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HOW TO REALISE THE FULL POTENTIAL OF 6 GHZ SPECTRUM

A White Paper

SEPTEMBER 2021

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 both the lower 6 GHz band (5925-6425 MHz) and the upper 6 GHz band (6425-7125 MHz) in a timely manner and on a consistent basis. 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.

Governments should act now to make as much of the 6 GHz band (5925-7125 MHz) available as possible on a technology-neutral, licence-exempt basis. Both the lower 6 GHz and upper 6 GHz bands should be subject to the same regulatory requirements so that licence-exempt equipment can easily be employed across the 6 GHz band.

As a very cost-effective technology, Wi-Fi is widely used in enterprise and industrial applications and to connect a broad variety of consumer devices, including mobile phones, laptops, tablets, televisions, cameras, games consoles, and speakers. Any Wi-Fi bottleneck means end-users experience reduced data speeds. Fixed broadband networks, 4G and 5G must all be supported by high quality Wi-Fi – the main solution of choice to distribute broadband connectivity indoors and in numerous hotspots. Approximately, half of all IP traffic now travels via Wi-Fi,[1] while 5G networks will depend on Wi-Fi capacity to offload traffic.

5G mobile networks and Wi-Fi will work together to support a wide range of compelling new applications and services. For example, an individual on the move might use very low power Wi-Fi 6E[2] to connect an augmented reality or virtual reality headset to a 5G smartphone to access immersive entertainment, educational, e-Health and industrial applications, improving training, accelerating product design and enabling new business models.

As explained in a recent paper[3] by Senza Fili research, 5G provides wide-area coverage and mobility support, while Wi-Fi brings capacity and speed indoors or in high-density locations: they are complementary technologies. For individuals, 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 normally associated with cellular contracts.

On announcing that it will allow low power indoor Wi-Fi across the full 6 GHz band, US regulator the FCC noted that Wi-Fi and other unlicensed technologies "have become indispensable for providing low-cost connectivity in countless products". Brazil, Canada, Chile, Saudi Arabia, South Korea and other countries are also making the entire 1200 MHz in the 6 GHz band available for licence-exempt Wi-Fi use.

The EU, Morocco, the UAE and the UK have decided to initially open the lower 6 GHz band to Wi-Fi and other radio local area networks, while Taiwan, Singapore, Mexico, Japan, Australia and New Zealand are working towards making the 6 GHz band available for Wi-Fi. As a result, more than one billion people will soon be able to take advantage of Wi-Fi 6E.

[1] Source: https://newsroom.cisco.com/press-release-content?articleId=1967403
[2] The latest and most advanced Wi-Fi technology designed to work in the 6 GHz band
[3] Source: https://senzafili.com/publications/5g_wifi_strongertogether/

Wi-Fi is set to deliver global value of US$3.3 trillion in 2021, a figure that could rise to US$4.9 trillion by 2025, if the technology has access to sufficient spectrum, according to research by the Wi-Fi Alliance/Telecom Advisory Services.[4]

NEXT STEPS

In Europe, the immediate priority is the implementation of the EC Decision on licence-exempt access to the lower 6 GHz band at a national level. In order for Europe to alleviate congestion in existing licence-exempt spectrum and to benefit from now-available Wi-Fi 6E equipment, national regulations need to be updated as soon as possible.

Similarly, in Africa, governments need to urgently implement the ATU recommendation to enable licence-exempt technologies to operate in the lower 6 GHz band at power limits consistent with those for Europe. Those limits have been carefully designed to protect incumbent fixed services and fixed satellite services. The Arab States should continue to open up the 6 GHz band, preferably the full 1200 MHz, for licence-exempt use.

To realise the full potential of the 6 GHz band, administrations need to maintain as much flexibility as possible and that flexibility would be reduced if WRC-23 identified the upper 6 GHz band (6425-7125 MHz) for IMT in ITU Region 1 (EMEA). The best way to benefit 5G is to authorize licence-exempt use throughout the entire 1200 MHz of the 6 GHz band to enable additional support for mobile offload (via Wi-Fi), 5G backhaul (via existing fixed links), and possibly 5G NR-U operation, should equipment become available.

Satellite operators[5] and some administrations have expressed concerns that IMT networks in the upper 6 GHz band would interfere with incumbent fixed and satellite services, due to the high transmit power required for cellular coverage.

There is a substantial amount of spectrum below 10 GHz that has already been identified for IMT that could and should be harnessed before specifically identifying yet more spectrum for IMT. Successive WRCs have identified specific bands for the deployment of IMT systems and this spectrum constitutes a good mix of 'coverage' bands (below 5 GHz) and 'capacity' bands (mmWave spectrum above 24 GHz). In all three ITU Regions, IMT has access to at least 1348 MHz of prime spectrum below 5 GHz – far more than is available for wireless access systems (WAS)/radio local area networks (RLANs).

As Wi-Fi 6E devices are already available, reserving a portion of the 6 GHz band in case IMT may eventually be allowed in that band would forego the short-term economic gains that would have accrued from opening the full 6 GHz band to licence-exempt operations. Wi-Fi 6E will bring major long-term benefits to consumers and economies across the globe, while enabling enterprises to innovate and develop compelling new digital products and services.

[4] Source: https://www.wi-fi.org/discover-wi-fi/value-of-wi-fi
[5] EMEA Satellite Operators Association (ESOA) at Forum Global WRC-23 Webinar on 6 GHz, 17 May 2021

THE PIVOTAL ROLE OF WI-FI

BOLSTERING THE ECONOMY AND SOCIETY

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

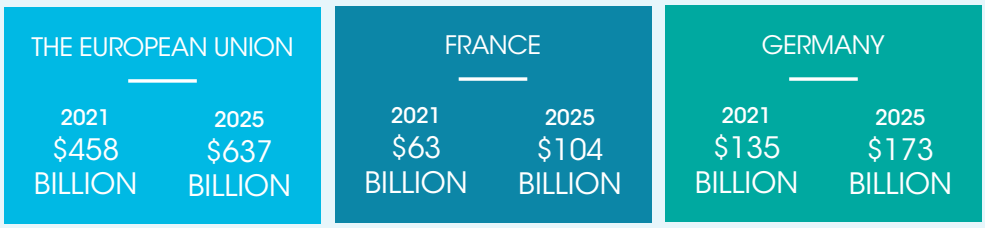
For individuals, Wi-Fi is often the most cost-effective way to get online, enabling extensive use of Internet-based applications and services without incurring the hefty connectivity charges normally associated with cellular contracts. Globally, more than 16 billion Wi-Fi devices are in use today and a further four billion are shipped every year, according to research firm IDC. Flexible, affordable and reliable connectivity makes citizens more productive. The Federal Communications Commission (FCC) in the US has noted that Wi-Fi is now "indispensable for providing low-cost connectivity in countless products".[6]

Already huge, the value of Wi-Fi to the economy and society will continue to rise as next generation products and deployments are introduced. Wi-Fi is set to deliver global value of US$3.3 trillion in 2021, a figure that could rise to US$4.9 trillion by 2025, if the technology has access to sufficient spectrum, according to research by the Wi-Fi Alliance/Telecom Advisory Services.

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$135 billion to the German economy in 2021, a figure that could climb to US$173 billion in 2025, according to Telecom Advisory Services. The equivalent figures for France are US$63 billion and US$104 billion respectively.

FIGURE 1: VALUE OF WI-FI – SELECT MARKETS IN EUROPE



Source: Telecom Advisory Services

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

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.

In Egypt, for example, there are more than 470,000 free Wi-Fi hotspots[7] in the main cities of the country. Moreover, there has been a spike in Wi-Fi usage as a result of the pandemic. At the end of May 2020, smartphone users in Egypt spent 63.5% of their online time connected to Wi-Fi rather than using cellular data, up from 54.6% at the beginning of 2020.[8] The total value of Wi-Fi to Egypt is set to increase from US$9 billion in 2021 to US$17 billion in 2025, according to Telecom Advisory Services.

In Saudi Arabia, the Communications and Information Technology Commission (CITC) has released the entire 6 GHz band on a licence-exempt basis. The CITC said it is making the 5925-7125 MHz band licence-exempt because of the "importance of WLAN use in the Kingdom and substantial amount of Wi-Fi traffic, which was exemplified during the COVID-19 lockdowns, and the emergence of a promising device ecosystem that can be taken advantage of starting from 2021 to enable a wide range of innovative digital services". This action will have a positive impact on the growth of the economic value of Wi-Fi in the Kingdom, spurring an increase from US$17 billion in 2021 to US$24 billion in 2025 (see Figure 2), according to Telecom Advisory Services.

Similarly, the total economic value of Wi-Fi in Morocco is set to rise from US$6 billion in 2021 to approaching US$8 billion in 2025, following the decision by the Moroccan National Telecommunications Regulatory Agency (ANRT) to open up the lower 6 GHz band on a licence-exempt basis.

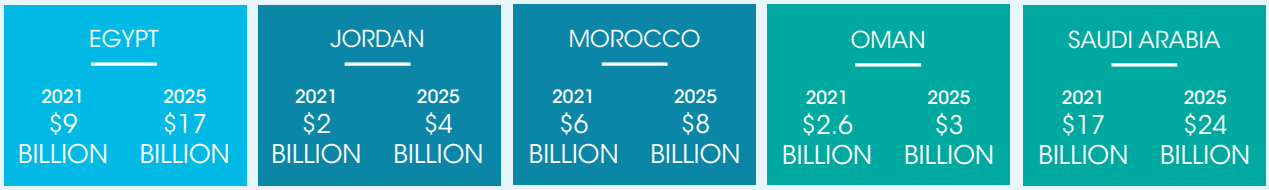
ECONOMIC IMPACT IN AFRICA

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 adoption of Wi-Fi (and the value it creates) is growing rapidly across the continent.

Telecoms Advisory Services estimates the economic value of Wi-Fi in Nigeria, for example, will grow from US$16 billion in 2021 to US$33 billion in 2025, while in South Africa the economic value of Wi-Fi is set to rise from US$31 billion in 2021 to US$44 billion in 2025 (see Figure 3).

As more licence-exempt spectrum becomes available, the importance of Wi-Fi to connectivity in Africa will rise further. The African Telecommunications Union (ATU) has approved the recommendation by its Emerging Technologies group to enable licence-exempt technologies to operate in the lower 6 GHz (5925-6425 MHz) band.

FIGURE 2: VALUE OF WI-FI – SELECT MARKETS IN THE MIDDLE EAST

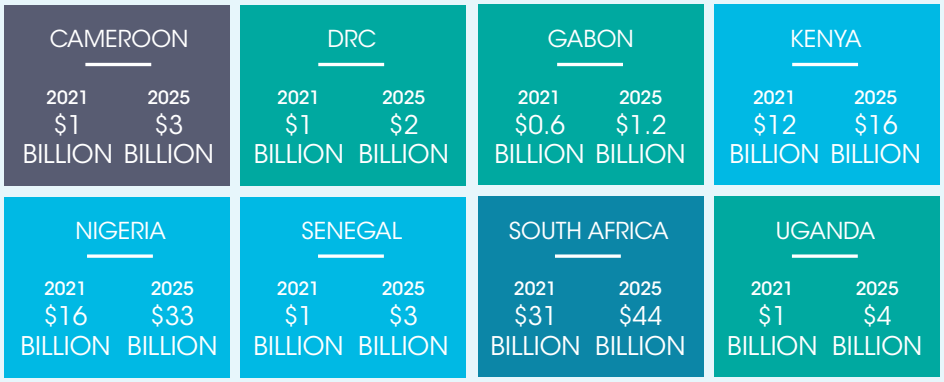


Source: Telecom Advisory Services

[7] Source: https://www.wiman.me/egypt (June 4, 2021)

[8] Source: https://www.opensignal.com/2020/06/08/mobile-network-experience-during-the-covid-19-pandemic-june-update

FIGURE 3: VALUE OF WI-FI – SELECT MARKETS IN AFRICA



Source: Telecom Advisory Services

Following that recommendation, Kenya is now considering extending licence-exempt access for Wi-Fi to the lower part of the 6 GHz band. That reflects the growing importance of Wi-Fi in the country and will help spur the increase in the economic value of Wi-Fi from US$12 billion in 2021 to US$16 billion in 2025, according to Telecom Advisory Services.

Wi-Fi is also taking on a key role in the Democratic Republic of Congo (DRC). Approximately 52,000 public Wi-Fi hotspots are live in the country, with the installed base set to reach 150,000 by 2025, according to Telecom Advisory Services. The economic value of Wi-Fi to the DRC could increase to US$2 billion in 2025, if spectrum in the 6 GHz band becomes available.

FIGURE 4: PREDICTED GROWTH IN FIXED BROADBAND SUBSCRIBERS BY REGION

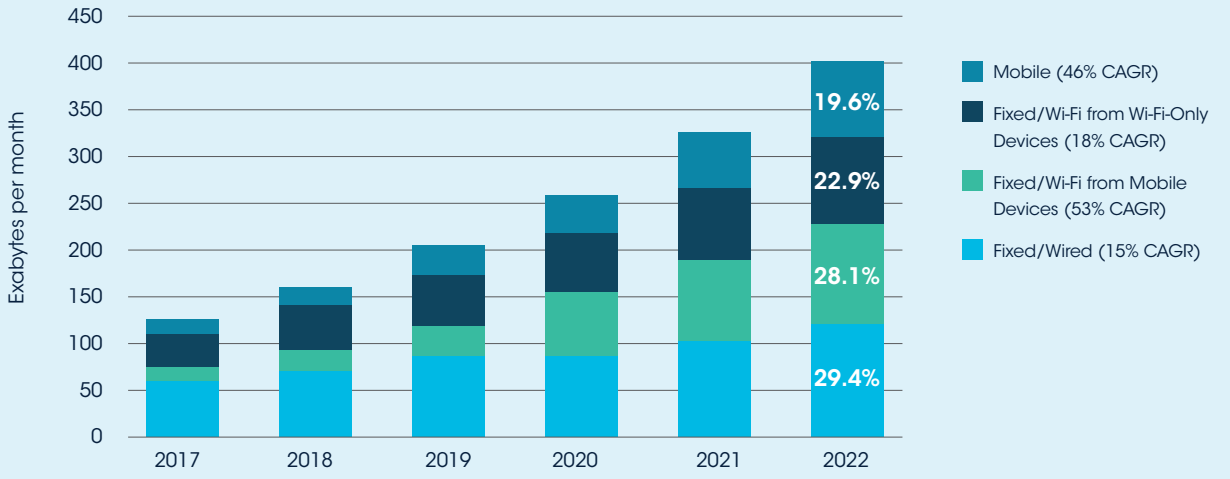
REGION	PREDICTED GROWTH, 2019-2030
Middle East and Africa	69%
Latin America	48%
South and East Asia	26%
Asia-Pacific	24%
Eastern Europe	22%
North America	16%
Western Europe	12%
World	33%

Source: Check Point

The importance of Wi-Fi to Africa is set to rise further as adoption of fixed broadband services increases: 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 4).

Check Point anticipates the number of fixed broadband connections in South Africa, for example, will grow 128% between 2019 and 2030. There are currently 640,000 public Wi-Fi access points in South Africa, according to Cisco, while the country's smartphone users spend more than half their online time connected to Wi-Fi.[9]

FIGURE 5: GLOBAL IP TRAFFIC, WIRED AND WIRELESS



** Wireless traffic includes Wi-Fi and mobile*

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

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 5),[10] 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 6). Without the ability to offload traffic to Wi-Fi, 4G and 5G networks would be 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 explained in a recent paper[11] by Senza Fili research, 5G supports the wide-area coverage and mobility required for ubiquitous connectivity, while Wi-Fi brings the capacity and speed required indoors or in high-density locations: they are complementary technologies. Both fixed and cellular broadband networks depend upon Wi-Fi to enable multiple people to enjoy simultaneous and easy access to Internet services.

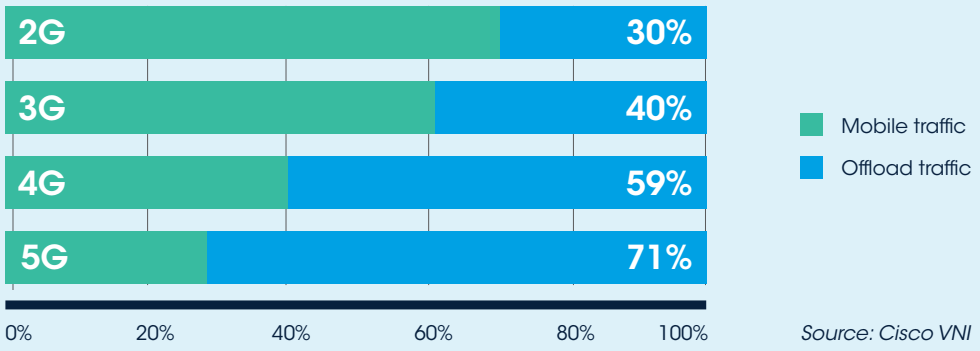
[9] Source: https://www.opensignal.com/2020/06/08/mobile-network-experience-during-the-covid-19-pandemic-june-update
[10] Source: https://newsroom.cisco.com/press-release-content?articleId=1967403
[11] Source: https://senzafili.com/publications/5g_wifi_strongertogether/

As IMT user equipment routinely supports Wi-Fi, there is no need to build out 4G and 5G small cells in places where Wi-Fi is available. Doing so would introduce unnecessary redundancy and add to equipment cost and energy consumption without providing tangible benefits to the 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. Further, both consumers and companies can set up and configure their own Wi-Fi networks, giving them precise control over the connectivity.

As Senza Fili notes in its recent paper, every laptop employs Wi-Fi, but few support cellular, and this is unlikely to change with 5G. "Most home IoT devices use Wi-Fi or Bluetooth because this reduces the cost and complexity of connectivity," the paper adds. "Users can manage their devices – commonly through their phones – without having to set up an account with their mobile operator."

FIGURE 6: WI-FI COULD CARRY MORE THAN 70% OF 5G TRAFFIC



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.[12]

Together, 5G and Wi-Fi will boost innovation and drive transformation as the world seeks to recover from the crisis, potentially supporting a cleaner and healthier planet. 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".[13]

High quality Wi-Fi will 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

[12] Source: https://www.ericsson.com/49da93/assets/local/mobility-report/documents/2020/june2020-ericsson-mobility-report.pdf
[13] 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

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 major increase in broadband accessibility. 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.

SUPPORTING RURAL CONNECTIVITY

Today, more than 40% of the world's people are not online, limiting their ability to participate in the growing digital economy and adjust to the COVID-19 pandemic. The lack of digital infrastructure is particularly acute in villages and small towns, resulting in a fundamental imbalance between urban and non-urban areas.

Broadband delivery to rural areas is a persistent problem that hasn't yet been fully solved anywhere in the world. Although progress is being made through public subsidies, geographic coverage requirements, fixed satellite connectivity, and new technologies, such as low orbit satellites, the cost of connecting a small rural community tends to significantly outweigh the likely service revenues.

Given the challenging economics of serving outlying rural areas, it is vital that each broadband connection is shared as widely as possible. Wi-Fi plays a fundamental role in enabling that to happen. Regardless of whether the broadband connection is provided via satellite, a fixed-line, a wireless connection or a mesh network, Wi-Fi can be used to make it accessible to anyone in the vicinity.

As Wi-Fi allows a number of individuals to share a single broadband Internet connection, the service becomes more affordable thereby increasing Internet penetration. In some cases, community Wi-Fi models can enable an individual subscription to support time- or data-bound service to potentially hundreds of users consuming small data bundles through a publicly accessible Wi-Fi access point.

Although Wi-Fi itself is primarily a local area technology, it can serve relatively large areas, where regulations permit it to transmit at standard power. The use of sharing mechanisms, such as databases, could enable standard power Wi-Fi to be deployed in frequency bands used by other services, such as fixed links.

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 6 routers, smartphones and TVs are available.[14] Figure 7 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 7: 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 gaining traction in both the business and consumer markets. Wi-Fi 6 products accounted for 37% of access point shipments to enterprises in the first quarter of 2021, up from 32% in the previous quarter, according to IDC.[15] In the consumer market, Wi-Fi 6 products now account for 20% of the consumer segment's total revenue, up from 16% in the fourth quarter of 2020, IDC added.

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 offload for 4G and in the future 5G.

Indeed, in outdoor environments, 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. Indoors, Wi-Fi 6 could work with a fiber connection to support these applications.

[14] For details, see: https://www.wi-fi.org/beacon/the-beacon/quarterly-update-wi-fi-6e-devices-driving-technology-innovation
[15] Source: https://www.idc.com/getdoc.jsp?containerId=prUS47918021&utm_medium=rss_feed&utm_source=alert&utm_campaign=rss_syndication

WI-FI IS OFTEN THE MOST COST-EFFECTIVE OPTION

Wi-Fi 6 (and its successors), fiber, and 5G are critical connectivity 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 as it does not depend on complex and expensive infrastructure, and Wi-Fi service providers do not need to participate in auctions to secure access to dedicated licensed spectrum.

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.[16] Support for a cellular connection can add as much as US$130 to the retail price of a tablet device.[17]

Thanks in part to spectrum harmonisation, the global Wi-Fi ecosystem benefits from enormous economies of scale.

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

[17] 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, and already today, Wi-Fi carries almost 50% of all IP traffic.[18]

In its Communications Market Report 2021,[19] UK regulator Ofcom noted: "Average monthly data use per fixed broadband connection increased by 36% to 429 GB, while average use per mobile data user was up by 27% to 4.5 GB per month." The vast majority of the fixed broadband traffic will be relayed to and from devices via Wi-Fi.

Demand for connectivity is also rising rapidly in other parts of EMEA. Internet penetration in Sub-Saharan Africa[20] rose to almost 29% in 2020, up from less than 25% in 2017, according to the ITU (see Figure 8). In the Arab States[21] Internet penetration has climbed to almost 55% from 47% in 2017, according to the ITU. That growth is likely to accelerate going forward.

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

Cisco forecasts that the number of public Wi-Fi hotspots[22] in the Middle East and Africa will grow by 30% per year between 2018 and 2023 (see Figure 9). In Saudi Arabia, for example, public Wi-Fi hotspots (including homespots) will grow 76-fold from 29,300 in 2018 to 2.2 million by 2023, according to Cisco. In South Africa, total public Wi-Fi hotspots (including homespots) will grow three-fold from 310,500 in 2018 to one million by 2023.

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 they have to share a limited amount of spectrum. In 2018, 46% of people in the EU-27 lived in flats, according to the European Commission, while in Saudi Arabia, there are 2.88 million apartments, accounting for almost 53% of all the homes in the country.[23]

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.

ASSIA has highlighted how congestion in both the 2.4 GHz band and the 5 GHz band is impacting quality of service.[24]

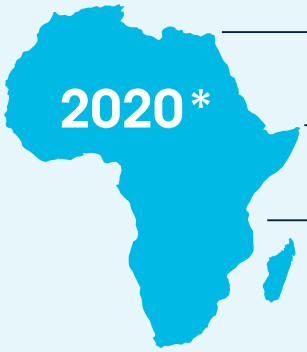
This is becoming an issue because licence-exempt mid-band spectrum is scarce: since the World Radiocommunication Conference in 2003, no new mid-band spectrum has been made available for Wi-Fi despite the exponential growth in the data traffic.

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 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 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.

[18] Source: Cisco VNI Global IP Traffic Forecast, 2017–2022
[19] Source: https://www.ofcom.org.uk/__data/assets/pdf_file/0011/222401/communications-market-report-2021.pdf
[20] 44 countries – full list here: https://www.itu.int/en/ITU-D/Regional-Presence/Africa/Pages/MemberCountriesinAfrica.aspx
[21] 22 countries in North Africa and the Middle East. Full list here: https://www.itu.int/en/ITU-D/Regional-Presence/ArabStates/Pages/MemberCountriesinArabStates.aspx
[22] Homespots use a second SSID (secure identity) to allow a hotspot to be delivered from existing home gateways
[23] According to Al-Eqtisadiah report, based on data from the General Authority for Statistics for the current year 2017.
[24] Source: https://www.assia-inc.com/state-of-wi-fi-reporting/

FIGURE 8: INTERNET PENETRATION IN AFRICA AND THE ARAB STATES IS RISING STEADILY

Mobile network coverage in Africa



88.4%

77.4% 3G

44.3% 4G

*Estimate

Internet access and use in Africa

	2017	2020*
Individuals using the Internet (%)	24.8	28.6 (2019)
Internet access using mobile broadband per 100 inhabitants	25.5	33.1
Internet access using fixed broadband per 100 inhabitants	0.4	0.5

Household Internet and computer access at home, Internet use by youth (15-24 years old), 2019

14.3 per cent of households in the Africa region had Internet access at home in 2019

7.7 per cent of households in the Africa region had access to a computer at home in 2019

Mobile network coverage in the Arab States

95.1%

90.8% 3G

61.9% 4G

*Estimate

Internet access and use in the Arab States

	2017	2020*
Individuals using the Internet (%)	47.2	54.6 (2019)
Internet access using mobile broadband per 100 inhabitants	53.9	60
Internet access using fixed broadband per 100 inhabitants	6.9	8.1

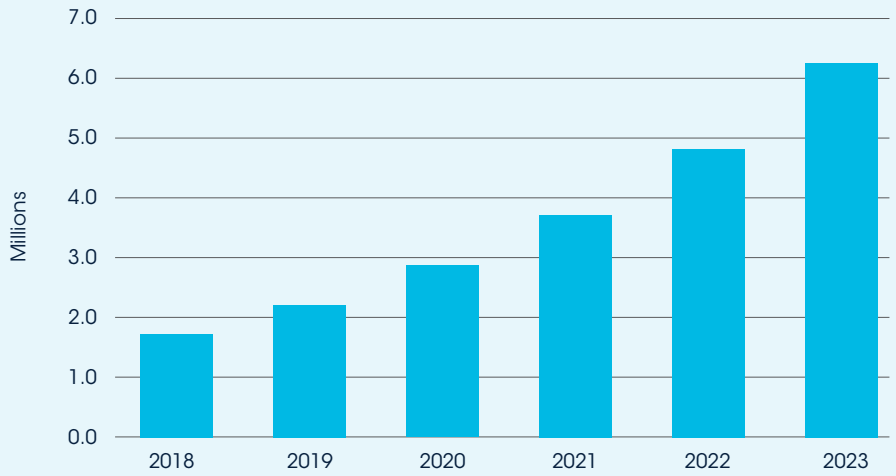
Household Internet and computer access at home, Internet use by youth (15-24 years old), 2019

58.9 per cent of households in the Arab States region had Internet access at home in 2019

52.8 per cent of households in the Arab States region had access to a computer at home in 2019

Source: The ITU

FIGURE 9: PUBLIC WI-FI HOTSPOTS IN THE MIDDLE EAST AND AFRICA

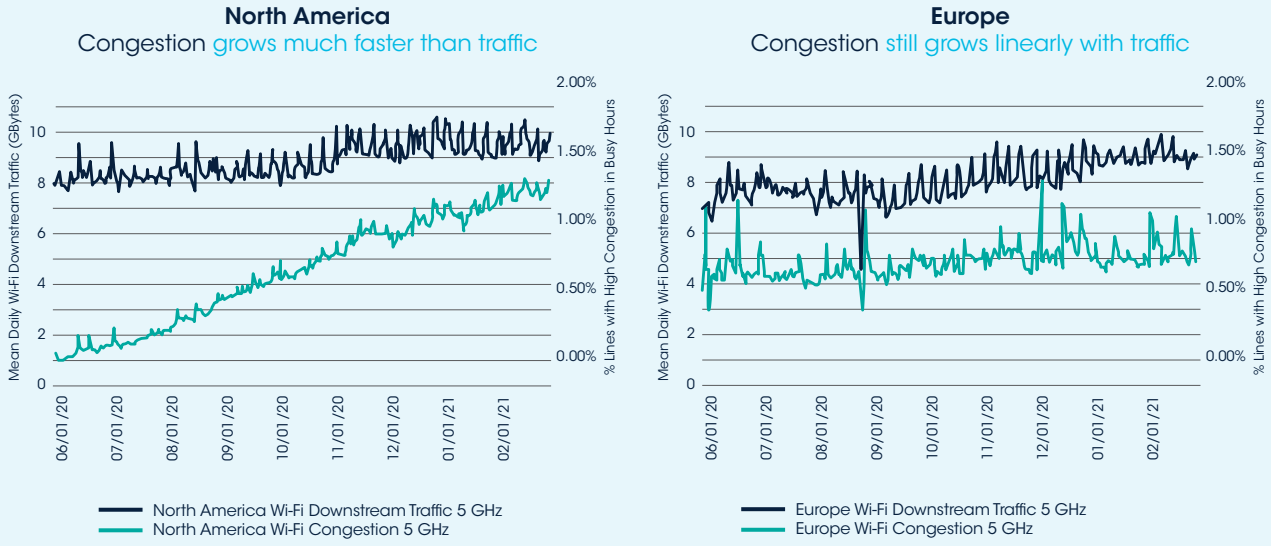


Source: Cisco's Annual Internet Report, February 2020

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 not generally available in Europe (with the exception of the UK) due to sharing issues with incumbents (i.e. radar) and technical conditions.

Figure 10 shows data collected by ASSIA in North America and Europe. While congestion is still growing in line with traffic in Europe, ASSIA warned that the region is approaching a tipping point and will experience congestion issues (similar to those in North America) within six months.

FIGURE 10: RISING WI-FI CONGESTION IN NORTH AMERICA AND EUROPE



Source: ASSIA

This spectrum shortage will prevent the region's citizens and companies from realising the full benefits of the affordable high-capacity Internet connectivity delivered by Wi Fi.

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."[25]

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. Making it available will greatly enhance the impact of Wi-Fi 6 and future Wi-Fi generations. In particular, harnessing the 6 GHz band will improve indoor connectivity and enable the emergence of a new generation of advanced applications and services based on the Wi-Fi 6 standard. It will, for example, support demanding personal area network applications, such as connecting an AR or VR headset to immersive 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[26] in the ITU Radio Regulations, no international action is needed and administrations can immediately open up the band. Extensive technical studies[27] have shown that WAS/RLANs can operate in the lower 6 GHz band (5925-6425 MHz) 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 CASE FOR MAKING THE ENTIRE 6 GHZ BAND LICENCE-EXEMPT

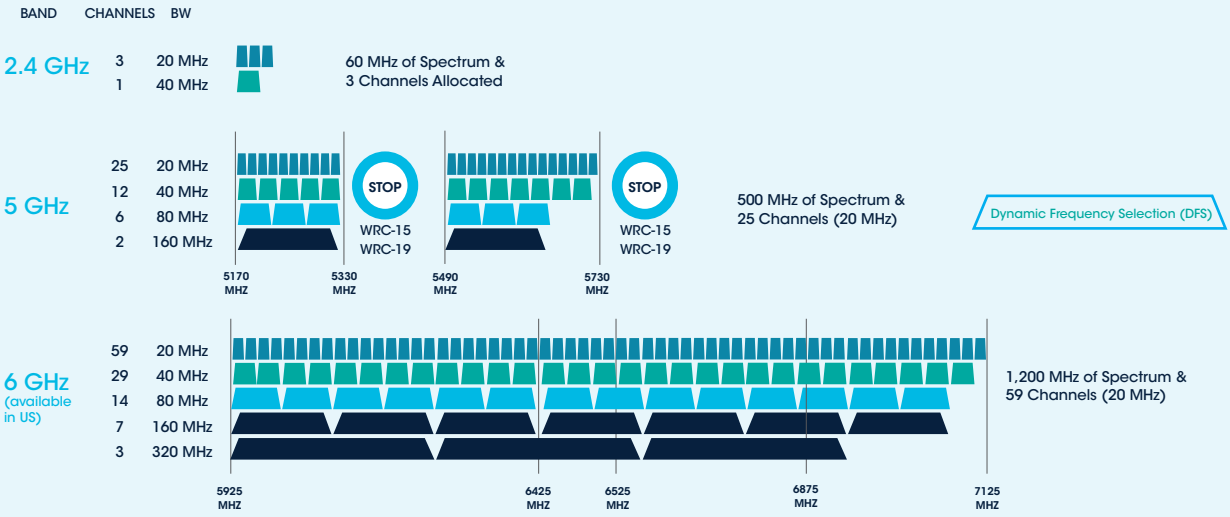
Next generation Wi-Fi, known as Wi-Fi 7, will employ 320 MHz channels to further improve latency, throughput, reliability and quality of service relative to Wi-Fi 6. The US has decided to open up 1200 MHz of spectrum (5925-7125 MHz) in the 6 GHz band to enable use of wider channels and meet growing demand for licence-exempt spectrum. In doing so, the FCC, the US regulator, noted:[28]

- "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

[25] Source: https://wballiance.com/wp-content/uploads/2019/09/WBA-Annual-Industry-Report-2020.pdf
[26] Meaning it can be used by IMT and other wireless connectivity services.
[27] 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 Report 302 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, ECC Report 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.
[28] Source: https://docs.fcc.gov/public/attachments/DOC-363490A1.pdf

FIGURE 11: THE 6 GHZ BAND CAN ACCOMMODATE MULTIPLE 160 MHZ & 320 MHZ CHANNELS



Source: Broadcom

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 11 shows how the full 6 GHz band could accommodate up to seven of these 160 MHz channels compared with just two in the licence-exempt spectrum available in the 5 GHz band. The full 6 GHz band can also accommodate three 320 MHz channels.

Recent economic research[29] 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.

By contrast, opening only 500 MHz of the 6 GHz band would mean Wi-Fi networks in dense deployments would have to continue to employ smaller channel bandwidths (as only one 320 MHz channel would be available). A lack of wider channels would have a detrimental impact on real-time video services and high-bandwidth immersive services, such as augmented reality and virtual reality services. Wider channel bandwidths increase spectrum efficiency and deliver high-bandwidth application and services, while maintaining the ability to share spectrum with incumbents and other licence-exempt deployments.

Subject to the results of appropriate sharing studies, it may be possible in future to use outdoor standard power (higher power) Wi-Fi operations to support use cases in manufacturing, logistics, agriculture, rural broadband, higher education, hospitality, healthcare, and other sectors. Standard power typically operates in conjunction with an automated frequency coordination (AFC) geolocation database capability, which is aware of incumbent user operations and can safely authorise licence-exempt use at a particular location while protecting the incumbents from harmful interference. In essence, the AFC approach involves blocking or protecting certain frequencies or channels at particular locations, while still yielding a sufficient number of wide-bandwidth channels.

In contrast to wide-area IMT deployments, outdoor Wi-Fi deployments would be limited in size, geographically well-defined, and aware of incumbents' spectrum usage, thus minimizing the interference potential to incumbents.

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

REGULATORY DECISIONS IN ITU REGION 1

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.

Ofcom is also considering whether to enable the use of Wi-Fi 6E in the upper 6 GHz band. In an interview with PolicyTracker, Philip Marnick, spectrum group director of Ofcom, said the move would enable the UK to benefit from the global Wi-Fi 6E ecosystem, while meeting growing demand for in-building solutions. "One of our duties is always looking at the efficient use of spectrum," the Ofcom official told the European Spectrum Management Conference. "We need to think about how to put all spectrum into use, to make it work, so we can support existing services, specialist services, and new sharing applications."

The European Commission has published an implementing Decision on the harmonised use of the 5945-6425 MHz frequency band by wireless access systems, including radio local area networks (WAS/RLANs). The Decision said the additional spectrum should support the wide channels required for many applications (including videoconferencing, downloading media, telemedicine, online learning and gaming, augmented reality and virtual reality) that need the bandwidth in order to achieve gigabit speeds. It also noted the EU internal market can now benefit from a spectrum resource potentially available worldwide, thus generating large economies of scale for equipment manufacturers.

The Kingdom of Saudi Arabia was the first country in ITU Region 1 to decide to open the full 6 GHz band on a technology-neutral basis to licence-exempt technologies. Jordan is consulting on whether to also open the full 6 GHz band to licence-exempt use. Morocco and the UAE have already opened the lower 6 GHz band for licence-exempt use.

Following the ATU's recommendation to enable licence-exempt technologies to operate in the lower 6 GHz (5925-6425 MHz) band at power limits consistent with those imposed in Europe, African governments now need to implement this recommendation: Timely adoption by each country will help address the licence-exempt spectrum shortfall and bring major socio-economic benefits to Africa.

MOMENTUM IN ITU REGIONS 2 AND 3

As well as the US and Saudi Arabia, Brazil, Canada, Chile and South Korea are among the countries making the entire 1200 MHz in the 6 GHz band available for licence-exempt Wi-Fi use. Taiwan, Singapore, Mexico, Japan and Australia are working towards making at least parts of the 6 GHz band available for Wi-Fi.

In ITU Region 2 (the Americas), countries representing 85.7% of the populations of North and South America, and 90.6% of its GDP, have adopted rules or launched consultations to declare the 6 GHz band to be open to licence-exempt use.

As in the US, Brazil will allow low power indoor access points to operate at power levels up to 5 dBm/MHz and 30 dBm for a 320 MHz channel. Regulator Anatel has also given the green light for very low-power portable operations throughout the entire band at up to 17 dBm in a 320 MHz channel, paving the way for further innovation and enhancements to Wi-Fi's capabilities.

In ITU Region 3, South Korea has decided to open up the entire 6 GHz band to Wi-Fi on the basis of low power (250 mW limit) indoor usage. Its 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:[30] "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."

South Korea is also considering opening the 6 GHz band for use at standard power indoors and outdoors by employing automatic frequency control (AFC) technologies and processes to prevent interference.

[30] 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 more and more governments make the 6 GHz band available on a licence-exempt basis (see Figure 12), vendors will be able to deliver the same equipment across multiple markets. As a result, Wi-Fi users will benefit from greater economies of scale, lower prices and a more diverse supplier base.

The first Wi-Fi 6E products are now being rolled out. The Wi-Fi Alliance projects that 338 million Wi-Fi 6E devices will be sold globally in 2021. Shipments of Wi-Fi 6E devices are set to ramp up very quickly in 2022 and beyond.

FIGURE 12: GOVERNMENTS MAKING ALL OR PART OF THE 6 GHZ BAND LICENCE-EXEMPT (AS OF AUGUST 2021)

Source: Policy Impact Partners

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

EXTENDING MOBILE BROADBAND COVERAGE

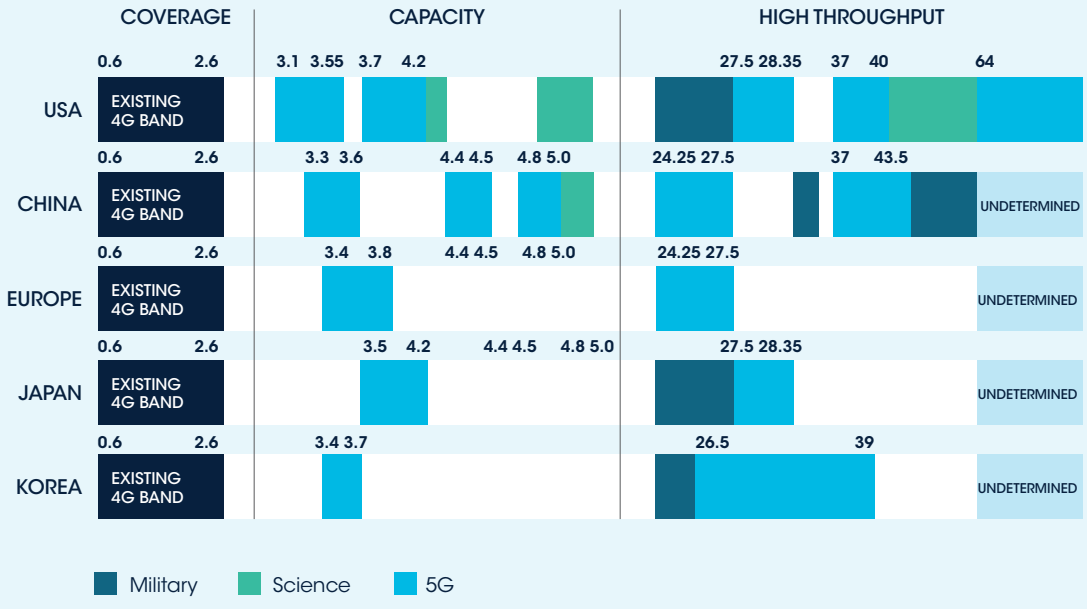
As people commute less and work from home more in response to the COVID-19 pandemic, telecoms operators are seeing greater demand for fixed-wireless access. In areas without fixed-lines, deploying fixed-wireless services in low frequency spectrum can be a cost-effective way to bring broadband to people's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

Although the GSMA recently called for the 6 GHz band to also be used for 5G, this relatively high frequency spectrum does not have the right propagation characteristics to support wide area coverage (see Figure 13). Some stakeholders are also concerned that wide area services would interfere with existing users of this spectrum, such as satellites and fixed-links (see the section on Preparing for WRC-23).

FIGURE 13: SPECTRUM BANDS BELOW 2.6 GHZ ARE BEST-SUITED TO EXTENDING MOBILE BROADBAND COVERAGE



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

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. Licence-exempt mid-band spectrum is also a great resource that small innovative companies can use to develop compelling new services, as there are few barriers to entry, while also creating greater scope for innovation.

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.

CEPT[31] Report 75 and subsequent EC Decision 2021/1067 pave the way for a fully harmonised approach that does not impose unnecessary, disproportionate or spectrum inefficient restrictions. European governments now need to implement the European Commission's decision at a national level as soon as possible.

Some European administrations have called for studies exploring whether licence-exempt technologies can be used across the entire 6 GHz band. For example, Pavel Sistek, head of the policy and strategy unit at the Czech Telecommunication Office, told the Dynamic Spectrum Alliance's Global Summit that more and more countries are exploring RLANs across the whole band and that he would like to see wider European harmonisation. The Wi-Fi ecosystem is calling for the CEPT to raise a work item to study the technical conditions for co-existence between WAS/RLAN (including Wi-Fi) and the incumbent fixed and fixed satellite services in the 6425-7125 MHz band.

NEXT STEPS IN AFRICA AND THE MIDDLE EAST

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 maximize economies of scale and reduce the cost of equipment for end-users.

In Africa, national governments now need to implement the ATU recommendation to enable licence-exempt technologies to operate in the lower 6 GHz (5925-6425 MHz) band at power limits consistent with those imposed in Europe. The African Spectrum Allocation Plan (AfriSAP or ATU-R Plan 001-0) includes WAS/RLAN as a typical application in the 5925-6425 MHz band. AfriSAP was approved at the ATU WRC-23 preparatory meeting.

The Arab States also need to continue to open up the 6 GHz band, preferably the full 1200 GHz, to licence-exempt technologies, such as Wi-Fi. Administrations in the region should consider initiating national consultations on licence-exempt access to the entire 6 GHz band.

[31] The European Conference of Postal and Telecommunications Administrations

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 major markets, such as the US, Canada, South Korea, and Brazil, have already made 5925-7125 MHz licence-exempt, administrations should be aware that the upper 6 GHz band will not be harmonised globally for licensed 5G.

In any case, ITU Radio Regulations already provide for a mobile allocation in the upper 6 GHz band. That means national administrations can allow IMT services to use this spectrum in their sovereign territory if they so choose. That said, as there is no 3GPP 6 GHz New Radio (5G) specification, there is no commercially-available IMT equipment for this band.

In an August 2020 report, Coleago Consulting estimated 5G will not be deployed in the 6 GHz band for at least a decade. The report, entitled *The 6 GHz Opportunity for IMT*[32], refers to "the 10+ year timeframe anticipated for 5G at 6 GHz".

Furthermore, some regulators are concerned that IMT networks in the upper 6 GHz band would interfere with the important fixed and fixed satellite links currently operating in that band, due to the high power requirement for IMT coverage outdoors.

Mali and Niger have outlined their concerns about high power IMT sharing the 6 GHz band with incumbent satellite services. Their joint input to ITU-R Working Party 5D notes that: "Many countries, within the African continent, rely heavily on C-band satellite services offering vital services which in many cases cannot be reliably provided, or provided at all, by other means, and that existing studies between FSS and terrestrial mobile technology have demonstrated that sharing is not feasible in the same geographical area."

Presenting at the Dynamic Spectrum Alliance's Global Summit on 9 June 2021, Philip Marnick, group director of spectrum for Ofcom, the UK regulator, cautioned: "IMT identification is being considered for Region 1 at WRC-23. But coexistence between existing users and high power outdoor mobile is not possible – would require clearing incumbents."[33]

The satellite community in Europe also has concerns. In a presentation at the Forum Global WRC-23 Webinar in May 2021, the EMEA Satellite Operators Association (ESOA) stated: "IMT use of the band 6425-7125 MHz would not be compatible with current and future satellite use of the band."[34]

Administrations also need to be aware that, in ITU Region 1, the 6725-7025 MHz band is subject to Appendix 30B of the ITU Radio Regulations. This appendix is intended to guarantee, for all countries, equitable access to the geostationary-satellite orbit in the 6725-7025 MHz band. Therefore, individual nations have rights to operate this band over their territory without time limits. Any deployment of wireless technologies in the 6725-7025 MHz band will need to protect these national allotments.

Within the ITU-R, studies of the potential interference between IMT services and incumbents in the upper 6 GHz band are yet to start. These studies should be based on justifiable technical characteristics and realistic and agreed propagation characteristics.

AVAILABLE MID-BAND SPECTRUM FOR IMT

There is a substantial amount of spectrum below 10 GHz that has already been identified for IMT (see Figure 14) that could and should be harnessed to improve coverage before specifically identifying more spectrum for IMT. Successive WRCs have identified specific frequency bands for the deployment of IMT systems and this spectrum constitutes a good mix of 'coverage' bands (below 5 GHz) and 'capacity' bands (mmWave spectrum above 24 GHz). In all three ITU Regions, IMT has access to at least 1348 MHz of prime spectrum below 5 GHz – far more than is available for WAS/RLAN.

Saudi Arabia's regulator CITC has said that the 3 GHz band "will be sufficient to cover the mid-band spectrum needs of IMT for the foreseeable future. The existing mid-bands for exclusive IMT use have robust ecosystems already, as well as superior propagation characteristics."

[32] http://www.coleago.com/app/uploads/2020/09/The-6GHz-Opportunity-for-IMT-Coleago-1-Aug-2020-002.pdf
[33] http://dynamicspectrumalliance.org/wp-content/uploads/2021/06/Session-3-Keynote-Philip-Marnick.pdf (slide 6)
[34] EMEA Satellite Operators Association (ESOA) presentation at the Forum Global WRC-23 Webinar on 6 GHz, 17 May 2021,

As regulators globally have made the 3 GHz band available for 5G, a wide variety of compatible equipment is available on the market.

In Europe, CEPT has designated the IMT mid-bands flexibly (meaning they are not wedded to a particular generation of technology or use case), allowing the use of this spectrum for 5G. In total, there is now approximately 2 GHz of radio spectrum available for 5G in the EU.[35]

In contrast to the mid-band spectrum previously identified for IMT, the 6 GHz band has less favorable propagation characteristics to support wide area coverage. Tellingly, the EU's Radio Spectrum Policy Group (RSPG) has not identified the 6 GHz band for 5G.

In areas with low or no network coverage, the priority should be to roll out networks and leverage the existing European 5G priority bands and/or existing IMT identified bands. Making available additional spectrum for IMT does not improve the connectivity when there is no network.

FIGURE 14: LOW AND MID-BAND SPECTRUM IDENTIFIED FOR IMT

SUB MMWAVE BANDS IDENTIFIED FOR IMT (MHZ) IN REGION 1	BANDWIDTH (MHZ)
694/698-960	262
1427-1518	91
1710-2025	315
2110-2200	90
2300-2400	100
2500-2690	190
3300-3400	100
3400-3600	200

Note: An IMT identification does not preclude the use of this band by any application of the services to which it is allocated and does not establish priority in the Radio Regulations. In effect, it is up to each country to determine which bands will be made available for IMT in each country/region depending on national/regional requirements.

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. That will be sufficient to ensure that each mobile operator can get access to 100 MHz contiguous spectrum and therefore offer a high quality of service in the areas where their networks are deployed.

The best way to harness 6 GHz spectrum for the benefit of 5G is to authorise licence-exempt use throughout the entire 1200 MHz of the band. Such a move would allow for mobile offload, 5G backhaul, and possibly 5G NR-U operation, should equipment become available. Licence-exempt technologies support a substantial amount of mobile traffic offloads for indoor environments, saving operator capital expenses and conserving licensed mobile spectrum. Further, even after permitting licence-exempt use, fixed link incumbents can remain in the 6 GHz band, meaning these fixed links will be available to support 5G networks.

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

Regulators globally have recognised the important and critical role that licence-exempt technologies, such as Wi-Fi, play in furthering the 5G market and cite this as a reason to allocate the entire 6 GHz band to licence-exempt use. 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.

As Wi-Fi 6E devices are already available, reserving a portion of the 6 GHz band for a later decision on whether to allow IMT (or not) would forego the immediate economic gains that would have accrued from opening the full 6 GHz band to licence-exempt operations. ISED, the regulator in Canada, said such a move would "hinder access to affordable broadband services for Canadians in rural and urban areas and would negatively impact the opportunities for innovation".

To conclude, 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.

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