TELEFONICA response to RSPG Questionnaire on Long-term vision for the upper 6 GHz band

A. Questions directed to the MFCN and the WAS/RLAN stakeholders.

Telefónica is an integrated operator providing fixed and mobile connectivity, IP TV and digital services across a wide range of European and Latin American countries. As such, we have good understanding of the connectivity needs of end users, and an interest in ensuring that the fixed and mobile networks we deploy are capable of meeting those needs in the most efficient way for us and for our customers.

We can credibly state that making the upper 6 GHz band available for IMT macro base station deployment without power restrictions, beyond those agreed in WRC23 for the protection of satellite services, is the framework that would create the highest benefit for European citizens and companies.

Our assessment is that there is already a sufficiently large amount of spectrum allocated to unlicensed WAS/RLAN for our customers to cope with the expected growth in indoor traffic at home and work, while a relevant number of cellular sites would become congested by the end of the decade without access to the upper 6 GHz band – resulting in a quality decrease of mobile connectivity for our customers. Taking a longer-term perspective, our view is that a licensed framework without undue power restrictions provides a stronger foundation for innovation in digital services in the widest possible circumstances, including mobility. It also provides better incentives for spectrum users to invest in technologies that make efficient use of the scarce resource.

We see nevertheless value in the use of the band to enhance WiFi connectivity in geographic areas where cellular networks are not eventually deployed and welcome the ongoing efforts to assess different options. We feel, in any case, that regulators have a duty to ensure that the costs of facilitating that possibility do not outweigh the benefits. They should, in other words, acknowledge that spectrum sharing should not be the objective, but a tool introduced only after careful assessment of costs and benefits to society.

I. Explain the demand for MFCN or WAS/RLAN in the U6GHz band before and beyond 2030.

Fixed and mobile traffic growth

Broadband traffic in publicly available fixed and mobile networks in Europe is expected to continue to increase at double digit rates across the EU into the foreseeable future. Mainstream uses such as films and live sports streaming, social networks, gaming, e-commerce and web browsing will all require an increase in the amount of GB per hour used, driven by higher definition screens and content that is more intensive in video.

Without accounting for additional growth drivers and emerging use cases, and assuming that usage times are stable, Arthur D. Little (ADL)[1] estimates that mobile traffic per user in the EU will increase, on average, from 13 GB/month in 2022 to 76 GB/month in 2030, a compound annual growth rate of 25%. Over the same period, fixed data consumption per home should also increase, albeit at a lower annual growth rate of 19%, from 224 GB/home/month to 912 GB/home/month.

Analysis Mason[2] foresees lower growth figures of 17% CAGR between 2022 and 2029 for mobile in Western Europe. Critically, however, the growth rate expected for fixed data consumption is also lower, a CAGR of 13%. Analysis Mason also estimated the ratio of mobile data traffic over all fixed and mobile traffic as 14.9% at the end of 2022, up from 13.6% in 2020. While Wi-Fi connections accounted for 5 times more traffic than cellular connections in 2022, as expected considering the wide range of devices using Wi-Fi (e.g., smart TVs, laptops etc),

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[1] ADL, THE EVOLUTION OF DATA GROWTH IN EUROPE

[2] Analysis Mason Datahub, retrieved 20 July, 2024

on handsets Wi-Fi accounted for approximately half the traffic clearly demonstrating the importance of cellular services for mobile devices.

The figures above do not account for the possible impact of emerging use cases which, leveraging ongoing innovation in end user devices and artificial intelligence, could drive mobile traffic demand much further, especially beyond 2030. They also do not account for the possible use of 5G public networks to serve critical industry applications in a cost-efficient way. As 5G technology matures, its full range of capabilities enabled by the rollout of standalone cloud-native core networks and mobile edge computing, will provide enterprises and organisations with the ultra-reliable connectivity required to automate critical operations and the reduced latency to support real-time image recognition and other AI-based applications.

In the 2030s, we expect new use cases to trigger additional traffic growth in cellular MFCN networks. It is difficult to make accurate forecasts, but it is clear that additional spectrum in mid-bands will be needed for 6G initial deployments. Beyond 2030, in any case, adaptability becomes key to be able to cope with uncertain demand, and we believe the licensed use of the upper 6 GHz for IMT is more flexible and preferable than unlicensed usage by Wi-Fi, because IMT is capable to address broadband traffic growth in any circumstance (indoor and outdoor, country-wide), while Wi-Fi can realistically handle traffic only indoors at home or offices and is not suited for critical uses demanding reliable QoS.

Capacity constraints for MFCN in the absence of the upper 6 GHz band

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[Confidential ends]

Using network densification to solve the foreseen network congestion is an option seriously constrained by operational difficulties (e.g. finding new sites), technical limits (e.g. interference between sites) and financial challenges. Much higher investment and additional yearly operating costs are needed for new sites compared to deploying an additional frequency layer in existing sites. A limited number of additional sites can be expected, but aggressive further network densification is just not viable operationally and financially and would have a very relevant impact on energy consumption and our carbon footprint.

The exact timing of congestion of the existing grid will vary for each operator, but it will inevitably happen at some point in time. Spectrum is a key input to efficiently enhance capacity in cellular networks, and lack of additional mid-band frequencies would negatively impact consumers through a mix of higher prices and lower quality.

Capacity constraints for RAS/RLAN in the absence of the upper 6 GHz band

Broadband capacity will not be limited in the foreseeable future by scarcity of WAS/RLAN spectrum. The 480 MHz recently allocated for RLAN in the lower 6 GHz band provide additional 3 channels of 160 MHz that are not yet being used. They almost double the amount of spectrum available and provide enough capacity for meeting expected demand, even in homes with high a high number of intensive users[3].

In our experience, a relatively large number of users demand a low throughput range as demonstrated by the fact that there is still a relevant share of Wi-Fi 4 equipment in the market[4] providing a theoretical maximum speed up to 450 Mbps. Wi-Fi capacity can be generally improved by updating Wi-Fi access points to a newer (not even the newest) generation, increasing the spectral efficiency: WiFi 6 is a standard commercial offering today, supporting throughputs of up to 2.4 Gbps per device or up to 9.6 Gbps in total using the 2.4 GHz and 5 GHz bands.

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3 GSMAi (2023). The socioeconomic benefits of the 6 GHz band.

4 32% of Wi-Fi scans done by Ookla for GSMA in Berlin were Wi-Fi 4, and 44% WiFi 5. See GSMA response to this consultation.

Adding to that, as recent tests conducted by Comtel show[5], the limiting factor is, in many homes, Wi-Fi coverage rather than capacity. The solution to that problem is installing more access points, rather than increasing the amount of spectrum per access point.

Beyond 2030, if extreme traffic scenarios materialise, selective densification of Wi-Fi access points is the most efficient way to address Wi-Fi quality of service in apartments, houses and offices with very high-throughput demand. We expect that Wi-Fi APs densification with Fiber To The Room (FTTR) solutions will become more widespread in such locations. The 60 GHz spectrum band of spectrum would complement FTTR deployments for providing extremely high throughputs.

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

1) Environmental impact assessment

GSMAi conducted in 2023 a report analysing the impact of spectrum policy on the fight against climate change[6]. It concluded that artificial scarcity of spectrum for 5G has a significant negative environmental impact:

- With limited spectrum, operators require more base stations to serve the same amount of traffic. This results in more energy use per unit of traffic and increased footprint in terms of equipment, construction and transport.
- GSMAi estimates that reducing the amount of spectrum for 5G by 100 MHz could result in 5 percentage points lower 5G penetration, with a negative impact on the enablement effect of mobile that, in terms of tonnes of CO_2 emissions, would be more than ten times larger than the direct impact on the footprint of the mobile sector itself.

Analysis Mason[7] reached similar findings in a report focused specifically on the impact of assigning the upper 6 GHz to either WiFi or IMT:

- When the upper 6 GHz is assigned for mobile networks, carbon emission savings from having less network densification are at least 2.9 times greater than the carbon emission cost of deploying and operating new mid-band radios.
- The availability of the upper 6GHz band for WiFi would not translate into any reduction in carbon emissions when targeting an aggregated throughput of 1Gbit/s per premise.

2) Social economic impact

A detailed economic impact assessment by GSMA Intelligence[8] of the different allocation scenarios of the 6 GHz band across 24 countries, including Germany, France and Italy, found that optimal socio-economic benefits are achieved from the allocation of at least 700 MHz, namely the whole of upper 6 GHz band, for licensed 5G use. Even in countries with extensive fibre broadband penetration, the allocated additional 500 MHz of spectrum for unlicensed use in the lower 6 GHz band (5.925-6.425 GHz), representing roughly a doubling of the previous supply of licence-exempt spectrum, will be sufficient to address expected Wi-Fi demand.

The key factor that explains the results is that the probability of congestion in mobile networks is much higher than the probability of congestion in fixed networks.

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[5] Indoor Connectivity - English - Comtelitalia

[6] Spectrum: The Climate Connection (gsma.com).

[7] Impact of additional mid-band spectrum on the carbon footprint of 5G mobile networks: the case of the upper 6GHz band (analysysmason.com)

[8] GSMA Intelligence. The socioeconomic benefits of the 6 GHz band: considering licensed and unlicensed options, June 2022.

III. Provide information about:

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

Test results in real environments for the upper 6 GHz band performed by Telefónica Germany in Stuttgart[9] are extremely encouraging. Peak download speeds of 3 Gbps were achieved using just a 100 MHz bandwidth. Even at the outdoor cell edge, 500 meters away from the roof-top site, 0.5 Gbps were obtained with a stable uplink signal in the same band. This implies that if the uplink and signaling is handled in another lower frequency band, the cell range could even be further extended, as the uplink is the range limiting factor while capacity demand is usually heavily downlink focused. Throughout the cell coverage the averaged download speed outdoor was almost 2 Gbps. Indoor coverage was also tested at 200 meters distance from the site obtaining very high download speeds of 1.7 Gbps, implying a building entry loss of 20…25 dB even for thermally active windows, comparable to 3.5 GHz. Overall, the trial showed the viability of upper 6 GHz for macro rollout, indoor service provision and coverage equivalence to 3.5 GHz.

We are witnessing proposals that try to improve the sharing case for indoor WiFi and outdoor mobile usage by reducing mobile base station power, so the interference into WiFi is also reduced. Telefónica is extremely concerned by such an approach that will degrade the capacity and performance of the band to an extent where its value for cellular deployments drops to the point where it will not be used. Ultimately, as the majority of mobile use is indoors and supported by mid-bands standard power base stations, reducing the 6 GHz power would limit its coverage and capacity making it in practice similar to mmWaves bands.

Power limits drastically reduce the capacity of a new 6 GHz layer in existing sites. The chart below, derived from input submitted by Ericsson to CEPT, shows the impact of different power limits. In practice, those power limits imply that adding an U6GHz layer would be, from a capacity point of view, not very different from adding the same layer in the 26 GHz band, destroying the inherent differential value of mid-band spectrum discussed above.

Limiting the power of the macro base stations would produce a capacity loss of 40% up to 90% of the 6 GHz band and so, result in a very inefficient usage of the band for mobile that is unacceptable for justifying the capex to deploy another frequency layer.

Initial EIRP (dBm/100 MHz)	Final EIRP (dBm/100 MHz)	Initial Cell Capacity (Mbps)	Final Cell Capacity (Mbps)	Cell capacity loss (%)	Coverage loss (% pop)	Total Capacity loss[10]
83	71	1419	888	37.4%	3.8%	**41.2%**
83	65	1419	609	57.1%	8.4%	**65.5%**
83	59	1419	345	75.7%	14.6%	**90.3%**

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

Current deployments in the 3.5 GHz band can in our view be taken as a proxy for future deployments in the 6 GHz band to address future capacity needs due to organic traffic growth in mainstream uses. It is natural for deployments in upper 6 GHz to use the 3.5 GHz grid, given the relatively low incremental costs compared to the

[9] https://cept.org/ecc/groups/ecc/ecc-pt1/client/meeting-documents/file-history?fid=81128

[10] The cell median throughput is equivalent to the available cell capacity for the mix of users served by the cell both outdoor and indoor. The reduced median throughput consequence of limitations in power would mean a reduction of the cell capacity shown on the Cell capacity loss column. Coverage loss reflects the percentage of population that are left outside of coverage when compared with the full power cell.

alternative of building a new site and the similar propagation characteristics. It is also logical to expect that the first sites where the 3.5 GHz layer will be exhausted are the same sites that first required it.

In our view, current deployments in 3.5 GHz, as shown below, are already significant and indicate that adding a future new layer in the 6 GHz band could provide value to a significant number of end users.

[Confidential begins]

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