Hewlett Packard Enterprise

Response to the Questionnaire on the ‘Long-term vision for the upper 6 GHz band’ issued by the Radio Spectrum Policy Group (RSPG)

20th August 2024

Introduction

Hewlett Packard Enterprise (HPE) welcomes the opportunity to respond to the Questionnaire on the 'Long-term vision for the upper 6 GHz band' issued by the Radio Spectrum Policy Group (RSPG) on 8th July 2024 (further on referred to as the 'Questionnaire').

HPE is a global technology leader focused on developing intelligent solutions that allow customers to capture, analyze and act upon data seamlessly from edge to cloud. Our edge to cloud vision is founded upon the GreenLake hybrid cloud platform which allows users to operate and securely manage data between their public and private clouds, on-premises infrastructure and edge solutions. Its Aruba Networking division is a global leader in Enterprise Network and Mobility Solutions and the world's second largest provider of Enterprise Class Wireless Access Points. In 2021, HPE Aruba Networking was the first company worldwide to commercially launch an enterprise-grade 6 GHz Wi-Fi Access Point. With the acquisition in June 2023 of Italy-based company Athonet, a leading provider of Private 5G network solutions we further extended our managed connectivity, Secure Access Service Edge (SASE), and edge compute portfolios which enables us to address the private networking needs of both enterprises and telecom network operators even better.

As a leading edge-to-cloud infrastructure provider, HPE fully supports the establishment of a new Connected Collaborative Computing Network (3C Network) to drive forward Europe's end-to-end infrastructure and platforms for telco cloud and edge to leverage new technologies such as AI. Working with our vast network of over 20,000 European channel partners, we support the enablement of the European local ecosystem to drive innovation and strengthen deep tech skills within Europe.

HPE has led society's digital transformation since the very beginning, as one of the founders of Silicon Valley in 1939. Present in Europe for over fifty years, we work with European businesses and organisations to capture, analyse, and act upon data to accelerate business growth and modernise public administrations. HPE is deeply vested in the EU's ambitious digital and green transformations, from SMEs to the public sector, underpinned by strong privacy rules, targeted R&I investment, support for science, and a multistakeholder approach that sustains Europe's openness to innovation and responds to market needs.

HPE is present in all European countries, operating eight innovation centres in the region and manufacturing liquid cooled supercomputers and servers for data driven organizations. Approximately one third of HPE's global workforce of more than 60,000 employees are based in Europe.

HPE responses to the RSPG's Questionnaire

HPE commends the RSPG for its continued efforts to have radio spectrum used as efficiently as possible and to achieve the digital connectivity targets for Europe, as laid down in the Digital Decade Policy Programme 2030 (DDPP).

Being a leading provider of private 5G (P5G) and Wi-Fi-based enterprise network solutions, we limit our response to Part A of the Questionnaire '*Questions directed to the MFCN and the WAS/RLAN stakeholders'*. Below please find our responses.

1. Demand for MFCN or WAS/RLAN in the upper 6 GHz band before and beyond 2030

Demand for WAS/RLAN

WAS/RLANs, and in particular those using Wi-Fi technology, have become indispensable for providing convenient, affordable, reliable, and performant wireless connectivity to European enterprises and businesses. Approximately 90% of data traffic is transported over fixed networks, and more than 90% of that fixed traffic travels over Wi-Fi. Globally, there are an estimated 21 billion Wi-Fi devices in use today[1].

According to Vodafone[2], Wi-Fi usage has increased by 53% in European households in 2023. The rise in home Wi-Fi usage directly correlates with the fast-growing number of smart devices found in each household – with the average number of connected devices in Europe now standing at 12 per home. This figure is considerably lower than those reported for the Unted States (17[3]) and Australia (24[4]), so that a significant increase can be expected during the next years.

Until a few years ago, Wi-Fi data rates were typically higher than those provided by the access network. Today, with the increased roll-out of fibre-to-the-home (FTTH) and hybrid fibre coax (HFC) networks, Wi-Fi is increasingly becoming a bottleneck. Although Wi-Fi technology has made great technological advances, especially with the introduction of Wi-Fi 6 and Wi-Fi 7, the lack of adequate spectrum resources in Europe prevents users from fully exploiting the capabilities of these technologies. With ever faster fibre services becoming available, the local/indoor connectivity gap is widening rapidly.

The telecommunications industry typically uses Nielsen's Law of Internet Bandwidth to represent historical broadband Internet speeds and to forecast future broadband Internet speeds[5] (see Figure 1). Many years ago, Jakob Nielsen predicted a high-end user's downstream connection speed would grow by approximately 50% compound annual growth rate (CAGR), and as the examples provided further on in this document show, Nielsen's Law still holds.

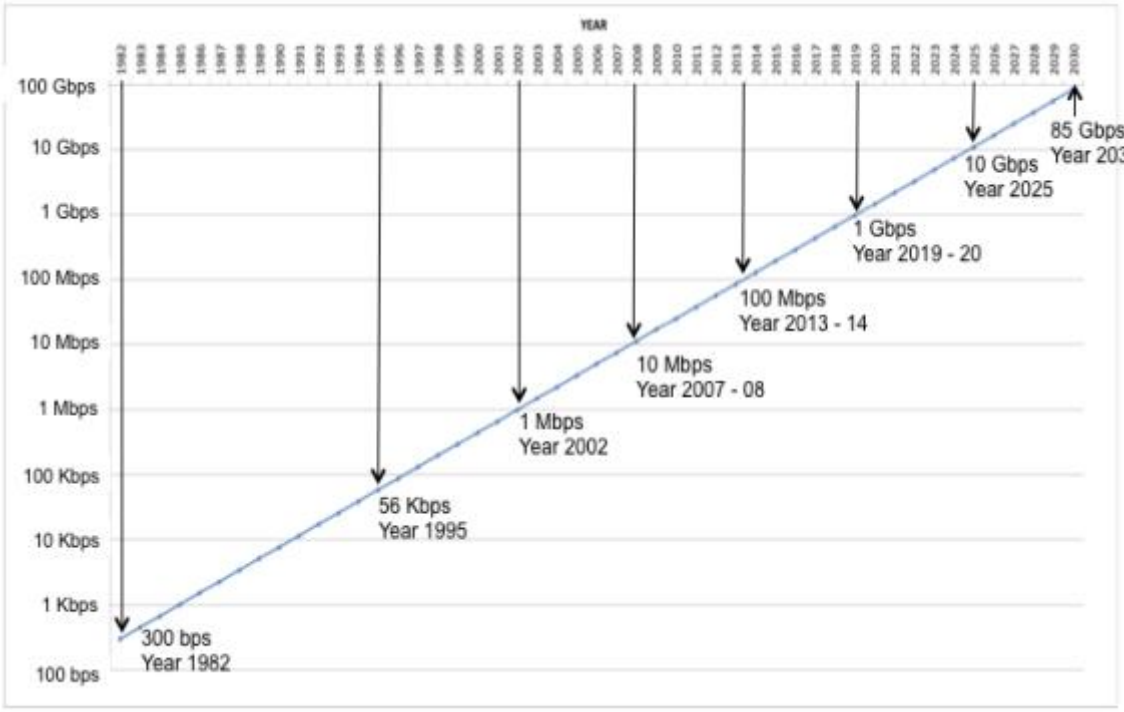

Figure 1: Nielsen's law: Maximum Internet Service Tier offered (downstream)[6]

[1] https://www.wi-fi.org/news-events/newsroom/wi-fi-alliance-celebrates-25-years-of-wi-fi-innovation-and-impact
[2] https://www.vodafone.com/news/products/home-wi-fi-usage-increases-as-european-households-become-more-digital
[3] https://www.parksassociates.com/blogs/in-the-news/parks-average-us-internet-home-had-17-connected-devices-in-2023
[4] https://www.telsyte.com.au/announcements
[5] https://www.cablelabs.com/blog/keeping-pace-nielsens-law
[6] https://spectrumfutures.org/5g-and-6g-are-overhyped-but-it-does-not-matter/

One of the central objectives of the European Commission's Digital Decade Policy Programme (DDPP) is that by 2030, all end users at a fixed location will be covered by a gigabit network and that a data rate of 1 Gbps will be available to all households.

Considering current developments, 1 Gbps will most probably be the minimum data rate that will be offered to fibre customers by 2030. Already today, many European network operators are in the process of rolling out XGS-PON[7] which can achieve symmetric speeds of up to 10 Gbps. In France, for instance, operator SFR launched the 8 Gbps Box 8X in February 2022, followed by Bouygues Telecom which launched an 8 Gbps service in July 2023. At the same time, Iliad's Free, relying on 10G EPON technology, also claimed a speed of up to 8 Gbps. In January 2024, Orange announced it will deploy XGS-PON technology in France as it attempts to keep pace with competitors in the construction and provision of FTTH[8]. The carrier aims to have 30% of its domestic customers covered by the end of 2024, and 100% by the end of 2026.The new Orange Livebox 7 that was launched in October 2023 is compatible with XGS-PON and provides residential users with data rates of up to 5 Gbps downlink and 1 Gbps uplink while business customers are offered up to 8 Gbps downlink and 2 Gbps uplink. According to Orange, financial and environmental issues were taken into consideration when introducing XGS-PON. In Germany, provider Westconnect is deploying XGS-PON to offer symmetrical data rates of up to 10 Gbps to 80,000 consumers and businesses[9].

Meanwhile, 25GS-PON is being rolled out, and the development of next-generation 100G PON technology is underway. Swiss operator init7 is offering a symmetrical 25 Gbps service to residential and business customers[10]. Google Fiber announced in October 2023 that it will be using 25GS-PON along with a Wi-Fi 7 router to deliver symmetrical 20 Gbps services to residential customers in the United States. Google Fiber plans to enable symmetrical 20 Gbps service in all of its markets by the end of 2024[11]. The 20 Gbps service tier is intended for power users and is priced accordingly. Market analysts Dell'Oro expect that as Wi-Fi 7 devices including phones, laptops, tablets, and smart TVs, begin to proliferate in the home, the need for each of these devices to access data at multi-gigabit speeds will also grow[12].

It is obvious that for users to enjoy the benefits of the (multi-) gigabit speeds delivered by fibre networks, those must be complemented by adequately performant Wi-Fi networks. The above examples demonstrate that the need to make the full 5945-7125 MHz band available for high-capacity Wi-Fi arises long before 2030. This need was acknowledged by the FTTH Council Europe which recommended the 6425-7125 MHz band (the 'upper 6 GHz band') be made available for licence-exempt use[13] in addition to the currently available 5945-6425 MHz band.

Households account for a large portion of overall data consumption, and during the coming years, household data consumption is expected to maintain its impressive growth, with the vast majority of data being transferred over fixed access networks. Even the very conservative study Arthur D. Little produced for the mobile industry expects the amount of fixed data consumed by households in Germany to increase from 222 GB per month in 2022 to 894 GB per month in 2030[14]. A study developed by Goldmedia for Vodafone predicts fixed data consumption per household in Germany may even reach 2.6 TB to 8.9 TB per month by 2030[15].

For comparison we provide data from the United States reported by Openvault[16]. In the U.S., the average amount of data consumed per household per month stood at 605 GB at the end of Q1 2024. It must be highlighted here that a considerable number of users, i.e., almost one fourth, consumed more than 1 TB per month (the percentage of power users consuming 1 TB or more per month in 1Q24 was 19.5%, and the category of 'super power users' consuming 2 TB or more per month increased from 3% to 3.9%, i.e., a 30% year over year increase). OpenVault forecasts that average data usage per household will reach 700 GB by the end of 2024 and 1 TB by the end of 2028.

For enterprises, Wi-Fi connectivity is at least as important as it is for consumers. Enterprise connectivity is much more than connecting smartphones, notebook PCs, and tablets wirelessly when in the office. We provide more information on enterprise Wi-Fi use cases in Section 4 of this document (*Use cases, expected deployments and timeframe)*. The fast adoption of Wi-Fi 6E was primarily driven by enterprises upgrading their networks to capitalize on the advantages brought about by Wi-Fi 6 technology and the availability of the 6 GHz band. Unsurprisingly, the adoption rate was highest in countries that opened the full 5925-7125 MHz band for licence-exempt use.

[7] Ten (X) Gigabit Symmetric Passive Optical Network
[8] http://anycom-fiberoptics.com/orange-plans-to-launch-xgs-pon-in-france-by-the-end-of-2026/
[9] https://www.fibre-systems.com/article/homes-businesses-north-rhine-westphalia-gain-superfast-fibre-connectivity
[10] https://www.init7.net/de/internet/fiber7/
[11] https://www.telecompetitor.com/google-fiber-gets-aggressive-on-xgs-pon-25g-pon-advanced-wi-fi/
[12] https://www.delloro.com/25gs-pon-continuing-to-gather-market-momentum/
[13] https://www.ftthcouncil.eu/committees/policy-regulation/6ghz-spectrum-usage
[14] Arthur D. Little: The Evolution of Data Growth in Europe, Report 2023
[15] Evolution-von-HFC-Netzen-Kurzstudie-Goldmedia-Vodafone-Institut.pdf
[16] https://openvault.com/wp-content/uploads/2024/05/OpenVault_1Q24_OVBI_Report_v3-1.pdf

In the European Union, there are approximately 32 million enterprises, of which 99.8% are small and medium-sized enterprises (SMEs) with less than 250 employees. Large enterprises account for 35% of the total of 160 million employees. In 2023, the vast majority (93.9%) of EU enterprises used a fixed broadband connection to access the internet. The share was even larger for medium and large enterprises, where almost all enterprises reported connecting to the internet via fixed broadband[17]. Enterprise density correlates with population density, i.e., it is highest in dense and very dense urban areas[18].

In 2023, 76% of SMEs and 32% of large enterprises in the EU recorded low or very low digital intensity levels, and only 45% of all EU businesses used cloud computing services[19]. In the course of the digital transformation of Europe these levels will increase significantly, driving up the need for multi-gigabit fibre connectivity in SMEs and large enterprises alike.

In its Proposal for a Decision of the European Parliament and of the Council establishing the 2030 Policy Programme "Path to the Digital Decade"[20], the European Commission very clearly identified the importance of making gigabit fibre connectivity available to European enterprises:

> *By 2030, networks with gigabit speeds should become available at accessible conditions for all those who need or wish such capacity. A universal Gigabit target is needed to ensure that all EU citizens and businesses are reached by at least one modern, energy efficient and future proof digital connectivity infrastructure wherever they live or work. Similar to electricity, these data transport networks are the precondition for citizens and enterprises to benefit from new digital communications services and capabilities.*
>
> *In order to meet the connectivity demands of its consumers and businesses in Europe, it will be necessary to accelerate investment in such optical fibre networks within the next few years […].*
>
> *Analysis of household behaviour and upcoming digital use cases suggests that both residential and business consumers will progressively require Gigabit connections to meet their needs […].*
>
> *Although today some of the connectivity needs of regular businesses still can be met by standard mass products, the connectivity needs of digitally intensive businesses can increasingly only be met with fibre broadband connection reaching closer and closer to the end users, such as Fibre to the Premises (FTTP) and upgraded cable connections. Fibre connections are also key to enabling small and medium-sized enterprises (SMEs) and public sector sites such as schools to drastically reduce the need for own servers and dedicated IT resources and ultimately unnecessary cost.*
>
> *Well before the end of the decade, digitally intensive businesses in all sectors will need Gigabit connections and data infrastructures with reliable, fast in both uplink and downlink directions, and low-latency fibre access greatly facilitating cloud computing and data processing. The high bandwidth and reliability offered by Gigabit connectivity networks will for instance be important in offices, permitting work outside their premises, faster upload and download of files and more reliable access to Software-as-a-Service and cloud-based software.*
>
> - *In manufacturing, fibre networks will provide support for industrial IoT based on Wi-Fi 6, or local backhaul for use cases based on 5G, for instance serving as the local area network in industrial or campus sites.*
> - *In the public sector, fibre networks will accelerate the development of 'smart cities' by enabling the application of IoT technology to utilities and services in public spaces, including street lighting, energy, waste and water management.*
> - *In education, fibre networks will enable enhanced digital learning, allowing the download of large amounts of educational content at the same location, immersive learning environments and virtual field trips.*
> - *In healthcare, the higher bandwidths provided by fibre networks will permit more detailed remote patient monitoring using smart sensors, remote video consultation and surgery and remote AI-supported diagnosis.*

[17] https://ec.europa.eu/eurostat/web/products-eurostat-news/w/ddn-20240125-2
[18] Source: Eurostat
[19] https://ec.europa.eu/eurostat/web/interactive-publications/digitalisation-2024
[20] COMMISSION STAFF WORKING DOCUMENT Accompanying the document Proposal for a Decision of the European Parliament and of the Council establishing the 2030 Policy Programme "Path to the Digital Decade" {COM(2021) 574 final}, 15.09.2021

For Europe, no information on enterprise data usage could be obtained. In the United States, enterprise data usage increased by 136% between 2019 and 2023, compared to 86% for residential users[21] which is consistent with Gartner's assessment that traffic within enterprise networks doubles approximately every 2.9 years[22].

Demand for MFCN

Upfront, a word of clarification about the use of the term 'MFCN'. While some members of the IMT industry consider 'MFCN' to exclusively denote high-power wide-area cellular networks, we use it in the generic sense as defined in CEPT Report 49: "*The term "MFCN" (Mobile/fixed communications networks) includes IMT and other communications networks in the mobile and fixed services*". Hence, we also consider low- and medium-power private 5G (P5G) networks to fall under the definition of MFCN.

As acknowledged by the European Commission, IMT 5G so far has not fulfilled expectations[23]. Take-up rates in Europe are low, not because of a lack of available spectrum but because of a real or perceived lack of benefits for consumers and businesses.

A study on mobile usage conducted by GWS[24] in the UK revealed that consumers are satisfied with their everyday mobile network speeds ranging between 1-5 Mbps. The findings reveal that speed is not a key driver for people to move networks, with poor signal and blackspots ranking much higher than speed as a reason to change. Social media and browsing currently account for 43% of the total mobile screen time amongst UK adults. UK consumers spend 54% of all daily mobile use on just 10 apps.

HPE expects the biggest growth potential for IMT 5G to be in the 'Verticals' segment where private 5G (P5G) networks will be deployed to address enterprises' need for outdoor coverage and mobility. Between 2022 and 2028, the number of private mobile networks is expected to grow by 1400%, from 4,000 to over 60,000. In terms of private 5G network investment, analysts predict a CAGR of approximately 42% from 2024 to 2027, with contributions from vertical industries such as manufacturing, utilities, and many others. The integration of these networks is expected to generate nearly $9 billion by the end of 2028[25].

In its white paper "How to master Europe's digital infrastructure needs?"[26], the European Commission highlights the importance of the 'Verticals' segment for 5G and vice versa. As stated above, we believe that those verticals will best be served by P5G networks which, unlike public networks controlled by large mobile network operators (MNOs), can deliver, in a timely manner, the required performance, data security and sovereignty, and scalability, just to name a few major advantages.

We are optimistic that the European Commission's efforts to harmonize the 3800-4200 MHz band for that purpose will be successful and that P5G networks will be operating predominantly in that band where they will complement Wi-Fi enterprise networks operating in the 6 GHz band. We believe that in the future, private 5G and Wi-Fi will work jointly, enabling new use cases for customers in which outdoor coverage and latency play a fundamental role; this synergy finds application in contexts such as ports, defence applications, mining activities and sporting events.

Concerning the mobile traffic projections presented by the IMT industry we share the view expressed by many experts who question the validity of these projections and the need for additional spectrum for Wireless Broadband Electronic Communications Services (WBB ECS) / IMT in the upper 6 GHz band[27].

Statistics published by administrations in Germany, France, Spain, the UK, and other countries show that mobile network traffic typically accounts for 3-10% of all data traffic, while fixed network traffic accounts for 90-97%. According to statistics published by German industry association VATM (Verband der Anbieter von Telekommunikations- und Mehrwertdiensten) on fixed and mobile data usage in Germany, mobile's share of total traffic increased from 0.8% to just 2.0% between 2016 and 2023[28].

[21] Openvault Broadband Insights Report (OVBI) 4Q23
[22] https://www.aryaka.com/blog/time-wan-reset-gartner-looks-sd-wan-future-enterprise-networks/
[23] European Commission White Paper "How to master Europe's digital infrastructure needs?"; COM(2024) 81 final, 21.02.2024
[24] https://gwsolutions.com/2024/03/15/uk-mobile-users-satisfied-with-speeds-in-the-sweet-spot-ranging-between-1-5mbps/
[25] Analysys Mason, Telecoms capex: Worldwide trends and forecasts 2018–2028, 2024
[26] https://digital-strategy.ec.europa.eu/en/library/white-paper-how-master-europes-digital-infrastructure-needs
[27] https://www.linkedin.com/posts/deanbubley_wrc23-5g-spectrum-activity-7128827661589602307-lwE5/; https://www.linkedin.com/posts/william-webb-065640b_current-forecasts-for-mobile-demand-growth-activity-7130159461356199938-SZRw/
[28] Source: 23. VATM TK-Marktanalyse 2021; 24. VATM TK-Marktanalyse 2022; 25. VATM TK-Marktanalyse 2023

With 70-80% of mobile traffic being generated or terminated indoors[29], outdoor mobile traffic accounts for a mere 0.6% to 3% of total data traffic.

There are no indications that mobile traffic, particularly outdoors, will increase significantly during the next years, as 90% of AR/VR/HD video usage which is typically presented as capacity-hungry IMT use case will occur indoors and be handled predominantly by Wi-Fi. Clearly, high-quality AR/VR services cannot realistically be provided from public IMT networks using high-power outdoor macro base stations which is the use case targeted by the IMT industry for the upper 6 GHz band. Even optimistic forecasts such as the one developed by Arthur D. Little for the GSMA project the share of mobile traffic in Europe to reach just 9% of total traffic by 2030[30]. In the face of declining growth, industry experts project that mobile data usage will plateau in the next years[31,32,33].

Cellular capacity bottlenecks which are frequently cited as another major reason to get the upper 6 GHz band allocated to IMT only occur in very small geographical areas, such as railway stations and only during very limited periods of time. These bottlenecks can be removed by utilizing mid-band spectrum already available to WBB ECS/IMT more efficiently, by deploying 5G millimetre wave (mmWave) networks, or by handing over traffic from cellular networks to Wi-Fi. An example for the latter can be found in the city of Melbourne (Australia) where cellular congestion occurs at some railway stations in the city's central business district, albeit only for a few minutes per day during peak commute times[34]. This congestion is expected to be relieved by a major upgrade of Melbourne's free Wi-Fi network which will also cover the train station areas[35].

For WBB ECS/IMT, multiple alternatives to the upper 6 GHz band exist in the mid-range and millimetre wave spectrum bands. In mid-band, existing WBB ECS/IMT allocations are still heavily underutilized, according to the 5G Observatory Report[36]. In June 2023, the European Telecommunications Network Operators' Association (ETNO) reported that while 5G coverage had reached 73% of the European population, 5G take-up stood at only 19%[37].

Areas with high capacity demand can be served by mmWave systems. According to the GSMA[38], "*Mobile operators are deploying millimetre wave (mmWave) 5G networks in crowded locations, such as sports arenas, stadiums, airports, concerts, busy shopping streets and other large venues. Operating at frequencies of 24 GHz and higher, these 5G Frequency Range 2 (FR2) networks are able to deliver multi-gigabit data rates and very low latency. The mmWave bands offer a 10-fold increase in available contiguous bandwidth compared to sub-6 GHz 5G Frequency Range 1 (FR1) bands. As a result, mmWave networks can handle a greater number of connections, while also boosting the peak data rates for individual devices*".

Another argument frequently presented by the IMT industry is that the upper 6 GHz band will be needed to provide fixed wireless access (FWA) over 5G. FWA can be an option to provide broadband connectivity to areas in which deploying a fixed network may not be technically and/or economically feasible. It must be clearly understood, though that FWA is not a replacement for Wi-Fi but needs, like fibre, cable, or satellite access networks, Wi-Fi to provide indoor connectivity to users.

For FWA, bands other than the upper 6 GHz band are available, such as mmWave bands which provide significantly more capacity and hence higher data rates per user. In June 2024, Greek regulator EETT stated that high-speed mmWave FWA becomes mature and can provide an experience similar to that of fibre and that the mmWave ecosystem is ready, i.e., mainstream chipsets and a large number of low-priced CPE are available[39].

According to Nokia, mmWave can be used in urban, suburban, and rural areas without the need for costly network densification. It can also be used in non-line-of-sight conditions, and it can cover distances exceeding 12 km in rural environments. mmWave is touted as relatively low-cost, high-capacity spectrum that can fuel FWA growth for many operators who face capacity challenges or have unused spectrum[40].

When Cyprus recently introduced a voucher scheme to provide users with affordable ultrafast broadband services (up to 2 Gbps downstream and 250 Mbps upstream), the Department of Electronic Communications (DEC) determined that FTTH/ GPON was the only technology able to satisfy the performance requirements, particularly in the uplink direction. The use of

[29] https://www.ericsson.com/en/blog/2021/11/delivering-consistent-high-performance-indoor-5g-experience
[30] Arthur D. Little: The Evolution of Data Growth in Europe, Report 2023
[31] https://www.lightreading.com/5g/led-by-ericsson-mobile-traffic-forecasts-are-looking-suspect
[32] https://www.linkedin.com/pulse/end-era-mobile-data-grwoth-sight-william-webb/
[33] https://www.gazettabyte.com/home/2024/8/1/is-network-traffic-growth-dwindling-to-a-trickle.html
[34] https://stanfordasl.github.io/wp-content/papercite-data/pdf/Chinchali.ea.AAAI18.pdf
[35] https://www.itnews.com.au/news/melbournes-free-city-wi-fi-poised-for-major-upgrade-607315
[36] https://5gobservatory.eu/observatory-overview/observatory-reports/
[37] ETNO: *Review of 5G Progress to date*, CEPT Workshop 6G – 29 June 2023
[38] GSMA: 5G mmWave Coverage Extension Solutions Whitepaper, December 2022
[39] https://www.eett.gr/wp-content/uploads/2024/06/2024_06_04_Next_Giga_Connect_Europe.pdf
[40] https://www.nokia.com/networks/fixed-networks/fastmile/5gmm-receiver

FWA operating in mid-band spectrum was found not to be feasible. FWA in 26 GHz was considered to be a potential future option, but until now this band has not been made available in Cyprus[41].

Short-, medium- and long-term spectrum needs

As outlined above, the multi-gigabit fibre connections available to European households by 2030 will have to be complemented by adequately performant indoor wireless connectivity solutions which in turn will require a sufficient amount of spectrum to be available.

The upper 6 GHz band is the only remaining spectrum that is suitable for supporting the projected strong growth of fixed network traffic of which an estimated 90% will be transferred over Wi-Fi. The latest generations of Wi-Fi (Wi-Fi 6E and Wi-Fi 7) are designed to deliver maximum performance with multiple non-overlapping wide channels (i.e., 160 MHz or 320 MHz) which can only be reliably achieved if the entire 5945-7125 MHz band is made available for licence-exempt access use.

A 2024 study conducted by Plum Consulting[42] concluded that with the amount of 5 and 6 GHz spectrum currently available for Wi-Fi in Europe, gigabit connectivity could be provided in only around 50-60% of residential building area. To ensure whole-building coverage, a minimum of ten 160 MHz channels would be necessary.

While having multiple non-overlapping 320 MHz-wide channels is expected to be of high importance only for certain enterprise use cases where very large volumes of data must be transferred within a very short time and with minimum latency (e.g., in large healthcare facilities)[43], availability of a large number of non-overlapping channels of 40, 80, and 160 MHz width is essential for delivering high user data rates at low latency in dense deployments such as universities, schools, hospitals, logistics facilities, and large public venues. Typically, a minimum of 14 non-overlapping channels was considered necessary to provide optimum user experience in very dense deployments such as large sports stadiums or arenas but with performance requirements skyrocketing, the maximum possible number of non-overlapping channels is now used. In countries that have already made the entire 6 GHz band available for licence-exempt use, we are seeing major Wi-Fi 6E deployments in the aforementioned sectors, and many of HPE's European enterprise customers are eagerly waiting for the entire 6 GHz band to become available for licence-exempt use.

2. Sustainability of the above explained demand

Energy efficiency and sustainability

The IMT industry currently proposes to provide indoor broadband connectivity in urban and dense urban areas from high-power outdoor macro base stations operating in the 6425-7125 MHz band. While this proposal is misguided in many ways, the sustainability aspect stands out.

First of all, the IMT network would compete with the FTTH infrastructure which is currently being deployed and which will be able to connect every household in urban and dense urban areas in the future, thus reducing the potential return on investment for fibre operators and increasing the risk that a considerable amount of resources spent on FTTH build-out will have been wasted. Secondly, it would be a fully redundant network delivering lower performance than the fibre network already in place. Numerous trials showed that under ideal conditions 6 GHz IMT can achieve downlink data rates of 1 Gbps per cell, whereas FTTH + Wi-Fi can deliver more than 1 Gbps per user in downlink and uplink direction.

RF wall attenuation of modern thermally insulated buildings can easily exceed 50 dB. To compensate for building entry loss, IMT signals would have to be transmitted at very high power. IMT terminals operating indoors would, in many cases, have to transmit at higher power, too, resulting in faster battery drain, shorter recharge cycles, reduced battery life, and eventually more electronic waste.

[41] https://dec.dmrid.gov.cy/dmrid/dec/ws_dec.nsf/All/DD59F4395F65E3C4C22588480025E43A/$file/Public%20Consultation%20Report.pdf

[42] https://plumconsulting.co.uk/wpdm-package/mar-2024-wifi-spectrum-requirements/

[43] As an element of the future IEEE802.11bk standard, precision location using 320 MHz wide channels could become another important enterprise use case.

Environmental impact assessment

A study by WIK Consult[44] found that making the upper 6 GHz band available to IMT instead of Wi-Fi could increase energy consumption by 16% which would result in an additional 3.2 megatons of CO2 emissions in Europe per year, assuming that all traffic expected to be transported by Wi-Fi would be transferred to the mobile network.

The German Federal Environmental Agency recommended users to access the Internet via WLAN because transferring data over the mobile network consumed considerably more energy[45].

Various studies found that fibre, and specifically FTTH, also when used in combination with Wi-Fi is the most energy efficient solution to provide users with gigabit connectivity[46,47].

French regulator ARCEP[1] found that the combination of fibre and Wi-Fi is the most efficient solution in terms of energy consumption, performance, and flexibility – 10x more efficient than mobile broadband.

In 2020, a study[2] on the energy efficiency of streaming video over various broadband access technologies was conducted for the German Umweltbundesamt (Federal Environmental Agency). Among its findings which were endorsed by the German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection[48] were:

- Optical fibre is the most climate-friendly transmission medium.
- Network access via wired broadband is better than mobile network access.
- A video stream provided through a fibre optic network produces greenhouse gas emissions of 2 grams per hour, whereas a modern 5G network produces around 5 grams.
- Using Wi-Fi networks is more environmentally friendly than using mobile networks. Environmentally conscious tariffs could, for example, offer free telephone calls on Wi-Fi networks instead of flat rates for mobile telecommunications.
- From an environmental point-of-view it would be good to have more public Wi-Fi hotspots because streaming over Wi-Fi is more climate friendly than streaming over the mobile network.

In October 2022, network operator Orange announced it would advise its employees and customers to switch to Wi-Fi during peak times, to reduce energy consumption[3].

FWA has been touted as a key use case for IMT 5G in the upper 6 GHz band. 5G FWA can be useful to provide broadband access to users in rural and remote areas (Austria and Finland are examples here). For urban areas, however, 5G FWA deployments would be very problematic because a) these areas are fully covered by fibre networks which provide much better performance than mobile, and b) the high energy consumption of FWA compared to fibre.

A study[49] aiming to determine the best approach for achieving Sweden's 2025 broadband goals (98% of Swedish households and workplaces should have at least 1 Gbps broadband access) compared fibre and three FWA-based scenarios, namely existing commercial macro cells, newly installed mmWave small cells, and hybrid macro and small cells. The study concluded that:

1) The pure fibre-based solution should be the "default" choice in order to achieve the Swedish government's 2025 broadband goal.
2) Even though FWA using mmWave small cells is potentially capable of achieving the 1 Gbps @ 98% goal, the trade-off will be the high total cost levels and more energy consumption. In addition, the end user experience is subject to variations in weather and environmental conditions, and the distance to the network antenna.
3) FWA using existing commercial macro cells alone is not capable of reaching the 1 Gbps @ 98% goal, despite the estimated relatively low cost. In addition, the estimated energy consumption level is also significantly higher than the pure fibre-based solution.

[44] WIK Consult - Sustainability Benefits of 6 GHz Spectrum Policy, 31 July 2023
[45] https://www.umweltbundesamt.de/umwelttipps-fuer-den-alltag/elektrogeraete/smartphone#gewusst-wie
[46] Kohn et al.(2020) and Nuutinen (2021). Current FTTH access networks have been found to be two and a half times more energy efficient than current cellular/5G mobile.
[47] Kohn et al. (2020), Laidler (2019) and Andrae (2020). Current 5G access networks are estimated to consume between 0.05-0.09 kWh/Gigabit compared with 0.02 kWh/Gigabit for FTTH including Wi-Fi.
[48] https://netzpolitik.org/2020/studie-zu-co2-emissionen-videostreaming-ist-am-umweltschaedlichsten-im-3g-netz/
[49] Li, Jie; Forzati, Marco: "Cost, performance and energy consumption of 5G fixed wireless access versus pure fiber-based broadband in Sweden"; ITS Online Event, 14-17 June 2020

The above findings were confirmed by other studies which concluded that fibre is considerably more energy-efficient than FWA[50].

Establishing two parallel connectivity infrastructures, one that is energy efficient (FTTH plus Wi-Fi) and one that is not (IMT macro cells) to serve the same user groups (businesses and consumers predominantly in urban areas) would be highly inefficient and grossly contradict Europe's sustainability objectives. Hence, from a sustainability perspective, deployment of 5G FWA should be limited to areas which cannot be served by fibre, and the upper 6 GHz band should not be used for this purpose.

Wi-Fi energy-saving features

The IEEE802.11 family of standards defines a number of energy-saving mechanisms, the most recent ones being Target Wake Time (TWT) and Restricted Target Wake Time (RTWT) which allow client devices to schedule their wake-up times, minimize unnecessary power consumption during idle periods, help conserve battery life, prolong device usage, and reduce energy waste.

RTWT is a Wi-Fi 7-specific enhancement of the TWT mechanism introduced with Wi-Fi 6. In TWT, access points (APs) and client devices negotiate specific times for the client devices to wake up and communicate, thereby conserving power by allowing devices to remain in a low-power state when not actively transmitting or receiving data. RTWT refines this concept by introducing more granular control and scheduling flexibility.

RTWT allows devices to specify not only the wake-up times but also the restrictions around these times. This means devices can wake up at more precise intervals and for shorter durations, significantly reducing power consumption and improving battery life, which is crucial for battery-powered IoT devices and other power-sensitive applications.

On network level, the energy consumption of enterprise Wi-Fi networks is optimized across many or all APs in a deployment by reducing the number of those nodes that are active. One example for such a network-level energy-saving feature is HPE Aruba Networking's Green AP which dynamically enables, disables, or reduces functionality of an allocated AP based on network utilization to reduce the consumption of energy without impacting user experience.

The network management system (NMS) provides data on network traffic and usage patterns to the network operating system ArubaOS. Based on this data, the APs can be put into a deep sleep mode when there is low or no network activity. APs are configured to wake up periodically (typically every 2 hours) using Bluetooth Low Energy (BLE) to check for network activity: If the NMS detects increased network traffic, it signals the APs to wake up from deep sleep mode.

On AP level, the CPU frequency can be adapted dynamically based on load to reduce individual AP power consumption.

Measurements show that despite adding ever more features and functionality, the average energy consumption per unit of traffic (measured in Watts per Mbps) of HPE Aruba Networking's enterprise APs was reduced by 70% within the last years.

Furthermore, the following aspects should be considered

- Current 6 GHz Wi-Fi chipsets and most equipment can operate across the full 6 GHz band.
- Hence, opening the upper 6 GHz band for licence-exempt use would not result in a significant increase of energy consumption.
- By opening the upper 6 GHz band, capacity in dense deployments would be increased resulting in fewer data collisions and re-transmissions, thus reducing power consumption.

Social and economic impact

We refrain from (once again) citing figures from the various studies that were published on the socio-economic impacts of 6 GHz licence-exempt wireless technologies/Wi-Fi and IMT 5G. Instead, we would like to remind that Wi-Fi is used by hundreds of millions of European citizens and in millions of European businesses every day. Wi-Fi is powering the smart home, connecting thermostats, light bulbs, home surveillance cameras, tracking and control devices, doorbells, monitors, roller shutters, consumer electronics, vehicles and many more. More information on use cases is provide in Section 4 of this document.

[50] https://europacable.eu/wp-content/uploads/2022/07/Europacable-Whitepaper-on-Energy-Efficiency-of-Fiber-networks-05-July-2022.pdf

Wi-Fi is used for productivity purposes for a large part of time and on a diverse set of equipment (notebook PCs, desktop PCs, tablets, smartphones) in residential, office, industrial, and many other enterprise environments. In contrast, IMT (4G/5G) is predominantly used on smartphones. Numerous studies on smartphone usage conclude that mobile connectivity is mostly used for messaging, social media, reading news, online shopping, checking the weather, banking, and watching videos (in order of priority).

Unlike the public mobile / IMT ecosystem which is dominated by a few big international corporations, the Wi-Fi ecosystem is characterized by a large and diverse global vendor base which is particularly important for small and medium-sized enterprises (SMEs) as it provides for choice, security of supply, competitive prices, and, last but not least, innovation. Representing more than 99% of all businesses in the EU, SMEs are the backbone of Europe's economy[51].

Besides its ease of installation and network and data sovereignty, Wi-Fi is characterized by its superior cost-performance ratio compared to IMT. With chipset prices typically an order of magnitude lower than those of IMT 5G[52], Wi-Fi makes high-speed and reliable communications affordable for businesses and consumers.

Frank Fitzek, Head of the 'Deutsche Telekom Chair of Communication Networks' at the Technical University of Dresden is quoted to have said during the 2023 6G Summit in New York: "*Never forget Wi-Fi. They have something that 5G will never have: lower cost*."[53].

Artificially restricting the use of Wi-Fi in favour of cellular communications would not only diminish the competitiveness of European industry but disadvantage less affluent parts of the population which could lead to a widening of the digital divide in Europe.

3. The possible role of the upper 6 GHz for MFCN or WAS/RLAN

HPE considers the upper 6 GHz band to be crucial for addressing wireless connectivity needs in the enterprise networking domain, and we are of the opinion that the best and most efficient use of the 6 GHz band will be made by authorizing licence-exempt WAS/RLAN operation in the full band (5945-7125 MHz).

For numerous reasons, which are highlighted in this document we see no need for providing additional spectrum for IMT wide-area networks in the upper 6 GHz band. A number of key reasons are listed below:

- 90% of data usage occurs indoors. With connectivity provided by outdoor high-power IMT macro base stations, as envisaged by the IMT industry, IMT 5G operating in the upper 6 GHz band is not suitable for delivering gigabit speeds indoors to consumers and enterprises.
- As various field trials of 6 GHz IMT have demonstrated, wide area 5G cannot deliver sufficiently high data rates in the uplink direction. The main limiting factor is the maximum transmit power of the user equipment which is predominantly smartphones.
- Without a sufficiently resourced indoor wireless connectivity technology, achieving the DDPP target of making 1 Gbps available at every household's doorstep in the EU is meaningless.
- Wi-Fi provides broadband indoor connectivity to virtually all internet-connected households and businesses. For providing gigabit wireless indoor connectivity, Wi-Fi is the most cost-effective, performant, and energy-efficient solution.
- The IMT industry targets urban and dense urban areas for providing 5G connectivity in the upper 6 GHz band. In the future, 100 percent of these areas will be covered by fibre networks. Deploying a redundant, less-performant, and more energy-consuming 5G network would be extremely inefficient.
- If high-power IMT were to be deployed in the upper 6 GHz band, incumbent services (FS, FSS, RAS) would most probably have to vacate the band. IMT base station e.i.r.p. and the projected number of deployed base stations presented in ECC PT1 are significantly higher than those assumed in the studies preceding WRC-23. Limits defined for mitigation techniques such as the IMT "expected e.i.r.p. mask" which depend on the number of deployed base stations would have to be re-assessed.

[51] https://single-market-economy.ec.europa.eu/smes_en
[52] https://scet.berkeley.edu/the-impact-of-5g-on-existing-internet-systems/
[53] https://www.lightreading.com/6g/6g-summit-brings-unusual-plea-from-carriers-slow-your-roll

- Utilization of existing 5G bands is low. MNOs should first use the large amount of spectrum already available for IMT.
- Demand for MNO-provided 5G is low. Many MNOs need to achieve a return on their investment in 5G networks before they can invest in new bands (6 GHz) and networks. Analysts report that in H1 2024, operators further reduced their spending on the network infrastructure segment due to a lack of 5G monetization opportunities. The transition to 5G Standalone (SA) also slowed down during H1 2024 as operators claim that they do not see any business opportunities in deploying a dedicated 5G core[54].
- In some European countries such as Germany, per-site EMF limits have already been reached so that additional antennas (for 6 GHz IMT) cannot be installed and activated at existing sites unless other antennas in operation are deactivated. As new sites would have to be identified anyway, those should better be used for densifying the existing mid-band network.
- The areas where mobile congestion occurs or may occur are very small (frequently in and around train stations). MNOs can either densify their networks in hotspot areas or adopt existing mechanisms to handover cellular traffic to Wi-Fi.
- While one European administration claimed the upper 6 GHz band was essential for deploying future 6G networks, WRC-23 found the upper 6 GHz band not to be suitable for 6G and decided to study other bands that are also being supported by the IMT industry.

4. Use cases, expected deployments and timeframe

The digital transformation of European industry and society overall fuels the demand for private local networks, whether they are based on Wi-Fi, 5G or both. The major reasons driving this demand are that enterprise users want full control over their networks, data, and quality of service.

WAS/RLAN

The vast majority of enterprise use cases are today covered by WAS/RLAN, i.e., Wi-Fi. Among the most popular enterprise use cases are education (universities and schools), large public venues (conference centres and stadiums), healthcare (hospitals), factories, logistics centres, offices, public administrations, hospitality (hotels & resorts), retail, transport, and tourism.

The move towards cloud-based services as well as the increasing use of sensors/IoT results in enterprise traffic becoming increasingly symmetric. The same is true for large public venues (LPVs) where uplink traffic frequently exceeds downlink traffic.

Residential traffic too is becoming more symmetrical, due to home office work and the use of IoT/sensors, HD cameras, etc. in the smart home (examples for Wi-Fi smart home devices were provided in Section 2 of this document).

Exemplary enterprise Wi-Fi use case: Major sports stadium/arena

For major sports stadiums and arenas in the United States, being able to provide ubiquitous high-performance Wi-Fi connectivity has become a differentiating factor and key selling point. While data traffic during events had constantly increased during the past years, it surged with the advent of Wi-Fi 6/6E and the opening of the 5925-7125 MHz band. In 2022, Ohio State University reported a record Wi-Fi data usage of 34.8 TB during a single event[55], and in early 2024, the Mercedes Benz Stadium in New Orleans reported data usage had reached levels of 600 MB per attendee[56] (the stadium has a capacity of 83,000 attendees). The number of unique clients registered during an event can exceed 90% of the number of attendees, and the number of concurrently active clients has exceeded 60% during certain events[55].

The currently largest indoor arena in Europe, the Veltins Arena in Gelsenkirchen (Germany) can accommodate close to 80,000 attendees. Assuming user behaviour to be similar to that in the US, about 50,000 clients could be active concurrently. Uploads and streaming of live content from an event are becoming increasingly popular, and the amount of uplink traffic now frequently exceeds that of downlink traffic. Uploading a 4K video to YouTube requires a data rate of 35-68 Mbps[57].

[54] https://www.counterpointresearch.com/insights/ericsson-nokia-samsungs-h1-revenues-slump-amid-5g-monetization-challenges/
[55] https://stadiumtechreport.com/feature/ohio-state-sets-new-top-wi-fi-mark-34-8-tb-at-michigan-game/
[56] https://www.hpe.com/us/en/newsroom/press-release/2024/04/amb-sports-and-entertainment-amps-up-event-experiences-at-mercedes-benz-stadium-with-wi-fi-6e-from-hpe.html
[57] https://elfsight.com/blog/requirements-uploading-video-youtube/

Even if only a fraction of active clients were to stream 4K video, the maximum number of non-overlapping 80 MHz channels available in the 5 GHz and full 6 GHz bands, i.e. 19 channels[58], would be needed to provide the required capacity[59].

With the development of AR/VR technology and equipment progressing rapidly, AR is increasingly used to enhance user experience at concerts, sports matches, and other events[60], driving the need for more downlink capacity.

Exemplary enterprise deployments of full-band 6 GHz Wi-Fi

In 2022, the University of Michigan deployed a new Wi-Fi network comprising more than 16,000 Wi-Fi 6E access points. With greater capacity in the 6 GHz band and wider channels up to 160 MHz, download speeds of up to 750 Mbps and enough bandwidth to support 70,000 concurrent Wi-Fi connections, Wi-Fi 6E brings new capabilities to students, faculty, and staff. University of Michigan facilities include very large classrooms that accommodate up to 500 students at a time. To utilize AR/VR for teaching a large number of students concurrently requires an adequate number on non-overlapping and sufficiently wide Wi-Fi channels. Another design requirement was that all personal devices should at least be able to receive an HD-quality video stream even at the busiest times and in the most densely populated areas. Replacements of hundreds of wired switches and thousands of wired ports also resulted in enormous savings of energy and maintenance costs.

Also in 2022, the Chase Center in San Francisco became the first major sports venue to deploy Wi-Fi 6E on a large scale. Using the full 5925-7125 MHz band, Wi-Fi 6E not only enables the more than 18,000 attendees to capture videos and audio and share that content on social media but also provides services such as mobile ticketing and in-seat food ordering.

In February 2024, the University of Maryland announced the deployment of a new Wi-Fi network with more than 19,000 access points to respond to increasing student, faculty, and staff expectations for reliable and fast connectivity for the skyrocketing number of mobile, connected, and IoT devices. In countries that opened the full 6 GHz band for Wi-Fi use there are many more universities that are upgrading their networks to Wi-Fi 6E and Wi-Fi 7.

Houston airports, one of North America's largest public airport systems is deploying a Wi-Fi 6E network by HPE Aruba Networking to improve wireless and location-based services for the approximately 60 million annual passengers and visitors across its George Bush Intercontinental Airport and the William P. Hobby Airport. The various services offered to guests over Wi-Fi 6E include detailed wayfinding to help travellers get to their gate, baggage claim, and airport amenities, providing information about estimated walking times and real-time parking space availability, and locating where a person's vehicle is parked within a structure. Other features include previewing security checkpoint wait times, visualizing restaurant and shop locations, and receiving real-time flight information. A major driver for deploying Wi-Fi 6E was the availability of 1200 MHz of spectrum to satisfy the skyrocketing expectation for seamless and reliable content streaming, including consuming bandwidth-hungry 4K video. The organization's new Wi-Fi also contributes to Houston Airports sustainability initiative. It provides wireless networking infrastructure with built in power saving capabilities, helps IT operate efficiently, and enables further development of location analytics to supply data for optimizing spaces in support of reducing energy consumption.

MFCN

In our view, no compelling use cases for 5G IMT in the upper 6 GHz band have been presented until now.

Referring to 5G in general, Yoko Nakata, Deputy Director of the Global Strategy Division of Japan's Ministry of Internal Affairs and Communications (MIC) stated during the 6G Global Summit which was held in London from 21-24 May 2024:

"*We haven't found the killer app unique to 5G yet and we are hoping to find one with the rollout of the standalone system*."

"*But we believe there will be no 6G without the success of 5G so it's really important that we find some applications accepted by everyone in society*".

A statement frequently heard from industry is "5G is not for the consumer", along with "5G must get into the verticals". HPE agrees that there is a strong potential for 5G to grow in the "verticals" segment. We are convinced, however, that the connectivity needs of verticals can best be addressed by "hybrid" local private networks which integrate Wi-Fi and 5G technology and provide seamless connectivity between stationary, mobile, indoor and outdoor network users. The 3.8 – 4.2 GHz band that the European Commission identified as preferred band for low- and medium power local networks would

[58] 14 channels in the 5945-7125 MHz band, 2 channels in the 5150-5350 MHz band, and 3 channels in the 5470-5725 MHz band. Estimate based on usage of MCS-11 and 2 spatial streams.
[59] Assuming a density of 50 users per AP which currently is standard for stadium deployments.
[60] https://ecommercelplatforms.info/ar-applications-for-enhancing-live-events-and-performances/

provide 400 MHz of highly re-usable spectrum for P5G and ideally complement the 5945-7125 MHz band, if that was opened for licence-exempt use in full.

Technology readiness/Timeline

Wi-Fi 6E is a mature technology. A large 6 GHz Wi-Fi ecosystem exists today (more than 2000 devices from access points to smartphones, tablets, laptop and desktop PCs to TV sets had been certified by mid-2023) but because of artificial spectrum restrictions, European users can exploit only a portion of their capabilities. Official Wi-Fi 7 certification has been available since the beginning of 2024, and products already entered the market. In its Annual Industry Report 2023, the Wireless Broadband Alliance (WBA) found that 53% of service providers, technology vendors and enterprises have deployed Wi-Fi 6, and an additional 44% said they were working to adopt Wi-Fi 6E in the next 12-18 months. Further, 33% of those respondents confirmed that they already had plans to deploy Wi-Fi 7 by the end of 2024[61]. Analysts Dell'Oro now predict a 77% CAGR for Wi-Fi 7-capable CPEs and residential routers for the period 2024-2028[62].

By way of contrast, there is no ecosystem for 6 GHz WBB ECS / IMT, and judging from the demonstrations of 6 GHz IMT prototypes given by various mobile network operators, it would likely take years before 6 GHz IMT equipment would be mature enough for deployment. If Europe made the upper 6 GHz band available to IMT, this would entail a risk that should not be ignored: Given China's stated intention to allocate the entire 6 GHz band to IMT, the resources available to Chinese companies for the development of 6 GHz IMT equipment, and the preferred access to the domestic market enjoyed by Chinese companies (as of 2023, close to 90 percent of all 5G base stations in China had been manufactured by Huawei and ZTE[63]), Chinese companies could gain a significant technological advantage over their European counterparts.

5. Standardization and technology impact

As mentioned above, Wi-Fi equipment capable of operating in the (lower and) upper 6 GHz band(s) is readily available and already being deployed globally in large volumes. ETSI EN 303 687 v1.1.1, which covers the lower 6 GHz band is available and could be applied by analogy to certify products operating in the upper 6 GHz band.

In the Wi-Fi world, the pace of innovation is fast; a new generation becomes available every 4-5 years. IEEE 802.11bn ('Ultra High Reliability'), the basis for the future Wi-Fi 8, is already under development. The focus of 802.11bn, which, like Wi-Fi 7, will be able to operate in the 2.4 GHz, 5 GHz, and 6 GHz bands is on improving reliability, minimizing latency, and further reducing power consumption. The standardization of 802.11bn is scheduled to be completed in May 2028.

Another technical development that will require a considerable amount of spectrum is Wi-Fi-enabled location-based services. These services are becoming increasingly important not only in large arenas and conference centres but also in retail and logistics. Utilizing 320 MHz wide channels, the future IEEE 802.11bk standard will enable location services with a precision of less than 10 centimetres[64].

IEEE802.11/Wi-Fi standards for operation across the 5925-7125 MHz band will continue to be developed, and products adhering to these standards will continue to be deployed in countries in all three ITU regions. Europe should not decouple itself from this global development and risk weakening its competitive position and the position of ETSI as a global standards setting organisation.

Summary

Unlike certain other stakeholders, HPE does not categorically oppose the concept of "hybrid sharing" in the upper 6 GHz band[65]. However, we are convinced that the greatest value for Europe can be generated from the upper 6 GHz band if it is made available for licence-exempt use in the short term. In this context we would like to rectify an apparent misperception. Occasionally, we hear from regulators that they would not want to "give all 700 MHz to one technology", namely IMT or Wi-Fi. In the case of IMT, this makes sense. If the spectrum were allocated to IMT, all other users would have to vacate the

[61] https://www.rcrwireless.com/20231121/fundamentals/reliability-over-throughput-a-wi-fi-7-update
[62] https://wifinowglobal.com/news-blog/roundup-delloro-forecasts-77-cagr-for-home-wi-fi-7-intel-extreme-team-up-plume-iqs-latest-insights/
[63] https://www.statista.com/statistics/1194757/china-market-share-of-5g-base-stations-by-manufacturer/
[64] https://blogs.arubanetworks.com/solutions/wi-fi-location-based-services-how-did-we-get-here/
[65] https://www.policytracker.com/mobile-industry-acknowledges-importance-of-unlicensed-spectrum/ (subscription required)

band. With Wi-Fi, the case is different. The spectrum would not be taken away from existing users and given to Wi-Fi, but Wi-Fi would effectively be “invisible”, accessing the spectrum without affecting existing users.

Finally, a general remark: HPE is of the opinion that essentially complementary technologies such as 5G/IMT and Wi-Fi should be utilised in a way that the individual strengths of each technology are exploited to the maximum. One technology option we believe the EC should strongly promote is the seamless handover from cellular to Wi-Fi when a user enters an office building, a shop, a public venue, or another indoor location. The technology exists today[66] but it has not been widely adopted by MNOs outside the US.

[66] https://www.arubanetworks.com/techdocs/central/latest/content/allowlist/airpass-overview.htm

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