

How Re-Allocating the 5.9 GHz Band Could Affect Road Safety

DSRC, C-V2X and implications of the proposed spectrum changes

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Abstract

The Federal Communication Commission (FCC) has issued a Notice of Proposed Rulemaking¹ (NPRM) to change the 5.9 GHz band allocation that dedicated short range communications (DSRC) uses for vehicle-to-everything (V2X) safety applications and allocate the majority of the band (45 MHz) for commercial use such as general-purpose Wi-Fi® and cellular applications. The remaining 30 MHz would be dedicated for transportation and vehicle purposes, while opening it up for multiple, mutual incompatible technologies. In our view, the benefit to society of 45 MHz of additional Wi-Fi spectrum is small compared to the value of additional road safety.

The National Highway Traffic Safety Administration (NHTSA) estimated that V2X technology like that which is being deployed in Europe, could eliminate or mitigate the severity of up to 80 percent of non-impaired crashes² in the United States where more than 37,000 lives were lost and 2.7 million were injured in the U.S. in 2017³.

The remaining 30 MHz of the 5.9 GHz band will not be enough for either DSRC or Cellular vehicle-to-everything (C-V2X) to serve the emerging V2X use cases and the future needs of Cooperative Intelligent Transportation Systems (C-ITS)⁴. There is also the risk of dividing cars into two sets which cannot talk to each other directly. The reduction may inhibit emerging crucial V2X use cases such as truck platooning, vulnerable road user protection, and services for L4/L5 self-driving vehicles. An estimated billion dollars of public and corporate spending has been made to mature V2X technology and deploy infrastructure, which might be wasted if the infrastructure becomes obsolete when the proposal is accepted. Furthermore, we believe that taking band away from DSRC (a mature technology which has already been deployed) and giving it to C-V2X (a yet-to-mature technology) would be against the principle of technology neutrality.

At NXP, we strongly support the U.S. Department of Transportation (USDOT) analysis “Preliminary Technical Assessment: Concerns with Draft FCC NPRM: Use of the 5.850-5.925 GHz Band [ET Docket No. 19-138]”. The analysis indicated that the NPRM in its current form might not benefit the road safety of U.S. citizens, and is likely to delay the introduction of V2X technology in U.S. by more than five years⁵.

¹ FCC 19-129, ET Docket 19-138, NOTICE OF PROPOSED RULEMAKING, <https://www.fcc.gov/ecfs/filing/1217200308588>

² Press release on V2V proposal, NHTSA, https://one.nhtsa.gov/About-NHTSA/Press-Releases/ci.nhtsa_v2v_proposed_rule_12132016.print

³ US-DOT, “The Safety Band” Fact Sheet article, <https://www.transportation.gov/content/safety-band>

⁴ “Road Safety and Road Efficiency Spectrum Needs in the 5.9 GHz for C-ITS and Cooperative Automated Driving”, CAR 2 CAR Communication Consortium, 2020

⁵ US DOT, “Preliminary Technical Assessment of FCC 5.9 GHz NPRM”, <https://www.transportation.gov/research-and-technology/preliminary-technical-assessment-fcc-59-ghz-nprm>



Introduction

As stated by ITS America⁶, “In a country that reels from nearly 36,000 roadway deaths every year, it is unfathomable that the United States would literally give away our top safety tool – and with it, our best chance to save tens of thousands of lives”. Unfortunately, in our opinion, this is exactly what is proposed. The recent FCC filing of a NPRM⁷ suggests reallocating part of the safety bandwidth to Wi-Fi and non-safety-related cellular use.

As of today, seven channels of 10 MHz are reserved for DSRC-based license-free automotive use cases, mainly focused on safety in the context of vehicle-to-vehicle and infrastructure communications. This enables real-time applications such as collision avoidance, crash mitigation and emergency brake warning. Even though the roll-out of these applications in the U.S. has been slow due to several reasons such as legislation uncertainty, it is finally taking off worldwide. It begs the question as to why the FCC should choose this moment to propose removing the safety band label, and potentially DSRC technology altogether, from the spectrum allocation (Figure 1) in favor of commercial interests.

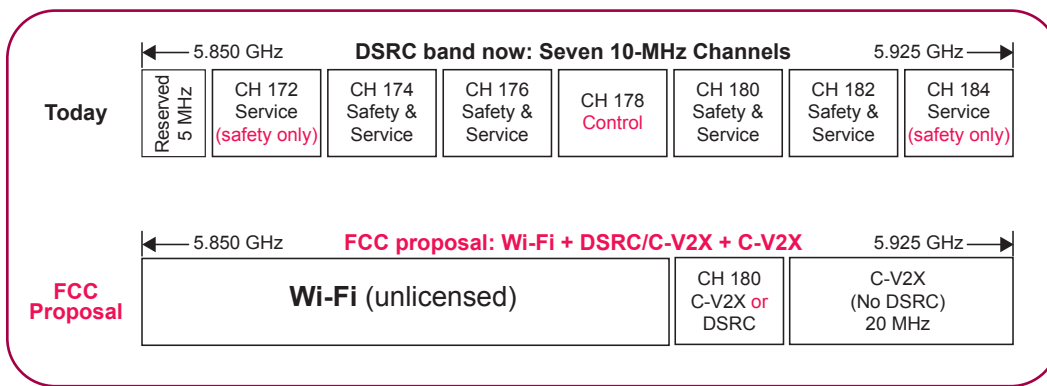


Figure 1 FCC proposal for ITS band reforming

We urge the FCC to revisit the current version of the NPRM and carefully consider the input of all voices active in the safety domain. Although safety applications may not be as financially attractive as entertainment applications, they are of utmost relevance to improve road safety.

USDOT Analysis

In our view, in the reply of the USDOT⁸ the anticipated implications of the FCC proposal are rightfully elaborated, such as an impact on public traffic safety and accident reduction, loss of life-saving applications for vulnerable road users, loss of truck platooning operation, impact on development of automated vehicles, and possible economic cost of over \$500 million of existing DSRC roadside deployments. NXP fully agrees with the analysis performed by the USDOT. In our opinion, safety should remain the number one priority and the current allocation of the ITS band should remain unchanged.

⁶ ITS America President & CEO Shailen Bhatt on FCC 5.9GHz Safety Spectrum Proposal, <https://www.itsa.org/newspress-releases>

⁷ FCC 19-129, ET Docket 19-138, NOTICE OF PROPOSED RULEMAKING, <https://www.fcc.gov/ecfs/filing/1217200308588>

⁸ US DOT, “Preliminary Technical Assessment of FCC 5.9 GHz NPRM”, <https://www.transportation.gov/research-and-technology/preliminary-technical-assessment-fcc-59-ghz-nprm>

Safety First

Removal of “safety” label from the reserved band

As one of the players in the automotive value chain, we believe that the FCC proposal will set back the automotive industry at least five years in deploying V2X technology. In the proposal, not only is the available bandwidth reduced, but the safety label is also removed from the proposed V2X channels. As observed on page 2 of the USDOT comment, “... FCC fundamentally removes the public safety use of this spectrum, thereby allowing commercial uses”. In our opinion, safety should remain a collective priority, and hence the Intelligent Transportation Safety (ITS) band should remain under the public safety use regulation, rather than opening the spectrum for commercial service.

DSRC safety accelerating worldwide

Worldwide roll-out of DSRC technology has begun and its pace accelerated in 2019. In Europe, all versions of the new Volkswagen Golf model 8 are equipped with DSRC technology⁹. Road operators such as ASFINAG¹⁰ in Austria are rolling out DSRC across several countries. In Asia, Japan has deployed DSRC on a large scale¹¹.

Roll-out of DSRC in the U.S. has also started¹², and a large number of automakers were committed to deployment, prior to the FCC’s proposed changes to the 5.9 GHz band. Looking at the official database from the USDOT, the number of DSRC-based on-board units (OBUs) and roadside units (RSUs) has grown significantly between 2018 and 2019, with the number of RSUs increasing from 2,044 to 6,182 and the number of OBUs from 3,340 to 15,506¹³. This is impressive growth of about 3 to 5X in the number of units year-on-year and would potentially continue. However, due to the current uncertainties with V2X deployment, we already see car manufacturers withdrawing their deployment, resulting in significant delay¹⁴.

V2X Bandwidth Reduction Might Have an Impact on Safety Applications

With deployment starting, we expect growth in applications which will drive demand on bandwidth and the need for additional channels. Applications currently in standardization are truck platooning, maneuvers coordination, vulnerable road user protection and collective perception (sharing of sensor information). In truck platooning, for example, multiple brands are working together defining the platooning implementation. This requires more than a single dedicated DSRC channel^{15, 16}. Trucks will be driving at very close distance to improve fuel efficiency and road utilization, leaving little time for a human driver to react in case of problems. Latency is safety-critical indicating the use of direct V2V communication.

Setting priority to IEEE 802.11ax in 6 GHz

IEEE 802.11ax is currently reaching the market. The Wi-Fi Alliance® recently announced Wi-Fi 6E¹⁷ to label the 6 GHz band implementation of IEEE 802.11ax. In the 1.2GHz under consideration in the 6 GHz band, Wi-Fi 6E can come into its own as legacy devices (including IEEE 802.11ac) will not impede the new medium access features (MU-OFDMA). Rather than allocating a small amount of spectrum to legacy Wi-Fi versions with marginal effect, we believe that it is more appropriate to take a forward-looking view.

⁹ “New Golf is launched with high-tech standard equipment”, Volkswagen press release, <https://www.volkswagen-newsroom.com/en/the-new-golf-international-vehicle-presentation-5609/new-golf-is-launched-with-high-tech-standard-equipment-5617>

¹⁰ “Warum Österreichs Autobahnen jetzt WLAN bekommen”, Trending Topics, <https://www.trendingtopics.at/warum-oesterreichs-autobahnen-jetzt-wlan-bekommen/>

¹¹ “Applications of DSRC in Japan: DSRC applications to Vehicle Safety”, ITS Forum Japan, https://itsforum.gr.jp/Public/E4Meetings/P01/seki5_2_3.pdf

¹² “V2V Safety Technology Now Standard on Cadillac CTS Sedans”, press release Cadillac, <http://media.cadillac.com/media/us/en/cadillac/news.detail.html/content/Pages/news/us/en/2017/mar/0309-v2v.html>

¹³ “Uses of the 5.9 GHz band: Connected Vehicle Deployment Location”, USDOT, https://www.transportation.gov/sites/dot.gov/files/pictures/CVLocations_USA_latest_NoNames.11.15.jpg

¹⁴ E.g. Toyota in response to FCC proposals, <https://static1.squarespace.com/static/596fb16003596e0fa70a232f/t/5cc36cda0d92970826c3655b/1556311258955/4-26-2019+Toyota+FCC+Comment.pdf>

¹⁵ Project ENSEMBLE on Multi-brand Truck Platooning, Document D2.8 page 18 paragraph 3.4, https://platooningensemble.eu/storage/uploads/documents/2019/02/11/ENSEMBLE_D2_8_V2X_communication_Final.pdf

¹⁶ “Road Safety and Road Efficiency Spectrum Needs in the 5.9 GHz for C-ITS and Cooperative Automated Driving”, CAR 2 CAR Communication Consortium, 2020

¹⁷ “Wi-Fi Alliance brings Wi-Fi 6 to 6 GHz”. <https://www.wi-fi.org/news-events/newsroom/wi-fi-alliance-brings-wi-fi-6-into-6-ghz>

DSRC Shows Benefits for V2X Technology

Interoperability remains as DSRC evolves

DSRC is a lively, evolving technology, and IEEE 802.11bd development is defining the next step for backwards-compatible DSRC communication. In contrast, the C-V2X approach proposes three new generations of standard which are not backwards-compatible by design. IEEE 802.11bd targets interoperability and coexistence in the same channels where 802.11p stations are deployed and augmenting existing implementations with new capabilities of 802.11bd¹⁸.

The drawbacks of adding C-V2X technology

Even though the FCC calls C-V2X a “promising new technology”¹⁹, Release 14 is based on classic 4G LTE²⁰, so in our opinion, it is actually “old technology”. Release 15 and Release 16 are not backwards-compatible²¹, and it might take years before real-life technology testing can start.

In our view, LTE C-V2X Release 14 does not bring a technical advantage over DSRC, despite claims from the 5GAA report²² which was subsequently commented by NXP²³. An incorrect measurement method was later acknowledged in a further 5GAA publication²⁴. In addition, the recent field tests by CAMP do not show performance gains over reported DSRC numbers^{25, 26}.

DSRC has a strong and proven real-life performance based on millions of driven kilometers in trials across U.S., Europe, and other countries around the world. DSRC has a mature ecosystem and the technology is deploying now.

Doubts on timely and affordable C-V2X deployment

C-V2X Rel-14 has several technical aspects that have been documented in technical materials, such as large latency²⁷, half-duplex and near-far problems²⁸, difficulty to cope with dynamic²⁹ change of data traffic, and problematic congestion control schemes and existence of problematic flawed configurations³⁰.

¹⁸ “IEEE 802.11bd – A seamless evolutionary access layer for ITS-G5 / DSRC”, CAR 2 CAR Journal Issue 23, https://www.car-2-car.org/fileadmin/downloads/PDFs/car-2-car-journal/Journal_23_C2C-CC_Oct_2019_web.pdf

¹⁹ FCC NPRM proposal, FCC-19-129A1.pdf page 51, <https://www.fcc.gov/ecfs/filing/1217200308588>

²⁰ Release 14 enhancements list: “LTE support for V2x services”, <https://www.3gpp.org/release-14>

²¹ “It is not intended for NR V2X to replace the services offered by LTE V2X. Instead, the NR V2X shall complement LTE V2X ...”, 3GPP report TR 38.913, <https://www.3gpp.org/DynaReport/38913.htm>

²² 5GAA Petition for Waiver, GN Docket No. 18-357, Appx. A (filed Nov. 21, 2018)

²³ NXP response to 5GAA, [https://ecfsapi.fcc.gov/file/10129081209560/NXP%20C-V2X%20Technology%20Comments%20\(Final%20-%201.29.2019\).pdf](https://ecfsapi.fcc.gov/file/10129081209560/NXP%20C-V2X%20Technology%20Comments%20(Final%20-%201.29.2019).pdf)

²⁴ 5GAA Ex Parte, <https://ecfsapi.fcc.gov/file/102221524815309/5GAA%20Ex%20Parte%202.22.19.pdf>

²⁵ “C-V2X Performance Assessment Project”, CAMP report 2019, <https://www.campllc.org/project-cellular-v2x-device-to-device-communication-c-v2x/>

²⁶ “On the 5GAA comparison between LTE-V2X and DSRC/IEEE 802.11p”, <https://www.nxp.com/docs/en/white-paper/LTEDSRC5GCOMWPA4.pdf>

²⁷ “Comparison of DSRC and LTE-V2X PC5 Mode 4 Performance in High Vehicle Density Scenarios”, Toyota, ITS World Congress 2019 presentation AM-TP2188

²⁸ “IEEE802.11p ahead of LTE-V2V for safety applications”, NXP White paper 2017, <https://www.nxp.com/docs/en/white-paper/LTE-V2V-WP.pdf>

²⁹ “Survey on ITS-G5 CAM statistics”, C2C_CC 2018, https://www.car-2-car.org/fileadmin/documents/General_Documents/C2CCC_TR_2052_Survey_on_CAM_statistics.pdf

³⁰ 3GPP contributions: Huawei R1-1717003, NXP R1-1717046 and R1-1717096, <https://www.3gpp.org/>

We have doubts as to whether LTE C-V2X Release 14 will be deployed. The next step, which is 5G V2X, is still a number of years away (see USDOT comment page 1). The unspecific description of the technology in the FCC document, referring to the generic C-V2X name instead of specifically LTE-V2X, is confirmation of this point (see USDOT Preliminary Technical Assessment³¹, page 2). Furthermore, the lack of comment on the substantially reduced spectrum availability for automotive safety in the 5G Automotive Association (5GAA) reaction³² to the announcement of the FCC's NPRM, as universally criticized by automotive³³ and traffic³¹ community stakeholders, raises the question on the C-V2X proponents' intention to develop V2X into a flourishing and valuable application.

In our view, the FCC should clearly indicate the requirement for FRAND access (Fair, Reasonable, and Non-Discriminatory access) to any patents and license agreements, which is the case for DSRC technology. Examples already exist today of cases brought by car makers against a major 5G chipset provider³⁴ related to access to cellular technology.

Recommendation on Usage of ITS Band

We recommend keeping the 5.9 GHz band reserved for transportation and vehicle applications, with a special focus on safety. Based on the current state of technology, we recommend seven DSRC channels of 10 MHz, to enable uncompromised road safety based on the mature and strong DSRC technology.

³¹ US DOT, "Preliminary Technical Assessment of FCC 5.9 GHz NPRM", Concerns with Draft FCC NPRM: Use of the 5.850-5.925 GHz band, <https://www.transportation.gov/research-and-technology/preliminary-technical-assessment-fcc-59-ghz-nprm>

³² 5GAA Statement on FCC Chairman's Proposal for the 5.9 GHz Band, <https://5gaa.org/news/5gaa-statement-on-fcc-chairmans-proposal-for-the-5-9-ghz-band/>

³³ Global Automakers Files Ex Parte Letter to FCC on Safety Spectrum, <https://secure.autosinnovate.org/posts/press-release/global-automakers-files-ex-parte-letter-to-fcc-on-safety-spectrum>

³⁴ "Connected car prices may rise if Qualcomm wins antitrust case auto makers", <https://finance.yahoo.com/news/intel-says-qualcomm-tactics-forced-150229495.html>

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