Public Consultation on Granting of Radiofrequency Usage Rights in the 700 MHz, 2 GHz, 3400 – 3800 MHz and 26 GHz bands

Qualcomm would like to thank National Telecommunications and Post Commission (EETT) for the opportunity to provide comments on its public consultation on Granting of Radiofrequency Usage Rights in the 700 MHz, 2 GHz, 3400 – 3800 MHz and 26 GHz bands. Qualcomm believes that making spectrum available in those bands by 2020 will be key for the deployment of 5G in Greece.

1. Spectrum availability

a) 700 MHz (703 - 733 MHz / 758 - 788 MHz)

Qualcomm encourages EETT to make available the 700 MHz band by 2020 as this would lead to substantial benefits. 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 5G in Europe, as highlighted by RSPG that has identified this band as a 5G pioneer band in Europe. Late availability of the 700 MHz may have negative consequences on Greece's ambitions in 5G.

b) 2 GHz (1920 - 1980 MHz/ 2110 - 2170 MHz)

Qualcomm welcomes EETT's decision on the provision of 2 GHz spectrum allocations before license expiration in order to create planning and investment security for interested parties as well as a stable regulatory framework. The approach would make it possible to provide larger frequency blocks for the effective use of 5G technologies. This initiative is aligned with the current action by the European Commission. Indeed, the Commission proposed to amend Decision 2012/688/EU, as regards an update of relevant technical conditions applicable to the frequency bands 1920-1980 MHz and 2110-2170 MHz (the paired terrestrial 2 GHz band) for terrestrial systems capable of providing electronic communications services. The harmonization of the new technical parameters according to the CEPT report 72 (Report A) will make the paired terrestrial 2 GHz band suitable for 5G, while preserving the principle of technology and service neutrality.

c) 3.4 - 3.8 GHz

Qualcomm welcomes EETT' decision to tackle band fragmentation and supports its decision to release 400 MHz of spectrum in the 3.4 - 3.8 GHz band. It would be important to ensure that each operator could have access to wide contiguous blocks of spectrum in the order of 100 MHz to reap the full benefits of this frequency range for 5G.

The 3400-3800 MHz frequency range offers an optimal balance between coverage and capacity, which will support a broad range of 5G applications, including: Augmented Reality/Virtual Reality (AR/VR), Ultra High Definition (UHD)

video, smart home, smart manufacturing, health care and drones. The 3400-3800 MHz band will also provide both mobile connectivity "and Fixed Wireless Access (FWA) for domestic and business applications.

d) 24.25 – 27.5 GHz

Qualcomm believes that the 26 GHz band offer a tremendous opportunity for the deployment of 5G services in Greece and supports its release. Indeed, Qualcomm believes that availability of new spectrum in both sub-6 GHz spectrum and the 26 GHz band is key to unlocking the full potential associated with 5G.

Qualcomm recommends EETT to take all the possible actions to make available to the market this band as soon as in 2020. Qualcomm appreciates also the challenges of 5G co-existing with existing Point to Point and Point to Multipoint Links in the band[1]. Given their significant number in Greece, in this portion of the band this is a challenging issue. Ideally the fixed links should be moved over time while 5G zones could be identified and made available also in the entire 26 GHz band.

Qualcomm would like to inform the regulator that 5G NR equipment supporting the 26.5 – 29.5 GHz band (3GPP TDD band n257) is already widely available and commercial deployments of 5G end-to-end system at mmWave has already started or is about to start in several countries in the world including the US, Korea, Japan[2], Russia, Italy and many others.

According to GSA (Global Supplier mobile Association), the 24.25 – 29.5 GHz range covering the overlapping bands n257 (26500–29500 MHz), n258 (24250–27500 MHz) and n261 (27500–28350 MHz) has been the most-used 5G mmWave spectrum range to date above 6 GHz with:

- 113 operators in 39 countries that are investing in 5G (in the form of trials, licences, deployments or operational networks) across this spectrum range
- 66 operators licensed to deploy 5G in this range
- 12 operators understood to be actively deploying 5G networks using this spectrum.

Please see the picture below from taken from GSA spectrum report[3].

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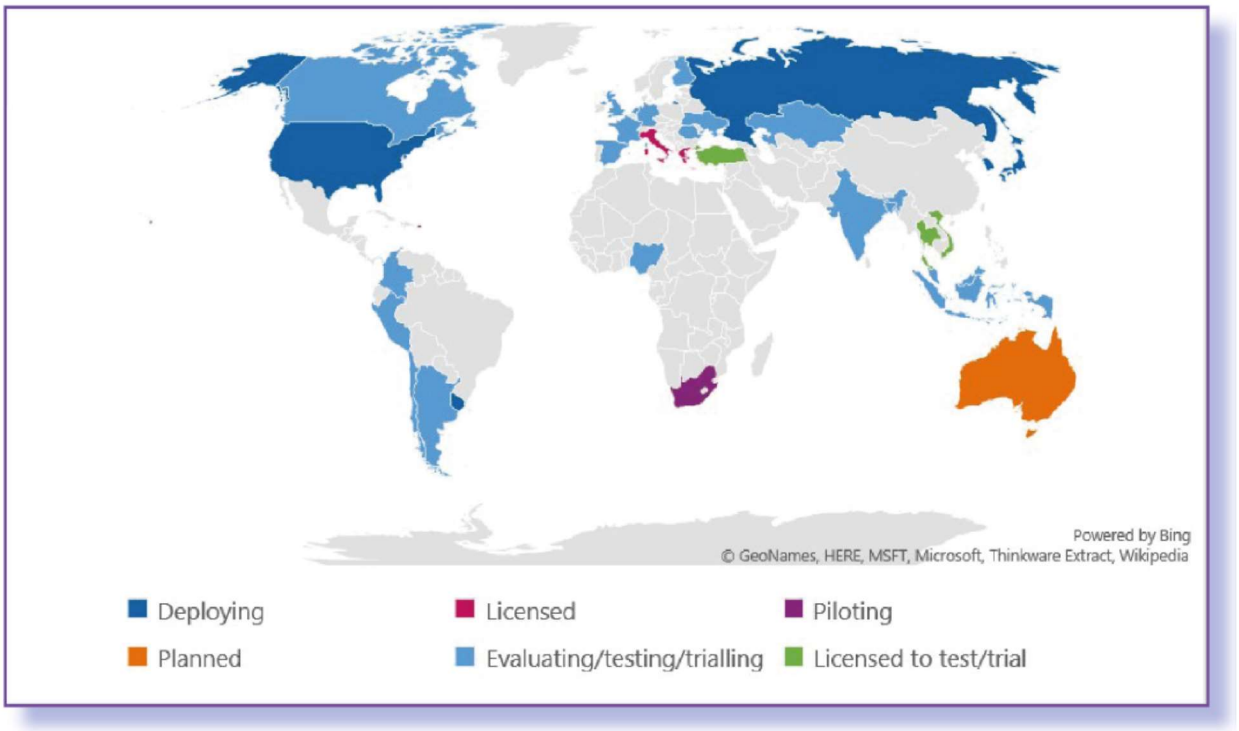
[1] In Greece, the use of the 26 GHz-FS band has been laid down by Ministerial Decision (69097/1496/20-10-2016, Government Gazette 3455/B/26-10-2016), for a period of 15 years. Furthermore, the Decision limits the number of national spectrum rights in this band up to 15 blocks of 2x56 MHz and prescribes guard bands of 28 MHz between adjacent operators.

[2] https://www.nttdocomo.co.jp/english/corporate/ir/binary/pdf/library/presentation/200318/new_product_presentation_200318_e.pdf

[3] Spectrum above 6 GHz:Global Licensing & Usage Overview - A special report based on GSA's continuous LTE and 5G research programme

Figure 1: Use of 5G spectrum between 24.25 GHz and 29.5 GHz, countries plotted by status of most advanced operator activities



When it comes to devices supporting mmWave spectrum, GSA has published the following picture in its February 2020 report about eco-system availability: over 33% of the 5G announced devices support mmWave spectrum.

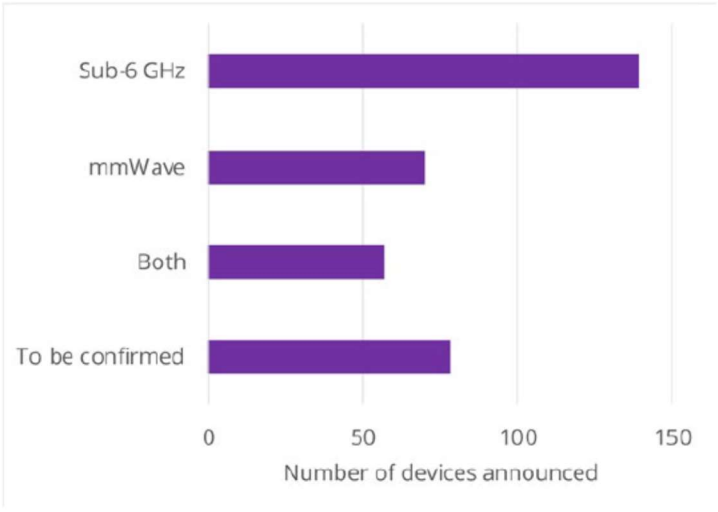


Figure 3: Announced devices with known spectrum support, by broad category (data not available for all devices)

Furthermore, Qualcomm Technologies, Inc. announced in February 2020 the Snapdragon X60 5G Modem-RF System, its third generation 5G modem-to-antenna solution (the Snapdragon X60).

The Snapdragon X60 is the last generation 5G modem-RF system from Qualcomm, succeeding the Snapdragon X55 5G Modem. In 2019, Qualcomm introduced 5G CPE reference design with support for both mmWave and sub-6 GHz spectrum bands and based on the second generation of the Snapdragon X55 5G modem and the Qualcomm RF Front End (RFFE) components and modules, making this a true "modem to antenna" solution. The reference design is built to help manufacturers address multiple operator's needs as they look to improve network performance, increase range, provide an unsurpassed user experience, and expand fixed broadband coverage by taking advantage of 5G infrastructure.

Snapdragon X60 features the world's first 5-nanometer 5G baseband and is the world's first 5G Modem-RF System to support spectrum aggregation across all key 5G bands and combinations, including mmWave and sub-6 using frequency division duplex (FDD) and time division duplex (TDD), providing ultimate operator flexibility to uplift 5G performance utilizing fragmented spectrum assets.

This 5G modem-to-antenna solution is designed to enhance the performance and capacity for operators worldwide while increasing average 5G speeds in mobile devices. The Snapdragon X60 also features the new Qualcomm® QTM535 mmWave antenna module, engineered for superior mmWave performance. QTM535, the company's third generation 5G mmWave module for mobile, features a more compact design than the previous generation which allows for thinner, sleeker smartphones.

Building on the success of the industry-leading Snapdragon X50 and X55 5G Modem-RF Systems, the Snapdragon X60 is the world's first to support mmWave-sub6 aggregation allowing operators to maximize their spectrum resources to combine capacity and coverage. Additionally, the Snapdragon X60 contains the world's first 5G FDD-TDD sub-6 carrier aggregation solution, in addition to supporting 5G FDD-FDD and TDD-TDD carrier aggregation, along with dynamic spectrum sharing (DSS), allowing operators a wide range of deployment options – including the ability to repurpose LTE spectrum for 5G – to effectively deliver higher average network speeds and accelerate 5G expansion. This 5G modem-to-antenna solution can deliver up to 7.5 gigabits per second (Gbps) download speeds and 3 Gbps upload speeds, and the aggregation of sub-6 GHz spectrum in standalone mode allows the doubling of peak data rates in 5G standalone mode compared to solutions with no carrier aggregation support. VoNR support in Snapdragon X60 will be an important step in the global mobile industry's transition from non-standalone to stand-alone mode, as it will allow mobile operators to provide high-quality voice services on 5G NR.

Qualcomm Technologies is scheduled to ship samples of Snapdragon X60 and QTM535 in the first quarter of 2020, with commercial premium smartphones using the new Modem-RF System expected in early 2021. **Qualcomm mmWave antenna modules support 3GPP bands n.260, n261 and n.257 (26.5 – 29.5 GHz) and n.258 (24.25 – 27.5 GHz).**

2. Allocation procedures

a) Allocation methods for 3400 – 3800 MHz band

Qualcomm believes that it is important to ensure that each operator could have access to wide national contiguous spectrum assignments in the order of at least 80 MHz but ideally 100 MHz to reap the full benefits of this frequency range (3.4 – 3.8 GHz) for 5G. By design, 5G NR will optimally support wideband operation, allowing operators to fully take advantage of larger allocations of contiguous spectrum to increase peak rates and user experience, with manageable terminal complexity and minimal power consumption.

3. Spectrum Usage Rights Characteristics

a) License duration

Qualcomm agrees with EETT which proposes that the underlying rights to use the frequencies be allocated for a period of 15 years, with the possibility of an extension of 5 years in line with what is stipulated in the European Communications Code electronic (EECC) to ensure regulatory predictability for rights holders and encourage investment in infrastructure.

b) Coverage obligations

Sub 6 GHz band

Qualcomm applauds EETT's efforts to expand coverage to underserved areas through its proposed obligations, which aim to improve the quality of mobile coverage in most of the rural area. Qualcomm supports EETT's approach, which is focused on providing consumers with good quality voice and data services. Rural consumers should be able to enjoy the same services that their urban counterparts enjoy. Coverage obligations on new mobile licenses are one important "lever" that can used to help address the rural/urban coverage divide.

26 GHz Band Usage Scenarios and Authorizations

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)[4] in suburban and rural macro scenarios. Applications such as Mobile Virtual/Augmented Reality and Ultra High Definition Video, 5G fixed wireless

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

access services and smart home, smart manufacturing, autonomous vehicle, Health care will all benefit from 5G deployments.

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.

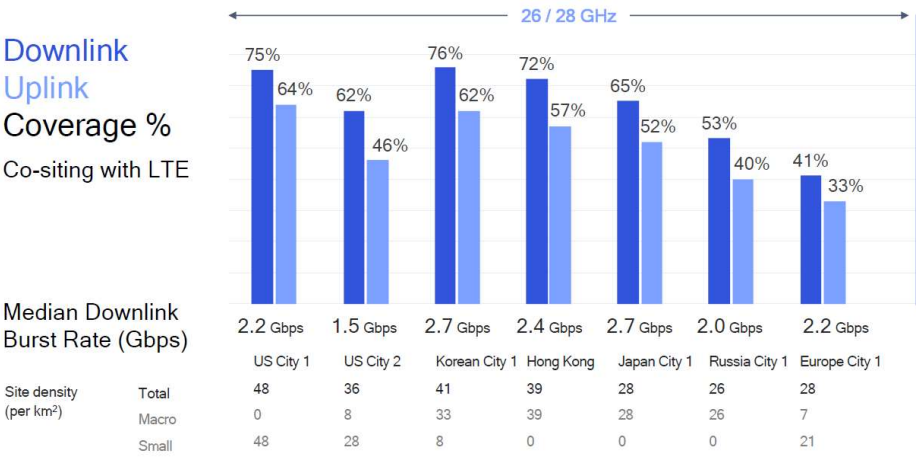
One area of focus for 5G NR mmWave mobile deployments will be high-traffic urban areas in large global cities. To help assess this deployment challenge for 5G NR mmWave, Qualcomm conducted an extensive set of 5G NR mmWave network coverage simulation studies in numerous global cities. The results of the simulation studies conducted across ten global cities, show that significant outdoor downlink coverage is possible when co-siting 5G NR mmWave with existing 4G LTE macro and small cell sites. The positive results show that mobile deployments in urban-areas based on existing LTE cell cities is feasible, especially when considering the tight-interworking of 5G NR with 4G LTE.

Although mmWave outdoor-to-indoor coverage for mobile is not feasible, the outdoor mmWave coverage will significantly free up resources in the spectrum bands below 6 GHz for outdoor-to-indoor capacity, utilizing either 4G LTE or 5G NR technology. In addition, outdoor mmWave coverage can be complemented with targeted indoor mmWave deployments.

Simulation results for a number of usage scenarios are presented hereafter.

Outdoor Coverage Simulation Study using mmWave Smartphone for Mobility Application

Results of outdoor simulation studies performed at dense urban traffic hotspots across major global cities are reported in the picture below. The studies are based on co-siting mmWave transmission points with current LTE site locations of major tier-1 MNOs, used accurate high-resolution 3D geo-maps, and also factored in additional hand, body and shadowing losses



From the above, it is evident that a significant percentage of outdoor areas could very well be covered by 5G NR mmWave mobility services using smartphone and offer unprecedented experience to the end users.

Following is a more detailed snapshot of a Qualcomm case study performed in 10 sq-km cluster of San Francisco by reusing actual LTE deployment of a major tier-1 service provider. The observations remain the same that just by reusing existing deployment, nearly 70% of the outdoor area could be covered with a user-experience that far-exceeds what existing technologies can offer.

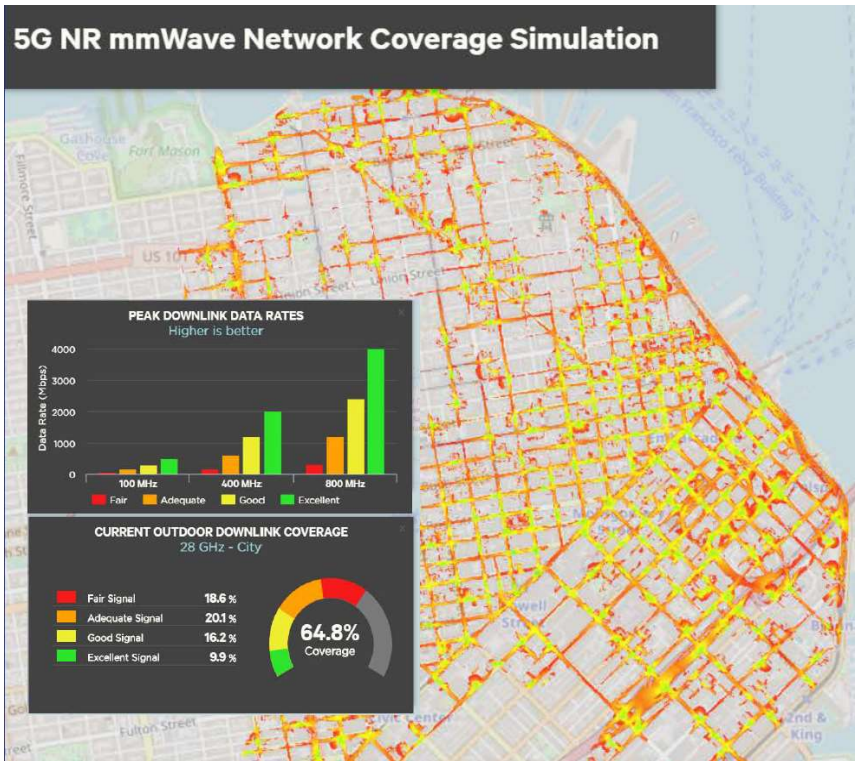
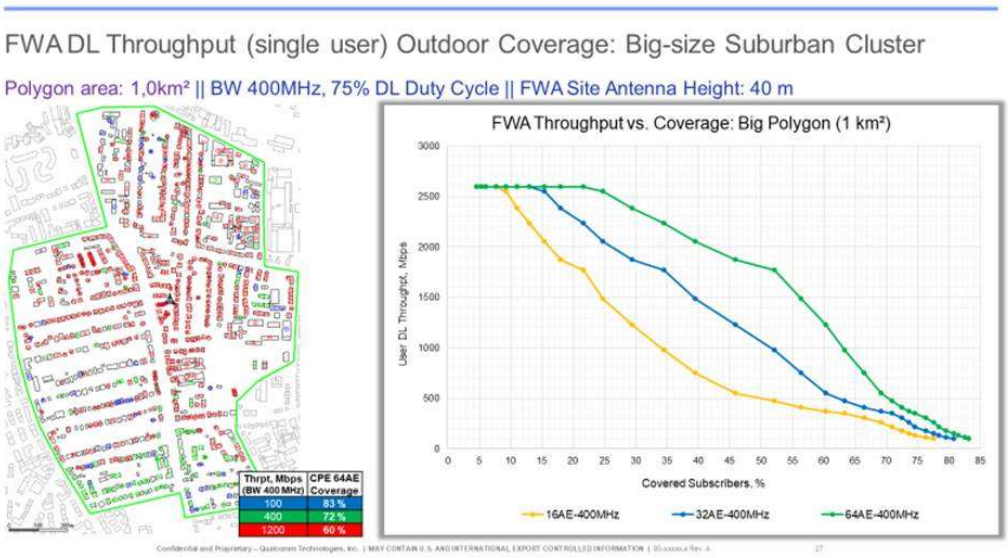


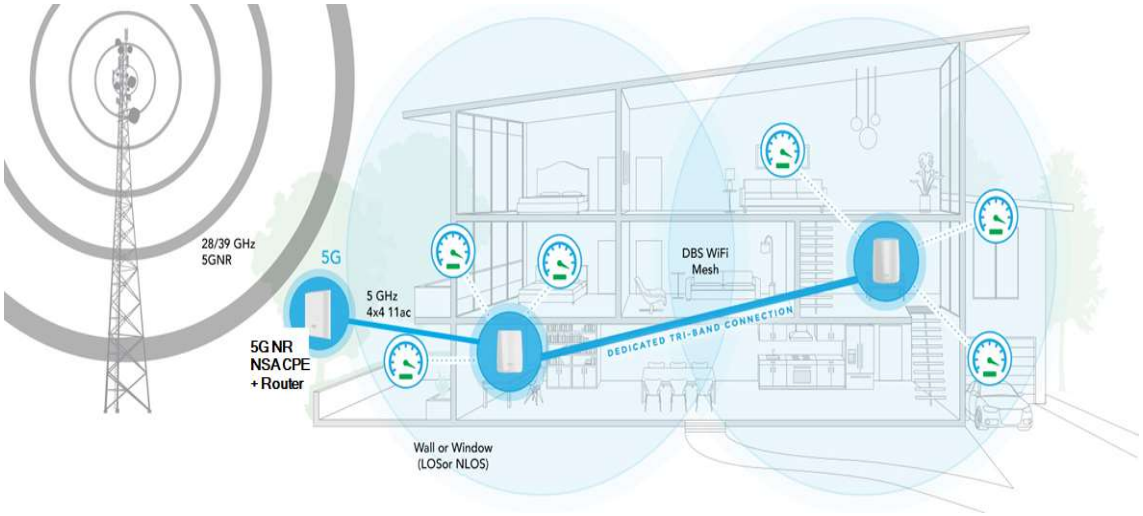
Figure 1: 5G NR mmWave outdoor coverage simulation

Fixed Wireless Access (FWA) Coverage Simulation Study

Qualcomm has carried out several coverage simulations studies of 5G NR mmWave Fixed Wireless Access (FWA) deployments at 26.5 – 27.5 GHz. Cluster location used was Hamburg vicinity area with a size of 12.8 km², mostly suburban environment and a high office building was used as the FWA macro-site. Results show a very good FWA coverage for suburban/rural clusters (DL Cell edge throughput = 120 Mbps for carrier bandwidth 400 MHz) obtained for a macro-cluster with cell radius 800m (2 km² = 16% of the full cluster area) which included 850 houses. In general, coverage depends on morphologies, environment type and a number of other factors. Possible solutions for further increasing the coverage include using repeaters, mesh network approach, more sites, gNB antenna height. By modelling FWA throughput in a big size suburban cluster (1 km2 area, 400 MHz Bandwidth, 40 m FWA site antenna height, 64 antenna element CPE), results have been also very good with single user throughput reaching 1.2 Gbps for 60% of the area, 400 Mbps in 72% of the area and 100 Mbps in 83% of the area as depicted in the graph below:



In respect of FWA applications, one question that often comes up is how to transfer traffic from outdoor CPEs to serve broadband applications. To facilitate this, Qualcomm has already come up with innovative solutions that already started hitting the markets as commercial product, some examples of which are captured below.



Taking 5G NR mmWave indoors

With more than 80% of mobile data traffic originating or terminating indoors, one enormous opportunity for mobile operators and service providers is to bring mmWave services to indoor locations. Today, we are already seeing deployments of 5G mmWave for fixed wireless access. On this front, we have analyzed potential deployment scenarios in various dense urban cities, and one example is how a dense metropolitan city with an existing outdoor LTE network can re-use sites deploying 5G NR mmWave. By using rooftop CPEs, our simulation showed that co-siting 5G NR mmWave with LTE small cells can deliver service speeds of 1.6 Gbps downlink and 150 Mbps uplink to 80% of the buildings in the city.

The fact that mmWave may not propagate well from the outside to inside is beneficial for deploying mmWave indoors as well, since the same mmWave spectrum can be reused indoors with limited coordination with the outdoor deployment. This benefit opens up new possibilities for mobile operators to offer private indoor mmWave networks, in addition to expanding mmWave indoors as part of their public networks.

Complementing existing indoor Wi-Fi services, 5G NR mmWave can elevate user experiences to new heights by bringing multi-Gigabit speed, ultra-low latency, and virtually unlimited capacity to a wide range of devices such as smartphones, tablets, XR (extended reality) headsets, and always-connected laptops. Qualcomm has been working with indoor venue owners and operators to understand how 5G NR mmWave will perform in a wide range of indoor environments.

Figure 2:Taking 5G NR mmWave to a wide range of indoor locations

For indoor enterprises

One exciting opportunity for 5G NR mmWave is indoor enterprises. Today, most offices have Wi-Fi connectivity for computers and other enterprise devices. With 5G NR mmWave private networks, enterprises can realize the vision of "mobile office of the future", bringing enhanced performance, convenience, security, and user experiences not possible with today's connectivity solutions.

Figure 3: Opening doors to new and enhanced enterprise user experiences.

To understand how 5G NR mmWave performs in enterprise settings, we have studied a few different office layouts and performed comprehensive system-level simulations. As an example, we looked at one office floor at our San Diego headquarters and simulated coverage and performance with 5G NR mmWave small cells placed at the same locations as existing Wi-Fi access points. The rationale behind co-siting is that both power supply and wired backhaul connectivity are already available at these locations, and it is the most efficient way to start any 5G NR mmWave deployments. With 1-to-1 co-siting, we were able to achieve ~98% downlink coverage and ~99% uplink coverage. The median throughput achieved with this setup is 5 Gbps. Note that the red outline shown in the figure below are areas not covered by the co-sited mmWave small cells, as they are surrounded by concrete walls (e.g., balcony, stairwell). Such areas could typically be covered with macro sites, or if needed, additional small cells can be deployed to provide a more comprehensive coverage.

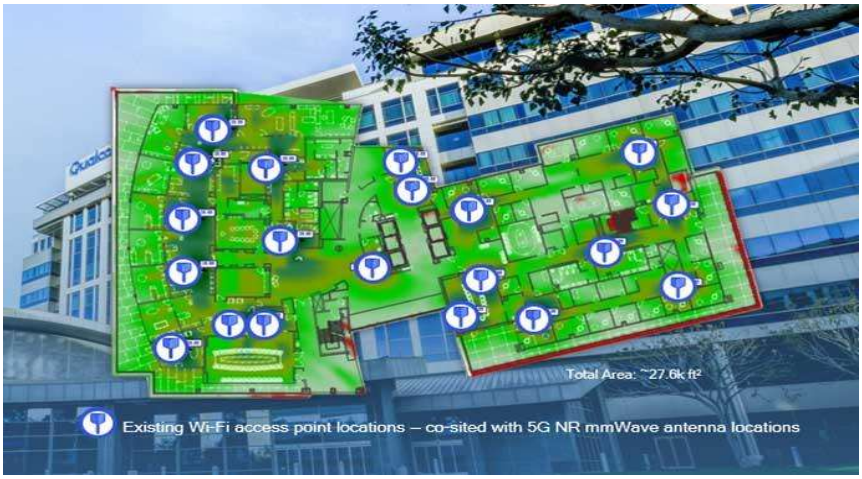


Figure 4:Co-siting 5G NR mmWave for higher-density indoor enterprise.

For dense venues

Large venues, such as convention centers, concert halls, and stadiums, are often plagued with wireless connectivity issues. As the venues are packed with large number of visitors during events, many users will be accessing the wireless network at the same time. The key challenge is for the wireless network to have enough capacity to sustain reasonable performance. While LTE and Wi-Fi network densification helps, they are still limited by the amount of available bandwidth. With 5G NR mmWave, venue networks can now have access to 100's of MHz of mmWave bandwidth that can satisfy the growing data demand.

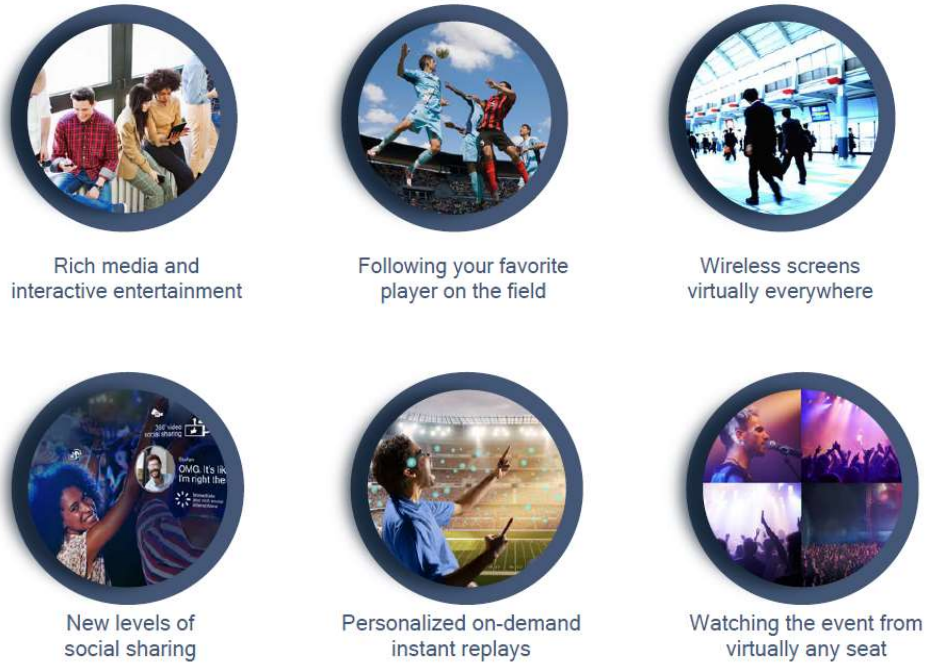


Figure 5: Bringing enhanced venue experiences with 5G NR mmWave.

We have simulated 5G NR mmWave coverage and performance for a wide range of venues. One such simulation happened at an NFL stadium with 100 000 seats.

The results were very encouraging. We were able to achieve a significant coverage and more uniform user experience. The median downlink throughput achieved is more than 700 Mbps using 400 MHz DL bandwidth and the cell edge throughput achieved is more than 100 Mbps.

Figure 6: Simulating 5G NR mmWave (28 GHz) at NFL stadium.

For transportation hubs

Lastly, we also looked at various transportation hubs, such as airports and train stations. For an airport concourse that is about 160 thousand square feet in size, comprehensive coverage and a median throughput of ~4.2 Gbps could be achieved using just ten co-sited 5G NR mmWave small cells.

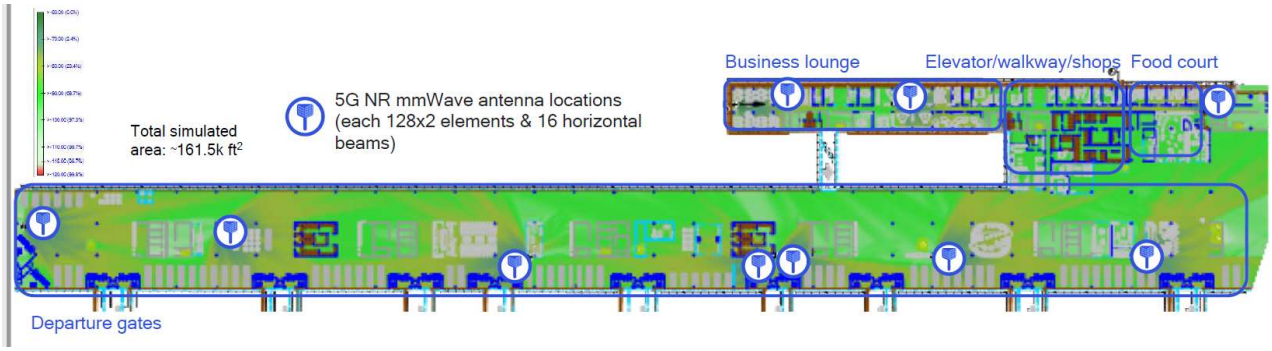


Figure 7: Delivering 100% 5G NR mmWave coverage and multi-Gbps speeds with at an airport concourse.

Fixed Wireless Access obligation

Qualcomm supports EETT's decision to impose Fixed Wireless Access obligation, in line with the provisions of the Electronic Communications Code for the inclusion of the fixed broadband internet service into the universal service.

With the evolution to 5G, Fixed Wireless Access (FWA) offers a path to deployments on a massive scale and better services for customers. 5G FWA changes the economics of connecting homes and businesses Today, there is already a strong business case for using FWA as an add-on improvement to mobile broadband (MBB). FWA is particularly attractive in areas where there is no existing copper, fiber, or hybrid infrastructure to deliver wired broadband, or when the current fixed infrastructure is unable to provide sufficient service. The business case for FWA only becomes stronger as LTE continues to advance to 5G. One of the 5G use cases currently gaining momentum around the globe is using FWA to provide broadband service for homes and small and medium-sized enterprises (SMEs). With the help of 5G, Fixed Wireless Access will grow on a massive scale. With 10 to 100 times more capacity than 4G networks, 5G will enable cost-efficient FWA deployments on a massive scale. Using larger ranges of radio spectrum to provide consumers with low latency connectivity (1ms) and major capacity gains, the evolution to 5G will take FWA to a whole new level.

5G FWA is expected to enable robust services at sustainable rates high enough to meet the needs for residential use well into the future. 5G FWA will not only eliminate the need for costly deployment of deep-fiber fixed access infrastructure, it will offer peak rates that few fixed technologies will be able to match.

c) Verticals

The deployment of private mobile networks for verticals has emerged as an important market. The demand for private LTE (and increasingly, 5G) networks has been driven by the spiraling data requirements of modern business and government entities. Organizations of all types are combining connected systems with big data and analytics to transform operations, increase automation and efficiency, or to deliver new services to their users.

5G is a new technology and a new market which requires global scale to gain market lift off during the launch phase. Mobile operators play a key role in order to help generate a competitive equipment market. Thus, mobile operators' role in the commercial deployments in the mmWave spectrum is critical. When considering vertical industries needs in the mmWave spectrum, it is important to highlight that network virtualization in 5G will provide the opportunity for networks to cater for diverse vertical market needs, with different performance requirements, via network slicing. Hence, different types of deployment can be catered for via the same network, without needing to assign specific spectrum for each different use.

Flexibility in spectrum use, ability for MNOs to acquire different spectrum amounts, and ability for verticals and/or other sub-national operators to gain access to spectrum (and/or for new business models to emerge) could be aided if 5G licenses allow for spectrum leasing to occur. Thus, in order to help establish the 5G market in the first take off phase it is recommended that operators have access to the 26 GHz band with a footprint as wide as possible and possibly national. At the same time, it would be important to preserve the ability for verticals and/or other sub-national

operators to gain access to spectrum in particular in those areas/those cases where Mobile operators do not plan or are not in a position to roll out services. Local indoor and outdoor licenses could help in such cases.

Qualcomm believes that it is important to ensure that each network could use at least 400 MHz but ideally 800 MHz of spectrum with a national footprint in the 26 GHz range.

An interesting authorization model worth investigating further is the one adopted by the Italian regulator AGCOM in its 26.5 – 27.5 GHz auction rules whereby 5 lots of 200 MHz each for the 26.5 – 27.5 GHz with a cap at 400 MHz have been offered. In particular, for the 26 GHz band, the regulator has adopted an innovative sharing model based on club use whereby winners could use up to 1 GHz of spectrum in a dynamic way when the other operators in the club do not use spectrum in any given location.

More information on the Italian mmWave auction outcome and authorizations is provided below.

The Italian Club Use model

Italy has been the first country to auction 5G mmWave spectrum in 26.5 – 27.5 GHz in September 2018. The auction resulted in five winners; each being assigned 200 MHz worth of spectrum. National individual licenses were issued, and additional provisions were introduced to promote efficient use of spectrum, competition and innovation with a clear focus on light touch regulations with market-driven dynamics. Such innovative regulatory framework has been termed "Club Use". In particular:

- The use of the frequencies in a shared manner is foreseen among licensees (i.e., the members of the "Club"), with priority access for each licensee to its own block.
- Licensees can share spectrum on a geographical basis: a licensee can obtain access to the entire 26.5-27.5 GHz band in locations where the spectrum is not used by other licensees.
- Licensees can stipulate reasonable and non-discriminatory commercial agreements combining spectrum sharing and infrastructure sharing policies. For example, MNO-A can engage with MNO-B to have access to MNO-B's spectrum at a certain location. If MNO-A and MNO-B agree on fair and reasonable commercial terms, MNO-A can build a network in that location, pooling spectrum from its own assets and MNO-B's assets (e.g. 200 MHz + 200 MHz). Within the commercial agreement, MNO-A can trade the use of MNO-B's spectrum with the allowance for MNO-B to use its infrastructure. MNO-B will not have access to MNO-A spectrum, but it will have priority access to its own spectrum. Also, in this way that location will be served by a single network.
- Licensees could make agreements with a trusted Third Party ("Neutral Host") to manage concurrent installations and delegate to a third party the construction of the physical infrastructures of the radio network (without transferring the right of use of the frequencies). Commercial agreements (in the form of Service Level Agreements – SLAs – between licensees and the Neutral Host) will regulate how licensees share spectrum while operating on the common infrastructure.

Furthermore, AGCOM has put in place additional provisions to define how a licensee can lease spectrum to the so-called "vertical" players (i.e., entities that do not provide public electronic communications services). The Italian Ministry of Economic Development (MiSE), AGCOM and the mmWave spectrum licensees are working on the practical implementation of the regulatory framework based on Club Use.

d) MVNOs

The current service provider access obligation is a factor in achieving the aims of regulation. Qualcomm believes that the service provider access obligation should be widened to include MVNOs. This would create the basis for new, innovative services and for offers tailored more to the customer. Telecommunications companies can act as partners (so-called enablers) of companies from other business sectors when it comes to innovative services and business models in areas such as Industry 4.0, smart factory, smart car or smart home. This applies to the incumbent nationwide mobile operators on the one hand. On the other, it is also possible for further nationwide network operators, regional or local network operators and mobile virtual network operators (MVNOs) and service providers to perform the role of enabler. Many enablers operating in competition, especially, could deliver maximum benefit in terms of choice, price and quality. This could be advantageous to both the consumer and the partner companies from other business sectors.