# Draft RSPG Opinion on the development of 6G and possible implications for spectrum needs and guidance on the rollout of future wireless broadband networks

## Qualcomm Response

Qualcomm welcomes the opportunity to provide its comments on the "Draft RSPG Opinion on the development of 6G and possible implications for spectrum needs and guidance on the rollout of future wireless broadband networks".

As 5G is being rapidly rolled out in Europe and around the world, expanding the capabilities of mobile networks through faster speeds, lower latency and greater traffic capacity, the current and future mobile technology generations of mobile communication will continue to move well beyond connecting people to connecting all places and things, everywhere, all the time, efficiently and reliably to blend the digital, virtual, physical and human realms. Mobile communications are increasingly becoming key to unlocking and harnessing the potential of other new technologies, like Artificial Intelligence ("AI"), edge-compute, and Internet-of-Things ("IoT").

## ***Identification of fresh new spectrum for 6G in a timely fashion***

Each new mobile technology generation requires new spectrum, and identifying fresh spectrum for 6G in a timely fashion is instrumental to the development and deployment of the next generation. In this context, while the Draft RSPG Opinion provides a very valuable assessment on the 5G development in Europe, it does not seem to take a proactive approach in the development of a European 6G spectrum roadmap and action plan. Important decisions with respect to future spectrum are urgently required in the European Union if Europe wishes to be at the forefront of, and benefit from, technological developments.

Even as the technical capability and requirements of 6G are still under discussion within technical forums, as of now, 6G is expected to result in another fivefold increase in speed and traffic capacity, tenfold decrease in latency, and continued power efficiency improvements[1]. These advances will support evolutionary use cases and new innovative applications that take full advantage of AR/VR-fueled immersive experiences and AI capabilities.

The economic and societal benefits of repurposing spectrum for mobile broadband and other expanded uses are well documented. As the economic impact of 5G deployments is now apparent in Europe, it is too early to fully quantify the economic and societal benefits of the next generation of wireless connectivity, which will materialize by the middle of the next decade. One thing that is known, is that 6G will build on the prior mobile technology generations that have already led to massive economic gains. Even larger productivity gains than 5G gains are expected from 6G, as

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[1] *See* "Draft new Recommendation ITU-R M.[IMT.FRAMEWORK FOR 2030 AND BEYOND] - Framework and overall objectives of the future development of IMT for 2030 and beyond", ITU-R SG05 Contribution 131 (WP 5D), available at https://www.itu.int/md/R19-SG05-C-0131/en

mobile technology further permeates our connected society, creating new services and applications that take advantage of the near-real-time connectivity tools and massive throughput and extreme reliability 6G is being designed to support.

## ***Large channel bandwidths for 6G***

Each new mobile technology generation has used wider channel bandwidths than prior generations to support increasing peak user data demands for increasingly demanding use cases.[2] 2G digital cellular networks used channel bandwidths between 200 kHz (GSM) and 1.25 MHz (CDMA). 3G communication technologies (like W-CDMA and EV-DO Rev. B) used wider 5 MHz channels for higher data rates, giving rise to the mobile Internet. 4G LTE quadrupled channel bandwidth to 20 MHz for faster mobile data speeds, which spurred the smartphone revolution and connected billions of people across the world to the Internet. With 5G NR, channel bandwidths increased substantially once more, with 100 MHz channel bandwidths in sub-7 GHz spectrum and 400 MHz channel bandwidths in millimeter wave bands, to deliver much needed capacity for the unprecedented growth in mobile video traffic associated with social media use, remote work and education, and streaming entertainment, and accelerate the adoption of fixed wireless access.

While 5G deployments will continue to expand over the rest of this decade, 6G will be the innovation platform for the next decade, integrating communications, artificial intelligence, machine learning, and sensing to create a new type of more energy-efficient network architecture. 6G's use of advanced sensing will provide spatial perception to further improve spectral efficiency and communications applications providing highly immersive experiences. 6G uses cases

2 NextG 6G Report at 15.

expected to drive productivity, such as advanced XR and holographic communication, will rely on extremely high capacity that are not currently available.

Advanced XR and holographic communication will revolutionize countless fields, including education, public safety, medicine, and travel by providing immersive experiences that improve our lives and the daily services we rely upon. Similarly, integrated communications and sensing will allow for applications like digital twins that can provide real-time monitoring, maintenance and design improvements of large-scale undertakings, such as traffic flow inside cities, roadway infrastructure status, and public safety response improvements. All these use cases require much higher capacity than 5G networks can provide, and the only way to support them will be for operators to have access to large channel bandwidths of 500 megahertz.

Large channel bandwidths also will encourage the adoption of technological innovations like Sub-Band Full Duplex ("SBFD"),[3] which enable full duplex operations in unpaired spectrum. Extensive research performed in academia and industry shows that SBFD technology implemented in high power macro networks provides flexibility in network deployments,[4] improves uplink coverage and latency, and leads to more efficient spectrum use compared to static spectrum resource allocations in the time domain between uplink and downlink transmissions when using TDD slot structures.

3 3GPP has studied full duplexing techniques in detail in the ongoing Release-18 study item with extensive contributions from multiple companies in the wireless eco-system.

4 *See* 2022 Qualcomm SBFD demonstration at Mobile World Congress, Barcelona 2022, https://youtu.be/H1zSdCJp6x8 (SBFD in 0:33 - 2:01); *see* 2023 Qualcomm SBFD demonstration at Mobile World Congress, Barcelona 2023, https://youtu.be/z8vyE3G3-Kk (SBFD in 0:35 - 2:28).

These 6G network advancements hinge on the availability of wide bandwidths of contiguous spectrum. Contiguous channels of at least 500 MHz will ensure 6G technology achieves wide area coverage akin to that available in lower spectrum bands today, and operational performance improvements to serve orders of magnitude more users within the same cell, fostering innovative use cases like immersive experiences and digital twins that interconnect the physical world and digital world.[5]

Further, contiguous 6G spectrum blocks of 500 MHz will result in efficiencies along multiple vectors, including lowering power consumption and deployment costs while enabling new applications and supporting exponentially increasing data demands. In contrast, regulatory actions that do not support lower-cost deployments will directly impact the extent of 6G adoption and compromise attaining universal goals like addressing digital equity and closing the digital divide.

In the context of facilitating the transition to the next generation of wireless technology and given the continuous technological advances of wireless technology, the societal and economic impact of each generation of wireless technology, RSPG should explore whether existing policies continue to be appropriate for evaluating the nature of the tradeoffs between competition and efficient use of spectrum. In particular, RSPG should develop a fulsome record on whether allocating larger bandwidth spectrum blocks presents a genuine risk of foreclosing entry by competitors or new entrants, via obtaining the available spectrum, that is not outweighed by the risk of not deploying the next generation of wireless technology. RSPG should also explore

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[5] For example, for applications that require body and/or obstacle proximity, as well as gesture recognition, the resolution will need to be at "centimeter-level" accuracy. Bandwidths of at least 500 MHz will allow for the positioning accuracy necessary for 6G.

whether there are technical solutions to limit the potential for foreclosure, such as spectrum sharing and whether those solutions raise any new competition concerns.

## ***Evaluating Spectrum Sharing Scenarios***

Given the need for large spectrum blocks to implement the next generation of wireless technology, further exploration on potential spectrum sharing between mobile network operators throughout a 500-MHz spectrum block is warranted. Shared licensed operations can be enabled in several different ways. For example, in a network-managed sharing scenario, several mobile network operators can operate on the same spectrum in the same geographic area and at the same time. A dynamic network controller can assign resources to Operator A to serve a customer in a specific location while enabling reuse of those same resources by Operator B to serve a customer in another location within the same serving cell. Given the highly directive antenna systems under development for 6G systems, more than one mobile network operator can support highly reliable levels of connectivity to many users within the same serving cell. In cases where customers of different operators or customers of the same operator are in the same spot, spectrum resources can be divided in time to serve them both using the same channel bandwidth. There also is an equipment-based sensing approach that can be implemented to support sharing of a 500 MHz spectrum block among multiple network operators. This approach uses synchronized spectrum sensing to allow multiple licensees to share the same spectrum band by synchronizing operations to allow multiple operators to simultaneously share the same swath of spectrum in the same location without interference. RSPG should explore whether sharing mechanisms like the ones described above, can effectively allow multiple wireless licensees to share a wide bandwidth spectrum block. RSPG could explore how spectrum sharing approaches like these can mitigate

interference to other operations in this band. Other sharing mechanisms could also be explored including how those might impact the regulatory framework for the next generation of wireless technology, including the auction design.

## ***Suggestions on spectrum related aspects to be considered in relation with 6G.***

- Qualcomm recommends that spectrum related aspects need to be addressed by Europe from an early stage, considering that identification and harmonization of spectrum for the initial 6G deployments can be a long process. Europe will need to be part of the important decisions that will be taken around the world in 2023 already and which will be fundamental in putting the pillars for the future 6G spectrum strategy.

- Qualcomm understand the importance Europe is placing on the CSDP and space policies, but we cannot minimise the importance of identifying the relevant spectrum required to assure that 6G is timely implemented across Europe in 2030 and onward, in line with the objectives of the Digital Decade. We believe that there is scope for technical studies to determine if and how IMT-2030 could co-exist and be operated in some sub-bands of the range 7-15 GHz6 while not negatively impacting the CSDP and space policies.

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6 Qualcomm position on WRC-23 AI 10:
Qualcomm supports a new agenda item for IMT at WRC-27, with a focus on the following bands:
- 7.125-8.5 GHz
- 10.7-11.7 GHz
- 11.7-12.75 GHz
- 12.75-13.25 GHz
- 14-14.8 GHz
- 14.8-15.35 GHz

- Based on previous experience with 5G spectrum, including the identification and harmonization of pioneer bands, we see scope for RSPG to apply similar efforts towards 6G. We encourage therefore the RSPG to consider similar plans to identify and make available primary and pioneer bands for 6G deployment in a timely manner. We also acknowledge the importance of coordinated 6G strategies across Europe that will be essential in determining efficiently the timeline for spectrum release.

- Considering the long-tail process of identifying and making available spectrum for new usages, we consider the study cycle towards WRC-27 to be crucial to evaluate and identify the right spectrum bands in which 6G can be deployed from the very early roll-out stage. Decisions on spectrum for IMT-2030/6G at WRC-27 will allow for this spectrum conditions to be defined in due time for the initial deployments.

- Qualcomm encourages the RSPG to commence its work on the 6G spectrum roadmap from 2023 and to publish it in 2024.