RSPG Consultation on the Internet of Things (IOT)

Qualcomm Response

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Executive summary

Qualcomm welcomes the opportunity to contribute to the RSPG strategy and policy thinking to enable the take of the Internet of Things in Europe. Qualcomm would like to stress that today's innovation, in particular in IOT and on the road to 5G, should be based on high quality cellular networks, satisfying reliability, QoS and security needs, strong, industry-led standards, ensuring the return on investments, necessary to drive innovation and new and innovative regulatory regimes to support all these innovations. Playing a leading role in the IOT space is a necessity for Europe, and the RSPG efforts should continue its spectrum regulatory work in order to enable the take-up of IOT.

Mobile is Europe's biggest technology platform. As we move into an era where 4G connected devices drive productivity gains and service delivery, and with 5G offering the potential for new services, Europe's strategic position in the Internet of Things (IOT) offers unprecedented potential. For Europe's thriving mobile and emerging IOT ecosystems, this means fewer technology limitations and more freedom to focus on innovation and value creation. For European citizens, it means seamless connectivity, enhanced experiences and innovative services. For the IOT ecosystems, it means an end-to-end secure eco-system, enabling new data based business models and efficiencies in the Industry 4.0 paradigm.

The IOT will be heterogeneous, enabling indoors and outdoors connectivity, short and long range access and mains and battery powered. It will encompass devices ranging from smart computing products to more basic machines with communication capabilities, which all have in common the ability to connect with each other and/or with the network. A healthy EU Digital Single Market (DSM) IOT strategy will enable new services ranging from healthcare, smart grid, smart transportation to the connected home. Security and data control will be a key enabler of many existing and future industries and ecosystems being digitalized.

Qualcomm strongly welcomes and encourages current efforts at EU level to promote policies supportive of IOT roll-out. A strong supporter of the DSM, Qualcomm believes that a coordinated effort at EU level can achieve a unified European market, based on strong standards, allowing for innovation by SMEs and strong benefits for consumers.

Standards and Innovation for the IOT take-up in the DSM

In the knowledge economy, ICT is increasingly pervasive and is now an enabler for e-health, e-energy and smart grids, e-learning, smart cities and home and the Internet of Things (IOT) and in the near future will all be pillars of our connected economy. The IOT is connecting devices to the network across products as varied as cars, washing machines, smartphones, as well as connecting the home and smart cities. This will require large scale interoperable wireless connectivity solutions, such as 5G. The expected economic growth; mass markets and job creation, will only occur with seamless interoperability between devices and services. Existing value chains and traditional means to doing business are likely to be rearranged and merged with neighboring sectors that were formerly separated. In the near future, therefore, significant effort will be required to deliver the complex interoperability solutions needed to mesh traditionally disparate sectors and value chains. European standardization, with its proven record of success, will play a critical role in ensuring interoperability and the diffusion innovative solutions to the Single Market and beyond. We believe ETSI is both well placed and well adapted to play a key role in standardization for the whole economy, including beyond the ICT sectors, e.g. IOT and 5G.

SSOs must be flexible and agile enough to not only develop standards but to ensure their evolution as technology solutions improve. UMTS and LTE and their various evolutions over the years are a very good example of this. Given standards competition, if speed results in an inferior standard, either the market will gravitate to the best performing standard or other jurisdictions and markets that adopt the best performant standard will evolve faster and compete more effectively. The desire for speed should therefore be tempered by the need for quality. We want to emphasize in this context that ETSI/3GPP have been extremely efficient in responding to the development and integration of new standards in various non-ICT industrial sectors, e.g. LTE-MTC, NB-IOT, LTE eMBMS (Broadcast), LTE V2X (vehicle to vehicle, infrastructure, pedestrian), LTE Public Safety / D (device to device).

Fostering Investments in high quality networks

Continuing upfront investments in R&D and infrastructure throughout the industry is needed in order to strengthen connectivity, boost data speed, tighten security, build robust networks and enhance consumers' experience. And such investment will be needed on a rolling bases to improve, evolve and optimize these networks for IOT services.

Policies that promote innovation and reward investment in both networks and innovative standards are needed. Indeed, European investment in networks has been decreasing over the past few years – a dangerous trend if it continues. Network operators have been wary about investing in network expansion and upgrades because they have not been able to recoup their investments. The new regulatory framework under the DSM needs to make sure that mobile infrastructure itself becomes a viable business. This is even more important, as it allows for the emergence of the IOT economy.

Wireless network operators should be allowed to invest in network capacity and network improvements with assurance that they can offer specialized services to end users – in particular IOT services, such as mobile health, smart cities and connected cars – that are based on specific commercial agreements and quality-of-service levels.

High-quality standards are a fundamental requirement to connect devices and industries through faster, secure and reliable wireless communications and to enable truly interoperable pan-European IOT services. Standardization should be encouraged and rewarded. Standardization efforts bring together players with different business models and interests on the premise that the best technology solutions can be collaboratively developed and included in a standard, based on their engineering merits, through an open and consensus-based process. This leads to a standard with the broadest level of marketplace acceptance and interoperability. The alternative – creating proprietary solutions or vertically integrated IOT business models will lock players out and will fragment the DSM, thus frustrating the European growth potential.

The IOT will also considerably drive demand for more and diverse spectrum. A holistic spectrum regulatory approach, encompassing licensed, unlicensed and licensed shared access (LSA) regimes, will therefore be needed to meet the variety of demands and the diversity of requirements to maximize the societal and economic benefits in Europe. In particular the upcoming availability of the 700MHz band across Europe represents an opportunity to make available low-band licensed spectrum for IOT.

Spectrum and Connectivity

The Internet of Things (IOT) does not correspond to a single type of applications. IOT applications have varying requirements in terms of link budget, cost, bandwidth and target QoS. IOT will rely on many different connectivity solutions leveraging both licensed and unlicensed spectrum, e.g. the 2.4 GHz and 5 GHz unlicensed bands, the MFCN mobile bands.

While unlicensed bands are optimal for fast deployment, they cannot provide guarantees in terms of coverage or QoS, since interference cannot be fully controlled because of the very nature of the authorisation regime. This does not reduces the relevance of LPWAN, which can respond to certain many IOT requirements, but it underlines that there is no 'one solution fits all' for IOT.

IOT applications requiring guarantees in terms of coverage and/or QoS can leverage solutions either in the MFCN bands (e.g. 700, 800, 900 MHz) or through the identification of new licenced bands for IOT networks (e.g. 733-736 / 788-791 MHz band).

From a spectrum management perspective, the challenge remains to make additional spectrum available to meet this IOT demand and there are three ways to achieve this: the traditional licensed approach for exclusive use, through auctions of cleared spectrum, which remains the industry's top priority; the unlicensed approach, in which spectrum is shared among users without anyone having priority, such as 5 GHz; and, finally, LSA (Licensed Shared Access) which unlocks spectrum that cannot be cleared nationwide, 24/7, but is not used at given times and/or at given locations, allowing users to obtain licensed rights to access the spectrum when and where it is unused and to deliver a predictable quality of service. LSA, as defined by the Radio Spectrum Policy Group (RSPG),[1] will help address some IOT use cases, particularly when it comes to quality of service and cost aspects.

Licensed spectrum

3G/4G is the main driver for the growth and scalability of the IOT. LTE-Advanced is the next major milestone in the evolution of 4G, incorporating several enhancements, all of which will be beneficial for the roll-out of M2M applications and products. Leveraging carrier aggregation and hyper-dense HetNets to increase network capacities and data rates are one aspect. Leveraging the potential benefits of the use of part of the harmonized 700MHz band at European level for M2M applications is another core one.

There are many benefits to the delivery of IOT services over existing mobile infrastructure, including reducing the costs linked to passive infrastructure (e.g. masts, power, backhaul) and leveraging the economies of scale provided by mobile technologies. However, providing dedicated IOT services with specific QoS over existing MFCN spectrum can be challenging due to issues such as the cost of spectrum and the regulatory environment linked to such bands, e.g. net neutrality and infrastructure competition. It would be beneficial to identify licensed spectrum where the award procedures would be tailored towards IOT, rather than towards mobile broadband. This applies in particular to coverage requirements, spectrum fees, limitations on infrastructure competition and network sharing, net neutrality. This interplay between regulation and the incentive for MNOs to offer IOT services over MFCN licensed spectrum is studied in details in the section 5 of a recent study by Analysys-Mason[2].

Qualcomm supports the harmonization of 2X3 MHz in that band, namely 733 – 736MHz and 788-791MHz, for M2M applications. The latter would then benefit from the considerable economies of scale driven by commercial mobile broadband LTE services to be deployed in the adjacent spectrum (703-733 MHz and 758-788 MHz). This option is currently under study in CEPT and the ECC should take a decision on such harmonization by end 2015. We invite BEREC to continue supporting this harmonization at CEPT and EU levels. A 2x3 MHz in the 700 MHz band for M2M would offer a 24/7, national and European wide ubiquitous coverage; controlled QoS; high reliability (redundant network design) and strong penetration; a robust security (built-in security features used in government and financial sectors); extremely low power consumption; and finally scalability, as the lower total cost of

[1] Radio Spectrum Policy Group: Opinion on Licensed Shared Access, RSPG 13-538, November 12th, 2013.

[2] http://www.analysysmason.com/Research/Content/Reports/investment-in-5G-and-IoT-infrastructure-Dec2016/

ownership due to a large established ecosystem, leveraging existing mobile infrastructure and global standards enables seamless interoperability.

From a technology angle, LTE eMTC (evolved Machine Type Communication) and NB-IOT (Narrowband IOT) will both address the requirements of many M2M applications. Both technologies are part of the LTE Advanced evolution and part of 3GPP Release 13 and 14. An important dimension of these technologies is that they allows the coexistence between M2M applications and adjacent mobile services in the same band, leading to considerable economies of scale. This is to be combined with enhanced security elements, extended coverage and up to ten years battery power. LTE eMTC and NB-IOT could be ideal candidates for enabling M2M applications in the 2x3MHz of the 700MHz band. Finally, when it comes to automotive connectivity and the paradigm of vehicle to vehicle/to infrastructure/to pedestrians (V2X), it is to be noted that 3GPP is currently working in its Release 14, on an evolution of LTE matching exactly these specific requirements in the automotive sector, e.g. LTE V2X and LTE ProSe. These technologies too, will guarantee resilience, latency and high levels of security, while benefitting from the ubiquitous coverage of wireless networks. The automotive 5G connectivity paper equally highlights the potential of LTE V2X to solve many of today's automotive connectivity challenges.

LSA spectrum

In complement to the traditional licensed approached, LSA will play key role for enabling the IOT. LSA applies to underutilized spectrum that some users, especially government users such as the Ministry of Defense, do not use nationwide every hour of every day, but cannot vacate because they still need it from time to time or in specific locations or situations.

With LSA this spectrum can be shared, on an exclusive basis, with a commercial operator in time or location or both. This exclusive, licensed shared access means that the existing user and the new commercial user never interfere with each other and can leverage the very best performance of their equipment, which ensures reliability and quality of service. An operator would aggregate its LSA spectrum with its licensed spectrum, using LTE-Advanced carrier-aggregation features, to significantly augment its network capacity, data rates and performance. LSA is ideally suited for higher frequency bands like the 2.3 GHz and 3.6 GHz bands and would optimally benefit from heterogeneous network architecture with small cells. Higher frequency bands and low power small cells allows to efficiently share the spectrum between the commercial operator and the incumbent by minimizing the risk of interference. In addition, LSA spectrum cost will be lower than licensed spectrum due its shared nature and the limitations in geographical coverage and time availability. The low spectrum cost would help making new harmonized spectrum available for innovative services that can be scalable and growing while maintaining predictable QoS, unlike the cases when using unlicensed spectrum.

LSA can address those IOT use cases and applications where predictable QoS, short range and low cost for access are key requirements. It can therefore be particularly attractive for health monitoring and control, as well as for home and enterprise security applications.

Unlicensed spectrum

Unlicensed spectrum optimally addresses best effort service use cases and applications where predictable QoS and security are not key requirements. There is no spectrum access cost and thus market entry barriers are low. It enables to introduce new services quickly.

There are four unlicensed bands of relevance to the IOT: 2.4 GHz, 5 GHz, 60 GHz and 900 MHz/SRD. Qualcomm connectivity solutions currently integrate 802.11 a/n/ac, which operates in the 5 GHz band, 802.11 b/g/n, in the 2.4 GHz and 802.11 ad, in the 60 GHz. Those tri-band Wi-Fi solutions allow up to gigabit performance and are particularly suited to enable the connected home with kids on tablets, adults on computers, everybody with smartphones and non-stop gaming, music, movies and surfing. Today's average home has five or more connected devices. In the future, that number might be closer to 50.

The 802.11ah standard is currently under development and being designed to address wideband SRDs with advanced spectrum sharing capability in the 870-876 MHz and 915-921 MHz frequency bands. A system reference document has been developed in ETSI and the 870-876 MHz and 915-921 MHz bands are considered for harmonization such use in CEPT countries. The 915-921MHz band is of particular importance for 802.11ah and similar technologies, as a band that could deliver near worldwide harmonization for SRDs supporting IOT. We believe that this will enable to useful for specific IOT use cases, in particular wearable devices and similar SRD-oriented applications, e.g. home automation or low-power sensors with higher achievable data rates and improved propagation and penetration of 900MHz radio waves through walls and obstructions. With 802.11ah, Wi-Fi coverage improves in previously hard to reach places such as garages, back yards, attics, buildings, factories, malls, for applications with modest data rates.

LTE features, such as carrier aggregation have made it possible to operate LTE in unlicensed bands as well – in bandwidth-rich spectrum in the 5 GHz band that can be used to augment capacity. The insatiable thirst for capacity indoors is what is creating a huge opportunity for operators to use small cells that deploy LTE in unlicensed spectrum indoors – concurrently with Wi-Fi as both can coexist harmoniously – utilizing all their spectrum assets and leveraging their existing core network. Carrier aggregation between the licensed and unlicensed bands will create faster speeds and higher capacity, with an anchor in the highly reliable licensed spectrum – by which the add-on capacity of the unlicensed band is managed. Commercial deployments of LTE-U in Europe will be possible after changes in the LTE air interface in order to support LBT (Listen-Before-Talk) at milliseconds scale, already standardized in 3GPP Release 13.

Conclusion

Qualcomm believes that Europe has a key opportunity to valorize its existing assets and infrastructure, including in the wireless field, however it needs to continue its holistic approach, out of which spectrum availability and management is only one of the key components, along with favoring strong standard setting bodies, such as ETSI, to continue foster the required standards and innovation, but also a policy that promotes fair return on investments for those innovators. Regarding spectrum specifically, we favor licensed spectrum approaches for the IOT, building on existing and upcoming infrastructure investments and leveraging already, on the road to 5G, the innovations coming from the LTE Advanced standards family. This requires a detailed assessment not only of the pure spectrum requirement, but of the award mechanism that can best trigger development of IOT oriented services. To complement these approaches, we believe that WIFI evolutions and SRD will add additional

possibilities, however we would like to caution against reserving specific frequency bands for such technologies at this stage in time.