Consultation Title	RSPG Questionnaire on the long-term vision for the upper 6 GHz band
Deadline	20 August 2024
Geographical Scope	European Union
Co-Signatories	Amazon Inc., Broadcom Inc., Cisco Systems Inc., Hewlett Packard Enterprise (HPE), Intel Corporation, Meta Platforms Ireland Limited
Date	23 August 2024

Dear Colleagues,

The undersigned companies, representing an important cross-section of the world's leading silicon vendors, system manufacturers, and application providers, welcome the opportunity to respond to the Radio Spectrum Policy Group's public questionnaire regarding the upper 6 GHz band.

I) Explain the demand for MFCN or WAS/RLAN in the upper 6 GHz band before and beyond 2030

- Across Europe, about 90% of Internet traffic travels via fixed lines and is relayed to end users via Wi-Fi[1]. This trend is set to continue for the rest of this decade and beyond 2030.
- As fixed-line and Wi-Fi traffic grows rapidly, users urgently need licence-exempt access to the entire 6 GHz band.
- The volume of traffic carried by Wi-Fi is growing much faster than the volume of traffic carried by mobile networks. In Germany, the absolute increase in the volume of fixed traffic in 2023 (11 billion GB) was more than four times the absolute increase in the volume of mobile traffic (2.4 billion GB) in the same year.[2]
- In most of Europe, the difference in volume between fixed and mobile data traffic is huge (see table), and substitution is rarely strong, according to a paper by Analysys Mason[3], which notes that fixed networks are the more likely beneficiaries of any surge in growth brought about by widespread adoption of augmented reality (AR) and virtual reality (VR). High mobile usage is driven by the absence or unaffordability of fixed networks, which is usually a temporary phenomenon, rather than applications, the paper adds.

Table 1: Fixed and mobile data traffic as published by the national authorities.

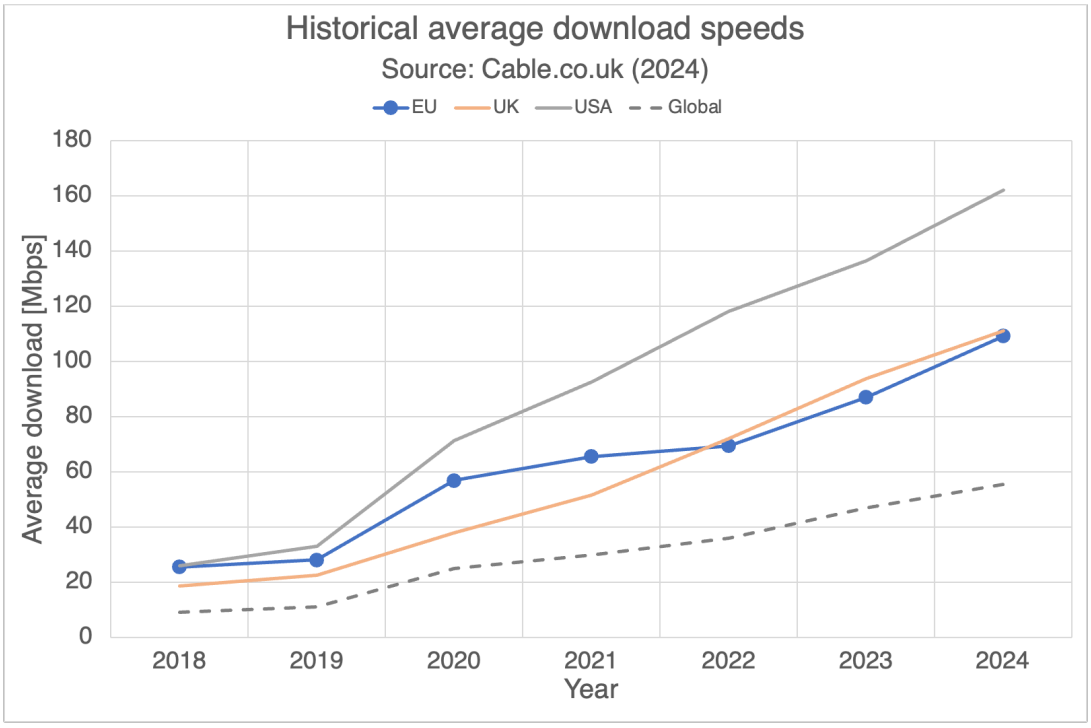
Country	Fixed data traffic [EB/year]	Mobile data traffic [EB/year]
Czech Republic (2022)	14.1	0.9
Denmark (2022)	12.2	2.5
Germany (2023)	132.0	9.1
Italy (2023)	54.9	15.0
Portugal (2023)	15.1	1.2
Romania (2023)	18.4	2.5
Spain (2022)	62.0	6.2

[1] Approximately, 92% of fixed broadband traffic in Europe is relayed via Wi-Fi, according to the ASSIA "State of Wi-Fi" report.

[2] Source: Jahresbericht Telekommunikation 2023

[3] Source: https://www.analysysmason.com/research/content/articles/bandwidth-overproduction-crisis-rdns0/

- According to the FTTH Council for Europe[4], the number of subscribers to FTTH/B (fibre-to-the-home or building) services in Europe is set to rise to 201 million by 2029 from 121 million in September 2023. At the same time, the number of homes passed will jump to 312 million in 2029 from 244 million in September 2023 as telcos lay more fibre in the ground.
- According to cable.co.uk[5], average broadband speeds across the EU have increased by 37% a year between 2017 and 2024. The average downlink speed is now more than 109 Mbps.



- In July 2024, the difference between the average median country speed of fixed and mobile networks in the EU was 44.5 Mbps for download and 50.4 Mbps for upload, according to Ookla[6], which also says that the median latency and jitter on fixed networks were, respectively, 14.4 and 5.4 ms lower than on mobile networks.
- UK regulator Ofcom has forecast that Wi-Fi demand in residential environments could grow between six and ten times between 2020 and 2030, driven by increased video quality and the adoption of virtual reality devices. In public venues, such as arenas or concert halls, demand could increase up to 15 times over the same period.[7]

II) Provide information about the sustainability of the above-explained demand, especially the:

1) Environmental impact assessment

- Most Wi-Fi networks operate at low power levels, indeed much lower than cellular systems. This means that in many scenarios, Wi-Fi is the most energy-efficient connectivity option. In particular,

[4] Source: https://www.ftthcouncil.eu/resources/blog/ftth-market-forecasts-2023-2029

[5] Cable.co.uk collated and analysed over 1.5 billion speed tests in 12 months ending 30 June 2024 to reveal broadband speeds in 229 countries. Source: https://www.cable.co.uk/broadband/speed/worldwide-speed-league/

[6] Source: https://www.speedtest.net/global-index (updated June 2024)

[7] See UK Ofcom Improving Spectrum Access for Wi-Fi, July 2020, section 3.24

the French regulator ARCEP[8] found that the combination of fibre and Wi-Fi is the most efficient solution in terms of energy consumption, performance, and flexibility.

- Wi-Fi provides a highly efficient way to deliver high-speed connectivity indoors. By contrast, outdoor-to-indoor networks need to consume high levels of power to penetrate building walls, particularly for newer, more energy-efficient buildings. Connecting an indoor device to an outdoor base station will use considerably more energy,[9] while also resulting in more frequent recharge cycles, increased battery wear, and additional electronic waste.
- Wi-Fi connectivity enables people to fulfil tasks and conduct meetings remotely, reducing energy consumption and emissions related to transportation. As they can deliver high-speed and very responsive connectivity, Wi-Fi in the 6 GHz band is well suited to delivering high-resolution video streams and VR/AR services that can help people interact effectively without being physically present in the same location. Most of these applications will be used indoors, where Wi-Fi is the technology of choice. In outdoor scenarios, Wi-Fi will be widely used to connect smartphones to VR/AR headsets.
- Making the full 6 GHz band licence-exempt allows for more channels, which improves performance and reduces interference and costs. Less interference means lower power consumption, thus making the full 6 GHz band licence-exempt the most energy-efficient approach.

2) Social economic impact

- Wi-Fi boosts GDP growth by providing low-cost broadband access and helping to bridge the digital divide by making the most of whatever backhaul connectivity solution is available. It is also a fundamental building block of the digital economy, allowing organisations to deliver digital services that benefit citizens and fuel economic growth.
- As Wi-Fi allows a number of individuals to share a single broadband Internet connection, the service becomes more affordable, thereby increasing Internet penetration.
- Wi-Fi can deliver unparalleled end-user experience in crowded space as Wi-Fi network can be designed to respond to local requirements
- The widespread availability of compatible equipment means most Wi-Fi users would see an immediate benefit from licence-exempt access to the 6 GHz band. Even users without 6 GHz compatible equipment will benefit from the new spectrum, as legacy bands become less congested with traffic moving to the 6 GHz band.

III) Provide information about:

1) the possible role of the upper 6GHz for MFCN or WAS/RLAN

- On its own, the lower 6 GHz band (5945-6425 MHz) won't provide sufficient spectrum to meet the fast-rising demand for indoor wireless connectivity. In Europe, there are currently only five 160 MHz channels available for licence-exempt usage, two of which are in the 5 GHz band with DFS restrictions and, therefore, mostly unavailable[10]. With the current spectrum allocation, Wi-Fi can only support gigabit coverage for approximately 50-60% of residential building area[11]. To ensure whole-building coverage, a minimum of seven 160 MHz channels in the 6 GHz band are necessary. Therefore, Wi-Fi access to the 6425-7125 MHz is imperative to support the goals of the EU's Gigabit Infrastructure Act and the Digital Decade Policy Programme 2030.[12]

---

[8] The digital environmental footprint in France: ADEME and Arcep report to the Government, 19 January 2022. Available online

[9] To provide indoor coverage from outdoor base stations, MFCN has to compensate for the 23dB building entry loss (ITU-R P2109, 30/70 Thermal/Traditional, 50%). As a result, 200 times more power is required to cover indoor than outdoor.

[10] Also, in practical deployments, smaller channel widths will generally be selected at 5 GHz to give more channel reuse options and accommodate legacy devices.

[11] "Wi-Fi Spectrum Requirements" by Plum Consulting. Source: https://plumconsulting.co.uk/wi-fi-spectrum-requirements/

[12] See Gigabit Infrastructure Act at https://digital-strategy.ec.europa.eu/en/policies/gigabit-infrastructure-act; Europe's Digital Decade Policy Programme available at https://digital-strategy.ec.europa.eu/en/policies/europes-digital-decade

- As many of the world's leading economies have made the full 1200 MHz in the 6 GHz band available on a licence-exempt basis, there are already thousands of Wi-Fi 6E and Wi-Fi 7 products available that can operate across the entire band. In Wi-Fi 6E deployments in universities, stadia and other busy locations, licence-exempt access to the full 6 GHz band has significantly reduced congestion and boosted Wi-Fi performance.
- LPI and VLP Wi-Fi would allow all incumbent users to continue using the band and even to expand.

2) use cases, expected deployments (e.g. number of BS for MFCN) and timeframe

- Fibre speeds are increasing fast. Already today, some EMEA operators are offering fibre broadband with speeds of up to 25 Gbps to residential customers. Governments can only capitalise on the huge investments in fibre by allowing citizens to make use of the tremendous speeds available through Wi-Fi.
- With access to the 6 GHz band, Wi-Fi 6E and Wi-Fi 7 can support industrial applications, such as factory robots and sensors, AR, healthcare monitors and wireless medical equipment, that have stringent QoS (quality of service) requirements. Unlike previous generations of Wi-Fi, Wi-Fi 6/6E and Wi-Fi 7 are based on OFDMA technology and are thereby able to achieve very high QoS levels, particularly in managed networks. According to Intel[13], AR/VR applications require a minimum throughput of between 400 Mbps and 2.35 Gbps and a maximum streaming interactive latency in the order of 10ms.
- For enterprise applications (such as large public venues, healthcare, education, hospitality, logistics, and manufacturing), a large number of available channels and a wide range of channel widths (from 20 MHz to 320 MHz) enable performance enhancements and the realisation of new services and architectures. Examples include multi-layer operation, service segmentation and prioritisation, context-aware wireless networks, and hyper-aware access points.
- With access to 320 MHz channels, Wi-Fi can reliably support a wide range of demanding use cases, from telesurgery and haptic applications to controlled vehicles and augmented reality. Wide channels also enable Wi-Fi to identify the position of a connected asset within one meter, enabling enterprises to better track and monitor their equipment and inventory.
- 5G and Wi-Fi 6/7 can work together to support a wide range of AR applications. A 5G smartphone could connect to an AR headset or another wearable using Wi-Fi 6/7, giving people access to immersive entertainment, educational, e-health and industrial applications, improving training, accelerating product design and enabling new business models. For such use cases, the performance requirements on the link between headsets and smartphones are much more stringent than those between the smartphone and a 5G base station.
- Wi-Fi at 6GHz is particularly suited to deliver indoor coverage. Due to significant building entry loss, covering indoor from indoor (regardless of the technology) will provide superior quality of service (QoS) and better sustainability.

IV) Provide information about standardisation and technology impact

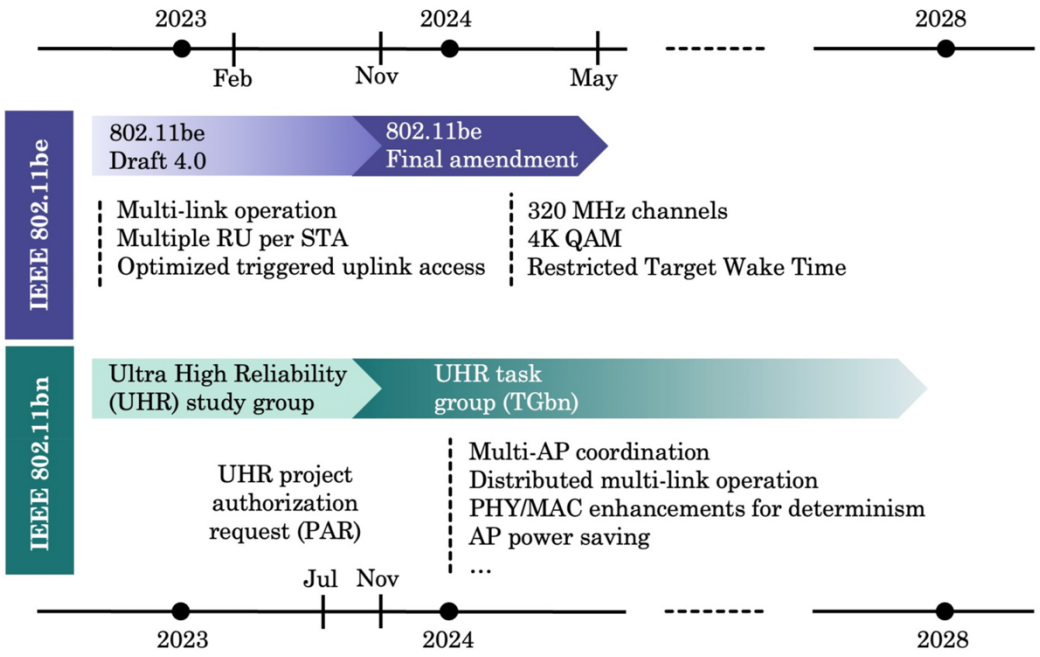
- The new Wi-Fi standards, Wi-Fi 6E and Wi-Fi 7, enable compatible devices to benefit from higher data rates, greater responsiveness, increased capacity, better performance in environments with many connected devices, and improved power efficiency, among other improvements. Wi-Fi 7 doubles the maximum channel width from the 160 MHz of Wi-Fi 5 and Wi-Fi 6 to 320 MHz.
- A new feature of Wi-Fi 7, called multi-link operation (MLO), can improve the connection between a device and access point, increasing reliability and lowering latency, particularly in dense areas with

[13] Source: Spectrum Needs of Wi-Fi 7 paper

uncoordinated networks. As a result, MLO is set to broaden the types of applications for which Wi-Fi can be used – likely increasing demand for licence-exempt spectrum. MLO does not eliminate the requirement for additional channels to serve a wide range of use cases.

- The eighth generation of Wi-Fi technology (Wi-Fi 8) is set to prioritise ultra-high reliability as its key characteristic, as opposed to previous standards, which focused on increasing peak throughput. As shown in the graphic below, Wi-Fi 8 has a target standardization cycle ending in 2028.

Table 2: Source: Reviewing wireless broadband technologies in the peak smartphone era: 6G versus Wi-Fi 7 and 8



- There is no MFCN equipment available for use in the 6 GHz band, and that is likely to remain the case for some time. During the intervening period, Europe's economy could forego billions of euros of economic value that could be generated by Wi-Fi at 6 GHz.
- Maximising the harmonisation of frequency bands benefits end users as the ecosystem becomes more readily available.
- As the RSPG itself noted in its opinion on digital sustainability, maximising the bandwidth of single frequency bands is a more sustainable option than combining several narrower sub-bands through carrier aggregation. As a Wi-Fi 6E or Wi-Fi 7 receiver can operate over the entire 6 GHz band, making the whole 6GHz band available to Wi-Fi would be optimal from a digital sustainability standpoint.

/s/

Signatories

Jordi Casanova Tormo
Head of EU Public Policy, Telecoms and Space
Amazon, Inc.

Christopher Szymanski
Director, Product Marketing
Wireless Communications and Connectivity Division
Broadcom, Inc.

Andrew Gowans
Spectrum Regulatory Policy Team Leader
Cisco Systems, Inc.

Detlef Fuehrer
Senior Manager, Spectrum Management and Regulatory Affairs, EMEA
Hewlett Packard Enterprise

Michael Kraemer
Director Communications Policy EMEA
Intel Corporation

Guillaume Lebrun
Global Connectivity Policy
Meta Platforms Ireland Limited