26 APRIL 2022

Vodacom's Supplementary Submission on the Draft Consultation Document on Spectrum Outlook.

1. TECHNOLOGY NEUTRALITY

In section 2.1 of Vodacom's submission, the following statement was erroneously typed and needs to be corrected as follows:

"Vodacom promotes ~~**net**~~ **technology** neutrality as well but does not support arbitrary service migration for different service classes by operators within the industry."

2. 6 GHZ BAND

During Vodacom's presentation, the Authority queried if Vodacom was aware of additional studies that could support the view of assigning the full 6GHz band (5925MHz to 7125MHz) to IMT. We expect that the following analysis, based on formal studies and/or research may be helpful to the Authority.

Importance of Mid-Band Spectrum

Mid-band spectrum will play a crucial role in delivering 5G services and meeting the ITU-R IMT 2020 vision of having a user experience of 100 Mbps in the downlink and 50 Mbps in the uplink, as previously explained in Vodacom's submission. According to Coleago Consulting and the GSMA, at least 2 GHz of mid-band spectrum will be required to meet this user experience, noting that this study was completed a year ago, and the growing demand for IMT services post the onset of the COVID-19 has permanently shifted the baseline demand for data, especially mobile data at home. Further evidence to support this is provided in the Windsor Place Consulting study quoted later in this submission.

According to the GSMA[1], 5G is expected to yield US$960bn in additional GDP value add to the global economy - approximately 0.70% of forecast global GDP, by 2030. The mid-band 5G contribution will represent US$610bn uplift to global GDP in 2030 – or 65% of total 5G benefits as illustrated below.

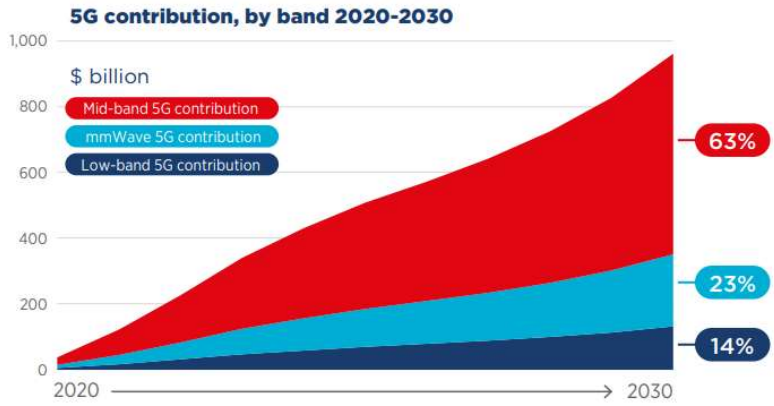


Figure 1: 5G Contribution by Band from 2020-2030

While the above are global trends, South Africa must be expected to follow a similar trajectory in terms of economic value from 5G, given that our 5G growth curve (albeit coming off a low base due to historical spectrum disadvantages) falls generally in line with the global 5G growth curve.

According to Ericsson on 5G market adoption in Sub-Saharan Africa (SSA)[2], South Africa is the leading market in SSA, so it will have more than 10% (Sub-Saharan average) of 5G subscriptions by 2027. This

[1] https://www.gsma.com/spectrum/wp-content/uploads/2022/02/mid-band-5G-spectrum-benefits-middle-east-north-africa-1.pdf

[2] https://www.itweb.co.za/content/8OKdWqDYW9ovbznQ

sentiment is shared by Africa Analysis[3], who expects that there will be 11 million 5G subscriptions by 2025 with 43% of population coverage. It is clear that South Africa leads other Sub-Saharan Africa countries in regard to mobile broadband demand projections, as highlighted during Vodacom's submission as well as supported by international vendors.

Therefore, it is crucial that enough mid-band spectrum is made available in order for operators to maximize the benefits capable of being delivered by 5G.

Performance of the 6 GHz Band

At the 6th Sub Sahara Spectrum Management Conference 2021, Huawei presented the results of preliminary testing they have completed using the 6 GHz band[4]. From their testing, it can be seen below that the effective coverage of the 6 GHz band, using advanced techniques, is very similar to that of the 3.5 GHz band.

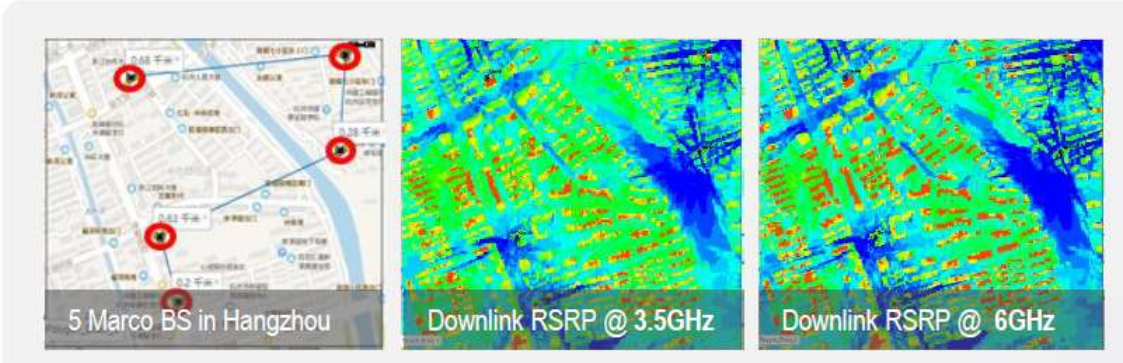


Figure 2: RSRP Coverage of 3.5 GHz vs. 6 GHz Band

In addition, the capacity provided by the band will be 2 to 4 times greater than that of the 3.5 GHz band due to the larger bandwidth available in the 6GHz band (100 MHz in 3.5 GHz band vs. 200 to 400 MHz in the 6 GHz band). As illustrated below, using the same total radiated power (TRP) and bandwidth between 3.5 & 6 GHz band, the 6 GHz band showed a 15% throughput gain when compared to the 3.5 GHz band on the same drive test route.

[3] https://www.rcrwireless.com/20210223/5g/south-africa-reach-11-million-5g-subscribers-2025-consultancy
[4] https://www.youtube.com/watch?v=NMVGhwt-omE&list=PL-w3m3Fi4ZVkqHJ9xU9NqpjVREfgFQ13j&index=10

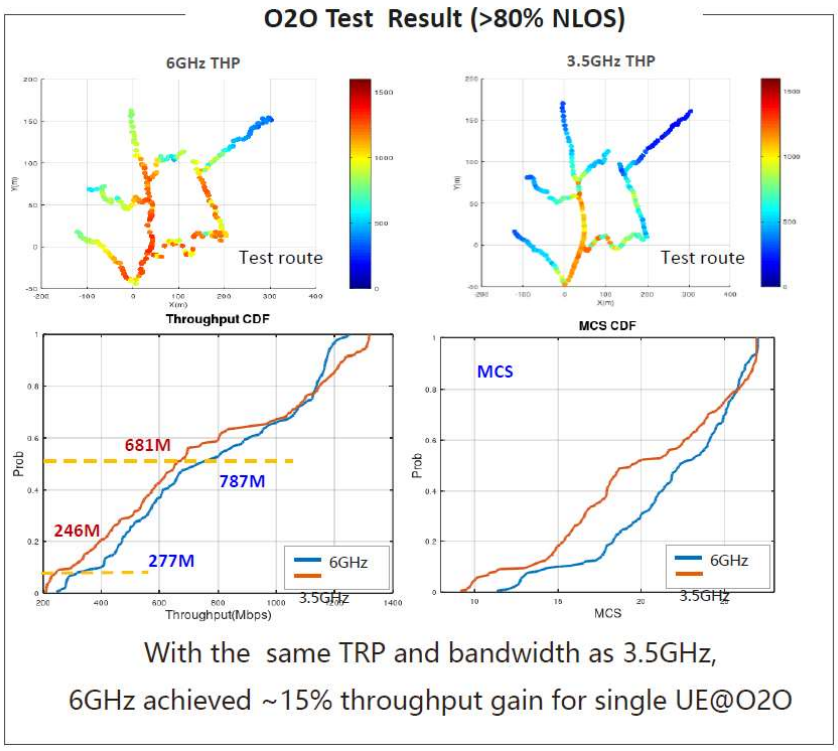


Figure 3: Throughput CDF of an Outdoor to Outdoor (O2O) Test using the 3.5 GHz vs. 6 GHz bands

This is highly beneficial as MNO can use their 3.5 GHz network footprint and overlay the 6 GHz to provide similar coverage and greater capacity. The cost of deployment of the 6 GHz band will therefore be similar to that of a 3.5 GHz deployment which is much lower when compared to a mmWave deployment as MNOs can potentially use their existing footprint and minimising the need to densify the network, as the effective coverage footprint is similar. In addition, for high density areas, where grid density is flexible, such as stadiums and shopping malls, the 6GHz band provides somewhat unique capacity advantages, allowing for a capacity to be focussed where it is needed the most.

This view is further supported by Analysys Mason[5],and a total of 23 telecom operators, vendors, and industry organizations who are in support of the band to be identified for IMT usage.

Figure 4: 23 Operators, Vendors and Industry Organizations in Support of the 6 GHz band for IMT

Socio-Economic Benefits of the 6 GHz Band

[5] https://www.analysysmason.com/contentassets/2a36d000895f4700a2273d3bfee449bf/discussion-on-the-6-ghz-opportunity-for-imt.pdf

The GSMA has released a study on the socio-economic benefits of the 6 GHz for 12 countries[6] (while South Africa was not specifically included, there are other analogous emerging markets included in the study that provide useful proxies for the potential benefits for South Africa). 3 scenarios were modelled, namely:

a) Scenario 1 licenses the entire 5925 – 7125 MHz range for IMT.

b) Scenario 2 keeps the entire 5925 – 7125 MHz range as unlicensed (or license exempt).

c) Scenario 3 licenses 6425 – 7125 MHz and keeps 5925 – 6425 MHz unlicensed (or license exempt).

Before diving into the economic value that the band can provide, an important set of results were presented regarding the effect of user experience and the supply vs. demand of Wi-Fi's capacity for this band.

According to the GSMA, the average 5G download speeds during peak times was modelled and is illustrated below for the 3 different scenarios. With the lack of 6 GHz spectrum, it will be challenging to obtain a 100 Mbps downlink user experience during peak times. While the average speed of 100 Mbps will be achievable, should no 6 GHz spectrum be made available for IMT, the peak hour user experience will degrade significantly.

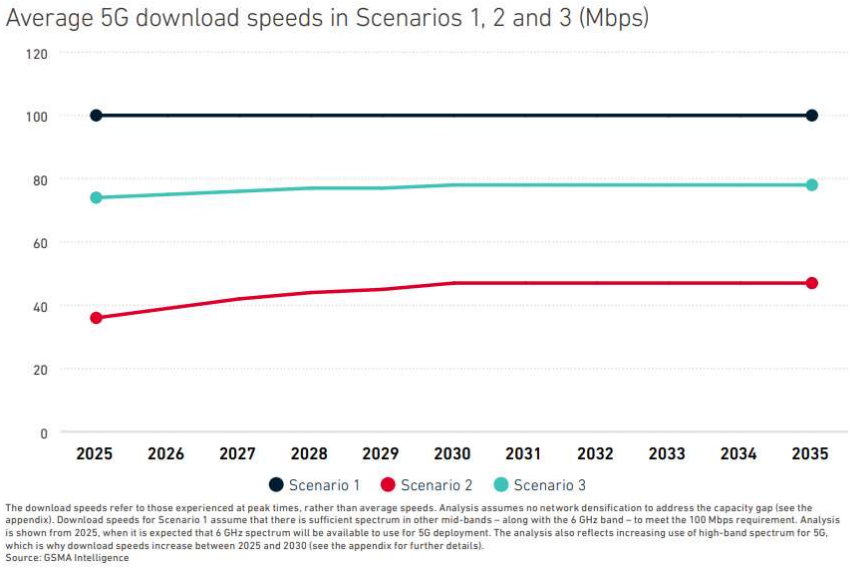
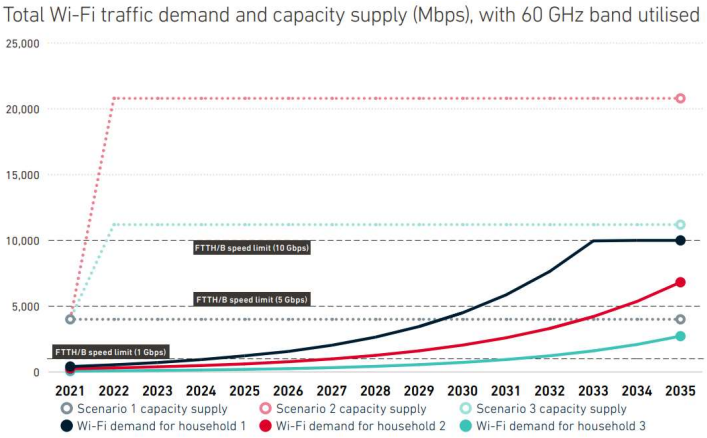


Figure 5: Average 5G Download Speeds for the 3 Different Scenarios

The next section discusses the Wi-Fi capacity supply vs. the Wi-Fi traffic demand. The chart below displays the following:

- The dotted coloured lines represent the Wi-Fi capacity supply with each colour representing the different scenarios.
- The solid coloured lines represent the Wi-Fi traffic demand for household 1, 2 and 3 whereby household 1 represent 11 connected devices, household represents 6 connected devices and household 3 represents 3 connected devices.
- The dotted grey lines represent the speed limit on FTTH/B packages

[6] https://data.gsmaintelligence.com/api-web/v2/research-file-download?id=69042233&file=310121-The-socioeconomic-benefits-of-the-6-GHz-band.pdf



- Figure 6: Wi-Fi Traffic Demand vs. Supply with 60 GHz Band

Considering the above, the following conclusions can be drawn:

- There is no need to allocate the entire 6 GHz band to Wi-Fi as the demand does not come anywhere near the supply, as the limiting factor will be the maximum FTTH/B speed provided.
- If FTTH/B provides a maximum user speed of 1 Gbps over the period, then household demand will not surpass the currently available spectrum capacity for Wi-Fi, even without any new/additional spectrum in the 6 GHz band.
- If FTTH/B provides a maximum user speed of 10 Gbps over the period to all households, then a capacity crunch without any spectrum assigned to unlicensed (scenario 1) will depend on the level of household traffic.
- If FTTH/B provides a maximum user speed of 10 Gbps over the period to all households, there are no capacity crunches if 500 MHz is assigned to unlicensed use (scenario 3).

The next section looks at the GDP contribution of the 3 different scenarios. Before looking at the GDP impact of the different scenarios, it is important to note that the adoption of fixed broadband in the 12 countries studied varies vastly, as illustrated below. Based on ICASA's State of the ICT Sector Report, South Africa is a country with very low Fixed Broadband adoption and very high Mobile Broadband adoption. Therefore, it won't be fair to compare the results of a country with high fixed broadband penetration to South Africa.

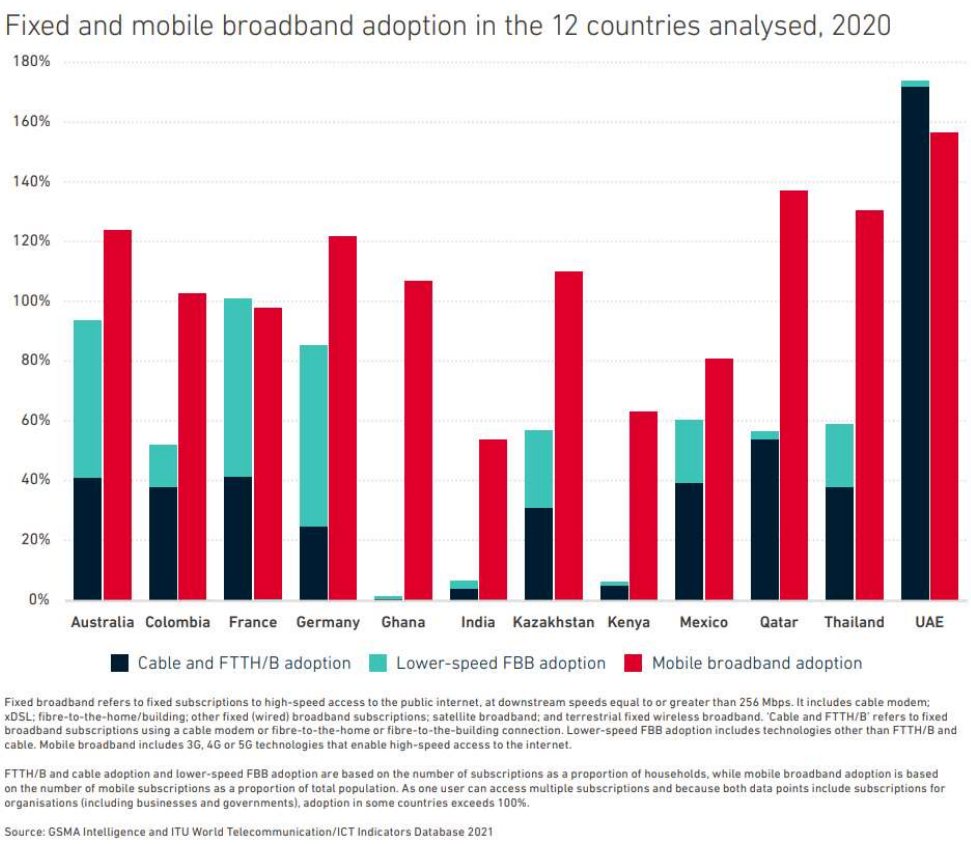


Figure 7: Fixed and Mobile Broadband Adoption in the 12 Countries

Figure 8: Summary of Economic Benefits of the 6 GHz Band

The illustration above highlights the GDP contribution (on the vertical axis) of the 6 GHz band for the 3 different licensing scenarios (the coloured circles) based on different maximum FTTH/B user experience provided and on whether the 60 GHz band is available for traffic offload for each of the 12 countries studied. Since the 60 GHz band has been allocated to Multiple GIGABIT wireless systems WAS/RLAN services in South Africa in the National Radio Frequency Plan 2021, the last 2 scenarios are irrelevant, as they assume there is no offload to the 60 GHz band. Currently, in South Africa, the fastest FTTH/B speeds is just under 1 Gbps under ideal conditions, with the average speed being much lower at 54.75Mbps[7]. The world average FTTH/B speed is currently at 72.67 Mbps with the fastest real-world speed being 261.82 Mbps from Monaco[8]. While this is a long-term outlook, and the possibility of FTTH/B packages reaching up to 5 Gbps in South Africa appears possible in future, it is highly unlikely that 10 Gbps will be available to every household in the near future and therefore we can for now disregard the analysis of the 3rd and final infographic from above as well. The above results can be summarized as follows:

- **Scenario 1 (full band licensed to IMT) will deliver the largest benefits across all countries if fixed broadband technologies do not provide maximum user speeds above 5 Gbps**. Based on existing spectrum availability, spectrum will not be a bottleneck for Wi-Fi unless fixed broadband offers speeds that can exceed at least 5 Gbps to all FTTH/B and cable users. This is because there is already sufficient capacity with existing unlicensed spectrum.
- **Scenario 2 (full band assigned to unlicensed) was not found to be the most beneficial allocation in any of the considered analyses**. Even in countries with very high Wi-Fi demand, and if fixed broadband speeds did someday reach 10 Gbps, it is assumed that there is substantial use of the 60GHz band to satisfy WiFi demand.

The GSMA has advised Vodacom that their socio-economic benefits of the 6 GHz study will have a phase 2 report released in mid-May which will include an analysis for South Africa in it. The Authority should review the new study once it is released to see the impact the 3 licensing scenarios will have on South Africa in terms of the GDP uplift.

A study titled "5G Versus Wi-Fi: Challenges for Economic, Spectrum, and Security Policy", which was conducted for the USA, and published in the Journal of Information Policy, 2021, Vol. 11 (2021), pp. 523-561[9] highlights a number of significant points to consider when considering the band for 5G vs. Wi-Fi. The important points of the study are listed below:

- The FCC has been recognized for many improvements in spectrum allocations, notably the use of auctions, as the 2020 Nobel Prize in economics underscores.
- The article explores the role of institutional entrepreneurship to suggest that the FCC's spectrum decisions are not necessarily a straightforward comparison of the cost and benefits of the technologies. Therefore, the rest of the world should be cautious when interpreting the FCC decisions on the 6GHz band, as it was not based on economic upliftment of IMT in this band, nor the benefit the technology could bring to the nation.
- The value of the C-Band auction allocated for 5G and the unlicensed spectrum in the 6 GHz band for Wi-Fi is tabulated below.

[7] https://mybroadband.co.za/news/fibre/388548-highest-home-broadband-speeds-in-south-africa.html
[8] https://worldpopulationreview.com/country-rankings/internet-speeds-by-country
[9] https://www.jstor.org/stable/pdf/10.5325/jinfopoli.11.2021.0523.pdf

	Amount of Spectrum (MHz)	Auction Proceeds	Value to Economy Once Deployed	Value per MHz
5G @ 3.7 GHz (C-Band)	280	$94 billion ($13 billion in clearing costs, and $81 billion in net proceeds)	**$191.80 billion** (based on Sosa $174 billion, prorated for 280 MHz over six years)	0.5871
Wi-Fi @ 6 GHz	1,200	$0	**$153.76 billion** (based on Katz $83.06 billion to gross domestic product (GDP), $67.78 billion in producer surplus; $2.92 billion in consumer surplus over six years)	0.128

- The value per MHz above for 5G does not include the auction proceeds, yet it is still 4.5 times greater than for Wi-Fi. In fact, the net auction proceeds of the C-band equal 53% of the total economic value of Wi-Fi projected for 6 GHz. Comparing the proceedings in these economic terms, auctions for spectrum rights are superior to unlicensed designations and suggests that the FCC was short-sighted to reject the proposal to halve the 6 GHz band into licensed and unlicensed portions. Before taking on additional efforts to share spectrum and make more grants for unlicensed spectrum, policymakers should revisit the opportunity cost assumptions of these efforts.
- The FCC should reconsider the social cost of its 6 GHz proceeding, and lost revenue of leaving the band to unlicensed use. If the FCC cannot conduct an auction for the 6 GHz band, it should consider requiring a fee for its use, a common spectrum instrument used across developed countries.

Another study, titled Optimising IMT and Wi-Fi mid-band spectrum allocations: The compelling case for 6 GHz band partitioning in Asia-Pacific prepared by Windsor Place Consulting[10] further highlights the following:

- The following has been extracted to highlight that faster broadband services (especially 5G) means reduced Wi-Fi offload

[10] https://www.mcmc.gov.my/skmmgovmy/media/Spectrum-File/23b_WPC.pdf

There is one issue to explore in some depth given the inter-relationship with the 6 GHz band. Both globally and regionally in Asia-Pacific, there is strong evidence that fast broadband services especially 5G results in consumers utilising Wi-Fi less, thus resulting in reduced Wi-Fi offload. In its recent paper, entitled *Quantifying the impact of 5G and COVID-19 on Mobile Data Consumption,* Opensignal concluded that:

> *"**A faster, better, 5G experience encourages more cellular usage**: In the past, mobile users relied on Wifi and only used cellular connections when Wifi was not available. **With high quality 5G, mobile users will rely on their cellular connection more of the time which increases cellular mobile data usage. Opensignal has already seen a marked speed advantage for 5G over public Wifi.** Already, Apple offers options for 5G users to set their iPhone to use more data on 5G automatically, rather than restricting cellular mobile data use to be different to Wifi because of 5G's quality. Also, a faster 5G experience makes cellular more viable for users to tether devices to their smartphone and share the cellular connection."*[48] [Our emphasis]

This is view shared by tefficient in its 2020 review of 105 global operators which it tracks. It found that the data usage per SIM basically grew for all operators and across those operators there was a global growth in mobile data traffic of 38 percent from 2019. tefficient considered this growth actually quite remarkable given the pandemic. It also stated that:

> *"The narrative that no mobile data would be used when people stay at home (and on Wi-Fi) didn't prove right".*[49]

- MNOs in South Korea, which are early regional 5G adopters, have found that there is decreasing Wi-Fi offload to the MNO's Wi-Fi networks notwithstanding that there is significant growth in wireless traffic.

Period	Delivery by IMT services (TB)	IMT as a proportion of total data traffic	Delivery by Wi-Fi (TB)	Wi-Fi as a proportion of total data traffic	Total wireless data (TB)
Dec-15	175,103	92.6%	10,430	5.6%	185,533
Dec-16	254,639	94.2%	12,952	4.8%	267,591
Dec-17	315,152	95.3%	14,495	4.4%	329,647
Dec-18	404,656	96.4%	15,099	3.6%	419,755
Jun-19	479,414	96.9%	15,552	3.1%	494,966
Dec-19	568,375	97.4%	15,110	2.6%	583,485
Jun-20	603,612	97.9%	13,025	2.1%	616,637
Dec-20	701,529	98.5%	10,408	1.5%	711,937
Jun-21	780,662	98.4%	13,051	1.6%	793,713
Jul-21	786,729	98.6%	11,306	1.4%	798,035

Source: Korean Ministry of Science and Technology (MSIT), August 2021.[50] Excludes Wi-Bro traffic 2015 to 2018. IMT services includes 2G, 3G, 4G and 5G as applicable

Figure 9: Decreasing Wi-Fi offload to MNO's Wi-Fi networks in South Korea

- Allocation of 1.2 GHz of prime spectrum to Wi-Fi is not supported by demand analysis. It is important to highlight that IEEE 802.11 compliant products normally sold under the Wi-Fi brand currently occupy, with some market exceptions up to 650 MHz of spectrum (not including other unlicensed spectrum in the 900 MHz, 3.5 GHz, 4.9 GHz and 60 GHz ranges depending on the market). The limit on Wi-Fi speeds in the home and smaller premises is the fixed broadband network speeds not Wi-Fi itself.

Based on the above study, if Asia Pacific markets are limited by fixed broadband speeds, which are supposed to be more mature networks compared with South Africa's fixed networks, there is no need to assign the 6 GHz band to Wi-Fi. The current Wi-Fi allocation in South Africa is being inefficiently used. If allocated to Wi-Fi, and the spectrum is to be used to generate a Mobile hotspot, the data traffic will be backhauled over the scarcer Mobile network's spectrum. Therefore, it would mean that there is duplicate use of spectrum in that

traffic would be carried over the operator's spectrum while the Wi-Fi spectrum will merely act as a relay to the local network. This will be inefficient use of the spectrum resource.

3. BROADCASTING NUMBERS

To further supplement Vodacom's response to section 2.30, the following should be noted. In the recent judgement for the matter between ETV and others vs. the Minister of DCDT and others[11] , Paragraph 46 states the following.

"According to Stats SA there are 14 million TV owning households in South Africa. 10.5 million self-migrated and 3.5 million are the qualifying households. The 10.5 million is made of: -

- DSTV 7.8 million
- Open View HD 2.3 million
- Starsat 450 000."

It is clear from these numbers that the majority of households have self-migrated from analogue broadcasting. While the broadcasters have claimed that additional spectrum will be required as they project an increase in viewership, based on the declining numbers, it may be irrational for ICASA to look at the broadcaster projections without looking at the current trend of terrestrial broadcasting locally.

Noting that some regional regulators in SADC have commented on DTT substitution in their markets, it may assist the Authority to engage with the other regulators to assess the extent of the substitution (satellite, OTT, etc.)

In the absence of further information on broadcasting demand, it may be prudent for the Authority to currently assign the current DTT MUXs in such a manner (i.e. below 603MHz) that will allow for flexible use of the 600MHz band in future (either IMT or broadcast), giving the Authority time to conduct further research into broadcasting demand, but crucially, not locking South Africa into a particular decision before the Authority has had time to thoroughly consider the most recent trend data.

[11] https://www.ellipsis.co.za/wp-content/uploads/2022/03/etv-and-others-v-Minister-of-Communications-and-Digital-Technologies-and-others-28-March-2022-Case-Number-51159_2021.pdf