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Attention
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PIP submission to Independent Communications Authority of South Africa's (ICASA) Inquiry into the Long-Term Spectrum Outlook in South Africa for Public Consultation

Introduction

Policy Impact Partners (PIP) is a global consultancy focused on connectivity and digital policy issues, with a particular focus on advocating policies and conducting analysis that promote the efficient utilization of radio frequency spectrum. PIP works on behalf of several companies in the Wi-Fi ecosystem to raise awareness of the importance of Wi-Fi connectivity and the need for a balanced regulatory approach between license-exempt and licensed spectrum to address the needs of all stakeholders involved. Since 2017, PIP, together with locally based consultants and client companies has been actively promoting spectrum sharing technologies and solutions including TV White Spaces, Tiered Spectrum Sharing/ Access and license-exempt access to the 6 GHz band to enable digital innovation that benefits South African citizens and industry. PIP therefore welcomes the invitation by the Independent Communications Authority of South Africa (ICASA) to provide a written representation to the Long-Term Spectrum Outlook inquiry for public consultation. In our response we provide some general comments and a completed template that answers the specific questions posed by the Authority.

We are available to participate in any further consultations with respect to this inquiry, including a public hearing.

General Comments

PIP strongly supports the intention of the Authority to conduct an inquiry into the Long-Term Spectrum Outlook for South Africa spanning between ten and twenty years. The consultation document contains an excellent analysis of the regulatory, technical, and economic factors, including relevant regional and international best practices.

PIP 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". Also, 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".

PIP strongly supports the principle of technology and service neutrality enabling access to spectrum in a timely manner to the benefit of South Africa's society and economy. There are increasing, competing demands for access to spectrum and, to be able to drive down costs of connectivity and stimulate innovation, we urge the Authority to implement a holistic spectrum regulatory framework that brings additional licensed and license-exempt spectrum into use to serve business and citizens.

Considering the 4th Industrial Revolution (4IR), spectrum sharing has become key to ensuring efficient utilization of the spectrum. Demand continues to increase, while the amount of available spectrum remains constant. This calls for innovative ways of using the scarce spectrum resource, such as sharing among several users or services, to ensure that there is sufficient radio frequency spectrum for important purposes such as universal access to broadband services, 5G and the future 6G applications.

We are pleased the Authority is addressing in its consultation how much spectrum, and in which bands, should be made available for license-exempt purposes (such as Wi-Fi). PIP highlights that 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. Further, there are 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 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. A Telecoms Advisory Services Economic Study conducted in 2021 demonstrated the value of Wi-Fi to the economic growth and societal development of South Africa, estimating 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[1]. These figures will only materialize if, as a minimum, the lower part of the 6 GHz band (5925 – 6425 MHz will be made available for license-exempt use.

[1] Wi-Fi Alliance 'Global Economic Value of Wi-Fi 2021-2025 '

Another recently published assessment of the economic value of unlicensed use of the 6 GHz band in South Africa, commissioned by the Dynamic Spectrum Alliance and conducted by Telecom Advisory Services, 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". This "amounts to US$57.76 billion, broken down by US$34.81 billion in GDP contribution, US$13.32 billion in producer surplus to South African enterprises, and US$9.63 billion in consumer surplus to the South African population.[2]"

To alleviate the Wi-Fi spectrum shortage, regulators around the world are now making all or part of the 6 GHz band (5925-7125 MHz) available on a license-exempt basis. The African Telecommunications Union (ATU) has recommended that African countries enable license-exempt technologies to operate in the lower 6 GHz band (5925-6425 MHz)[3]and 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). In other parts of the world, regulators are allowing license-exempt access to the entire 1200 MHz of the band, this includes The United States, South Korea, Brazil, Saudi Arabia, and Canada, among many others.

As the 6 GHz band already has a co-primary mobile allocation in the ITU Radio Regulations, no international action is needed, and administrations can immediately open the band for Wi-Fi use. Extensive technical studies[4] have shown that WAS/RLANs can operate in the lower 6 GHz band (5925-6425 MHz) without adversely impacting incumbents' operations. Timely adoption by the Authority of the ATU recommendation to enable license-exempt technologies to operate in the lower 6 GHz band (5925-6425 MHz) will help address the license-exempt spectrum shortfall and bring major socio-economic benefits to South Africa.

PIP also urges the Authority to consider opening up the upper 6 GHz (6425-7125 MHz) band for licence exempt WAS/RLAN use at its earliest convenience as latest generation Wi-Fi needs access to the full 1200 MHz in the 6 GHz band to support current and emerging innovative use cases. Opening only 500 MHz of the 6 GHz band would mean Wi-Fi networks in dense deployments would have to continue to employ small channel bandwidths (as only one 320 MHz channel would be available). With access to the full 1200 MHz, larger channel bandwidths of 160 MHz and especially 320 MHz could be more easily accommodated.

PIP respects the World Radiocommunications Conference 2019 decision to study coexistence between IMT and other incumbent services in the upper 6 GHz (6425-7125 MHz) band as part of WRC-23 agenda item 1.2. However, these studies should not delay opening the full 6 GHz (5925-7125 MHz) frequency range if administrations wish to do so. PIP does not believe an IMT

[2] Dynamic Spectrum Alliance 'Assessing the economic value of unlicensed use of the 6 GHz band in South Africa'
[3] https://www.atuuat.africa/wp-content/uploads/2021/08/En_ATU-R-Recommendation-005-0.pdf (page 84 - 92)
[4] 6 March 2020, CEPT Report 73

identification is needed in any part of the 6 GHz (5925-7125 MHz) frequency range as this would deny businesses and citizens the benefits of next generation WAS/RLAN technologies.

PIP, together with its industry partners, is conducting sharing studies to help 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 the Authority as soon as such a study is conducted for South Africa.

Similar work is ongoing in Europe with the decision by the ECC (Europe's Electronic Communications Committee) 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 upper 6 GHz (6425-7125 MHz) band. The responsible Spectrum Engineering Project Team (SE45) of CEPT has initiated the study at the beginning of March 2022, which should provide administrations with all the information they need to determine how best to harness this key tranche of spectrum. This work is likely to 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.

A full evidence base on license-exempt access to the 6 GHz band, containing policy reports, economic analysis and technical studies is available at www.6ghz.info.

We hope our contribution provides the Authority with additional information to ensure an appropriate regulatory and policy environment for the use of its high-demand and valuable spectrum resources. In the next section of this submission, we provide responses to some consultation questions that cover areas of expertise and interest to PIP and the industry partners we work with.

Specific Consultation Questions Addressed by PIP	
Q. 1	**Please comment on whether the above captures the relevant regulatory and policy aspects of long term spectrum planning.**
Comment	PIP 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[5] • Making the lower 6 GHz (5925-6425 MHz) band available for license-exempt use[6]. We also suggest that consideration is given to undertaking coexistence studies in the upper 6 GHz band between WAN/RLAN/Wi-Fi and incumbents.
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. PIP 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 the service without having to go through cumbersome regulatory processes and incur additional expenses. We also suggest further consideration is given to the joint role satellite communications and Wi-Fi can play in improving rural coverage and connectivity.

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

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

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	PIP, together with local South African partners Pygma Consulting, recently drafted a report analysing the suitability of so called 'Regulatory Sandboxes' for ICT regulation to address some critical shortcomings of mainstream regulation, which is more a consequence of the speed of digital innovation than of slow regulatory evolution. A Regulatory Sandbox framework allows live testing of new and innovative technologies, services and business models with less license compliance requirements, under the Authority's control and for a given period of time. After that period, the full license compliance requirements are enforced. PIP recommends that in the interest of consumer protection and bridging the digital divide, the Authority considers more experimental approaches to developing regulations for innovations that will require spectrum within the scope of this long-term outlook. This report is due for publication shortly after the deadline of this consultation and will be made available to the Authority.
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	**Wi-Fi 6E** 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[7]. 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 (targeting 2024) is expected to enable channels sizes of 320 MHz. For further information please visit www.6GHz.info.

[7] 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/

	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 – > [i]n 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[8]. 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. 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 bandwidth at 6 GHz to license-exempt technologies.

[8] 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

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[9]. 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, Cisco has a hospital customer 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, PIP urges the Authority to make available the unused spectrum licensed to the national mobile operators for shared access, using Tiered Spectrum Sharing Model (TSSM), also known as Tiered Spectrum Access (TSA)[10]. 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. TSSM is different from License Shared Access (LSA) in that new entrants in LSA typically use a different technology from the incumbents. PIP recommends that the Authority should use both LSA and TSSM, depending on the type of incumbents in the band.
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. Sharing mechanisms adopted globally for the 6 GHz band, i.e. Low Power Indoor (LPI) and Very Low Power (VLP) portable Wi-Fi, protect existing incumbent

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

[10] https://policyimpactpartners.com/wp-content/uploads/2019/10/Enhancing-Connectivity-Through-Spectrum-Sharing.pdf

	operations as well as future expansion. 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. The increased demand for commercial mobile will certainly lead to an increase in backhaul capacity but this will mainly be provided by fibre and FS bands in higher frequency bands like the 71-76 / 81-86 GHz bands as those can provide the required capacity and throughput. It is of course difficult to guess how that impact on demand will manifest itself in spectrum demand, but we urge the Authority to review this on an ongoing basis.
Q. 30	**What will impact on the demand for these services/applications in the coming 10-20 years? What is the realistic demand for these services in the next 10 to 20 years? Are there adequate spectrum allocations for Broadcasting services in South Africa?**
Comment	Over 50% of South Africa's 14.5 million households now receive television content via satellite, with MultiChoice's DStv having a total of 12.2 million subscribers in September 2021[11]. As this trend accelerates, less spectrum will be required for terrestrial television broadcasting.
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 carefully considered; harmonized globally to the greatest extent possible; and balanced noting the complexity in the design and implementation of databases. Regarding the 6 GHz band, there is little that needs to be done in the way of additional coexistence studies. Studies carried out within CEPT[12], 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 would likely be needed if the possibility of higher transmit powers outdoors, through Standard Power (SP) mode, for outdoors as well as indoor were to be considered and this future analysis might conclude that databases and / or registration schemes are preferable for these higher powers. It is important to carefully consider the future opportunity for outdoor Standard 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)

[11] https://www.news24.com/channel/tv/news/as-multichoice-keeps-losing-dstv-premium-subscribers-it-puts-premium-content-at-risk-20211113

[12] 6 March 2020, CEPT Report 73

	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. PIP 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 help in mitigating interference as more bands are made available for sharing. That said, AFC is not required for LPI and VLP 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 the reason for allocating the entire 6 GHz band to license-exempt use. Several companies have expressed interests 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 realizing the full benefits of the affordable high-capacity Internet connectivity delivered by Wi-Fi. Spectrum allocations should be sufficient to support both license-exempt and licensed technologies as they interact in important ways. As other frequency ranges are already allocated in mid-band for licensed 5G technologies, allocating the full 6 GHz band for license-exempt technologies will play an important role in ensuring a strong 5G future for all[13]. 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	PIP urges the Authority to conduct studies to determine the socio-economic value of using specific bands of interest. An example of such a study is one conduced by the Dynamic Spectrum Alliance (DSA) in collaboration with Telecom Advisory Services (TSA),

[13] http://dynamicspectrumalliance.org/wp-content/uploads/2021/08/6GHz-License-Exempt-Band-Why-1200-MHz-and-Why-Now.pdf

	that estimated the economic value of making the entire 6 GHz band available for license-exempt use in South Africa[14]. 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 amounts to US$57.76 billion, broken down by $34.81 billion in GDP contribution, $13.32 billion in producer surplus to South African enterprises, and $9.63 billion in consumer surplus to the South African population 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 a combination of Licensed Shared Access (LSA) and Tiered Spectrum Sharing Model (TSSM) in the licensed frequency bands. This will allow mobile broadband to be deployed by new entrants or other operators in non-mobile bands using LSA and in mobile bands using TSSM (as described in our response to question 14). TSSM can facilitate spectrum sharing between incumbent MNOs and new entrants, private networks or Community networks in the High Demand IMT spectrum bands. PIP 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	A number of countries have allowed for license-exempt access to the entire 6 GHz band to deploy Wi-Fi 6E today and Wi-Fi7 in near future. A good example is the USA. 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

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

	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 increased consumer surplus, and increased producer surplus? Which vertical markets will require most secured licensed spectrum to overcome their current interference and congestion issues?**
Comment	PIP advocates for the full 1200 MHz of spectrum in the 6 GHz (5925-7125 MHz) band to be made available for license-exempt use. Since the band is to be made available on a license-exempt basis, there is no cost implication attached to freeing the band. 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[15]; Contribution to GDP: $34.81 billion

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

	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 increased consumer surplus, and increased producer surplus?**[16]
Comment	**IMT spectrum** All IMT identified spectrum bands should be made available for sharing, either by TSSM or dynamically using a geolocation database.
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. With this in mind, 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-Fi 6E. Since the 6 GHz band has already been identified to be

	ideal for deployment of Wi-Fi 6E, it is expected that this band will be most affected by the future developments and deployments of carrier-grade Wi-Fi services. Due to applications such as IoT, and M2M communication, this band (6 GHz) is expected to suffer congestion in some years to come (just like the 2.4 GHz and 5 GHz bands have), creating a need to identify more spectrum for Wi-Fi services.

Yours sincerely

MORTIMER HOPE

Associate Director and Africa Lead

Policy Impact Partners