Public consultation on enabling mmWave spectrum for new uses

Making the 26 GHz and 40 GHz bands available for mobile technology in United Kingdom

Qualcomm Response

Qualcomm would like to thank Ofcom for the opportunity to provide its views on the public consultation on enabling mmWave spectrum for new uses and in particular on making the 26 GHz and 40 GHz bands available for mobile technology in the United Kingdom. At a time when digital technologies are essential tools to meet the economic, energy and environmental needs, 5G as an "open innovation platform "is a source of growth, innovation, and social inclusion.

In this context, the 26 GHz band will provide the mobile industry with an opportunity to tackle its increasing capacity needs in the short / medium term and should be made available with a matter of urgency no later than 1H 2023.

The 26 GHz band offers an opportunity for indoor and outdoor mobile services in urban, sub-urban and rural areas, for instance, city centers (e.g., busy streets and market squares), localized areas such as stadiums, railway stations, factories, campuses, shopping centers, etc., as well as fixed wireless access and enterprise/industrial broadband deployments. It is widely recognized that 5G in the 26 GHz band is a mature technology adopted in several markets with a mature ecosystem of devices.

Making sure to define the most suitable authorization framework for both the 26 and 40 GHz band is important to ensure that the market take off and flourishes. Qualcomm believe that mobile operators need to be a central part of this licensing and market development so that scale can be maximized which will benefit the entire ecosystem, including the so called ‘verticals’, and thus get the mmWave market off the ground. .

In particular:

- It is critical for mobile operators to get access to a sufficient amount of spectrum. This could be nationwide licenses or if this is not preferred then we would suggest a minimum of city/suburban wide licenses where the mobile operator is assigned the same spectrum across all cities/suburban areas. Providing MNOs with licenses with at least a national footprint would be important for the market to take off.
- Approximately 800 MHz of contiguous spectrum per operator/network should be assigned. We recognize that this needs to be balanced with the amount of spectrum available, number of operators and whether there is a desire to also make local area spectrum licenses available.
- If there is a desire to also make local area spectrum licenses available, then it is recommended that the Finnish approach is considered which offers a balance between local area and nationwide/city/suburban wide licenses. The lower portion of the 26 GHz spectrum is for local licensing and the remainder for nationwide or city/suburban wide licenses with a national footprint.

- Given the spectrum situation in the UK with respect to 40 GHz, Qualcomm suggests that this is also made available with suitable regulatory conditions to enable the option for mobile 5G to be deployed
- It is proposed that both 26 and 40 GHz (assuming making availability of the 40 GHz does not delay the release of the 26 GHz range) are made available by 2023 to enable the UK to benefit from the full 5G experience (low, mid and high bands). It is critical for the UK to make available at least the 26 GHz band in early 2023 and to provide the industry with a clear timeline so that Mobile Network Operators can plan accordingly investments and have a clear path to commercialization.

Last but not least, Qualcomm can confirm that infrastructure, chipsets and devices that support the 24.25-27.5 GHz band are widely available in the marketplace

Detailed answers to consultation questions

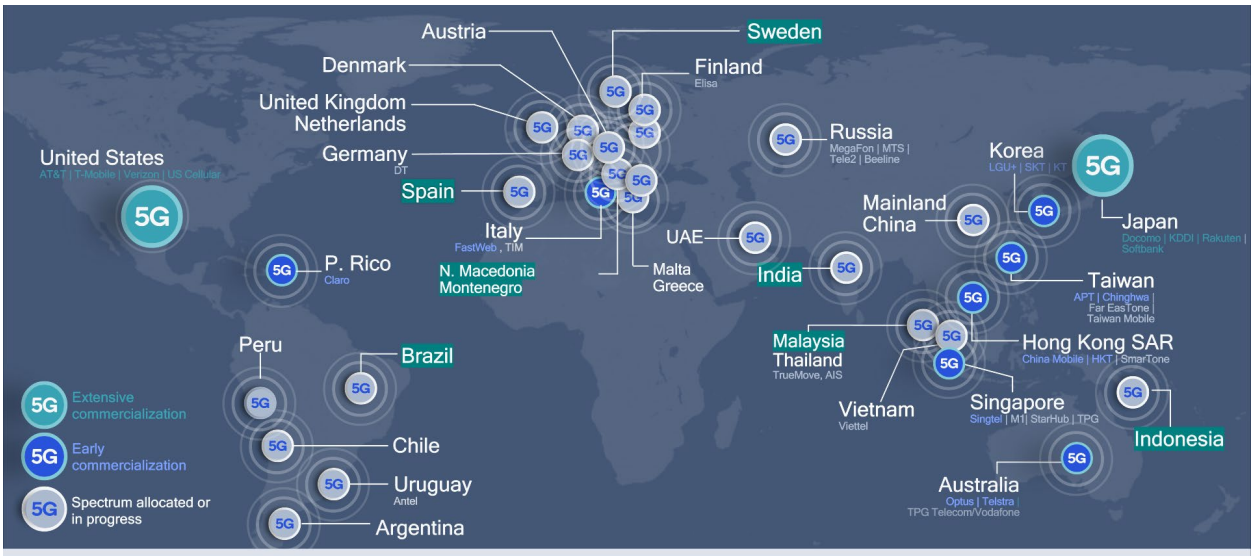
Question 1: (Section 2) Do you have any comments on our assessment of potential use cases, demand and deployment strategies for new uses of mmWave spectrum?

Qualcomm broadly agree with Ofcom's assessment of the potential future use of mmWave spectrum for mobile. We find the identification of use cases to be appropriate. The wireless industry has been pursuing different service delivery models designed to offset the high costs while ensuring favorable coverage and capacity. In this context, neutral host networking may also improve the economics of mobile networks by eliminating duplication of infrastructure.

mmWave offers an opportunity for indoor and outdoor mobile services in, for instance, localized areas such as stadiums, railway stations, busy streets, factories, campuses, shopping centers, market squares, etc as well as fixed wireless access and enterprise/industrial broadband deployments. We are in the very early stages of market development in Europe while in Asia and in the Americas we are witnessing a proliferation of commercial services. It is our view that the mobile operators are needed to be a central part of this so that scale can be maximized which then can then benefit the whole ecosystem, including the 'verticals', and to get the mmWave market off the ground in Europe.

Question 2: (Section 2) Do you have any comments on our proposed overall approach to mmWave spectrum (including our aim to make the 26 GHz and 40 GHz bands available for new uses on the same or similar timeframe)?

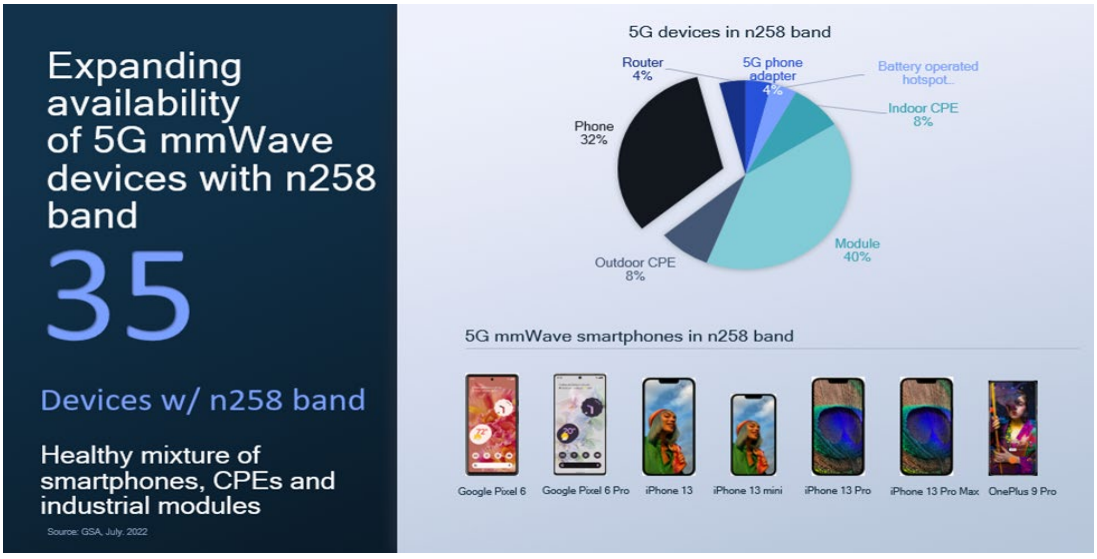
Qualcomm would like to highlight on the fact that making 26 GHz band available as soon as possible and not later than 1H 2023 needs to be the main priority. The allocation of the 26 GHz band and the definition of an authorization framework for developing a stable investment environment are fundamental elements. Indeed, there is a growing number of countries that are going to award the 26 GHz band in Europe in 2022 - 2023. As of today, mmWave spectrum is available in 14 countries (Italy, Finland, Denmark, Croatia, Slovenia, Greece, Malta, Germany, etc.) in Europe and will soon be released in Spain, Austria, Montenegro, North Macedonia to name just a few.



5G mmWave commercialization and spectrum

Commercialization - 28 telecom operators. Spectrum available - 31 countries

5G mmWave in 26 GHz band is a mature technology adopted in several markets with a mature ecosystem of devices. Furthermore, Qualcomm would like to point out that as mmWave adoption continues to spread across the world, handsets and a variety of other devices and CPEs supporting mmWave are being introduced into the markets. Consumers now have a wide selection of mmWave-enabled devices — smartphones, laptops, hotpots, fixed wireless access CPEs and more. There are 120+ 5G mmWave devices announced from ~50 vendors, including phones, hotspots, CPEs, modules, PCs, virtually all powered by Snapdragon ®.



Question 3: (Section 3) Do you agree with our approach of specifying high- and low-density areas in the UK, and authorizing new uses differently in those areas?

Qualcomm is of the view that providing mobile network operators with nationwide licenses or if this is not preferred with a minimum of city/suburban wide licenses (with a national footprint) where MNOs are assigned the same spectrum across all cities/suburban areas would be important for the market to take off.

Ofcom approach of specifying high- and low-density areas, provided it is kept simple and manageable and includes the above suggestions is certainly interesting. Indeed, in a economic study conducted by GSMA Intelligence, researchers examined a wide range of 5G mmWave deployment scenarios including different geographical regions, outdoor dense urban networks, indoor enterprises, and fixed wireless access (FWA). The overall findings are encouraging, with all scenarios showing how mmWave can be a cost-effective deployment strategy. Below is a quick summary of this study:

- *Dense urban networks:* the study looked at the period between now and 2025, and it finds that mmWave can be deployed cost effectively to deliver an additional capacity layer in dense urban areas in China and Europe.
- *FWA:* similarly, three different FWA deployments were analyzed, including urban China, sub-urban Europe, and rural U.S. The study shows that 5G FWA networks using mmWave spectrum can be cost effective if they are able to capture a significant percentage of the high-traffic residential broadband market.
- *Indoor enterprises:* the study looked at an indoor 5G mmWave deployment in a large office space. It finds that this strategy can also be cost effective and generate cost savings between 5% and 20% when a significant share of data traffic needs to be supported by indoor 5G services.

The study is provided in the attachment below:

210121-Economics-of-mmWave.pdf

In line with the findings of the economic study by GSMA Intelligence, Qualcomm expects initial use cases to focus on enhanced Mobile BroadBand (eMBB) and Ultra Reliable Low Latency Communications (URLLC) usage scenarios for indoor hotspots in enterprises and factories and outdoor mobile broadband in dense urban and urban areas as well as Fixed wireless access (FWA)[1] in suburban and rural macro scenarios. Applications such as Mobile Virtual/Augmented Reality and Ultra High-Definition Video, 5G fixed wireless access services and smart home, smart manufacturing, autonomous vehicle, Health care will all benefit from 5G deployments.

[1] A feasible use case for mmWave that provides expedited and low-cost deployment to replace fiber.

The multi-gigabit data rates possible with mmWave technology and the wide bandwidths available in 26 GHz will likely enable new use cases benefiting from high instantaneous data rates. On one hand, end users, who could be individual consumers and machines), will be able to download large amounts of data very quickly e.g., a movie before boarding a flight, fiber like services on always on laptops, or a high-definition map update to a vehicle. On the other hand, the network will be able to serve a lot of more highly demanding end points as the high instantaneous peak rates combined with Massive MIMO (M-MIMO) will dramatically increase network capacity and hence facilitate traffic offload to the existing 4G networks.

Capacity will be an important metric for 5G, as the amount of traffic will be burgeoning in the coming years with the more widespread adoption of competitive data plans comprising unlimited use of popular apps, video streaming or even full unlimited data usage. The capacity increase will focus on specific hotspots (cafes, venues, public squares, city centers, etc.) and aligned with the strategic deployment of high-capacity small cells covering the hotspot area. mmWave technology brings the benefits of Massive MIMO down to a small-cell scale, hence maximizing small cell capacity and hotspot coverage. Deployments will encompass venues (e.g., stadiums) and locations within city centers. Depending on traffic patterns, it would cover the main public squares and roads within the city center, as those would be the locations where most traffic is consumed.

One area of focus for 5G NR mmWave mobile deployments will be high-traffic urban areas in large global cities. To help assess this deployment challenge for 5G NR mmWave, Qualcomm conducted an extensive set of 5G NR mmWave network coverage simulation studies in numerous global cities.

While the initial focus for mobile operators is to quickly expand network capacities by starting deployments of 5G NR mmWave in existing dense urban markets, there are even more opportunities for mmWave beyond traditional

macro networks. One area of interest is to bring mmWave indoors to address the exploding demand of fiber-like wireless broadband access in crowded venues, such as convention centers, concert halls, and stadiums. These venues have traditionally been challenged with limited network capacity, thereby constrained with the quality of service (e.g., slow speeds and unreliable connectivity) they can deliver. With mmWave's significantly wider bandwidth and high spatial multiplexing gains, mobile operators and service providers could rapidly make multi-Gigabit, low-latency connectivity available to a large number of users.

Qualcomm has simulated a number of usage scenarios – these are presented hereafter:

5G mmWave is expanding into new use cases for indoor and outdoor deployments

Question 4: (Section 3) Do you agree with our overall authorization approach in high density areas for the 26 GHz band (i.e. to grant Shared Access licenses on a first come, first served basis for the bottom 850 MHz of the 26 GHz band, (24.25-25.1 GHz), and to auction citywide licenses for the rest of the 26 GHz band (25.1-27.5 GHz))?

Qualcomm view is that mobile network operators should have access to a sufficient amount of spectrum with at least a national footprint thus, we suggest Ofcom to adopt an authorization framework providing city/suburban wide licenses where every mobile operator ends up with the same spectrum across all cities/suburban areas, where 26 GHz and 40 GHz would be auctioned. Qualcomm recommendation is approximately 800 MHz of contiguous spectrum per operator/network. We recognize that this needs to be balanced with the amount of spectrum available, the number of operators and whether there is a desire to also make local area spectrum licenses available. This also needs to be balanced with the approach taken for the 40GHz spectrum. Given that there is a desire to also make local area spectrum licenses available in the UK we support the proposed approach ('the Finnish approach') which offers a balance between local area and nationwide/city/suburban wide licenses where the lower portion of the spectrum is for local licensing and the remainder for nationwide or city/suburban wide licenses. The proposal from Ofcom, is in line with

those of Finland and other Nordic countries which allocates a large part of the spectrum by auction to mobile operators and reserve a part for the verticals.

Question 5: (Section 3) Do you agree with our overall authorisation approach in low density areas for the 26 GHz band (i.e. to grant Shared Access licences on a first come, first served basis)?

Qualcomm agrees to the overall authorization framework proposed by Ofcom.

Question 6: (Section 3) Do you agree with adopting a similar approach to authorising the 40 GHz band as our proposals for the 26 GHz band, if we were to decide to re-allocate the 40 GHz band?

Should Ofcom decide to re-allocate the 40 GHz band, it would be important that the final outcome results in large contiguous blocks of spectrum for MNOs at least in cities / high density areas, with technical regulations based on CEPT deliverables.

Question 7: (Section 4) Do you agree with our proposed methodology for identifying and defining high density areas?

Should Ofcom decide to pursue the high/low density areas methodology, Qualcomm invites to consider identifying whether any exceptionally high traffic concentrations at very specific locations outside of dense urban areas might be included in the defined high-density areas. Ofcom should ensure that sufficient weight is placed on including locations where mmWave may be required to meet high traffic demand and not just considering population density. The 26 GHz band has the potential to solve problems at specific locations of high and exceptionally high traffic demand, by providing an additional capacity layer during peak demand periods.

Question 8: (Section 4) Do you agree with our proposed cut-off point of 40 high density areas?

Please see response above. Ensuring that important high traffic locations are included in high density areas might lead to considering more than top 40 areas. That being said Qualcomm understands that there should be a limit to the number of areas defined and that Ofcom might need to make decisions to keep the release process manageable and timely.

Question 9: (Section 5) Do you agree with our proposal to clear the fixed links in and around high density areas from the 26 GHz band?

Yes, Qualcomm agree.

Question 10: (Section 5, Annex 8) Do you agree with our estimates of the cost of migrating fixed links into alternative spectrum bands?

No comments

Question 11: (Section 6) Do you agree with the proposed approaches we have outlined to manage coexistence between new 5G users and the different existing users in the 26 GHz band? In particular, do you have any views on our

proposals to limit future satellite earth stations in this band to low density areas only, and to end access to this band for PMSE users with five years' notice?

Yes, Qualcomm agree.

In general, Qualcomm is of the view that it could be possible to preserve some of the existing earth stations in the Fixed Satellite Service (FSS), in case they are placed in low density areas.

Question 12:(Section 7) Do you agree with our initial assessment on which option for enabling the 40 GHz band for new uses would best achieve our objectives?

Qualcomm would like to point out that Option 1 is consistent with market mechanisms and would allow the market to determine the optimal use of the spectrum.

Question 13: (Section 7, Annex 8) Do you agree with our analysis of the impact on existing 40 GHz licensees, including our estimates of the cost of moving fixed links under the options involving revocation (options 2, 3 and 4)?

No commentsQuestion 14: (Section 8) Do you have any comments on our high-level Shared Access proposals (including technical and non-technical licence conditions and proposed approach to setting fees)?

Qualcomm welcomes Ofcom's proposal to specify Shared Access technical licence conditions based on TRP instead of EIRP. Although the proposed maximum TRP levels for low power BS are almost in line (2dB higher) with the current 26 GHz Shared Access indoor licences, we are of the view that the maximum TRP levels for medium power BS are somewhat restricting. Setting a max TRP limit of 30dBm/200MHz (i.e. only 5dBm higher than low power BS) may not provide a particularly attractive or suitable condition for medium power BS, especially considering that such licences may be deployed for longer distance links, to serve more than 50% of UK's population which is outside the identified high density areas. The propagation characteristics of mmWave spectrum compared to other Shared Access frequency bands e.g. 3.8-4.2 GHz, will result in higher path loss and thus, the potential area sterilization from allowing higher transmit power is likely to be smaller. Therefore, we would like to propose that Ofcom reconsiders the maximum TRP for medium power BS so that it can provide an attractive license condition for investment in mmWave deployments outside high density areas.

Furthermore, regarding the bandwidth options for mmWave Shared Access licenses, Qualcomm is of the view that considering the bandwidth required for future services and applications, channel bandwidths larger than 200MHz should be offered. The available 3.25 GHz of spectrum offer the opportunity for deployment of larger channel bandwidths and thus, licensees should be given the opportunity to deploy contiguous bandwidths of more than 200MHz, especially since the majority of UK airports and some of the hotspot outside high density areas would need to be served through Shared Access licenses.

Question 15: (Section 8) Do you agree with the overall approach we have set out to coordination and coexistence between new Shared Access users in the 26 GHz band and existing users?

Yes, Qualcomm agrees with the overall approach to enable co-existence with incumbents

Question 16: (Section 9) Do you have any comments on our initial thinking in relation to auction design?

Qualcomm desire would be to avoid in the auction design any unnecessary complexity and include availability of national licenses or if this is not desired, city - suburban licenses (along the lines expressed in the answers to the previous questions) to facilitate investment in networks at scale.

A simple award of national or city wide – suburban licenses, with available lots that reflect possible different value of parts of the band due to presence of fixed links, and regulatory measures to avoid fragmentation of assignments is encouraged.

Question 17: (Section 10) Do you have any comments on the licence duration options we have considered in this section for new licences for the 26 GHz and 40 GHz bands that we would auction?

Qualcomm considers that 10 - 15-year fixed term licenses are too short to be compatible with investment cycles, especially if it will be 5 years before licenses are useable in some places due to existing fixed links. Indefinite license with a 20-year initial term should be considered.

Question 18: (Section 11) Do you agree with our assessment of potential competition concerns and that it may be appropriate to impose a competition measure such as a 'precautionary cap?

Qualcomm agrees that under 40 GHz Option 1, as detailed in the consultation document, competition measures need to be considered in view of the scale of existing holdings relative to the spectrum to be awarded.