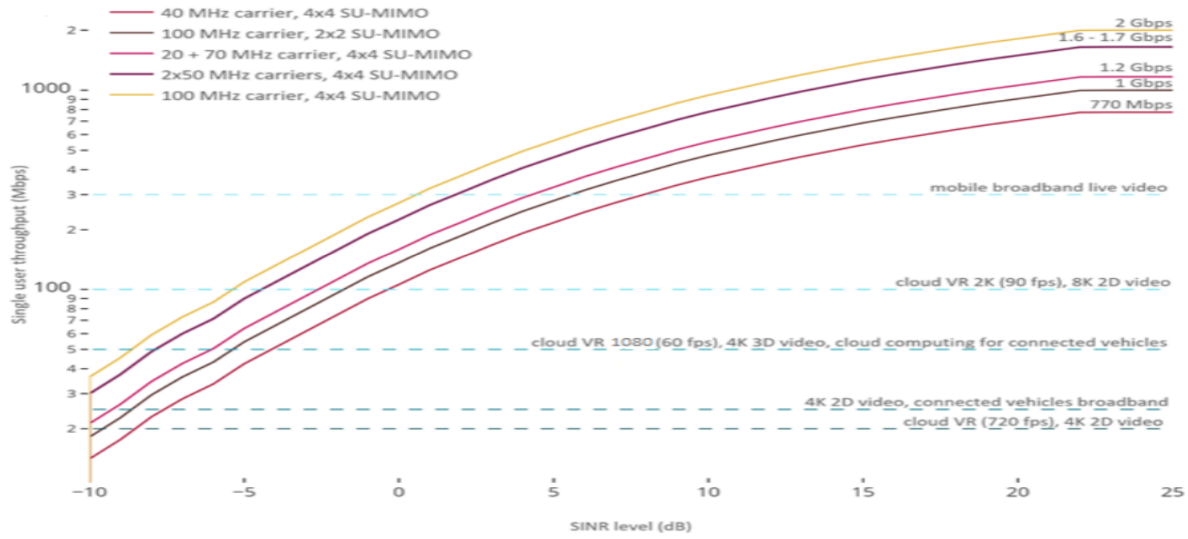


Figure 3: Downlink Single User Throughput (SUT) across different signal strengths in a cell compared with the minimum data rate requirements for some 5G Services (Ofcom)[11].

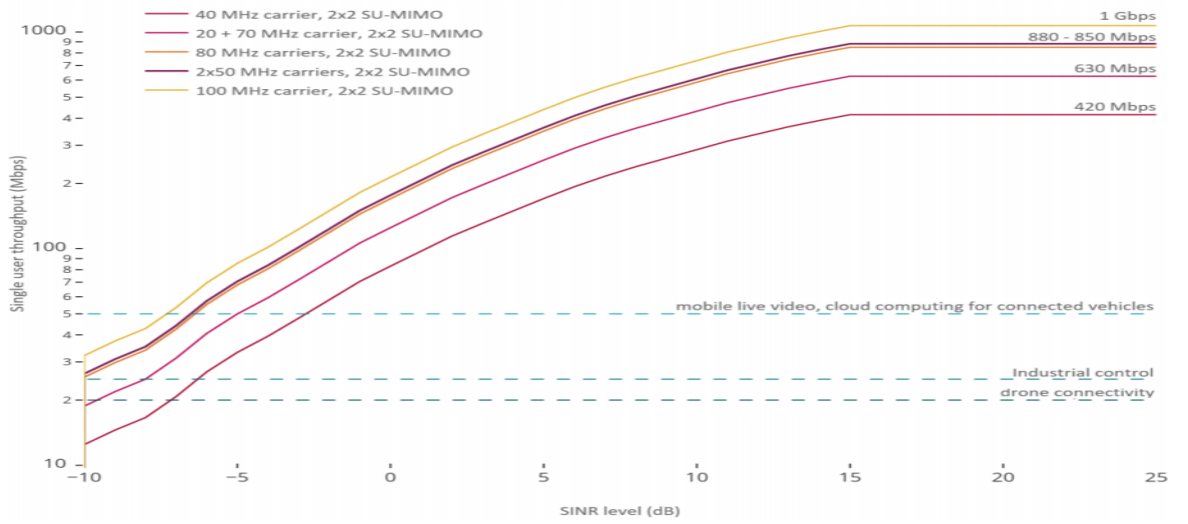


Figure 4: Uplink Single User Throughput (SUT) across different signal strengths in a cell compared with the minimum data rate requirements for some 5G services.

11 Source: Ofcom, Figure A7.26, *Award of the 700 MHz and 3.6-3.8 GHz spectrum bands: Annexes*, 13 March 2020.

Aarti Holla-Maini
Secretary General
sg@gsoasatellite.com

Satellite Usage of Ka and V band spectrum

GSOA has looked carefully at ICASA's findings on which frequency bands can be prioritised based on the maturity of the eco-systems as well as the value the society is to derive. This was made in view of existing South African national allocations in the 24.25-27.5 GHz, 37-40.5 GHz, 42.5-43.5 and 40.5-42.5 GHz bands.

It is essential to keep in mind that several frequencies of the Q/V-band spectrum are becoming critical to satellite systems. GSOA members are already working at ITU level to develop a regulatory framework to allow NGSO (Non-Geostationary Orbital) satellites to operate efficiently in the V-band (37.5-39.5 GHz, 39.5-42.5 GHz, 47.2-50.2 GHz, and 50.4-51.4 GHz). This spectrum is to be used, not only for receivers of HTS satellite signals and gateway feeder-links of next generation satellites, but also for HD-FSS terminals in the future.

This year, satellite systems using 40-50 GHz frequencies will be in service. These bands are currently under a lot of discussion and many operators are developing projects around this available spectrum. It is important to note that as per ITU RR. No.5.516B, a number of bands have been identified for High Density Fixed Satellite Services (HD-FSS) in ITU Region 1, including 39.5-40.5 GHz, 47.5-47.9 GHz, 48.2-48.54 GHz, 49.44-50.2 GHz for space to Earth transmissions. A few recent examples:

- ⇨ The Hughes Network Systems, LLC Jupiter 3 satellite will be launched this year with the use of frequencies in the 40/50 GHz band.
- ⇨ OneWeb has filed with ITU to use Q/V band for its future generation of LEO constellation.
- ⇨ Kuiper has filed with the ITU to use Q/V band for its future generation of LEO constellation.

International Trends of 5G in Africa

As ICASA has acknowledged in their 2021 report on The State of 5G in South Africa:

"There is considerable concern that the rollout of 5G could simply serve to aggravate the digital divide. For example, in sub-Saharan Africa less than half the population has access to mobile services, and the dominant technology remains 2G. Even in South Africa, around a third of subscribers do not have access to a smartphone."

According to GSMA itself, mobile penetration in Sub-Saharan Africa in 2020 was at 45%, while mobile internet user penetration was at 26%. In the foreseeable future, 4G will be the dominant technology which currently only amounts to 11% of all connections, while 2G still amounts to almost 45% of all connections. Furthermore, according to the GSMA:[12]

"5G trials have been conducted elsewhere in Sub-Saharan Africa, including in Gabon, Kenya, Nigeria and Uganda. However, mass adoption of mobile 5G is not imminent in the region. With significant unused 4G capacity and 4G adoption still relatively low, the focus in the near term for operators and other stakeholders is to increase 4G uptake".

[12] https://www.gsma.com/mobileeconomy/wp-content/uploads/2020/09/GSMA_MobileEconomy2020_SSA_Eng.pdf

Aarti Holla-Maini
Secretary General
sg@gsoasatellite.com

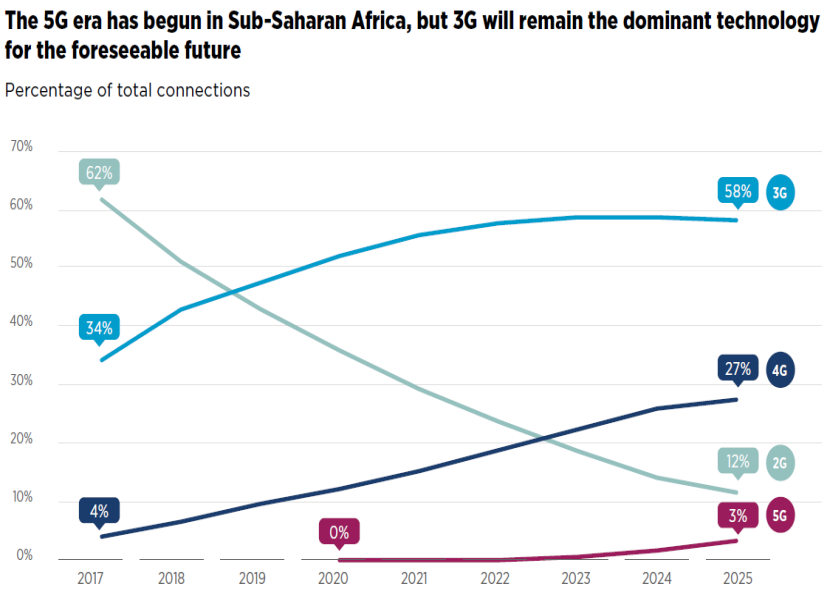


Figure 5: GSMA research does not support the need for more spectrum, since 3G/4G will be the dominate technology

As can be seen from the above figure, simply adding more mid-band spectrum is not the answer to the challenges faced by the mobile industry in South Africa and broadly speaking in Sub Sahara Africa.

Therefore, GSOA advocates - as agreed by ICASA - that efficient and effective management of spectrum is key to maximise the opportunities that mobile connectivity can bring to society, by making sure the required spectrum resources are available under the right conditions and thus lowering broadband costs, increasing coverage and boosting connectivity. Hence it is most efficient to first ensure that existing spectrum in both sub 1GHz and 3.5 GHz band ranges, as well as in other IMT bands, is fully utilized before seeking additional spectrum for future 5G technology. This considering that 5G technology will only account for 2% of all connections in Africa by 2025 (according to GSMA[13]) while migrating satellite services operating in C-band today will be welfare destruction.

More specifically, migrating the satellite services from the C-band has practical consequences and a negative financial impact. Satellite operators will incur costs in upgrading their equipment to meet the band clearance requirement and may also be impeded in providing services, resulting in loss of their existing or prospective customer base. Lastly, operators may require additional satellite capacity to ensure sufficient supply is available in the reduced FSS frequency range to absorb the incumbent services that must be moved and to meet contractual obligations for contingency capacity in the event of transponder or satellite failure.

Releasing 300 MHz of C-Band for Mobile Use Is In Line With International Comparisons

Administrations have taken a wide variety of approaches with respect to the amount of spectrum and specific frequencies that they have or will release for MNOs. In large parts, these differences reflect the extent to which spectrum is encumbered by existing uses that generate value.

[13] Source: GSMA, "The Mobile Economy 2020" Report, 2020

Aarti Holla-Maini
Secretary General
sg@gsoasatellite.com

Appendix A lists the amount of C-band spectrum allocated, or planned to be allocated, for 5G in 27 countries across the world. Twelve of these countries have allocated / identified less than or equal to 300 MHz of spectrum for 5G terrestrial use. These countries are predominantly in the America and Asia Pacific regions and include many well-developed mobile markets that provide some of the best mobile services in the world, such as the United States, South Korea, and Australia.

13 out of the 15 countries that have allocated more than 300 MHz for 5G terrestrial use are in Europe. Outside Europe, 80% of countries have allocated or plan to allocate less than or equal to 300 MHz of C-Band. This difference is important, because the situation in South Africa differs from Europe but resembles that of the America and Asia Pacific regions. More specifically:

- In Europe, the use of C-band for satellite is limited to large teleports and gateway antennas resulting in a small number of earth stations. This has made it possible to refarm upwards of 400 MHz of C-Band for mobile services. For example, the telecommunications regulator in Switzerland specifically included interference protection of a handful of Satellite Earth Stations that operate in the 3600-4200 MHz range. This situation is obviously not comparable to South Africa, where the number of earth stations and B-to-C locations is significantly higher.

- Elsewhere, in countries such as Singapore, or Taiwan, satellite (FSS) services are essential for video distribution, with the result that C-band spectrum is much more intensely used by satellite, both on a frequency and geographic basis. In South Africa, as is the case across Africa, C-band is the backbone for video distribution as was noted by the response to the ICASA inquiry for the implementation of the Radio Frequency Migration Plan and IMT Roadmap[14]. In addition, FSS serves as backhaul for cellular networks in much of Africa including South Africa.

These differences explain why releasing up to 400 MHz may be the norm in Europe, whereas elsewhere it is typical for countries to clear 300 MHz or less. In this respect, it would be exceptional (and in our view a grave error) for South Africa to consider clearing more than 300 MHz for 5G at this time. Indeed, we congratulate ICASA in taking the sound approach of identifying the 3.3 – 3.4 GHz instead. Additionally, we suggest ICASA carries out a feasibility study which precedes the development of a RFSAP for IMT in this band to ensure that implementing IMT in 3.3-3.4 GHz complies with the limits and provisions set in ITU footnotes 5.429B, 5.429D and 5.429F.[15]

Refarmed spectrum is another attractive substitute to purchasing additional spectrum to increase capacity, not least as operators have existing licences and have planned cell networks around the signal reach of these existing bands. In recent years, we have seen this transition across the world with operators switching off 3G networks, for example in the United States and across China. Spectrum refarming will eventually result in refarming of all spectrum used in 2G, 3G, and 4G networks to support 5G (or future technology).

Conclusion

"Considering the 5G use cases such as eMBB, URLLC and mMTC, satellite will play an important complementary role. MNOs will be able to complement their 5G services with satellite connectivity to

[14] Government Gazette Number 45247 (Notice 580 of 2021)
[15] GSMA. 2017. Considerations for the 3.5 GHz IMT range: getting ready for use. Available: https://www.gsma.com/spectrum/wp-content/uploads/2017/06/Considerations-for-the-3.5-GHz-IMT-rangev2.pdf

Aarti Holla-Maini
Secretary General
sg@gsoasatellite.com

offload their terrestrial networks on a large scale. Fixed Wireless Access and Satellite will be a recommended option to help bridge the digital divide in areas where optic fibre cannot be deployed."

The above statement from ICASA, found in the 2021 report on the State of 5G in South Africa, provides a clear recognition that 5G will essentially rely on a mix of technologies combining Terrestrial Mobile, Fibre, FWA and Satellite. The role of satellite in extending the reach and accelerating the deployment of 5G, as a backhaul to terrestrial wireless or as a stand-alone solution where terrestrial options don't exist, has long been acknowledged by international instances such as the ITU, CEPT, EU, 3GPP, as well as by the African Telecommunications Union (ATU) in their Recommendation 005 on Emerging Technologies.

Reliable access to adequate spectrum is critical to the development of satellite services and their ongoing contribution to bridge the digital gap which the advent of 5G will no doubt deepen. Certainty about spectrum allocations and exclusive access to core spectrum are all essential requirements for the satellite industry to thrive and remain viable, considering the substantial up-front cost and the long lifecycle of satellite systems.

Aarti Holla-Maini
Secretary General
sg@gsoasatellite.com

Appendix A. Amount of C-band allocated to MNOs in International Markets

Country	C-Band allocated for MNOs	Number of Nationwide MNOs[16]	State of allocation
Australia	225 MHz	3	Completed
Austria	390 MHz	4	Completed
Canada[17]	200 MHz	3	Auction date set
Czech Republic	360 MHz	3	Auction of 200 MHz completed, 2nd auction planned for remainder
Finland	390 MHz	3	Completed
France	310 MHz	4	Award in progress
Germany	300 MHz (20 MHz encumbered)	3	Completed
Hong Kong	300 MHz (100 MHz indoor use only)	4	Completed
Hungary	390 MHz	4	Completed
Iceland	300 MHz	3	Completed
Ireland	350 MHz	3	Completed
Israel	300 MHz	5	Auction planned
Italy	200 MHz	4	Completed
Japan	500 MHz	4	Completed
Luxembourg	330 MHz	3	Auction planned
Poland	320 MHz	5	Auction planned
Portugal	400 MHz	3	Auction planned
Saudi Arabia	400 MHz	3	Completed

[16] Nationwide MNOs are inclusive of only MNOs that operate nationwide and are exclusive of regional operators. Canada, for example, includes numerous regional operators that only operate in a subset of Canada's 10 provinces and 3 territories. We exclude new entrants that have announced plans to build nationwide networks such as 1&1 Drillisch (Germany) and Dish Network (United States). We include mergers that have completed as of 7 April 2020, such as T-Mobile/Sprint (United States) and VHA/TPG (Australia).

[17] Canadian regulator, ISED, is exploring the allocation of 3.7-4.2 GHz for terrestrial use, but is yet to release a plan for the clearance of incumbent satellite services. We exclude the 3.7-4.2 GHz.

Aarti Holla-Maini
Secretary General
sg@gsoasatellite.com

Country	C-Band allocated for MNOs	Number of Nationwide MNOs[16]	State of allocation
Singapore	200 MHz	4	Award in progress
Slovakia	400 MHz	4	Completed
South Korea	280 MHz	3	Completed
Spain	360 MHz	4	Completed
Sweden	320 MHz (20 MHz encumbered)	3	Auction in Progress
Switzerland	300 MHz	3	Completed
Taiwan	270 MHz	5	Completed
United Kingdom	390 MHz	4	Auction of 190 MHz completed, 2nd auction planned for remainder
United States[18]	280 MHz	3	Auction planned

[18] CBRS is excluded because it is allocated on a unique, three-tiered shared basis. The 150 MHz of spectrum will be shared between incumbent federal uses, a licensed "Priority Access License" tier, and an unlicensed "General Access Authorization" tier