"Public consultation on the Draft RSPG Opinion on spectrum related aspects for next-generation wireless systems (5G)"

Qualcomm Response

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Qualcomm welcomes the opportunity to respond to the "Public consultation on the Draft RSPG Opinion on spectrum related aspects for next-generation wireless systems (5G)". The development and implementation of a spectrum roadmap to facilitate the launch of 5G on a large scale in Europe by 2020 is critical to position Europe in a leadership position in the provision of 5G-based services to its citizens and in driving industrial and societal transformation and economic growth in Europe from 2020 and beyond.

Qualcomm believes that 5G will transform societies and industries to an even greater extent than previous service generations. 5G connectivity will create new services, new industries and devices, and empower brand new user experiences via support of ultra-low latency, ultra-low power, ultra-high reliability and ultra-high security devices with flawless connectivity.

5G will be scalable and adaptable across an extreme variations in requirements and will be a unified design across all spectrum bands and types (licensed, shared and unlicensed) from below 1 GHz for wide area coverage deployments to higher bands up to 6 GHz for more capacity focused deployments, to above 6 GHz and mmWave for extreme bandwidth and more targeted capacity deployments.

Qualcomm believes that the RSPG Opinion is timely to support the upcoming EC Action Plan. We've called for a 5G spectrum roadmap as soon as possible in the EU to enable 5G trials and initial rollouts in Europe from 2020. We believe the RSPG Opinion helps achieving this objective.

Furthermore, Europe should pursue early regional harmonization of mmWave spectrum before WRC-19 to send an important "signal" to other regions and to enable the industry to provide the needed enabling technology in a timely manner.

In particular, Qualcomm agree that:

- Bands already harmonized below 1 GHz, including particularly the 700 MHz band, are important for 5G in order to enable nationwide and indoor 5G coverage. The importance of the 700 MHz band is not only due to its large coverage benefits, but also to the role it is expected to play for the future of 5G in Europe, as recently highlighted by both commissioners Ansip and Oettinger[1]. Throughout Europe, 5G is expected to deliver not just improved mobile broadband, but critically a technology platform for the emergence of so-called verticals. 5G technology will enable verticals such as M2M/IoT and broadcasting to benefit from performance and economies of scale that can only be delivered by the mobile ecosystem. This view – shared across Europe – that 700 MHz could play a big role to enable new services and connectivity leading to 5G should also be taken into account when addressing the optimum use of the center gap. Furthermore, in the longer term, allowing spectrum in the sub-700 MHz frequency band to be used for downlink-only electronic communications services in cases where there is no or declining demand for terrestrial broadcasting television services at national level would be extremely beneficial for 5G, for example for optimal delivery of infotainment services for connected cars. .
- 3400-3800 MHz band will be the primary band in the spectrum between 1 GHz and 6 GHz for the introduction of 5G in Europe before 2020. This band is being considered for early trials and introduction of 5G services in a number of countries/regions in the world including China and Japan. The 3500MHz band in the U.S. and Korea might be good candidate too for 5G deployments – In the U.S. "The Mobile Now Act" proposes further studies for a number of bands including 3100-3550 MHz and 3700-4200 MHz. In order to reap the full benefits of this frequency band, considerable efforts will be necessary to ensure that it does not suffer from the current situation of fragmentation and the RSPG should make sure that this band is 5G-fit and define a suitable regulatory framework for 5G including the definition of coordinated auction and spectrum assignments rules (block sizes, caps, coverage and data rates requirements, licenses duration, reserve price etc.) across EU member states to maximize the potential of 5G

[1] http://europa.eu/rapid/press-release_IP-16-207_en.htm

NR (New Radio) and enable the delivery of consistent 5G connectivity (data rates, latency, coverage…) across the EU .

- By design, 5G NR will optimally support wideband operation, allowing operators to fully take advantage of such larger allocations of contiguous spectrum to increase peak rates and user experience, with reasonable terminal complexity and power consumption. For instance, 5G NR will support wider subcarrier spacing leading to reduced FFT complexity. LTE can use Carrier Aggregation to aggregate multiple 20MHz channels, but as the number of channels to be aggregated increases, LTE will become inefficient, especially in terms of terminal complexity, unlike 5G NR.
- 5G NR is being designed to natively incorporate advanced wireless techniques across a wide range of requirements. For example, massive MIMO is an important enabler to meet 5G requirements. As an example, massive MIMO at 3.6GHz allows re-use of existing macro sites at same transmit power and obtain a significant throughput gain at cell edge. Simulations carried out using an inter-site distance of 1.7 Km for macro-cell, 46dBm transmit power at base stations, 10 users per cell and 24 x 4 MIMO at 4 GHz using an 80MHz channel provide 3.9x to 4.1x gains at cell edge compared to 2 x 4 MIMO using the same 80 MHz bandwidth at 4 GHz and deliver an average cell throughput of 808 Mbps

- Furthermore, we believe it is key to auction the available spectrum in 3.4-3.8 GHz in 2017-2018 timeframe so that trialling 5G capabilities in terms of mobile broadband and IoT would be within a real EU strategy for 5G commercial rollout in 2020. Last but not least, for the long term, serious consideration should be given to the 3.8-4.2 GHz band, as a possible extension band to 3.4-3.8 GHz. This consideration should however not delay the release and rollout of 5G in the 3.4-3.8 GHz. Suitable sharing frameworks (which should be based on LSA) should be established with existing services in the band.
- It is important for RSPG to identify and communicate to the industry already in 2016 a suitable band to be made available in Europe above 24 GHz and included in the list of bands of A.I. 1.13. This would allow the industry to have sufficient time to develop and make available enabling technologies serving trials and initial rollouts in Europe from 2020. RSPG should make sure to prioritize the necessary work to assess what would be involved in enabling access (before 2020) to the selected pioneering band across European member states, pursue its early regional harmonization well ahead of WRC-19 and define an action plan coordinated across member states to make sure spectrum can be released by Member States before 2020.

It is important when selecting one band (above 24 GHz) to be harmonized in Europe for early 5G implementation to focus on frequency bands proposed by Europe at WRC-15 and in particular the bands 24.5-27.5 GHz, 31.8-33.4 GHz and 40.5-43.5 GHz. Although all three bands are extremely interesting for 5G, we recommend that the focus first on the 24.25 – 27.5 GHz and 31.8 – 33.4 GHz bands as they are close to the 28 GHz where 5G services are considered in the US and Korea. We further believe that priority should be given to the frequency band that can be harmonized in Europe and authorizations issued in Member States ahead of WRC-19 to enable early 5G deployments in 2020. In the longer run, the 40.5-43.5 GHz band, not extensively used by incumbents in Europe, could also provide large additional 5G capacity in subsequent upgrade steps to 5G networks as more and more services will be put onto these networks.

Last but not least, it is important to define for frequency bands intended for early 5G deployment Least Restrictive Technical Conditions (LTRCs) before WRC-19 in order to provide sufficient information to the mobile industry for standardization and design of base station and terminal equipment. Ideally, such information should be available by 2018. Furthermore it is also important to ensure that "technical and regulatory conditions for all bands already harmonized for mobile networks are fit for 5G use." That said, Mobile Operators are in the best position to decide if and when appropriate to transition to 5G services for spectrum already harmonized and currently used for 2G/3G/4G services..