Consultation Title	**Public consultation regarding the allocation of mobile radio frequencies available from 2029 for the provision of telecommunication services in Switzerland**
Deadline	26 February 2024
Geographical Scope	Switzerland
Co-Signatories	Amazon Inc., Apple Inc., Broadcom Inc., Cisco Systems Inc., Hewlett Packard Enterprise (HPE), Meta Platforms Ireland Limited
Date	23 February 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 comment on the public consultation regarding the allocation of mobile radio frequencies available from 2029 for the provision of telecommunication services in Switzerland.

General questions

1. **How do you think the market will develop long term (mobile technology / applications / end devices / mobile traffic volume etc.)?**

Since 2019, growth in mobile data traffic has been slowing down. Research firm Analysys Mason has found that worldwide mobile data consumption has slowed to around 22% annually, from about 50% for much of the past decade, while Tefficient estimates that mobile data traffic is now growing between 5% and 20% a year in most countries it tracks.

Consultancy Arthur D Little expects Europe's mobile data consumption per user to increase from 15 GB/month in 2022 to 75 GB/month by 2030, while it expects fixed data consumption per household to grow from 225 GB/month in 2022 to 900 GB/month by 2030. In other words, the absolute growth in fixed data traffic is set to be 3.75X that of mobile data traffic this decade (on the basis that an average household consists of three people).

Mobile data traffic growth started to slow down in Switzerland as early as 2015, as shown in Figure 1, as the number of mobile contracts stabilised. Indeed, as of 2022, the data traffic growth on mobile networks was only 14%, well below the global trend.

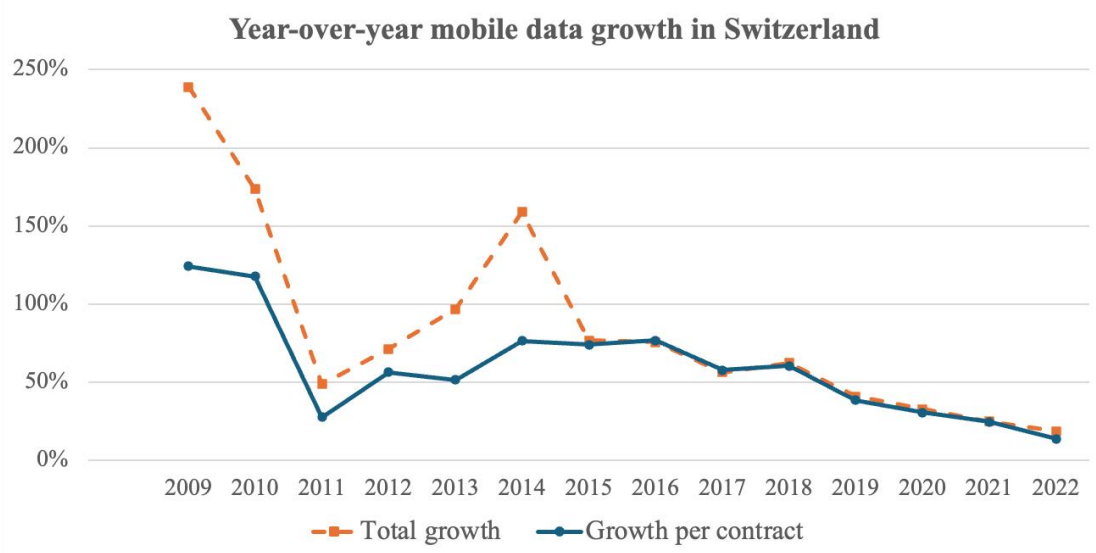

Figure 1: Year-over-year volume growth of broadband internet services on mobile networks. Source: OFCOM Statistical Observatory.

In order to properly understand the future demand for spectrum, we need to consider the type of applications that generate traffic and the demands of different clusters of users. Ericsson's Mobility Report shows that video accounts for over 55% of mobile data traffic, of which the great majority is from social video platforms – see Figure 2.

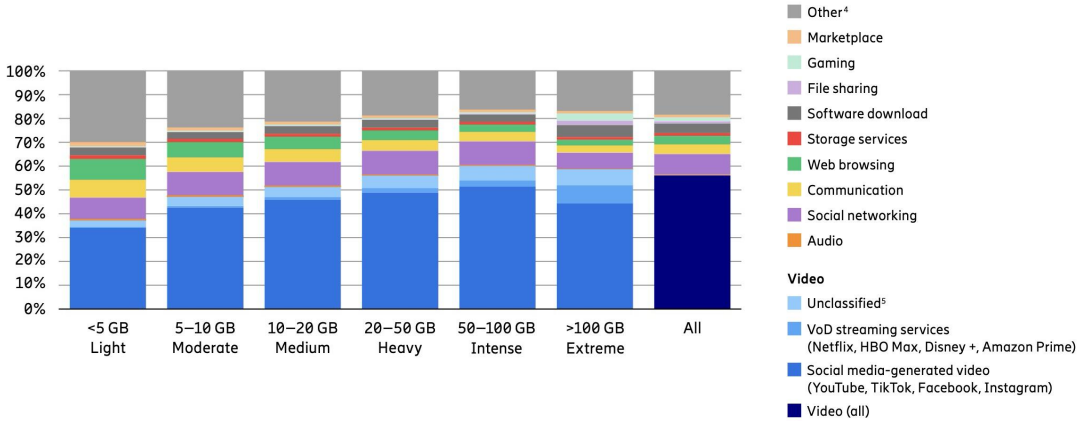

Figure 2: European service providers: Traffic volume per application type of different subscriber clusters (volume per month). Source: Ericsson Mobility Report June 2023. Note: the authors observe that a large share of the "Other" category is indeed video.

In their 2024 State of Digital Communication report, ETNO provide interesting comparisons between data traffic on mobile and fixed networks (see Figure 3). Specifically, social networks account for 23% of mobile traffic but only for 8% of fixed network traffic. Further, video traffic accounts for 61% of the total for fixed networks and 55% for mobile networks. ETNO also describe the different behaviours of users watching videos on the two networks. *"Fixed broadband networks are used for watching huge volumes of video and TV services (including in some cases linear IPTV),and can support multiple users at the same time. Although video content is increasingly consumed on mobile devices, viewing sessions on mobiles are typically shorter, the format of the content is lower in definition, and typically only one stream of content is delivered at a time. Around 70% of data traffic generated by mobile handsets is on fixed/Wi-Fi networks, a proportion that appears to be quite stable, despite the increased prevalence of unlimited data plans."* (see page 56 of the ETNO report).

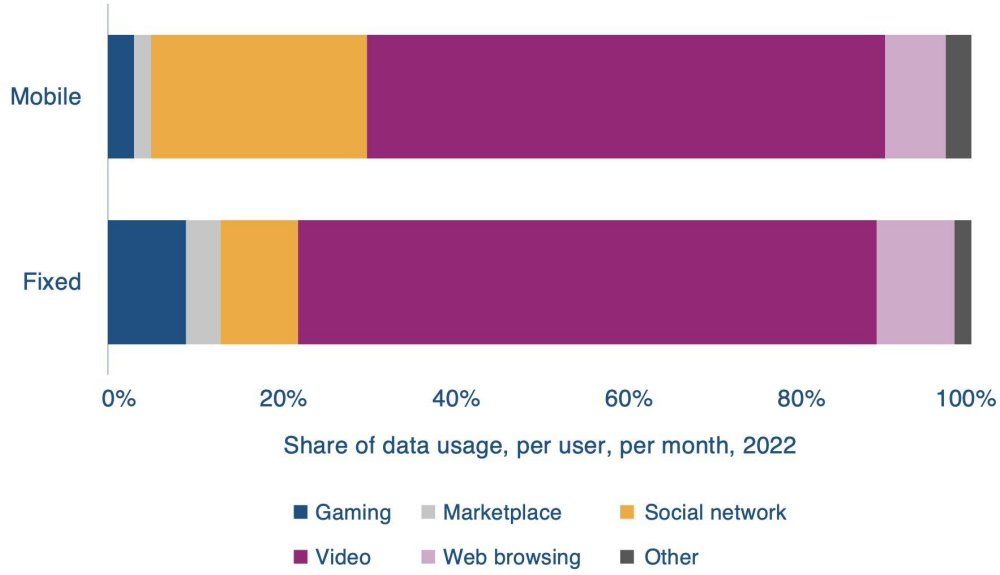

Figure 3: Share of data usage by application type. Source: Arthur D Little commissioned by ETNO, 2023.

Interestingly, Ericsson shows that the majority of European mobile subscribers consume less than 5 GB of data traffic per month, as shown in Figure 4. Conversely, more than 60% of mobile data traffic is generated by a small group of 'Intense' and 'Extreme' users, which make up less than 10% of the mobile subscriber base.

Evidently, any potential capacity bottlenecks in mobile networks will be due to a small minority of users. That suggests these bottlenecks can be best addressed with a combination of technical and commercial actions, such as encouraging these users to make more use of fixed connectivity infrastructure. Europeans spend about 90% of their time indoors, while up to 80% of data traffic is consumed indoors, according to Ericsson. While Ericsson, a leading vendor of mobile network equipment, argues that these stats mean 5G indoor coverage needs to improve, it would be far more cost-effective and energy efficient to transmit indoor traffic using a combination of fixed broadband and Wi-Fi.

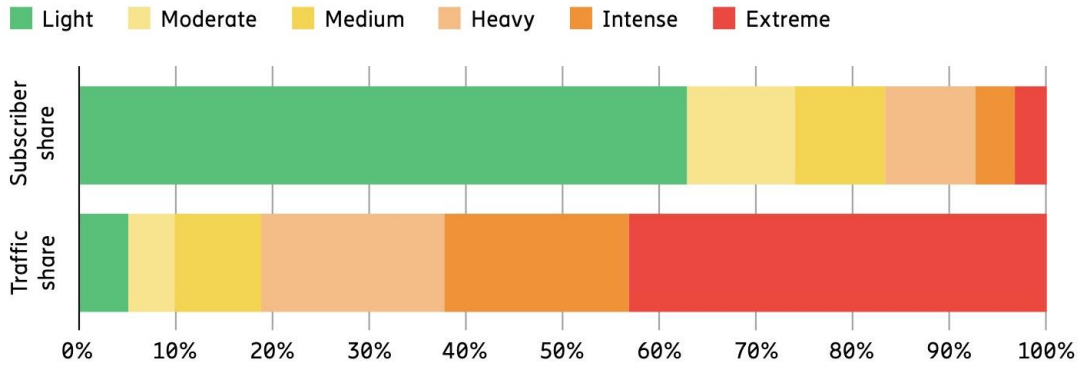

Figure 4: European service provider: Subscriber and traffic volume shares of different subscriber clusters. Source: Ericsson Mobility Report June 2023.

Historically, the most important KPI (key performance indicator) for mobile networks was downlink throughput speeds, but now that 4G and 5G networks can comfortably deliver broadband, the focus is shifting to reliability and the speed of the uplink (to support video calls and other applications involving the transmission of multimedia). As the effective cell size increasingly depends on the quality of the uplink connection, mobile operators need to focus on outdoor densification to meet their customers' expected quality of experience. The only cost-effective and energy-efficient way to deliver these KPIs indoors is to use dedicated indoor Wi-Fi networks.

It is also worth considering how the deployment of fixed connectivity has evolved in Switzerland. Figure 5 shows that high-speed optical fibre accounts for a growing share of fixed connections.

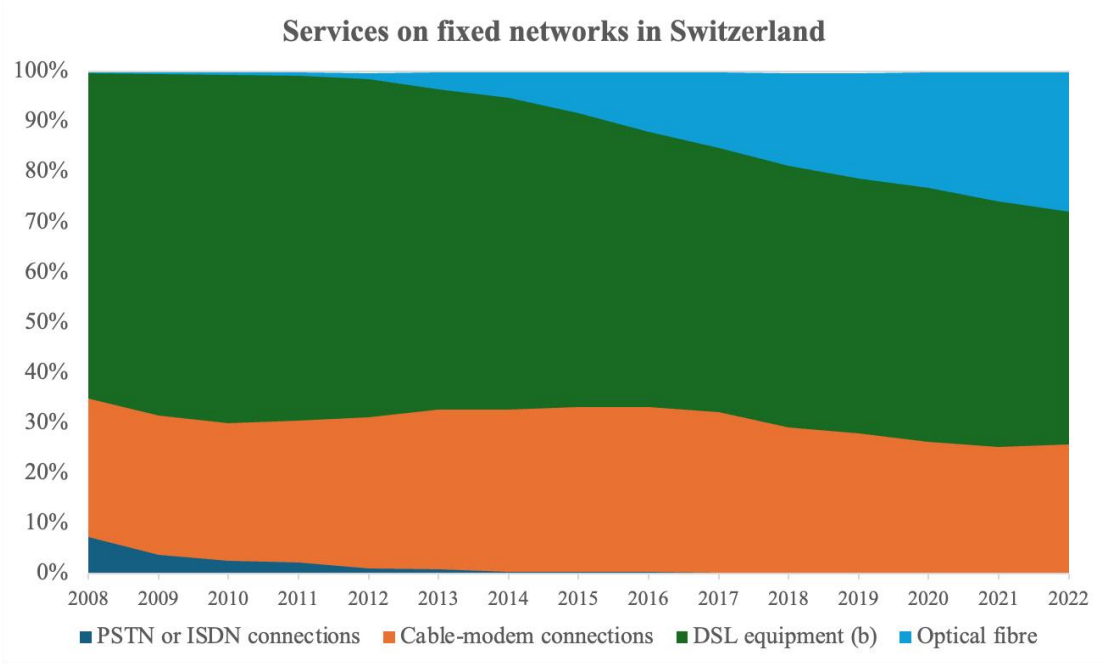

Figure 5: Share of different fixed line technologies in Switzerland. Source: OFCOM Statistical Observatory.

Indeed, fibre deployment is enabling users to enjoy more performant broadband connectivity (see Figure 6). As of 2022, the percentage of internet users with broadband download speeds above 100 Mbps was above 85%, and almost 23% had speeds above 1 Gbps.

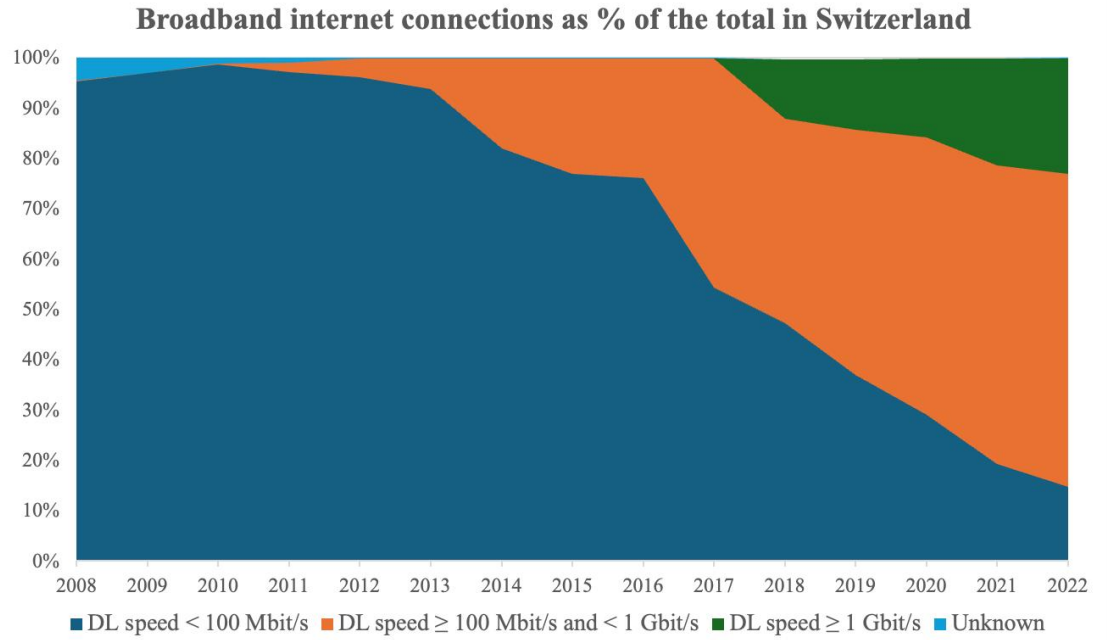

Figure 6: Share of fixed line connections by downlink throughput in Switzerland. Source: OFCOM Statistical Observatory.

In summary, while mobile data traffic will continue to increase, it is very important that the connectivity market is considered as a whole, taking into consideration where connectivity is used and how. As wireless is the preferred way to access internet services, administrations need to consider the full range of tools available when evaluating how best to harness spectrum.

Whilst mobile technology improvements will allow operators to deliver marginally more cell capacity, the benefits of additional frequency bands need to be carefully evaluated against other priorities, such as the requirements of incumbent services or those of other wireless applications.

Specifically, from a capacity point of view, the focus should be on meeting users' demands rather than on the specific technologies (or their generations) – this is particularly relevant for mobile networks considering that the most popular devices (e.g. smartphones) have multiple wireless access technologies, including 4G/5G, Wi-Fi and increasingly satellite communication links.

4. **What is your view on the use of Fixed Wireless Access (FWA) and which frequencies do you consider to be fundamentally appropriate? And which one are particularly well suited?**

FWA now accounts for a substantial proportion of mobile data traffic. Ericsson's Mobility Report 2023 estimates FWA data traffic represented 21% of global mobile data traffic at the end of 2022 and will grow to about 30% of total mobile data traffic by 2029. These forecasts imply that the proportion of overall traffic generated by mobile users will further decrease, resulting in even more demand for Wi-Fi. FWA services depend on Wi-Fi to connect the end devices inside a building, and there will need to be sufficient licence-exempt spectrum available to address this demand.

In a market report published in August 2023, Omdia observed that in most countries of Western Europe, FWA accounts for fewer than 1% of subscriptions. The principal exception is Italy with 11%. According to an article published by IDTechEx in April 2023, Italy has emerged as a leader in bringing 5G to consumers through the promotion of mmWave for fixed wireless access.

According to Nokia, mmWave can be economically deployed in urban, suburban and rural areas as part of a mixed-spectrum strategy. Nokia adds that operators with mmWave and sub-6 GHz spectrum can use both together for a more robust FWA service and cost-effective deployment.

It is worth mentioning that FWA is not a like-for-like alternative (or competitor) to FTTH connectivity. According to ETNO's 2024 State of Digital Communications report, "while certain variants of 5G fixed-wireless access (FWA) hold the potential for gigabit connectivity, few existing FWA services offer such high downlink speeds."

Further, ETNO notes that the picture for FWA varies from country to country and that while the availability of FWA services has steadily grown, FWA still only comprises a small proportion of Europe's connections and, in some countries, FWA will remain insignificant.

Detailed questions on possible new frequency bands

6GHz (Band 104)

34. **How do you rate the attractiveness and the economic and social benefits of this frequency band?**

Given the important role that Wi-Fi plays for the broadband ecosystem and its continuing growth, there is a need to make the full 1200 MHz in the 5925-7125 MHz (6 GHz) band available on a licence-exempt basis to support the ever-increasing demand for high-speed local connectivity and enable nations to meet their broadband goals and objectives for a digital society.

Wi-Fi is the distribution technology of choice for broadband connectivity indoors, used to connect a wide variety of devices, including desktop and laptop computers, mobile phones, tablets, television sets, gaming consoles, cameras, monitors, speakers, AR/VR headsets, and sensors. Indeed, adequate spectrum for Wi-Fi is crucial to leverage the deployed fibre infrastructure, as it has become indispensable for connecting people and devices everywhere. Organisations and individuals depend heavily on the availability of sufficient Wi-Fi spectrum, be it in corporate offices, home offices, SMEs, schools, universities, hospitals, public institutions etc.

Assuming regulators open the full 6 GHz band, the US$ 3.3 trillion of value Wi-Fi added to the world's economy in 2021 will rise to US$ 4.9 trillion in 2025, according to research conducted by Telecom Advisory Services for the Wi-Fi Alliance.

35. Are you interested in usage rights in this frequency range? If so, what are your requirements?

Although the upper 6 GHz band (6425 - 7125 MHz) obtained an IMT identification at WRC-23, numerous countries have already implemented or are planning to use the full 6 GHz band for Wi-Fi. Note that the IMT identification does not establish priority and that the use of the full 6 GHz band by Wi-Fi has been acknowledged in the Radio Regulations.

Indeed, it is important to consider the role of the 6 GHz band in the context of a broader holistic strategic roadmap for broadband connectivity. In particular, we recommend that Ofcom's strategy should be to encourage the use of indoor networks to provide broadband coverage indoors while employing IMT technologies to support mobility outdoors.

We, therefore, support CEPT's work on the potential hybrid use of the upper 6 GHz band and encourage Ofcom to participate in the ECC PT1 working group.

If hybrid sharing is implemented, it is critical that the resulting quality-of-service (QoS) reductions are appropriately shared between Wi-Fi and IMT. The investigations into hybrid sharing should take into account the fact that the vast majority of data traffic is generated indoors using Wi-Fi. To ensure indoor networks can meet the rising demand for indoor connectivity, regulators will need to make available enough spectrum for Wi-Fi use in the upper 6 GHz band. This allocation is essential to ensure high throughput rates (both in download and upload) and meet the low-latency requirements necessary for optimal functionality of extended reality services and other real-time applications in indoor environments.

We would like Ofcom (and other CEPT administrations) to clarify how they see mobile networks using the upper 6 GHz band. For example, would the band be used as a short-term capacity solution or for network densification in the future? It is important that potential mobile use of the 6 GHz band is not considered in isolation but as part of Ofcom's holistic broadband strategy.

Ofcom should also bear in mind that WRC-27 will consider the identification of an additional 1,750 MHz of spectrum between 4.4 GHz and 8.4 GHz for IMT use in ITU Region 1 (and an additional 550 MHz in the 14-15 GHz band globally).

Further, it is important that the work on hybrid sharing takes into consideration the different stages of implementation of the two technologies in the 6 GHz band. Ideally, the work will proceed at a pace that will enable Switzerland to benefit from full Wi-Fi 6E and Wi-Fi 7 connectivity, which are designed to use the entire 6 GHz band, without delays.

Given the increasing congestion in the existing Wi-Fi spectrum, access to the upper 6 GHz band has become critical to future Wi-Fi operations by consumers, governments and businesses. Moreover, making the band available for licence-exempt use now would also permit mobile operators to utilise the spectrum via the 5G NR-U protocol. Other IMT equipment could then be allowed to be deployed by mobile operators as the next phase of a common hybrid framework.

A hybrid-sharing framework will also need to provide sufficient certainty to encourage investment in deployments. The framework should ensure that existing 6 GHz Wi-Fi enterprise networks will not be interfered with by 6 GHz IMT base stations deployed in the same area and that enterprises will not be unduly restricted in the specification and deployment of new 6 GHz Wi-Fi networks. There is a clear risk that IMT networks operating in the 6 GHz band will be deployed in densely populated areas where many people rely on Wi-Fi.

36. For which application and coverage scenarios are these frequencies suitable?

For outdoor macro cellular networks to provide indoor connectivity, they need to use frequencies that can adequately penetrate through building materials. The 6 GHz band is not suitable for this purpose. It would be far more sensible and energy and spectrally efficient to focus resources on providing seamless handover between outdoor IMT networks and indoor Wi-Fi networks.

When considering scenarios for a hybrid-sharing framework for the upper 6 GHz band, a clean indoor-outdoor separation between Wi-Fi and IMT is worth investigating. For an indoor-outdoor separation to work, it is important that the two technologies leverage power levels that are compatible with each other. As 6 GHz IMT would only have to cover very small areas outdoors and not be used indoors, high-power transmissions would not be needed. High-power IMT is not required to provide adequate coverage to outdoor mobile users and would have a negative impact on Wi-Fi and its associated user benefits.

The best way to reduce the size of interference areas is to reduce the transmit power of the outdoor IMT base station(s) combined with a site-by-site authorisation.

If Ofcom believes that IMT and Wi-Fi need to share the upper 6 GHz band, we propose a phased approach, starting with a simple solution:

1. Open the band for low-power indoor (LPI) and very low-power (VLP) usage on the basis of the existing regulation for the lower 6 GHz band without any additional requirement;
2. Once an appropriate coordination mechanism has been identified and implemented for IMT, allow outdoor reduced power IMT deployments on a base station-by-base station basis; and
3. If appropriate and justified, consider implementing more sophisticated coexistence mechanisms that achieve a higher level of sharing and introduce these later.

37. Do network equipment and terminal devices that can be used in this frequency range already exist? If not, when can they be expected?

Wi-Fi 6E devices that can operate in the 6 GHz band are widely available. As of July 2023, there were almost 2,000 different types of Wi-Fi 6E devices available, a 58% increase since the start of the year, according to Intel's analysis of public information. Wi-Fi 7 devices, which also depend on the 6 GHz band, will also be available in commercial volumes this year.

In the US, Wi-Fi 6/6E client devices are entering the home at an unprecedented rate, surpassing 50% market share since these devices were introduced in 2019, according to a new report from the Wireless Broadband Alliance, which says there are now almost 20 Wi-Fi connected devices per household in developed markets.

In January 2024, the Wi-Fi Alliance introduced the Wi-Fi CERTIFIED 7 programme, which will enable a faster adoption of the new standard on client equipment. Companies including Broadcom, CommScope RUCKUS Networks, Intel, MaxLinear, MediaTek, and Qualcomm form the test bed for certification and are among the first Wi-Fi CERTIFIED 7 devices.

SkyQuest projected that the chipsets market for Wi-Fi 6 and Wi-Fi 6E will attain a value of USD 34.5 billion by 2030. In terms of shipment, IDC estimates the number of Wi-Fi devices supporting the 6 GHz band (i.e., Wi-Fi 6E and Wi-Fi 7) will reach 2.5 billion in 2028.

In summary, there is a large selection of commercial Wi-Fi equipment that is ready and able to access the upper 6 GHz band with immediate effect.

38. What other aspects need to be considered in this frequency band?

As the consultation document notes, this upper 6 GHz band in Switzerland is currently assigned to radio relay links and partly to satellite communication, and restrictions (e.g. in geographical terms, restriction to conurbations, indoor use) will be necessary in the event of any future use for mobile communications.

Technical studies on the operation of IMT services in the upper 6 GHz band have shown that incumbent fixed wireless, satellite services and radio astronomy in the band would face a significant risk of harmful interference against which they would need to be protected[1]. The satellite industry is very concerned about potential interference from IMT services. The Global Satellite Operators Association (GSOA) has said: "A geostationary satellite can "see" around one-third of the earth's surface and hence would receive interference from potentially millions of mobile base stations and terminals. Experience in some other frequency bands used by satellite uplinks, such as the 2.5 GHz band, has shown that IMT systems can cause interference to satellites that effectively prevent all satellite operations."

[1] Regarding fixed services, the text of the final CPM document says that based on Monte-Carlo simulations, the required separation distances for the main lobe range from 10 to 68 km. Further, one study which used deterministic calculation found that the separation distance is 59 km when the IMT BS is placed inside the clutter but increases up to 122 km for the worst-case scenario when IMT BS is located above clutter.

Respectfully submitted,

/s/

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