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March 4, 2022

Independent Communications Authority of South Africa
350 Witch-Hazel Avenue,
Eco Park Estate, Centurion, 0144
South Africa

Attention
Mr Manyaapelo Richard Makgotlho
VIA EMAIL (rmakgotlho@icasa.org.za)

Re: Dynamic Spectrum Alliance (DSA) Submission to Independent Communications Authority of South Africa's (ICASA) Inquiry into the Long-Term Spectrum Outlook in South Africa for Public Consultation

Dear Sir/Madam,

The Dynamic Spectrum Alliance (DSA[1]) respectfully submits comments in response to the Independent Communications Authority of South Africa's (ICASA) Inquiry into the '*Long Term Spectrum Outlook in South Africa*'. DSA commends ICASA for its efforts to ensure efficient assignment and use of scarce radio frequencies and to make spectrum available for new wireless services that will facilitate competition, enhance connectivity, and promote investment in South Africa.

DSA is pleased to accept the opportunity to support future spectrum scenario planning and urges the Authority to take a balanced approach between licensed, license-exempt, and lightly licensed options when allocating spectrum to wireless broadband services. An unbalanced approach may have the unintended consequence of creating artificial scarcity, which could, in turn, increase the cost of broadband access. Licensed and license-exempt spectrum bands will both play important and complementary roles in the delivery of advanced wireless services. We believe that coordinated shared spectrum should be considered in spectrum planning.

[1] The DSA is a global, cross-industry, not for profit organization advocating for laws, regulations, and economic best practices that will lead to more efficient utilization of spectrum, fostering innovation and affordable connectivity for all. Our membership spans multinationals, small-and medium-sized enterprises, as well as academic, research and other organizations from around the world all working to create innovative solutions that will benefit consumers and businesses alike by making spectrum abundant through dynamic spectrum sharing. A full list of DSA members is available on the DSA's website at www.dynamicspectrumalliance.org/members

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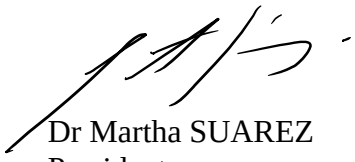
Our response is split into 'General Comments' and 'Responses to Specific Questions' using the template provided by the Authority.

The DSA is available to participate in any further consultations with respect to this inquiry, including a public hearing.

Respectfully submitted,



Dr Martha SUAREZ
President,
Dynamic Spectrum Alliance

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DSA
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DSA General Comments

DSA supports the Authority's objective (see Electronic Communications Act No 36, 2005) to "take into account modes of transmission and efficient utilization of the radio frequency spectrum, including allowing shared use of radio frequency spectrum when interference can be eliminated or reduced to acceptable levels as determined by the Authority".

The National Development Plan 2030 (NDP) for South Africa emphasizes the need to "implement a service and technology-neutral flexible licensing regime" and to "free spectrum for efficient use, to drive down costs and stimulate innovation".

DSA believes that providing additional spectrum access options through use of new spectrum management tools, such as dynamic shared access systems, will benefit competition, create conditions for innovation, and spur more rapid deployments of wireless networks and services.

A Telecoms Advisory Services Economic Study in 2021 estimated that the value of Wi-Fi to the South African economy in 2021 was $31 billion and expected to rise to $44 billion by 2025[2]. However, Wi-Fi traffic is doubling every three years, yet there was only 455 MHz (5150-5350 MHz and 5470-5725 MHz) of mid-band spectrum available for license-exempt use in most of Europe, Middle East and Africa. There are also several restrictions on the use of this spectrum, so as to protect other services. Additionally, since the license-exempt spectrum in the 5 GHz band is fragmented, it does not offer sufficiently wide channels for newer applications and services that will be available from new generation Wi-Fi 6E and Wi-Fi 7, noting that Wi-Fi 6E devices are already available and on the market. This spectrum shortage will prevent citizens and companies in South Africa (and across the region) from realizing the full benefits of the affordable high-capacity Internet connectivity delivered by Wi-Fi.

To alleviate the shortage, the DSA recommends two areas to be urgently considered as part of the Authority's current and future spectrum planning: 6 GHz band for license-exempt use and Tiered Spectrum Access/Sharing.

6 GHz band for license-exempt use

A recently published study by Telecom Advisory Services, commissioned by the DSA, presents the economic value of allowing unlicensed use of the entire 6 GHz band (5925-7125 MHz) in South Africa.[3] It estimates 'the cumulative economic value between 2021 and 2030 associated with allocating the 1200 MHz in the 6 GHz band to Wi-Fi in South Africa would be US$ 57.76 billion. This is broken down into US$ 34.81 billion in GDP contribution, US$ 13.32 billion in producer

[2] Wi-Fi Alliance "Global Economic Value of Wi-Fi 2021-2025"
[3] See https://www.totaltele.com/512580/6-GHz-unlicensed-access-and-Wi-Fi-6E-to-add-billions-to-Indonesian-and-African-economies-reveals-Dynamic-Spectrum-Alliance

surplus to South African enterprises, and US$ 9.63 billion in consumer surplus to the South African population.'[4]

In addition, the allocation of the entire band to unlicensed use will result in a significant contribution to a reduction of South Africa's digital divide. By providing affordable paid service and free access over hot spots as a result of allocating the full 6 GHz band to Wi-Fi, an incremental 1,252,600 South Africans will be able to gain access to the Internet by 2030.[5]

The African Telecommunications Union (ATU) Emerging Technologies Task Group has formulated its recommendation on license-exempt access to the lower part of the 6 GHz band (5925-6425 MHz). It took into account the extensive technical studies[6] that have shown that WAS/RLANs can operate in this band without adversely impacting incumbents' operations. 6 GHz networks have similar propagation characteristics allowing reuse of 5 GHz network coverage maps and metrics, and existing backhaul infrastructure. The recommendation, sent to all ATU countries for written input, includes an annex containing the technical and regulatory conditions for operating unlicensed technologies in the lower 6 GHz band. Timely adoption by ICASA of the ATU recommendation to enable license-exempt technologies to operate in the lower 6 GHz (5925 – 6425 MHz) band will help address the license-exempt mid-band spectrum shortfall and bring major socio-economic benefits to South Africa.

The European Commission has published an implementing Decision on the harmonized use of the 5945-6425 MHz band by wireless access systems, including radio local area networks (WAS/RLANs) and this is being implemented by the individual Member States. This means that in expediting access to the lower 6 GHz band, South Africa can take advantage of the economies of scale that will be created by the roll out of Wi-Fi 6E across the region.

Regarding the upper part of the 6 GHz band, at the last World Radiocommunications Conference (WRC) in 2019 it was decided to "conduct and complete in time for WRC-23 the sharing and compatibility studies (including studies with respect to services in adjacent bands, as appropriate) with a view to ensuring the protection of services to which the frequency band is allocated on a primary basis, without imposing additional regulatory or technical constraints on those services, and also, as appropriate, on services in adjacent bands, for the frequency bands: 7 025-7 125 MHz (globally) and 6 425-7 025 MHz (Region 1)".

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[4] Dynamic Spectrum Alliance, "Assessing the economic value of unlicensed use of the 6 GHz band in South Africa"
[5] Idem
[6] Studies by the European Conference of Postal and Telecommunications Administrations (CEPT) and in the US have found LPI and VLP outdoor Wi-Fi/RLAN networks are very unlikely to interfere with incumbent fixed radio services. Published in May 2019, the ECC 302 report found that it would be feasible for LPI Wi-Fi (200/250 mW EIRP-23/24 dBm) and VLP portable Wi-Fi (25 mW EIRP-14dBm) to coexist with fixed radio links in the lower 6 GHz band with minimal interference. Although that study looked at long-term interference, Draft ECC 316 has concluded that these power limits should also satisfy the short-term interference criterion (@140 seconds per year). In the US, the FCC's rules (released in April 2020) allow low power indoor for unlicensed use across the whole 6 GHz band with a maximum EIRP of 30 dBm. The FCC said: "We find that fixed microwave receivers will be protected from harmful interference from unlicensed indoor low power devices operating at the power levels we are authorizing." The FCC is also consulting on very low power use, both indoor and outdoor, in the entire 6 GHz band.

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There is no certainty about a possible IMT identification yet, because it will depend on the results of the technical studies. The additional upper 6 GHz mid-band spectrum would allow for 160 MHz and eventually 320 MHz channels, which can support exciting new services based on Wi-Fi 6/Wi-Fi 7 and enable 5G to offload demanding services, which would otherwise consume limited cellular network resources.

To realise the full potential of the upper 6 GHz band (6425-7125 MHz), administrations need to maintain as much flexibility as possible and that flexibility would be reduced if the next WRC-23 identifies the upper 6 GHz band (6425-7125 MHz) for IMT. Administrations should be aware that if IMT networks are deployed in the upper 6 GHz band in ITU Region 1, there is a risk that they could interfere with fixed and fixed satellite links currently operating in that band due to the IMT outdoor high power requirement for cellular coverage.[7] Studies within the ITU-R have just recently started and administrations should remain open minded when undertaking coexistence and sharing studies based on justifiable technical characteristics and realistic and agreed propagation characteristics.

Many other mid-band frequencies have been already identified for IMT in South Africa and the Authority has established an ambitious strategy that will enable the deployment of 5G Technology in such a manner that will be most beneficial to the Nation and the end users. From the economic study that we have done for South Africa, the DSA is convinced that the upper 6 GHz band can offer a higher value for the nation immediately if it is destinated for WAS/WLAN under a license-exempt framework. Licensed-exempt access will be a complement for 4G and 5G[8] and from the DSA perspective, it is important that the Authority complements the licensed mobile access with enough spectrum for licensed-exempt access. Users will have a better broadband experience in combination to the 5G mobile broadband services by using the 6 GHz band for license-exempt access; Furthermore, operators can also benefit of the 5G New Radio specification for unlicensed spectrum, called 5G NR-U, because 3GPP Release 16 includes the 6 GHz band for unlicensed access. From the DSA perspective, cellular and Wi-Fi spectrum are powerful complements, not rivals.

DSA urges the Authority to ensure flexibility in its spectrum outlook to allow for future allocation of the entire 6 GHz band for use by license-exempt technologies. We have recently published a whitepaper that explains the essential need for availability of the entire 6 GHz band to WAS/RLANs to support current and emerging innovative use cases.[9]

As the 6 GHz band already has a co-primary mobile allocation in the ITU Radio Regulations, no international action is needed, and should it wish to, the Authority can immediately open the band for Wi-Fi use.

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[7] *See* "How to realise the full potential of 6 GHz spectrum". Whitepaper. October 2020 (link)
[8] *See* Enterprises building their future with 5G and Wi-Fi 6, Deloitte's Study of Advanced Wireless Adoption (link)
[9] 6 GHz License-Exempt: Why the Full 1200 MHz and Why Now? License-Exempt http://dynamicspectrumalliance.org/wp-content/uploads/2021/08/6GHz-License-Exempt-Band-Why-1200-MHz-and-Why-Now.pdf

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Global Developments:

In preparation for future capacity and performance requirements, numerous countries in all three ITU regions, including the United States, Canada, Saudi Arabia, South Korea, Brazil and Chile have already opened the entire 6 GHz band (5925-7125 MHz) for license-exempt use.

In Europe, the ECC (Europe's Electronic Communications Committee) has agreed to adopt a work item to study possible technical conditions under which wireless access systems, including radio local area networks, could operate and coexist with existing services in the 6425-7125 MHz band. The Spectrum Engineering working group of CEPT has initiated the study, which should provide administrations with all the information they need to determine how best to harness this key tranche of spectrum. Furthermore, the United Kingdom has launched a public consultation on how to open the upper portion of the 6 GHz band (6425-7070 MHz) by using an already developed sharing framework.

DSA's industry members are initiating sharing studies in other jurisdictions to further establish the possibility of allowing license-exempt wireless access systems (WAS), including radio local area networks (RLANs) to share the upper 6 GHz (6425-7125 MHz) band with incumbent services. The findings of this sharing study will be presented to ICASA as soon as such a study is conducted for South Africa. Considering the results of similar studies on lower 6 GHz, it is expected that the studies will confirm that low power Wi-Fi systems can easily coexist with incumbent fixed and fixed satellite services in the upper part of the 6 GHz band, just as they can in the lower part of the band.

Tiered Spectrum Access/Sharing

In bands identified for International Mobile Telecommunications (IMT), DSA believes that a tiered spectrum access model could support wireless connectivity based on the 3GPP standards, enabling new spectrum users to benefit from the economies of scale resulting from international spectrum harmonization and the broad industry support for 3GPP-based technologies, such as LTE and 5G NR.

The application of spectrum sharing to IMT identified bands needs to protect incumbent operations that are not mobile, such as mobile (non-IMT), fixed services, fixed satellite services, electronic news gathering, military users, etc. Furthermore, it could harness spectrum that is licensed to mobile network operators (MNOs) but is unused in certain locations.

Drawing on established spectrum sharing frameworks that have been implemented by regulators around the world, including the TVWS framework stablished by ICASA in South Africa, the DSA advocates for a tiered and dynamic spectrum access model that protects incumbents and coordinates frequency usage by mapping the geolocations of the signal transmitters.

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In addition to the importance of making sufficient spectrum available for unlicensed technologies, including Wi-Fi, DSA would also like to highlight some real-world applications that have been developed in the United States as a result of automated shared access to the 3.5 GHz Citizens Broadband Radio Service (CBRS) authorized by the Federal Communications Commission (FCC) in January 2020.

By way of background, under the CBRS regulatory framework, the spectrum access system (SAS) coordinates CBRS frequency use and manages coexistence among the three tiers of access:

1) Incumbent (e.g., navy radar and commercial fixed satellite services)
2) Priority access licensed (PAL) and
3) General authorized access (GAA).

The environmental sensing capability (ESC) network detects incumbent naval radar use of the band and alerts the SAS to move new terrestrial commercial operations to non-interfering channels. The SAS also interfaces with the FCC's Universal Licensing System (ULS) to obtain information about Fixed Satellite Service (FSS) incumbents and grandfathered fixed wireless systems. Using this information, the SAS is able to calculate aggregate interference from new commercial users to incumbents and enforce protection of these systems. In the 2 years of commercial operational experience, no incumbents have reported interference from new CBRS users, demonstrating the effectiveness of SAS management of the band.

New commercial users in the CBRS band have multiple options for accessing this 150 MHz of spectrum:

a) Acquisition of a PAL in the FCC's 2020 CBRS auction where use-or-share rights for county-based licenses were offered;
b) Use of the GAA tier, which does not require an individual license to operate, but does require use of certified equipment and connectivity to a SAS to receive a spectrum grant for operations with a particular transmit power and antenna orientation at a specific location and height; or
c) Leased rights from a PAL license holder.

Based on the type of device (fixed or personal/ portable) and its coordinates, information about the transmitter's location and operating parameters, and the technical rules the regulator puts in place to protect incumbents and/or adjacent users from harmful interference, the SAS calculation engine determines the list of available channels at the PAL's and/or GAA's device location and its maximum permissible radiated power.

As described above, the SAS not only coordinates protection of incumbent users from new commercial operations, but also manages the assignment of frequencies to PAL and GAA users, protection of PAL operations, and co-existence among GAA users to maximize spectrum efficiency and provide deterministic access for all users. The automated SAS process provides near real-time

management of the CBRS band, speeding time-to-market while minimizing uncertainty and administrative burdens.

Through this automation of shared spectrum, a whole host of private wireless network opportunities, from smart energy to smart city, have emerged. From business to leisure, hundreds of smart office, airport and stadium private networks have been deployed using CBRS as the result of having access to spectrum without the need for an individual license. In fact, only two years into commercial service, over 210,000 CBRS cell sites have been deployed across the United States with the vast majority of them using the GAA tier. Examples of such deployments include:

1) Retail The American Dream Entertainment and Retail Complex in New Jersey has implemented CBRS to cover the entire 3 million square foot venue, servicing over 40 million annual visitors and more than 450 stores. Beyond the mall itself, CBRS has also been used for traffic and parking management, assessing approximately 33,000 parking spaces. Equipping security cameras, digital signage and other systems for both internal and external mall operations, CBRS has proved essential for supporting and enabling interesting such new use cases. This type of infrastructure deployment has proven to be faster and more economic than traditional fixed infrastructure, offering reliable and simple, yet effective means of connectivity.

2) Airport In Dallas, CBRS has transformed airport communication systems, bringing airport staff and management connections onto the CBRS spectrum. Such deterministic spectrum access is critical in emergency scenarios to cater to higher power requirements and improve coverage. This network supports critical airport communications and coexists with a robust Wi-Fi network.

3) Sport stadium Angel Stadium in Anaheim, California has adopted CBRS capabilities to support its internal communications, lightening the load on the Wi-Fi system, similar to what Dallas airport has achieved. Since the full commercial deployment of CBRS, they have also been working as a neutral host provider, offering Mobile Network Operators (MNOs) support in managing signal traffic for customers attending events. By not only supporting internal connectivity for both staff and customers but extending this service for the reinforcement of existing MNOs, CBRS has presented the opportunity to eliminate barriers and limitations, providing full, flexible coverage whenever it is needed – even when roaming.

4) Rural connectivity Fixed Wireless Access providers, also known as Wireless Internet Service Providers (WISPs), are able to harness the newly available CBRS spectrum, tripling the amount of spectrum previously available to them. WISPs, which typically operate in rural areas and have been using this part of the CBRS band for the past 12-15 years, are transitioning older WiMAX and proprietary systems to the new CBRS rules and LTE equipment to expand their reach and improve their service offerings.

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As we reflect on the use cases developing across the United States, it is clear that CBRS has revolutionized the ways in which spectrum is utilized to improve connectivity across a diverse number of vertical sectors. DSA believes that adopting a similar spectrum sharing model in South Africa will enable more users, including verticals, to access scarce and valuable spectrum resources, leading to lower-costs, lower barriers to entry, and most effective allocation for innovative businesses. This, in turn, enables and encourages competition and innovation by existing service providers as well as new entrants.

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Specific Consultation Questions Addressed by DSA	
Q. 1	**Please comment on whether the above captures the relevant regulatory and policy aspects of long-term spectrum planning.**
Comment	DSA commends the Authority for incorporating the ATU spectrum recommendations in its long-term spectrum outlook. Some other ATU spectrum recommendations that should be implemented by the Authority include: • Performance of regular spectrum audits and publication of the results[10] • Making the lower 6 GHz (5925-6425 MHz) band available for license exempt use[11]. DSA suggests ICASA undertake coexistence studies in the upper 6 GHz between WAN/RLAN/Wi-Fi and incumbents since we believe this is particularly important prior to any decision being taken on WRC-23 Agenda Item 1.2.
Q. 3	**Please comment on the above assessment of the status quo on broadband penetration in South Africa, and what role spectrum may play in addressing the gaps identified.**
Comment	Internet penetration in South Africa is low, as the assessment indicates. DSA urges the Authority to take measures to extend internet penetration and close the digital divide as soon as possible. Availability of spectrum to roll out communications services will help in closing the identified digital divide. There is need to offer affordable broadband services in the underserved/unserved areas due to the low-income nature of the said areas. This will be made possible if sufficient spectrum is made available for the service providers, and especially for rolling out community networks in those areas. Wi-Fi allows multiple members of a rural community to share a single broadband Internet connection, making the service more affordable. In some cases, community Wi-Fi models can enable an individual subscription to support time- or data-bound service to potentially dozens of users. Public Wi-Fi services run by community leaders, NGOs or businesses are proliferating across Africa. In most cases, users pay a small fee to access the Wi-Fi service on a pay-as-you-go basis – a more cost-effective option than paying for their own dedicated cellular connection. These kinds of community networks are best deployed using a license-exempt technology, such as Wi-Fi, because stakeholders can then rollout

[10] https://docs.google.com/viewerng/viewer?url=https://atuuat.africa/wp-content/uploads/2021/04/English-ATU-R-Spectrum-Recommendation-001-0.pdf
[11] https://atuuat.africa/wp-content/uploads/2021/08/En_ATU-R-Recommendation-005-0.pdf

	the service without having to go through cumbersome regulatory processes and incur additional expenses. Further consideration on the joint role of satellite communications and Wi-Fi can play in improving rural coverage and connectivity.
Q. 4	**What future changes, if any, should ICASA examine with regard to the existing licensing regime to better plan for innovative new technologies and applications and allow for benefits that new technology can offer, such as improved spectrum efficiency?**
Comment	The DSA has partnered with the UK Foreign, Commonwealth & Development Office to work in South Africa on the 'Digital Access Programme' with the aim to catalyse more inclusive, affordable, safe and secure digital access for excluded and underserved communities. As part of this work, DSA conducted a gap analysis study aimed at assessing the South African regulatory environment with respect to a set of ten principles that describe best practices for modern spectrum management. The preliminary results and recommendations have been already presented to ICASA and the full study will be finalised by April 2022. At this moment, DSA recommends that the Authority take steps to make more spectrum available on a shared or lightly-licensed basis by implementing automated dynamic shared access technology, which is readily available from multiple commercial providers and can greatly facilitate access by a wide variety of users. There is no question that today we have the technical ability to automate frequency coordination, which leads to lower transaction costs, more efficient use of spectrum, faster time-to-market for new services, protection of incumbents from interference with greater certainty, and expansion of the supply of wireless connectivity that is fast becoming, like electricity, a critical input for most other industries and economic activity. The introduction of new licensing options supported by automated dynamic spectrum sharing technology is the best path to support such deployments.
Q. 5	**What future emerging technologies are to be taken into consideration and which technologies will have a significant impact? When are these technologies expected to become available?**
Comment	There are three main categories of use cases that are driving consideration of improved access to license-exempt spectrum. The first is high bandwidth use cases which today is dominated by video and tomorrow will be challenged by proliferation of Augmented Reality and Virtual Reality in both the consumer and business category. The second is high density deployments requiring multiple channels. And the third is the uptake on the Internet of Things. Each of these categories places a significant emphasis on innovation and on the innovations that will demand improved access to spectrum. Thus, each of these supports the need

	for significant new access to spectrum such as the entire 1200 MHz of the 6 GHz band. The latest technology, known as Wi-Fi 6 – or when used in the 6 GHz band, Wi-Fi 6E – addresses the challenges of growth in demand and devices in a variety of ways.[12] For example, Wi-Fi 6 does not just communicate with associated devices on a 1:1 basis (one data stream at a time), but can simultaneously communicate with multiple devices. The key feature of Wi-Fi 6 that is of interest to spectrum policy is that it can utilize broad channels. Broad channels, 80 and 160 MHz-wide, enable data transmissions to occur much more quickly relative to smaller channel sizes. Importantly, Wi-Fi 7 is expected to enable channels sizes of 320 MHz. Wi-Fi 6 has been designed to use spectrum in the 2.4 GHz, 5 GHz, and 6 GHz bands, providing a more agile use of radio spectrum depending upon the users' needs. For enterprises and consumers, the adjacency of the 6 GHz band to the existing 5 GHz band is important for another reason – because the propagation characteristics are similar between 5 and 6 GHz, network coverage is similar, and multiple access points deployed in a network configuration can more easily be swapped out for the new generation of Wi-Fi without rewiring the network. While Wi-Fi 6E radios will still be capable of operating in the 5 GHz and 2.4 GHz bands, prior generation Wi-Fi devices will not operate at 6 GHz. Wi-Fi 6E is a "greenfield" technology in the 6 GHz band. At 6 GHz, it will not have to contend with generations of legacy devices, many of them operating with legacy inefficiencies. The UK's Ofcom noted, when they opened 6 GHz for license-exempt spectrum, that -in our consultation we said that opening up new spectrum, free from legacy devices, could enable a more efficient group of devices using new Wi-Fi standards from the outset, therefore offering a more future-proof solution to Wi-Fi demand. This would also make it easier to use existing bands to support increased use of Wi-Fi.[13] The IEEE has extended the latest Wi-Fi standard, IEEE 802.11ax (also known as "Wi-Fi 6") to include the 6 GHz band. License-exempt Wi-Fi 6E certified equipment is ready now so regulators can proceed knowing that consumers will soon see the benefits of a new designation for license-exempt spectrum.

[12] A good discussion of the basic capabilities of Wi-Fi 6 (including 6E) is available here.
See also the Wireless Broadband Alliance's website: https://wballiance.com/wi-fi-6/

[13] Ofcom (UK), Statement, Improving Spectrum Access for Wi-Fi, July 24, 2020 at 3.3.
https://www.ofcom.org.uk/consultations-and-statements/category-2/improving-spectrum-access-for-wi-fi

	The African Telecommunications Union (ATU) recognized the value of Wi-Fi 6E (Wi-Fi 6 in the 6 GHz band) and developed ATU-R Recommendation 005-0, which encourages African Administrations to allow license-exempt WAS/RLAN to use the lower 6 GHz (5925-6425 MHz) band. Wi-Fi 6E devices can employ 160 MHz channels and the uncongested bandwidth in the 6 GHz band to deliver multi-gigabit, low latency Wi-Fi, dramatically improving the user experience and spectral efficiency. This additional spectrum will also enable Wi-Fi to better support community and IoT networks, encompassing large numbers of connections. Wi-Fi 7 promises further enhancements and new capabilities. The Authority is urged to swiftly implement the ATU Emerging Technologies Recommendation to allow license-exempt WAS/RLAN operation in the lower 6 GHz (5925-6425 MHz) band and to ensure flexibility in its spectrum outlook to allow for potential allocation of the full 1200 MHz in the 6 GHz band to license-exempt technologies.
Q. 7	**Are there any IoT applications that will have a large impact on the existing license-exempt bands? If so, what bands will see the most impact from these applications?**
Comment	Internet of Things is resulting in economic sectors that are deeply digitizing in order to pull data from their business operations that will enable improved outcomes.[14] As businesses increase connectivity – adding connected devices, and sensors that utilize more wireless technology – more data becomes available that enables new insights into business operations. As an example, from the leading edge of this trend, in the United States, a hospital in Houston, Texas that sees 35,000 connected devices on its network per day. This would include everything from smartphones carried by staff and guests to patient diagnostic equipment, video displays, and nursing stations, to connectivity for back-office billing. This enables patient data to be shared electronically, resulting in not just more efficient operations, but better patient outcomes. There is no doubt that this is the direction that all enterprises are heading regardless of their sector and such a high density of devices also points to the need for more license-exempt spectrum.
Q. 14	**Is there a demand for more flexible frequency licensing and frequency assignment/allotments processes on a regional basis required to complement the national frequency licensing and frequency assignments/allotments in the next 10 to 20 years?**
Comment	Due to the growing demand for spectrum, the DSA urges the Authority to make available the unused licensed spectrum for shared access, under a "use it or share

[14] See generally https://www.wi-fi.org/beacon/richard-edgar/wi-fi-6-is-set-to-change-the-future-of-iot-here-s-why

	it policy" and/or using Tiered Spectrum Sharing Model (TSSM), also known as Tiered Spectrum Access (TSA)[15]. This will help in boosting the deployment of regional, private and community networks in the country. TSSM is similar to Shared Spectrum Access for Similar Technologies (SSA-ST) as described in ITU-R report SM.2404-0 (06/2017), which envisages sharing by entities using the same or similar technologies. The Authority has already approved several spectrum sharing agreements where one MNO has made its unused IMT spectrum available for use by another MNO. The MNOs have interpreted the spectrum sharing provisions of the Radio Frequency Spectrum regulations 2015 to mean that they can only share IMT spectrum among themselves. Whether this interpretation is correct or not, it has the effect of a "Trojan Horse" consolidation of High Demand IMT spectrum in the hands of a limited number of MNOs while preventing new entrants from joining the IMT spectrum club. The Authority is urged to introduce new policies promoting a larger ecosystem with different operators and incentivizing competition. In order to encourage competition and the rollout of affordable network services in underserved areas, the Authority should consider making it easier for Community Networks, Campus networks, businesses and similar entities to be licensed (or license exempt) and gain access to IMT spectrum free of charge or at reduced cost. The Authority should also consider the introduction and enforcement of "Use it or Share it" followed by "Use it or Lose it" provisions for high demand spectrum. High Demand Spectrum licenses should be allowed to share their unused spectrum, provided they have used this spectrum in more than half of the country (or some other percentage to be determined). If the High Demand Spectrum licensee has not used this spectrum within a certain period – say three years, they should lose that spectrum with it being returned to the Authority for further assignment.
Q. 24	**Will the demand for commercial mobile, license-exempt, satellite, or fixed wireless services/applications impact the demand for backhaul spectrum? If so, how and which of these**
Comment	License-exempt use of the 6 GHz band will not affect the continued use of this band by fixed or fixed satellite services since license-exempt WAS/RLAN can share the band with all incumbent services.

[15] http://dynamicspectrumalliance.org/wp-content/uploads/2019/10/Enhancing-Connectivity-Through-Spectrum-Sharing.pdf

	This is recognized by the ATU in Recommendation 005-0, which makes provision for license-exempt WAS/RLAN to share the lower 6 GHz band with incumbent fixed and fixed satellite services. There will be a need for appropriate spectrum to be made available for backhaul, but this can likely be addressed via existing backhaul bands and evolution of technology to latest spectrally efficient releases. It is of course difficult to guess how that impact on demand will manifest itself in spectrum demand, but we urge ICASA to review this on an ongoing basis.
Q. 45	**How much will spectrum management and orderly frequency planning improve the interference situations in certain frequency bands?**
Comment	There is a likelihood of high reliance on spectrum sharing technologies in the future. Innovative approaches to spectrum management, which could include using databases need to be considered and implemented; harmonized globally to the greatest extent possible; and balanced noting the complexity in the design and implementation of databases. Regarding the 6 GHz band, studies carried out within CEPT[16], and by other Administrations, have concluded that Low Power Indoor (LPI) and Very Low Power (VLP) portable Wi-Fi provide sufficient protection to the incumbent Fixed Service and Fixed Satellite Service. Further analysis is likely needed on the possibility of higher transmit powers outdoors and this future analysis might conclude that databases and / or registration schemes are preferable for these higher powers. It is also important to carefully consider the future opportunity for outdoor standard power (higher power) Wi-Fi operations to support use cases in manufacturing, logistics, agriculture, rural broadband, higher education, hospitality, healthcare, and other sectors. Standard power typically operates in conjunction with an automated frequency coordination (AFC) geolocation database capability, which is aware of incumbent user operations and can safely authorize license-exempt use at a particular location while protecting the incumbents from harmful interference. The AFC approach involves blocking or protecting certain frequencies or channels at particular locations, while still yielding a sufficient number of wide-bandwidth channels. DSA urges the Authority to consider Automated Frequency Coordination (AFC) in all the frequency bands that are being shared, and those that are likely to be available for sharing in the near future, such as the 6 GHz band. This will greatly

[16] 6 March 2020, CEPT Report 73

	help in mitigating interference as more bands are made available for sharing. That said, AFC is not required for Low Power Indoor (LPI) and Very Low Power (VLP) portable in the 6 GHz band.
Q. 46	**Please provide input on future spectrum requirements for the different service allocations as well as the urgency for such additional frequency allocations for such a service.**
Comment	The important and critical role of license-exempt technologies like Wi-Fi in furthering the 5G market cannot be underestimated. This forms one of the reasons for allocating the entire 6 GHz band to license-exempt use. Several companies have expressed interest in both licensed and license-exempt 5G technologies, and view both as necessary to deliver on future wireless demands. Until 2021, there was only 455 MHz (5150-5350 MHz and 5470-5725 MHz) of mid-band spectrum available for license-exempt use in most of Europe, Middle East and Africa. Further, there are a number of restrictions on the use of this spectrum, so as to protect other services. Also, since the license-exempt spectrum in the 5 GHz band is fragmented, it doesn't offer sufficiently wide channels for newer applications and services, such as high-resolution AR and VR. This spectrum shortage will prevent Africa's citizens and companies from realising the full benefits of the affordable high-capacity Internet connectivity delivered by Wi-Fi. Spectrum allocations should be sufficient to support both since the two technologies interact in important ways. Allocating the full 6 GHz band for license-exempt technologies will play an important role in ensuring a strong 5G future for all[17]. This should be done with urgency, to enable the best foundation to launch a strong and stable 5G ecosystem, now and for the future.
Q. 48	**Please provide your organisations strategy and suggestions on how the Authority can ensure that spectrum outlook and demand studies can contribute to stimulation of the South African economy.**
Comment	DSA urges the Authority to conduct studies to determine the socio-economic value of using specific bands of interest such as the study commissioned by the DSA in collaboration with Telecom Advisory Services (TSA), that estimated the economic value of making the entire 6 GHz band available for license-exempt use in South Africa[18]. The economic value of allowing license-exempt Wi-Fi in the

[17] http://dynamicspectrumalliance.org/wp-content/uploads/2021/08/6GHz-License-Exempt-Band-Why-1200-MHz-and-Why-Now.pdf
[18] http://dynamicspectrumalliance.org/wp-content/uploads/2022/02/Assessing-the-economic-value-of-unlicensed-use-of-the-6GHz-band-in-South-Africa.pdf

	entire 6 GHz band was estimated at US$76.53 billion between 2022 and 2031. This is the sum of GDP impact, producer surplus and consumer surplus over the period, with the economic value increasing over time. Such economic impact studies, along with sharing studies, should be used to help decide which service(s) should be allowed or allocated to specific frequency bands. Each frequency band should be allocated to the service that provides the highest socio-economic benefit to South Africa.
Q. 52	**Due to the scarcity of high demand spectrum and the consequential fact that Spectrum Sharing in certain bands are non-negotiable, how shall you describe the best sharing conditions for the South African scenario?**
Comment	South Africa should ensure that there is sufficient spectrum available for licensed, lightly licensed and license exempt use. Use of an Automated Frequency Coordinator (AFC) can help prevent harmful interference when a band is shared. The Authority should consider extending the capability of the existing geolocation database that is being used for TVWS or invite private entities to develop a new AFC for multiple frequency bands. South Africa should consider developing a Tiered Shared Access framework to enable spectrum sharing. This will allow mobile broadband to be deployed by new entrants or other operators both in IMT identified bands. DSA commends the Authority for introducing a regulatory framework for TVWS, based on a geolocation database. This type of dynamic spectrum sharing using geolocation databases can be extended to other frequency bands and incumbent services. Output power control can be used to introduce a new service to a frequency band, similar to the ATU-R Recommendation 005-0 which sets power limits and operation modes for WAS/RLAN (Wi-Fi) to access the lower 6 GHz band.
Q. 54	**What existing license-exempt frequency bands will see the most evolution in the next five years?**
Comment	Several countries have allowed for license-exempt access to the entire 6 GHz band to deploy Wi-Fi 6E. This band is expected to face the most evolution in the near future, due to its propagation characteristics that make it suitable for the next generation of Wi-Fi, proximity to the existing 5 GHz license-exempt band as well as 5G applications. As more enterprises continue to take up 5G services, this band is likely to see unprecedented evolutions soon.

	While there are many innovations in Wi-Fi 6E, some of the more important ones are: • Orthogonal Frequency Division Multiple Access (OFDMA) effectively shares channels to increase network efficiency and lower latency for traffic in high-demand environments. • Multi-user MIMO allows more downlink data to be transferred at one time, enabling access points (APs) to concurrently handle more devices. • 160 MHz channel utilization capability increases bandwidth to deliver greater performance with low latency. • Target Wake Time (TWT) significantly improves network efficiency and device battery life, including IoT devices. • 1024QAM modulation increases throughput for emerging, bandwidth-intensive uses by encoding more data in the same amount of spectrum. • Transmit beamforming enables higher data rates at a given range to increase network capacity. • The IEEE 802.11 ax standard which forms the basis for Wi-Fi 6 and Wi-Fi 6E includes support and channelization from 5.925 to 7.125 GHz. • The IEEE 802.11ax standard also supports 8-stream MU-MIMO for both uplink and downlink, compared to the 4-stream, downlink only MU-MIMO of 802.11ac. • Wi-Fi 6 also fixes a problem with existing 2.4 / 5 GHz Wi-Fi of sometimes excessive management overhead. • The new technology supports 'Out of Band' discovery of networks, further reducing management overhead. • Strict scanning rules prevent unnecessary use of spectrum (e.g. only scans on a subset of the 6 GHz channels)
Q. 55	**How much spectrum, and in which bands, should be made available for license-exempt purposes (such as Wi-Fi) over the 5, 10 and 20 years? What would the costs of freeing up these bands for IMT be? What would the economic benefits of doing so be, in respect of increase consumer surplus, and increased producer surplus? Which vertical markets will require most secured licensed spectrum to overcome their current interference and congestion issues?**
Comment	According to the study by TAS, the economic value to South Africa of allocating 1200 MHz in 6 GHz Band for broadband services on a shared license-exempt access will be as follows by 2030[19];

[19] http://dynamicspectrumalliance.org/wp-content/uploads/2022/02/Assessing-the-economic-value-of-unlicensed-use-of-the-6GHz-band-in-South-Africa.pdf

	Total Contribution to GDP: $US 34.81 billion Producer Surplus: $US 13.32 billion Consumer Surplus: $US 9.63 billion Allocating the entire 6 GHz band to license-exempt use will result in economic impact increasing gradually over time, eventually reaching over 2.58% of GDP in 2030.
Q. 56	**How much spectrum, and in which bands, should be made available for dynamic spectrum access over the next 5, 10 and 20 years? What would the costs of freeing up these bands for IMT be? What would the economic benefits of doing so be, in respect of increase consumer surplus, and increased producer surplus?[20]**
Comment	**TVWS** In the next 5 years, a total of 216 MHz, in the 470 MHz – 694 MHz (excluding the Radio Astronomy sub-band 606 MHz to 614 MHz) should be made available for TVWS technology, that uses dynamic spectrum access mechanism. The cost of freeing up the band is embedded in the process of digital migration, which is ongoing, and expected to end in March 2022 after analogue switch-off. TVWS has the potential of offering affordable and stable internet connectivity to the rural underserved areas. Deploying more TVWS networks in the rural areas will accelerate digital inclusion. **IMT spectrum** IMT identified spectrum bands are suitable for sharing. Specific ranges could be made available using dynamic spectrum access according to the local need and international best practices (there are international examples in the 3.1-3.8 GHz and the 3.8-4.2 GHz ranges).
Q. 57	**What existing license-exempt frequency bands will see the most evolution in the next five years?**
Comment	See also response to Q 54 but there will be little evolution in the 2.4 GHz and/or 5 GHz frequency bands since the focus for license-exempt mid-band spectrum is on the 5925-7125 MHz band going forward. This is because the 2.4 GHz and 5 GHz bands do not have sufficient bandwidth available to allow for evolution.
Q. 58	**Are there any IoT applications that will have a large impact on the existing license-exempt bands? If so, what bands will see the most impact from these applications?**

Comment	According to the TAS 6 GHz Economic Impact Study for South Africa, the availability of the 6 GHz band for license-exempt use to deploy Wi-Fi networks in South Africa will see a wide deployment of IoT applications in the country, cumulatively resulting in a $US 8.28 billion contribution to GDP by 2030, and a producer surplus of $US 3.68 billion over the same period.
Q. 59	**Will the trend for offering carrier-grade or managed Wi-Fi services continue to increase over the next five years? If so, will this impact congestion in Wi-Fi bands and which bands would be most affected?**
Comment	As the need to accelerate digital inclusion grows, Wi-Fi has been found to be one of the technologies that will help to affordably connect many people to broadband services. Public Wi-Fi hotspots, Wi-Fi in schools, libraries, hospitals and many other application areas are gaining momentum day by day, making Wi-Fi one of the most preferred technologies to help in closing the existing digital divide in many countries, including South Africa. The trend of offering carrier-grade or managed Wi-Fi services is expected to continue growing, with emergence of next generation Wi-Fi technologies such as Wi-Fi6E. Since the 6 GHz band is needed for deployment of Wi-Fi6E, it is expected that this band will be most affected by the future developments and deployments of carrier-grade Wi-Fi services. Due to technologies such as IoT, and M2M communication, this band (6 GHz) is expected to suffer congestion is some years to come (just like the 2.4 GHz and 5GHz bands have), creating a need to identify more spectrum for Wi-Fi services.
Q. 60	**Are there specific frequency bands that will be in higher demand over the next 10 to 20 years and do you expect higher demands for spectrum in these frequency bands in South Africa? Are there any other frequency bands that should be considered for release in the next 10 to 20 years for commercial mobile, fixed, satellite, or licensed-exempt that are not discussed above? Provide motivations for your proposal.**
Comment	The Authority should ensure that there is sufficient amounts of low band, mid band and high band frequencies available for broadband services. This will cater for wide area coverage (low band frequencies below 1 GHz), a mixture of coverage and capacity (mid band frequencies between 1 GHz and around 11 GHz), and high-capacity networks (high band frequencies above 11 GHz). Additionally, the 60 GHz band (57-71 GHz) should be considered for license exempt use. If the Authority proceeds to make the 66-71 GHz band available for IMT as proposed in the draft National Radio Frequency Plan (NRFP) 2021, then the DSA recommends that the 57-66 GHz sub-band should be made available for license exempt use in line with ATU-R Recommendation 005-0[21].

[21] https://atuuat.africa/wp-content/uploads/2021/08/En_ATU-R-Recommendation-005-0.pd

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