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HOW TO REALISE THE FULL POTENTIAL OF 6 GHZ SPECTRUM

A White Paper

OCTOBER 2020

EXECUTIVE SUMMARY

We are at a pivotal moment for the future of Wi-Fi, a major driver of economic growth and societal development. As Wi-Fi has limited access to suitable mid-band spectrum, there is an urgent need to open up the 6 GHz band on a licence-exempt basis.

Focused on Europe, Middle East and Africa (ITU Region 1), this paper explains the importance of enabling licence-exempt access to the lower 6 GHz band (5925-6425 MHz) and the upper 6 GHz band (6425-7125 MHz) in a timely manner. It also outlines why identifying the upper 6 GHz band for international mobile telecommunications (IMT) at the next World Radiocommunication Conference (WRC-23) would make it difficult for countries to realise the full potential of this spectrum.

Widespread access to high quality broadband is essential to help the world recover from the COVID-19 pandemic. To that end, policymakers need to ensure that both licensed and licence-exempt wireless technologies have access to the spectrum they need. Investors in connectivity infrastructure are looking for the flexibility to use the technology best suited to specific use cases and local factors.

Experience around the world suggests the 1800 MHz and 2600 MHz spectrum bands are well suited to 4G, while the international-harmonised 3400-3800 MHz band[1] can provide capacity for 5G. Lower frequency bands will also be necessary to cost-effectively use IMT technologies to extend broadband coverage into rural areas.

In future, 4G and 5G must be supported by high quality Wi-Fi – the distribution mechanism of choice for broadband connectivity indoors and in numerous hotspots. As a very cost-effective technology, Wi-Fi is widely used to connect a broad variety of devices, including mobile phones, tablets, televisions, cameras, and speakers. Any Wi-Fi bottleneck means consumers experience reduced data speeds, curbing the value of the underlying broadband.

Mobile 5G networks and Wi-Fi 6 will work together to support a wide range of compelling new applications and services. For example, a 5G smartphone could connect to an augmented reality (AR) or virtual reality (VR) headset using Wi-Fi 6, giving people access to immersive entertainment, educational, e-Health and industrial applications, improving training, accelerating product design, and enabling new business models. Countries that have opted for a rapid deployment of 5G, such as South Korea and the US, recognise the need to allow licence-exempt access to the entire 6 GHz (5925-7125 MHz) band.

NEXT STEPS

In Europe, the immediate priority is the timely adoption in Q1 2021 of the EC Decision on licence-exempt access to the lower 6 GHz band and expediting its implementation at a national level. In order for Europe to alleviate congestion in existing licence-exempt spectrum and to benefit from the latest Wi-Fi technology (Wi-Fi 6E), national regulations need to be published as soon as possible after the publication of the EC Decision as Wi-Fi 6E products are likely to be available by the end of 2020.

Similarly, in the Middle East and Africa, administrations should consider initiating national consultations on licence-exempt access to the 6 GHz band. Ideally, all countries and all regions should ultimately enable licence-exempt access to the entire 1200 MHz in the 6 GHz band. This harmonisation would result in major economies of scale, reducing costs for end-users and allowing people all over the world to benefit from innovative new services that harness the capabilities of Wi-Fi 6E.

[1] 3400-3800 MHz has much better coverage propagation characteristics than 6 GHz.

THE PIVOTAL ROLE OF WI-FI

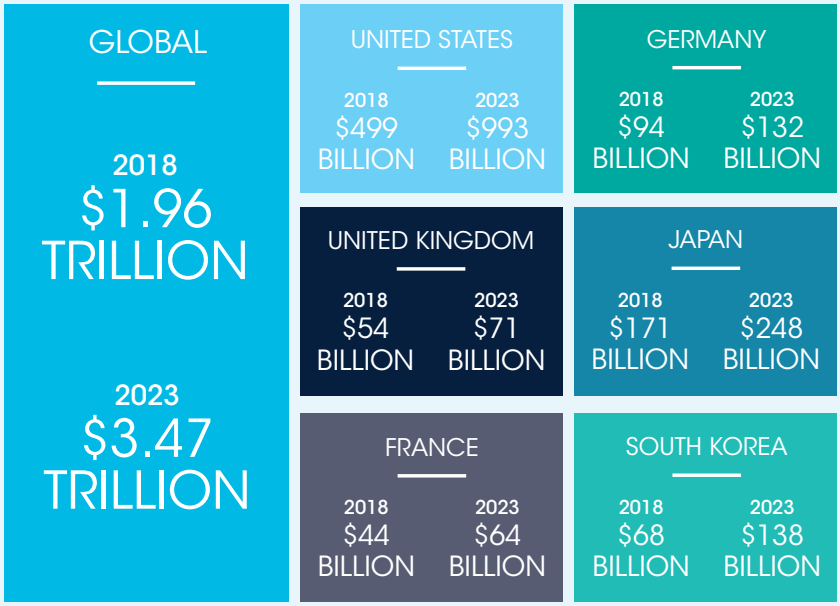
BOLSTERING THE ECONOMY AND SOCIETY

As a major enabler of connectivity in the home, at work, and in public spaces, Wi-Fi is fuelling economic growth and societal development. Wi-Fi contributes to GDP by providing low-cost, high-speed broadband access, helping to bridge the digital divide and supporting the digital economy, allowing organisations to deliver digital services that benefit citizens and fuel economic growth.

For individual citizens, Wi-Fi is often the most cost-effective way to get online, enabling extensive use of Internet-based applications and services without incurring the hefty connectivity charges associated with cellular contracts. Low-cost reliable connectivity makes citizens more productive. The Federal Communications Commission in the US recently noted that Wi-Fi "become indispensable for providing low-cost connectivity in countless products."[2]

Already huge, the value of Wi-Fi to the economy and society will continue to rise as next generation products and deployments are introduced (see Figure 1). Wi-Fi delivered global value of US$1.96 trillion in 2018, a figure that is set to rise to US$3.47 trillion in 2023, according to Telecom Advisory Services.[3]

FIGURE 1: VALUE OF WI-FI – GLOBAL ESTIMATE AND SELECT MARKETS



Source: Telecom Advisory Services

[2] Source: https://docs.fcc.gov/public/attachments/DOC-363490A1.pdf

[3] Source: https://www.wi-fi.org/news-events/newsroom/wi-fi-global-economic-value-reaches-196-trillion-in-2018

ECONOMIC IMPACT IN EUROPE

With fixed broadband widely available across Europe, Wi-Fi plays a central role in enabling Europeans to get online at work, at home, and while travelling. In so doing, it generates enormous economic value. For example, Wi-Fi contributed US$94 billion to the German economy in 2018, a figure that could climb to US$132 billion in 2023, according to Telecom Advisory Services. The equivalent figures for France are US$44 billion and US$64 billion respectively.

ECONOMIC IMPACT IN THE MIDDLE EAST

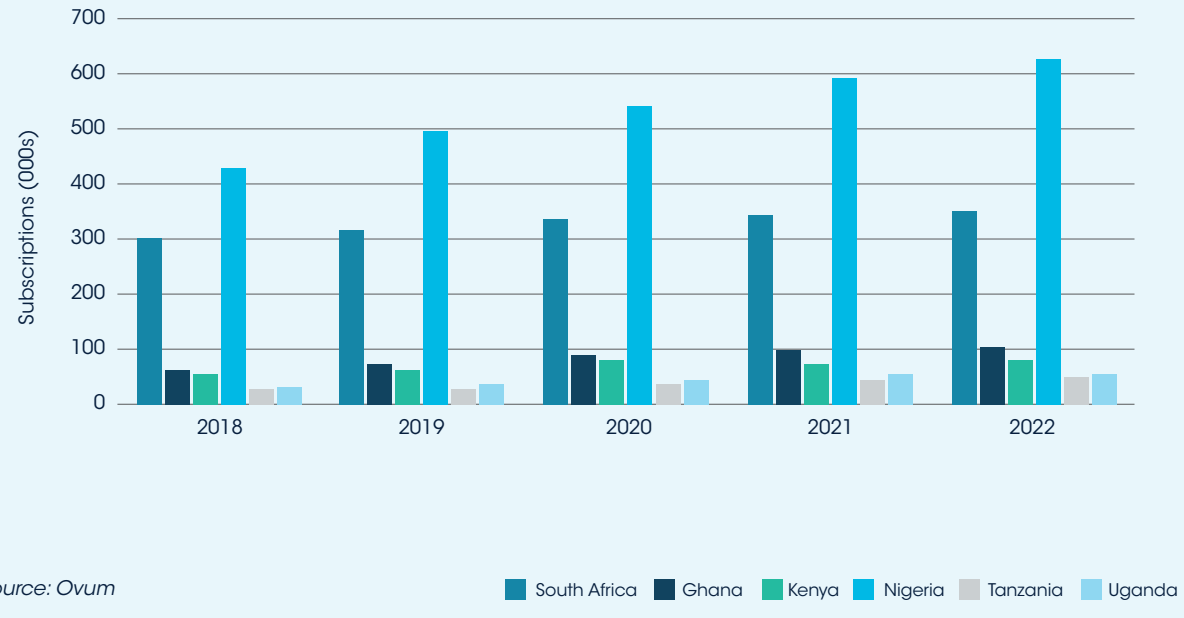
Although fixed broadband penetration varies significantly across the Middle East, it is growing in most Arab countries. Consequently, Wi-Fi is playing an increasingly important role in delivering connectivity. Wi-Fi could generate almost US$12 billion of value in Saudi Arabia by 2023 and US$10 billion of value in the United Arab Emirates in the same year, based on an extrapolation of the methodology used by Telecom Advisory Services to estimate the value of Wi-Fi in the markets shown in Figure 1.[4]

ECONOMIC IMPACT IN AFRICA

In Africa, fixed broadband penetration tends to be low, particularly in the residential sector: Research firm Check Point estimates fixed broadband penetration in Africa is just 3.45%.

But businesses in Africa are making extensive use of Wi-Fi to keep their employees connected and to monitor their operations. That trend is set to continue as adoption of fixed broadband services rises. Research firm Ovum forecasts[5] that the number of fixed broadband subscriptions in Sub-Saharan Africa will increase from 6.6 million in 2018 to 17 million in 2023, with enterprise fixed broadband subscriptions rising at a CAGR of 7.3% between 2018 and 2022 (see Figure 2).

FIGURE 2: ENTERPRISE FIXED BROADBAND SUBSCRIPTIONS ARE RISING STEADILY



Source: Ovum

[4] Source: PIP analysis based on the methodology used by Telecom Advisory Services in its 2018 paper

[5] Source: https://www.omdia.com/~/media/informa-shop-window/tmt/whitepapers-and-pr/fixed-wireless-access-drives-broadband-development-in-sub-saharan-africa.pdf

That growth is likely to continue throughout the decade: the number of fixed broadband connections in the Middle East and Africa is set to grow by 69% between 2019 and 2030, according to research firm Check Point, making it the fastest growing region in the world (see Figure 3). Check Point anticipates the number of fixed broadband connections in South Africa, for example, will grow 128% between 2019 and 2030.

The economic value generated by Wi-Fi in Africa will rise as fixed broadband connectivity spreads.

FIGURE 3: PREDICTED GROWTH IN FIXED BROADBAND SUBSCRIBERS BY REGION

REGION	PREDICTED GROWTH, 2019-2030
Middle East and Africa	69%
Latin America	48%
South and East Asia	26%
Asia-Pacific	24%
Eastern Europe	22%
North America	16%
Western Europe	12%
World	33%

Source: Check Point

WI-FI – CRITICAL FOR 4G AND 5G

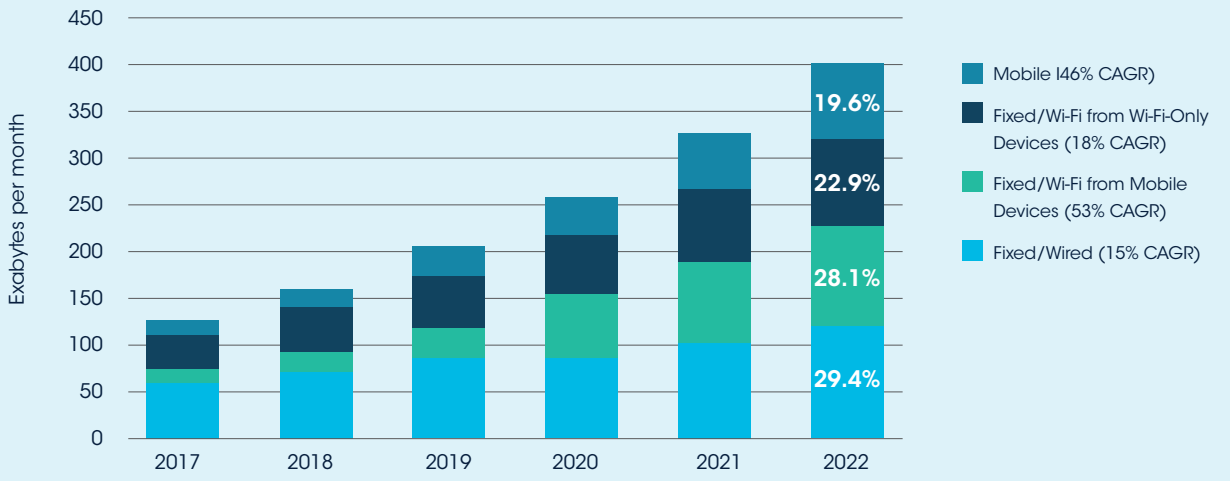
In Europe, Wi-Fi traffic now accounts for more than half of the total IP traffic (fixed and mobile). Globally, Wi-Fi will carry 51% of total IP traffic by 2022, compared with 29% on wired connections and 20% on mobile connections, according to Cisco (see Figure 4),[6] which also estimates that there will be nearly 628 million public Wi-Fi hotspots worldwide by 2023, up from 169 million hotspots in 2018.

Wi-Fi is key to 4G and 5G connectivity: Cisco estimates Wi-Fi supports the offload of 54% of mobile data traffic and this is set to grow to 71% with 5G (see Figure 5). Without the ability to offload traffic to Wi-Fi, 4G and 5G networks are more expensive and potentially less efficient. In the absence of Wi-Fi hotspots, mobile operators would need to invest more in network densification to meet user demand, deploying many more small cells in dense urban areas to offer high-speed throughput. As a result, services would become less affordable for end users.

As a licence-exempt technology offering very low barriers to entry, Wi-Fi serves as a platform for the creation of innovative business models that underpin unique services, while expanding access to communication services for mobile, fixed, and satellite networks through Wi-Fi hotspots.

[6] Source: https://newsroom.cisco.com/press-release-content?articleId=1967403

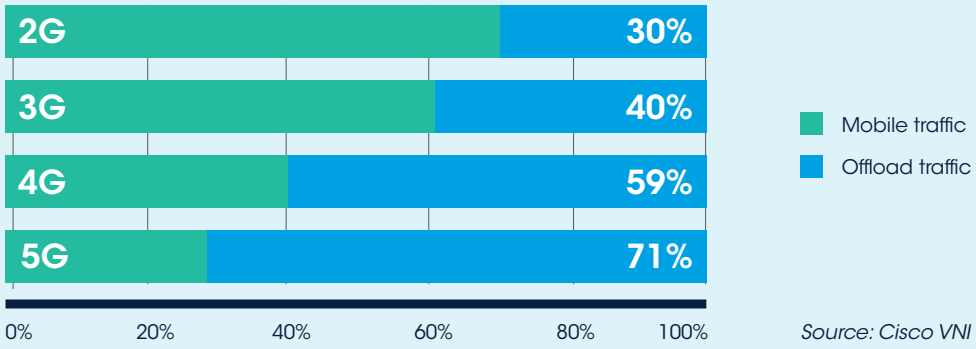
FIGURE 4: GLOBAL IP TRAFFIC, WIRED AND WIRELESS



** Wireless traffic includes Wi-Fi and mobile*

Source: Cisco VNI Global IP Traffic Forecast, 2017–2022

FIGURE 5: MORE THAN 70% OF 5G TRAFFIC WILL BE OFFLOADED TO WI-FI



Source: Cisco VNI

PANDEMIC RESILIENCE AND RECOVERY

In the wake of the COVID-19 pandemic, citizens, businesses and governments are relying heavily on Wi-Fi to remain connected with colleagues, teachers, healthcare professionals, and other vital services. In many places, in-home Wi-Fi has empowered a remote workforce to keep businesses operating and children connected to their learning institutions, limiting the economic and societal damage caused by the pandemic.

The average time spent on Wi-Fi has increased by two and a half hours per day during the crisis, according to a survey of 11,000 people across 11 countries (Brazil, China, France, Germany, India, Italy, South Korea, Spain, Sweden, the UK, and the US) by Ericsson Consumer & Industry Lab.[7]

A new generation of connectivity (based on 5G and Wi-Fi) will boost innovation and transformation as the world seeks to recover from the crisis, potentially supporting a cleaner and healthier planet.

[7] Source: https://www.ericsson.com/49da93/assets/local/mobility-report/documents/2020/june2020-ericsson-mobility-report.pdf

Policymakers recognise the need to make greater use of digital technologies. The EU's Green Deal strategy, for example, calls for Europe to "leverage the potential of the digital transformation, which is a key enabler for reaching the Green Deal objectives".[8]

High quality Wi-Fi is required to enable the EU to build the Digital Single Market by supporting the development of the European Gigabyte Society, which calls for all schools, transport hubs, and main providers of public services, as well as digitally-intensive enterprises, to have access to Internet connections with download/upload speeds of 1 Gigabit per second (Gbps) by 2025. In the same timeframe, the European Commission wants households, rural and urban, to have access to networks offering a download speed of at least 100 Megabits per second (Mbps), which can be upgraded to 1 Gbps.

In Africa, Wi-Fi can complement the development of a Pan-African E-Network – one of the flagship projects of the African Union's Agenda 2063. The African Union is aiming to double ICT penetration and its contribution to GDP between 2015 and 2023, supported by a 70% increase in broadband accessibility by 2020. It calls for digital broadcasting to be the norm and for every adult/youth to have access to a mobile phone.

In its National Broadband Strategy 2018-2023, Kenya says it plans to bring fixed broadband connectivity to 100% of tertiary institutions and public health facilities by 2020, and 50% of primary schools by 2022.

In the Middle East, most countries are looking to provide citizens with broadband connectivity with throughput of at least 40 Mbps by the year 2023. In countries in a state of civil unrest or involved in wars, Wi-Fi is set to play a major role in the development of their digital infrastructure once the conflicts are resolved.

[8] The European Green Deal, COM(2019) 640 final https://eur-lex.europa.eu/resource.html?uri=cellar:b828d165-1c22-11ea-8c1f-01aa75ed71a1.0002.02/DOC_1&format=PDF

THE EVOLUTION OF WI-FI

A new Wi-Fi standard, IEEE 802.11ax, also known as Wi-Fi 6, is enabling compatible devices to benefit from higher data rates, greater responsiveness, increased capacity, better performance in environments with many connected devices and improved power efficiency, as well as other improvements. New devices, including Wi-Fi 6E routers, have been announced. Figure 6 shows how Wi-Fi 6E (802.11ax) can support data rates of up to 9.6 Gbps, compared with 1.3 Gbps for Wi-Fi 5 (802.11ac).

FIGURE 6: WI-FI 6 (802.11AX) OFFERS A STEP CHANGE IN PERFORMANCE

PROTOCOL	FREQUENCY	MAXIMUM DATA RATE
Legacy 802.11	2.4 GHz	2 Mbps
802.11a	5 GHz	54 Mbps
802.11b	2.4 GHz	11 Mbps
802.11g	2.4 GHz	54 Mbps
802.11n	2.4 or 5 GHz	600 Mbps
802.11ac	5 GHz	1.3 Gbps
802.11ax	2.4, 5 or 6 GHz	9.6 Gbps

Source: Maravedis

Wi-Fi 6 is beginning to gain traction in the business market. For example, almost one quarter (24%) of the respondents in a survey of "Middle East IT leaders" by Computer Weekly said they plan to implement Wi-Fi 6 during 2020.

Delivering high capacity, low latency connectivity, Wi-Fi 6 is well-suited to supporting HD video streaming, Wi-Fi calling, smart home devices, hotspot access, automation of city-wide services, augmented reality (AR) and virtual reality (VR) applications, health monitoring devices, wearables, and seamless roaming, as well as off-load for 4G and 5G.

Indeed, 5G and Wi-Fi 6 could work together to support a wide range of AR and VR applications. A 5G smartphone could connect to an AR or VR headset using Wi-Fi 6, giving people access to immersive entertainment, educational, e-Health and industrial applications, improving training, accelerating product design, and enabling new business models.
In areas where fixed-lines are scarce, IMT technologies (4G/5G) can provide high-speed broadband coverage, with Wi-Fi being used to create hotspots and personal and private networks.

WI-FI IS OFTEN THE MOST COST-EFFECTIVE OPTION

The new Wi-Fi 6 standard and 5G are both critical infrastructure technologies that will shape the digital future. The technology choice will depend on the specific use case and economic considerations. Wi-Fi is a highly cost-effective wireless access technology due to ease of installation and user control over the network.

According to Intel, the cost of licensing the necessary intellectual property for cellular 5G alone is 3x that of a Wi-Fi chipset, and the entire 5G cellular modem cost is 50x the cost of a Wi-Fi chipset.[9] Support for a cellular connection can add as much as US$130 to the retail price of a tablet device.[10]

Given that Wi-Fi service providers do not need to participate in auctions to license the spectrum, the technology is a very cost-effective form of connectivity. Moreover, thanks in part to spectrum harmonisation, the global Wi-Fi ecosystem benefits from enormous economies of scale, enabling manufacturers to produce very cost-effective products.

[9] Source: Eric McLaughlin, General Manager Wireless Solutions Group, Intel during the WBA Congress in Frankfurt in September/October 2019.

[10] Source: https://www.apple.com/shop/buy-ipad/ipad-pro

THE LICENCE-EXEMPT SPECTRUM GAP

THE SPECTRUM SHORTFALL IN EMEA

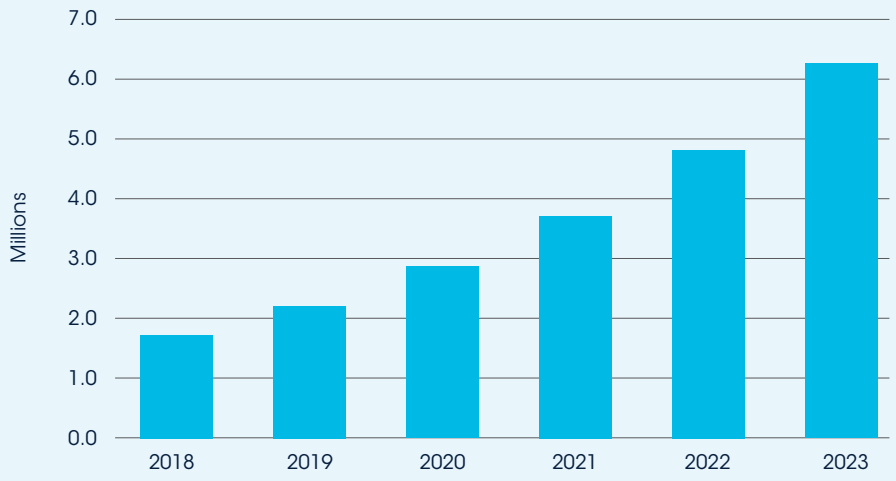
Unless urgent action is taken, there will be a licence-exempt mid-band spectrum shortfall that will directly impact citizens and businesses across Europe, Middle East and Africa (EMEA). Demand for Internet access is rising inexorably across the region.

In Africa, for example, there were 294 million Internet users in 2019, up from 190 million in 2015, according to the ITU. That growth is likely to accelerate going forward, and by 2023, the Middle East and Africa will have 611 million Internet users (35% of the regional population), up from 381 million (24% of regional population) in 2018, according to Cisco. In Saudi Arabia, for example, there will be almost 28 million Internet users (76% of the population) by 2023, up from almost 20 million in 2018. Meanwhile, in South Africa, there will be approaching 43 million total Internet users (70% of the population) by 2023, up from 28 million in 2018.

In response, telecoms operators are rolling out broadband networks that can support gigabit access, but the wireless interface is a bottleneck in the user experience; hence additional mid-band spectrum and wider channels are necessary to support reliable high-speed throughput.

Cisco forecasts that the number of public Wi-Fi hotspots in the Middle East and Africa will grow by 30% per year between 2018 and 2023. In Saudi Arabia, for example, public Wi-Fi hotspots (including homespots[11]) are set to grow 76-fold from 29,300 in 2018 to 2.2 million by 2023. In South Africa, total public Wi-Fi hotspots (including homespots) will grow 3-fold from 310,500 in 2018 to one million by 2023.

FIGURE 7: PUBLIC WI-FI HOTSPOTS IN THE MIDDLE EAST AND AFRICA



Source: Cisco VNI Global IP Traffic Forecast, 2017–2022

[11] Homespots use a second SSID (secure identity) to allow a hotspot to be delivered from existing home gateways.

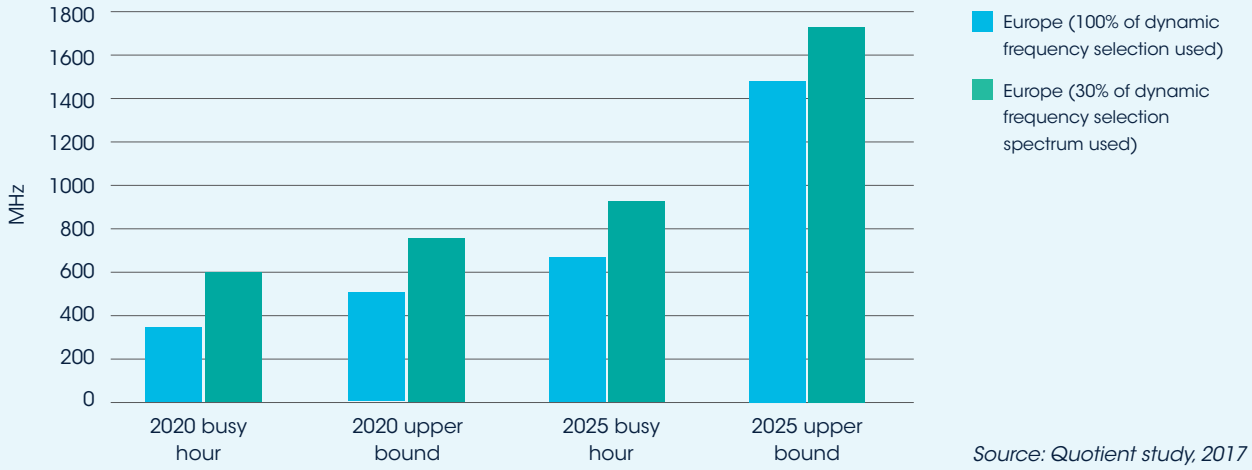
Today, the presence of multiple Wi-Fi networks in a single building (such as an apartment complex or a hotel) can impact the user experience as the occupants all try to access the same medium. In 2018, 46% of people in the EU-27 lived in flats, according to the European Commission, while apartments account for almost 53% of all homes in Saudi Arabia.[12]

Around the world, the average person lives in a household of 4.9 people, but this number is much higher in sub-Saharan Africa (6.9 people) and the Middle East-North Africa region (6.2 people). In cases where more than one household is sharing a Wi-Fi hotspot, the network could get congested.

Wi-Fi network congestion is becoming an issue because access to licence-exempt mid-band spectrum is scarce: since the World Radiocommunication Conference in 2003 no new mid-band spectrum has been made available for Wi-Fi despite the exponential growth in the data traffic. As things stand, there is only 455 MHz (5150-5350 MHz and 5470-5725 MHz) of mid-band spectrum available for licence-exempt use in Europe, Middle East and Africa. Further, there are restrictions on the use of this spectrum so as to protect other services. Also, since the licence-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.

As a result, Wi-Fi in Europe faces a mid-band spectrum shortfall of up to 1.6 GHz by 2025, according to a 2017 study by Quotient (see Figure 8). This spectrum shortage will prevent the region's citizens and companies from realising the full benefits of the affordable high capacity Internet connectivity provided by Wi-Fi.

FIGURE 8: THE POTENTIAL SPECTRUM SHORTFALL IN EUROPE



Source: Quotient study, 2017

In many countries, including the US and Canada, there is an additional 125 MHz available in the 5 GHz band (5725-5850 MHz). This spectrum is generally not available in Europe (with the exception of the UK) due to sharing issues with incumbents (i.e. radar) and technical conditions.

Leading telecoms operators acknowledge the need for more licence-exempt spectrum. JR Wilson, Vice President Tower Strategy & Roaming at AT&T and Chairman of the Wireless Broadband Alliance, for example, has noted: "Many believe that if Wi-Fi 6 is to reach its full potential, there is need for additional unlicensed spectrum. Wi-Fi 6 will enable new use cases for industrial IoT, smart homes and support for high-density deployments, to name a few, but access to wider channels is needed to support these new use cases. Indeed, some estimate that Wi-Fi needs will exceed its capacity on 2.5 GHz and 5 GHz in 2020."[13]

[12] According to Al-Eqtisadiah report, based on data from the General Authority for Statistics for the current year 2017.

[13] Source: https://wballiance.com/wp-content/uploads/2019/09/WBA-Annual-Industry-Report-2020.pdf

Many governments also recognise the need to balance the amount of licensed and licence-exempt spectrum available. Kenya's National Broadband Strategy (2018-2023) calls for spectrum policy to support both licensed and licence-exempt allocations and promote technology neutrality.

THE 6 GHZ BAND COULD FILL THE GAP

The 6 GHz band (5925-7125 MHz) is well suited to bridging the licence-exempt mid-band spectrum gap and will greatly enhance the impact of next generation Wi-Fi. Harnessing the 6 GHz band will improve indoor connectivity and enable the emergence of a new generation of advanced application and services based on the Wi-Fi 6 standard. It would support demanding personal area network applications, such as transferring data between a smartphone and an AR or VR headset to the benefit of providers of entertainment (gaming, content), industrial applications, eHealth and other services.

With access to the 6 GHz band, Wi-Fi is also set to play a pivotal role in the further automation of manufacturing plants and other parts of industry. In South Korea, Taiwan, the US and other advanced manufacturing hubs, businesses increasingly regard Wi-Fi as an effective and efficient way to both monitor and remotely control machinery and other assets. To remain competitive, companies in other parts of the world are set to follow suit once the 6 GHz band is available on a licence-exempt basis.

As the 6 GHz band already has a co-primary mobile allocation[14] in the ITU Radio Regulations, no international action is needed, therefore, administrations can immediately open up the band.

In Europe, the Middle East and Africa (ITU Region 1), it should be feasible to immediately open up the lower 6 GHz band (5925-6425 MHz), as extensive technical studies[15] have shown that WAS/RLANs can operate in this band without adversely impacting incumbents' operations.

Vendors can easily extend 5 GHz radios to cover the 6 GHz range; 6 GHz networks have similar propagation characteristics allowing reuse of 5 GHz network coverage maps and metrics, and existing backhaul infrastructure.

The additional 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 and enable 5G to offload demanding services, which would otherwise consume limited cellular network resources.

The US recently adopted a decision to open up 1200 MHz of spectrum (5925-7125 MHz) in the 6 GHz band to enable use of wider channels and meet growing demand for licence-exempt spectrum. In doing so, the FCC, the US regulator, noted:[16]

- "Making the entire band available for these unlicensed operations enables use of wide swaths of spectrum, including several 160 MHz channels as well as 320 MHz channels, which promotes more efficient and productive use of the spectrum."
- "To obtain unlicensed 5G-like capabilities, 160 MHz channels, or eventually 320 MHz under Wi-Fi 7, are absolutely necessary. Ultimately, this allocation will provide seven new and needed channels going forward, which can also be combined with the 5 GHz frequencies already in use. And this allocation for unlicensed services will accelerate, rather than compete with, the American effort to deploy nationwide 5G advanced wireless services. In sum, 5G will happen faster and more widely with our action here."

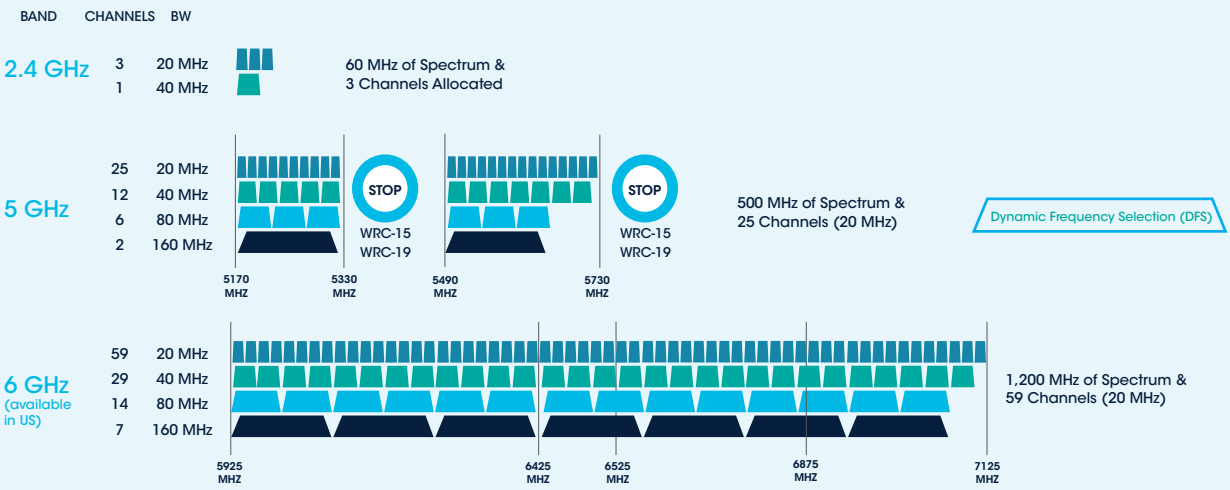
Figure 9 shows how the 6 GHz band could accommodate up to seven of these 6 GHz channels compared with just two in the licence-exempt spectrum available in the 5 GHz band.

[14] Meaning it can be used by IMT and other wireless connectivity services.

[15] 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 licence-exempt 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.

[16] Source: https://docs.fcc.gov/public/attachments/DOC-363490A1.pdf

FIGURE 9: THE 6 GHZ BAND CAN ACCOMMODATE SEVEN 160 MHZ CHANNELS



Source: Broadcom

JR Wilson, Vice President Tower Strategy & Roaming at AT&T and Chairman of the Wireless Broadband Alliance, has echoed these sentiments: "Certainly, if Wi-Fi 6 at 6 GHz gets more channels that are 160 MHz wide, this will enable many more simultaneous users to transmit and receive data at very fast speeds. …At the same time, this must be balanced with the needs of the current users of 6GHz – public utilities, public safety, and wireless backhaul – all of whom currently use 6 GHz band for vital microwave communications."[17]

Recent economic research[18] in the US shows how allowing Wi-Fi devices in the full 6 GHz band (5925-7125 MHz) will generate significant economic value by improving connectivity, extending the Internet of Things, boosting productivity and the development of richer applications and services.

In July 2020, UK regulator Ofcom announced it will make the lower 6 GHz band available for Wi-Fi and other RLAN technologies. It noted that people and businesses in the UK are increasingly using Wi-Fi to support everyday activities and new applications are driving demand for faster and more reliable Wi-Fi. Other jurisdictions, such as Brazil, South Korea, Taiwan, Singapore, Mexico, Japan, Canada, and Australia, are also working towards making all or part of the 6 GHz band available for Wi-Fi use. South Korea, for example, has decided to open up the entire 6 GHz band to Wi-Fi on the basis of low power (250 mW limit) indoor usage and telecoms operators are already harnessing Wi-Fi 6 to alleviate the pressure on their 4G and 5G networks. Youngseok Oh, senior manager of 5GX Labs under ICT R&D Center at SK Telecom, has said: "We expect the opening of 6 GHz band to boost the impact and proliferation of Wi-Fi 6 and enable new business models. We deployed Wi-Fi 6 in challenging venues, such as: COEX Mall Sajik Stadium in Busan, and the U-Square in Gwangju. As the biggest complex shopping mall in South Korea, COEX has about 250,000 visitors per day on weekends, and we experienced peak throughput of 800 Mbps and 5 ms latency."

Several countries in the Middle East and North Africa, such as Saudi Arabia, are running (or are planning to run) public consultations on opening up the lower 6 GHz band to licence-exempt technologies.

[17] Source: https://wballiance.com/wp-content/uploads/2019/09/WBA-Annual-Industry-Report-2020.pdf

[18] By Telecom Advisory Services: http://wififorward.org/wp-content/uploads/2020/04/5.9-6.0-FINAL-for-distribution.pdf

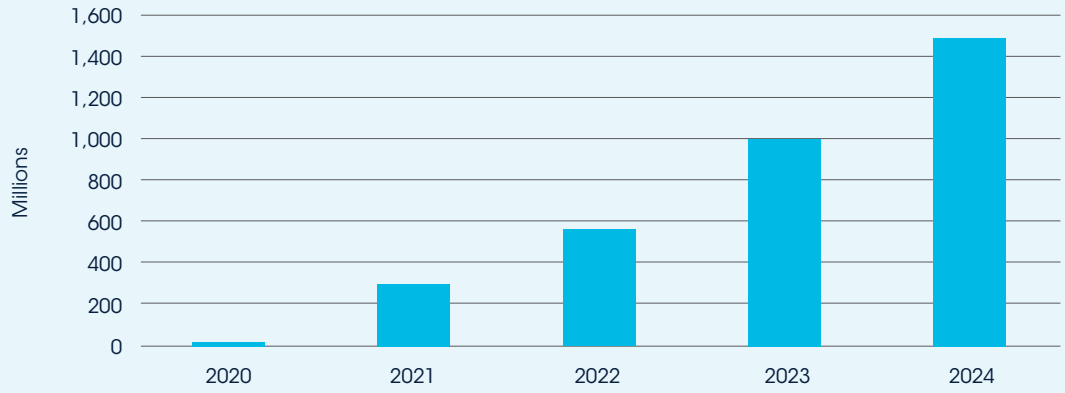
THE CASE FOR GLOBAL HARMONISATION

As governments make the 6 GHz band available on a licence-exempt basis, vendors will be able to deliver the same equipment across multiple markets. As a result, Wi-Fi users would benefit from greater economies of scale, lower prices and a more diverse supplier base.

The first Wi-Fi 6E products, which can employ the 6 GHz band, are set to be launched before the end of 2020. Research firm IDC has forecast that more than 316 million Wi-Fi 6E devices will enter the market in 2021 and shipments will rise rapidly over the next three years (see Figure 10). Phil Solis, research director at IDC, has said: "We expect Wi-Fi 6E will gain momentum and see rapid 2021 adoption with more chipsets targeting flagship smartphones, PCs, TVs, and even VR devices."

If equipment providers can distribute the same Wi-Fi 6E products around the world, they would be able to achieve economies of scale and end-users would benefit from lower prices and greater choice.

FIGURE 10: SHIPMENTS OF WI-FI 6E PRODUCTS WILL RISE RAPIDLY OVER THE NEXT FIVE YEARS



Source: IDC

THE WAY FORWARD

Governments should act now to make as much of the 6 GHz spectrum (5925-7125 MHz) available as possible on a technology-neutral, licence-exempt basis. The widespread use of licence-exempt mid-band spectrum across the globe has shown the potential benefits for consumers and economies.

NEXT STEPS IN EUROPE

On the basis of a European Commission mandate, European regulators and industry experts have been working meticulously for the past two and a half years to develop the harmonised technical conditions for opening up the lower 6 GHz band so that licence-exempt technologies can co-exist with incumbent users, notably urban railways, satellite, and fixed links.

The regulatory work to-date has demonstrated that Wi-Fi, with safeguards, can share the lower 6 GHz band without causing harmful interference to incumbent users. Precautions include limiting power levels and restricting operation of low power access points to indoor use only.

To enable the EU to benefit from this spectrum as soon as possible, the final EC Decision (based on CEPT Report 75) should enable a fully harmonised approach which does not impose unnecessary, disproportionate or spectrum inefficient restrictions. The implementation of any proposals to overprotect incumbent users in individual Member States would reduce spectrum efficiency and undermine the EU's single market by introducing country-specific requirements. This would hinder the free movement of goods and delay, or even prevent, all European citizens and enterprises from equally and fully reaping the benefits of an enhanced Wi-Fi experience.

European governments now need to work with the European Commission on translating the technical conditions into a harmonised European decision, which should be followed by swift implementation at a national level in 2021.

ETSI has begun the standardisation process to ensure that EN 303 687 is available to complement the EC 6 GHz mandate and associated EU/CEPT regulations allowing access to 5925-6425 MHz.

NEXT STEPS IN AFRICA AND THE MIDDLE EAST

Countries in Africa and the Middle East can immediately harness the lower 6 GHz band to improve the availability and performance of licence-exempt technologies due to the existing mobile allocation in the ITU Radio Regulations. Therefore, administrations in the region should consider initiating national consultations on licence-exempt access to the lower 6 GHz band.

The preparatory work being conducted in Europe could serve as a template for administrations in Africa and the Middle East – if the regulations are consistent across ITU Region 1, then device suppliers will be able to maximise economies of scale and reduce the cost of equipment for end-users.

BRINGING BROADBAND TO UNDERSERVED COMMUNITIES

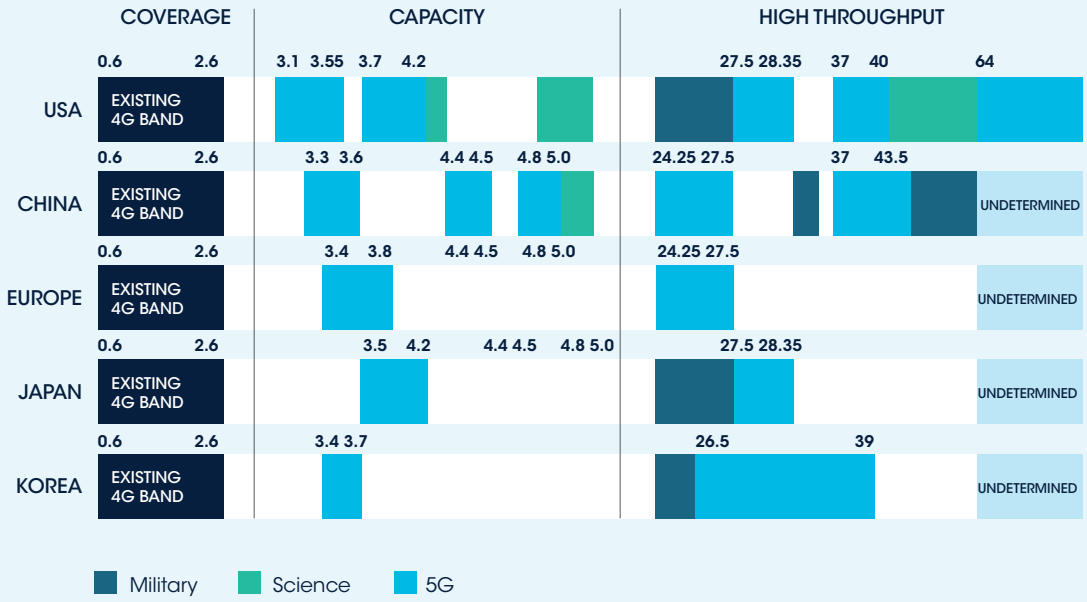
As people commute less and work from home more in response to the COVID-19 pandemic, telecoms operators are seeing greater demand for fixed-wireless access. In areas without fixed-lines, deploying fixed-wireless services in low frequency spectrum is the most cost-effective way to bring broadband to people's homes and places of work.

The 1800 MHz and 2600 MHz spectrum bands are well suited to providing fixed wireless access over 4G, while the international-harmonised 3400-3800 MHz band can provide capacity for 5G fixed wireless access. Indeed, use of this spectrum can enable operators to achieve a good balance between coverage and capacity.

In a 5G spectrum paper published in March 2020, mobile industry group the GSMA noted: "The majority of commercial 5G networks are relying on spectrum within the 3.3-3.8 GHz range. Other bands which may be assigned to, or refarmed by, operators for 5G include 1800 MHz, 2.3 GHz and 2.6 GHz." The GSMA has also noted that low frequency spectrum, such as the 700 MHz, 800 MHz and 900 MHz bands, will also be necessary to cost-effectively use IMT technologies to extend broadband coverage into rural areas.

As relatively high frequency spectrum, the 6 GHz band does not have the right propagation characteristics to support wide area coverage (see Figure 11). There is also a significant risk that wide area services would interfere with existing users of this spectrum, such as satellites and fixed-links.

FIGURE 11: SPECTRUM BANDS BELOW 2.6 GHZ ARE BEST SUITED TO EXTENDING BROADBAND COVERAGE



Source: https://medium.com/@miccowang/5g-when-will-we-see-it-7c436a4ad86c

PREPARING FOR WRC-23

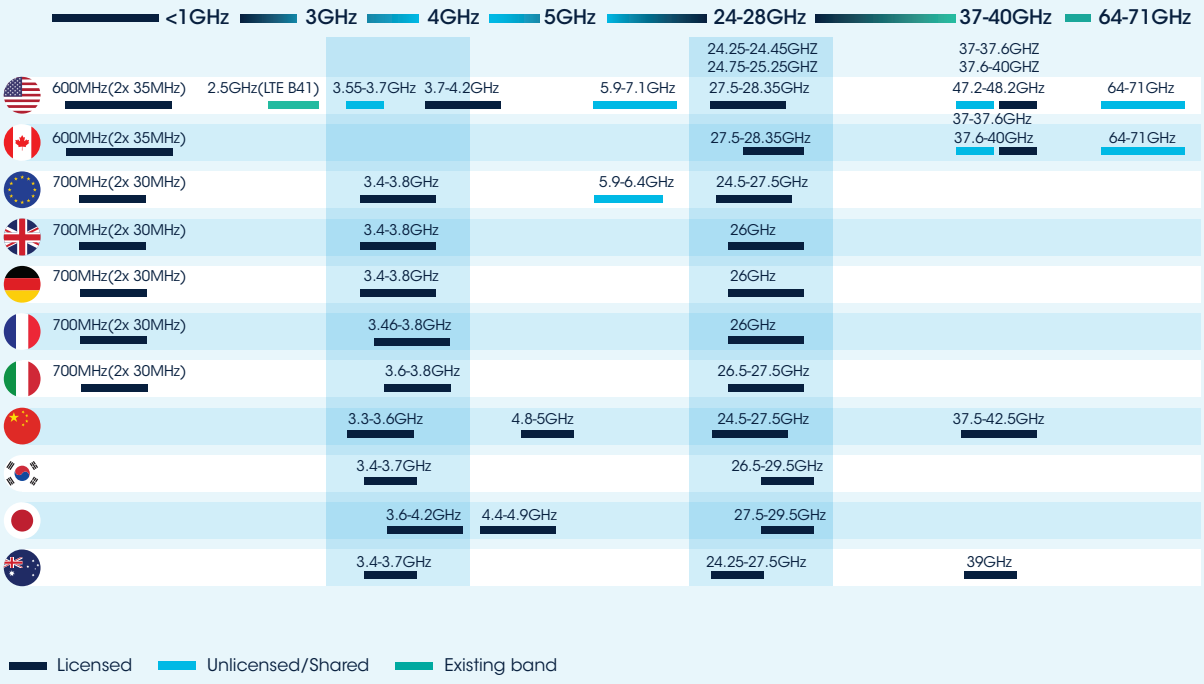
To realise the full potential of the upper 6 GHz band (6425-7125 MHz), administrations need to maintain as much flexibility as possible and that flexibility would be reduced if the next World Radiocommunication Conference (WRC-23) identifies the upper 6 GHz band (6425-7125 MHz) for IMT.

As ITU Radio Regulations already provide for a mobile allocation in the upper 6 GHz band, national administrations can allow IMT services to use this spectrum in their sovereign territory if they so choose.

That said, 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. Studies within the ITU-R are yet to start and administrations should remain open minded when undertaking coexistence and sharing studies based on justifiable technical characteristics and realistic and agreed propagation characteristics.

In any case, there is spectrum below 10 GHz that has already been identified for IMT (see Figure 12) that could and should be harnessed to improve coverage before specifically identifying more spectrum for IMT.

FIGURE 12: GLOBAL SNAPSHOT OF 5G SPECTRUM



Source: https://cdn.everythingrf.com/live/5G%20bands%20snapshot_636543792416696911.PNG

Successive WRCs have identified specific frequency bands for the deployment of IMT systems. In the EU, CEPT has already made all the IMT mid-bands technology-neutral, revising the conditions to allow the use of the bands for 5G. The one exception is the 2300-2400 MHz band, but the work required to make this spectrum available for 5G should be completed next year. In total, there is now approximately 2 GHz of radio spectrum available for 5G in the EU.[19]

Furthermore, most countries in the EMEA region are considering making the 3300-3400 MHz, 3800-4200 MHz and 4800-4990 MHz bands available for licensed spectrum use. Whilst not all countries can make all of these bands available due to existing usage, this is a significant potential resource for licensed mid-band spectrum in the medium term for many EMEA countries.

Those African countries employing the 3700-4200 MHz band for fixed satellite services can still make use of the 3300-3700 MHz band for 5G. Over time, many fixed satellite services are set to transition to higher frequencies (12 GHz, 28 GHz and 40 GHz bands) with much greater capacity, freeing up more mid-band spectrum for 5G.

Ideally, both the lower and the upper part of the 6 GHz band will be available to all licence-exempt technologies, which would provide mobile operators with greater offload capacity for 5G.

In summary, maintaining the international regulatory status quo in the upper 6 GHz band would allow it to be employed by the most appropriate wireless technology for the use case. That would ensure the entire 6 GHz band can be harnessed by innovative new services that will benefit individuals and businesses alike.

[19] Source: The Digital Economy and Society Index (DESI)[1] [11]

This report is drafted and published by Policy Impact Partners Ltd, in collaboration with the Dynamic Spectrum Alliance, on behalf of the 6 GHz Coalition, which is supported by multiple companies. We thank the representatives of those companies and our colleagues for their valuable inputs.

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