Qualcomm response to the Draft RSPG Opinion on Spectrum Aspects of Intelligent Transport Systems

9 January 2017

Executive summary

Qualcomm is pleased to have the opportunity to provide its views on the RSPG's draft recommendations on spectrum aspects of ITS. We believe that ITS applications will grow in importance in the coming years, reflecting growing industry investments in V2X technology, and that ITS spectrum on a technology neutral basis, enabling coexistence of different technologies in the 5.9 GHz band, will prove central to improve safety and efficiency and allow new business models.

1. The future of ITS and growing spectrum needs

Particularly over the past year, we have seen increased interest in connected driving technology as well as an acceleration in standardisation (notably, the inclusion of C-V2X in 3GPP Release 14, with targeted completion in March 2017) and industrial partnerships, as evidenced by the recent creation of the 5G Automotive Association.[1] This is a clear indication from industry stakeholders across sectors that V2X represents a key segment in the development of the Internet of Things (IoT) as well as the future transition towards 5G. In a sense, therefore, the current use of ITS spectrum does not provide a conclusive picture of the mid- to long-term needs associated with ITS applications, and we applaud the RSPG for recognising this in recommending that options to expand ITS in the 2x20 MHz above and below 5875-5905 MHz be kept available.

In light of the above, Qualcomm believes it will be essential to safeguard spectrum allocation for current and future transportation applications running in the 5.9 GHz band, as well as to guarantee quality of service and interference protection in the band. We believe that the use cases envisaged for road safety and traffic efficiency applications will require spectrum beyond the 30 MHz currently harmonised by ECC Decision (08)01, spanning at least the additional 20 MHz (5905-5925 MHz) identified therein for future ITS extension.

2. Technology neutrality for ITS at 5.9 GHz

As also recognised by the draft Opinion, technology neutrality should remain a key principle for the deployment of ITS technologies – not only in the 30 MHz designated for safety-related ITS but also in the adjacent 2x20 MHz as well as at 63-64 GHz. This is particularly important in light of the acceleration in 3GPP standardisation which we have noted above.

C-V2X short-range connectivity (V2V ad-hoc mode 4) can coexist in the same band with IEEE 802.11p-based radio access. Such co-existence of different technologies in the same 5.9 GHz ITS band is under study in 3GPP Release 14 and in other standards fora as further detailed below.

As the draft Opinion correctly states, mobile networks in licensed spectrum can provide opportunities for complementary ITS services, including with a view to 5G. Indeed, one of the main advantages of C-V2X is that it can provide both short-range (ad-hoc V2V/I/P at 5.9 GHz) and wide-area cellular connectivity (LTE and 5G in licensed spectrum) – and may be able to do so concurrently – thus addressing all V2X applications in a fully interoperable and scalable end-to-end system. Additionally, as part of the 3GPP standards family, C-V2X offers an evolution path from LTE to 5G. The use of C-V2X access technology at 5.9 GHz thus brings profound advantages in this respect, and C-V2X use of this band should not be impeded.

[1] http://5gaa.org/

3. C-V2X channelization and transmission characteristics

3.1 3GPP has defined band 47 (B47) as the 5855-5925 MHz TDD band for C-V2V/I/P.

As of today (3GPP TS 36.101 V14.1.0), B47 supports both 10 and 20 MHz channels. Requirement for an in-band co-existence mechanism

Technologies evolve over time and cars are typically on the road for many years. Without an in-band coexistence mechanism, the ITS band would be frozen for a specific technology and technology evolution would not be possible.

There is therefore a need for a technology co-existence mechanism that will enable, in particular, technology evolution in the band. This is regular practice in other bands where services like broadcasting or mobile introduce new technologies in their existing bands over time.

3.2 Generic coexistence analysis

There are several approaches to coexistence within a band, which fall into two main scenarios.

> First scenario: managed adjacent channel coexistence. 5.9 GHz ITS channelization is defined by a regulatory framework whereby each technology is assigned one or more 10 MHz channels. In such case, each car knows on which channel to transmit and can evolve over time according to the plan, e.g. as technology gets phased out or evolves.

Under this first scenario, an external entity (e.g. a government or a regulator) specifies which technology should use which channel for a specific time period. This is similar to the situation in the terrestrial broadcast band, where regulators assign specific channels to a specific technology (e.g. DVB-T or DVB-T2) and modify this channel plan over time.

> Second scenario: dynamic/self-organising. There is no pre-assigned channel plan and coexistence is based on dynamic channel hopping. Here the direct implication is when different technologies try to access the same channel and how to manage co-channel access in order for one technology to switch to a different channel.

Under the second scenario, coexistence of two technologies operating within the band is achieved by having each technology avoid using the same channel as the other technology. This is achieved by detecting where other cars using the same technology are operating and selecting the same channel, as well as detecting where other technologies are operating and avoiding these channels.

3.3 Conclusion/recommendation

Qualcomm recommends either:

- A regulatory framework (RSPG, CEPT, etc.) to put forward a channelization plan and send a mandate to ETSI to develop sharing studies in harmonised standard EN 302 571 according to such plan; or
- Leveraging coexistence mechanisms in standards organisations, such as 3GPP and ETSI.

4. Sharing of the ITS band with RLANs

Qualcomm believes that sharing of ITS spectrum requires great caution. ITS technology, especially in the ITS core band (5875-5905 MHz), delivers safety-critical services such as collision avoidance or hazardous road condition warning, therefore actively preventing injuries or death. RLAN technology is now embedded in most mobile terminals operating within vehicles as well as in vehicles themselves; such use of RLANs within a moving vehicle is expected to intensify with the trend towards autonomous vehicles. Opening the ITS core band to RLANs would allow such devices to operate in extremely close proximity to ITS receivers, thus creating significant risk of interference to safety-critical services. Qualcomm is not aware of mitigation techniques that would be efficient in such close proximity. Qualcomm believes that the risks associated with such interference are not worth taking and strongly recommends the 5875-5905 MHz band not be opened to RLANs.

Similarly, as we highlight in section 1 of our response, the 5905-5925 MHz band offers significant opportunities for future extension of ITS technologies. While the band is critical for ITS (nearly doubling the bandwidth of the core ITS band), it would offer only 20 MHz to RLANs, i.e. less than 3% of the 725 MHz that can be available at 5150-5875 MHz. Furthermore, these 20 MHz would not be contiguous to other Wi-Fi frequencies and would be much less valuable than spectrum contiguous to existing bands.

In light of the above, Qualcomm recommends that sharing between ITS and RLANs only be considered in relation to the lower 20 MHz (5855-5875 MHz) identified in ECC Recommendation (08)01. Though such bandwidth is limited, it is contiguous to the 5150-5850 MHz band and would provide additional capacity for RLANs. Further studies are required to ensure unlicensed technologies can adequately protect ITS co-channel at 5855-5875 MHz – and, critically, adjacent channel above 5875 MHz.

5. ITS for railways

Qualcomm believes that the future standardisation of C-V2X will be able to cater for a growing number of use cases, including urban rails, busses, railways and bikes, and will be able to provide a scalable, interoperable and future-proof solution for these systems. The flexibility inherent in the C-V2X end-to-end system, comprising both short-range and wide-area connectivity, would allow some of the options identified in the draft Opinion, including in a concurrent manner, e.g., the use of commercial networks or other bands as well as sharing with other applications. As legacy systems such as GSM-R are discontinued in favour of these options, the impact of such use cases on the use of ITS spectrum and the related spectrum needs should be reassessed.