IEEE P802.18

Radio Regulatory Technical Advisory Group

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Comments on FCC19-138 NPRM Revisiting Use of the 5.850-5.925 GHz Band | | | | |
| Date: 2020-02-14 | | | | |
| Author(s): | | | | |
| Name | Affiliation | Address | Phone | email |
| Joseph LEVY | InterDigital, Inc. |  | +1.631.622.4139 | jslevy@ieee.org |
| Jay Holcomb | Itron | Liberty Lake (Spokane) | +1.509.891.3281 | jholcomb@ieee.org |

Abstract

This document is a working draft of the 802.18 comments on the FCC19-138 NPRM Revisiting Use of the 5.850-5.925 GHz Band ([18-19/0163r1](https://mentor.ieee.org/802.18/dcn/19/18-19-0163-01-0000-fcc19-138-nprm-revisiting-use-of-the-5-850-5-925-ghz-band.docx)). Revision 0 (r0) was created by moving the content of the 802.11 document created in 802.11 TGbd: “Draft TGbd Comments on FCC NPRM Docket 19-138” ([11-20/0104r14](https://mentor.ieee.org/802.11/dcn/20/11-20-0104-14-00bd-draft-tgbd-comments-on-fcc-nprm-docket-19-138.docx)) in to this 802.18 document. The development of this document can be traced by looking a previous revision of 11-20/0104. Please note that 11-20/0104r14 is a “clean” version of the document with all changes accepted and only in line comments. An earlier version with Word track changes on shows edits, changes, and comments all in Word format can be found in [11-20/0104r13](https://mentor.ieee.org/802.11/dcn/20/11-20-0104-13-00bd-draft-tgbd-comments-on-fcc-nprm-docket-19-138.docx). This document is intended to be become IEEE 802’s reply to the United States (US) Federal Communications Commission (FCC) in response to the FCC’s call for comments in the Notice of Proposed Rule Making (NPRM) on the matter of use of the 5.850-5.925 GHz Band, ET Docket No. 19-138.

r0 – Content of [11-20/0104r14](https://mentor.ieee.org/802.11/dcn/20/11-20-0104-14-00bd-draft-tgbd-comments-on-fcc-nprm-docket-19-138.docx) moved to this document 18-20/0020r0, with some minor editorial edits. Note: there are various “in line comments” in the text these comments are for discussion and editorial comment, these comments are proceeded by a “}” and are in blue text. These comments should be removed from the final document.

r1 / r2 – just formatting clean up, no content changes, then accepted so a clean copy to work content in telecons. Jay Holcomb, however added Std and P and a couple of what acronymns stood for.

r3, 11feb20 – .18 ad hoc - suggested to remove authors as they contributed to the .11 document so recorded there. then general discussions and updates in ad hoc with about 11 people all contributing. sections 1 to 2.2 with section 2.1 not there yet.

r4,13feb20 - .18 normal teleconference, just some updates in introduction and 2.1

r5, 14feb20 - .18 ad hoc finished up sections 2 and 3 and started into section 4. it may need notable updates. also doing updates to the references and links.

r6, 18feb20 - .18 ad hoc: changes in section 5,6,7,8, still need to do moderate changes in section 4 and will be adding a section or two.

**Before the**

**Federal Communications Commission**

**Washington, D.C. 20554**

In the Matter of )

)

Use of the 5.850-5.925 GHz Band ) ET Docket No. 19-138

)

**Comments of IEEE 802**

Paul Nikolich

Chair, IEEE 802 LAN/MAN

Standards Committee

em: IEEE802radioreg@ieee.org

07 March 2020

# Introduction

IEEE 802 LAN/MAN Standards Committee (LMSC) is pleased to provide comments on the above-captioned proceeding to the NPRM on the use of the 5.850-5.925 GHz Band dated 17 December 2019.

IEEE 802 LMSC is a leading- consensus-based industry standards body, producing standards for wireless networking devices, including wireless local area networks (“WLANs”), wireless specialty networks (“WSNs”), wireless metropolitan area networks (“Wireless MANs”), and wireless regional area networks (“WRANs”). We appreciate the opportunity to provide these comments to the Commission. With the release of FCC NPRM 19-129 (E.T. Docket 19-138), the United States Federal Communications Commission has requested comments regarding assessing the 5.9 GHz band rules and propose appropriate changes to ensure the spectrum supports its highest and best use. In this NPRM it is proposed to: “… continue to dedicate spectrum—the upper 30 megahertz portion of the band—for transportation and vehicle safety purposes, while repurposing the remaining lower 45 megahertz part of the band for unlicensed operations to support high-throughput broadband applications.”

IEEE 802 is a committee of the IEEE Standards Association and Technical Activities, two of the Major Organizational Units of the Institute of Electrical and Electronics Engineers (IEEE). IEEE has about 420,000 members in about 190 countries and supports the needs and interests of engineers and scientists broadly. In submitting this document, IEEE 802 acknowledges and respects that other components of IEEE Organizational Units may have perspectives that differ from, or compete with, those of IEEE 802. Therefore, this submission should not be construed as representing the views of IEEE as a whole.[[1]](#footnote-1)

The IEEE Std 802.11p-2010 amendment, now incorporated into IEEE Std 802.11-2016, provides core technology for Dedicated Short-Range Communication (DSRC). The term "OCB" (outside the context of a BSS (Basic Service Set)) was introduced in IEEE 802.11p, which specified "Wireless Access in Vehicular Environments". The OCB specifications within IEEE Std 802.11 continue to support DSRC-compatible operation.

The IEEE 802.11 Working Group (WG) is now specifying an IEEE Next Generation V2X (Vehicle-to-everything) (NGV) amendment the IEEE P802.11bd project. As described below, the IEEE P802.11bd amendment is intended to provide a seamless evolution path from DSRC in the 5.9 GHz DSRC band. Any consideration of the rules governing use of the 5.9 GHz band must recognize the societal value of allowing DSRC and IEEE P802.11bd to operate together in the ITS band. It should be noted that one of the advanced features being considered for the IEEE P802.11bd project is 20 MHz bandwidth operation. Also, 20 MHz operation may allow for simple sharing of spectrum resources with other IEEE 802.11 based technologies.

Additional background information: the IEEE 802.11 Regulatory Standing Committee provided an open, public forum to study the issues surrounding U-NII-4 band sharing between Wireless Local Area Networks and Dedicated Short Range Communications; this DSRC Coexistence “Tiger Team” has examined some initial ideas for how band sharing could work. The complete record of the work of the Tiger Team since its inception in August 2013, identifies the issues surrounding the proposed band sharing ideas discussed in the group, assesses the level of support for these concepts among the participants in the group, and recommends next steps for validating the sharing methods. The record is contained in a subset of the documents stored at <https://mentor.ieee.org/802.11/documents?is_group=0reg>. The relevant documents are dated between 21 August 2013 and 11 March 2015; most, but not necessarily all, include the word "DSRC" and/or "Tiger" in the title.

The record will inform regulators about initial discussions regarding the feasibility and practicality of sharing the 5.9 GHz band and outlining future analysis and field/lab testing that needs to take place to assure that these techniques will protect DSRC transmissions from harmful interference when deployed in the mass market.

## Current deployments are using the entire band

As the US Department of Transportation noted, in October 2018 [3] there were already more than 70 active DSRC deployments, using all seven channels and with thousands of vehicles on the road. IEEE 802 believes that allowing automakers and infrastructure owner-operators to evolve their deployments to P802.11bd over time will protect past and future investments in DSRC, providing a critical incentive for additional deployment of these life-saving technologies. As outlined below, we are concerned that hybrid ITS allocations, such as splitting spectrum for ITS with incompatibile technologies e.g. C-V2X and IEEE P802.11bd will undermine existing investments and discourage widespread deployment of V2X technology.

## On Interoperability and Coexistence.

To facilitate this discussion, we offer specific definitions of key terms. These definitions describe various relationships between IEEE Std 802.11-2016 OCB (802.11p) devices and IEEE P802.11bd devices (also known as DSRC and IEEE NGV devices, respectively). While these definitions are for devices implementing the DSRC and IEEE NGV technologies, they may also be applied more generally to analyze the relationship between other V2X technologies. These definitions are agreed [15]within IEEE P802.11 TGbd (the task group developing the IEEE P802.11bd amendment):

• **Interoperability –** IEEE 802.11p devices to be able to decode at least one mode of transmission of IEEE 802.11bd devices, and IEEE 802.11bd devices to be able to decode IEEE 802.11p transmissions

• **Co-existence** – IEEE 802.11p devices to be able to detect IEEE 802.11bd transmissions (and hence defer from transmissions during IEEE 802.11bd transmissions causing collisions) and vice versa

• **Backward compatibility** – Ability of IEEE 802.11bd devices to operate in a mode in which they can interoperate with IEEE 802.11p devices

• **Fairness** – Ability of IEEE 802.11p devices to have the same opportunities as IEEE 802.11bd devices to access the channel

We recommend that the Commission decision on how to allocate spectrum to ITS technologies should be based on service deployment and V2X technologies evolution to meet the safety message interoperability and device coexistence with the existing IEEE Std 802.11p technology. The safety message should be interoperable by supporting common interface to IEEE 1609.x protocol stacks. In addition, devices should be able to coexist and support backward compatibility in terms of radio access scheme with existing and deployed IEEE Std. 802.11-2016 OCB based devices.

} is this too controversial to bring up? the answer it is not controversial as we are only talking about ITS and ITS was added in 1st sentence. done

~~who wants the $s. could look back at original FCC R&O on interoperability, 2003.~~

~~} the note above, inserted during 802.18 teleconference (6 Feb), was deleted in a comment by Hyun Seo OH, but the editor restored the note as he believes that 802.18 was considering further discussion on this note.~~

# Comments on the proposal to “… repurpose the lower 45 megahertz of the 5.9 GHz band (5.850–5.895 GHz) to allow unlicensed operations, and retain use of the upper 30 megahertz of the band (5.895–5.925 GHz) for ITS purposes,” [2], paragraph 5

## IEEE 802.11 support of the full band

IEEE Std 802.11-2016 including its draft amendment IEEE P802.11ax and IEEE P802.11bd currently in development provide specifications that are applicable for supporting WLAN and ITS (Intelligent Transportation System) applications (use cases) for the full 75MHz of spectrum between 5850 and 5925 MHz. IEEE 802 notes that the proposed rules designed to extend wider channels across 5850-5925 MHz enable IEEE Std 802.11-2016 and IEEE P802.11ax based devices to use 80MHz and 160MHz channels.

} 14feb: okay to go with above.

~~} There was discussion in 802.18 during the 802.18 teleconference 23 Jan 2020 regarding: if this section is following what was “agreed” at the 802.18 F2F meeting in January: to stay silent on the partitioning? Maybe the second sentence should be deleted or lessen the focus on wide band usage. This section needs more inputs, contributions are welcomed.~~

~~{Comment from 802.18 teleconference 23 Jan 2020: need to clarify using 802.11 technology family, and limit references to Wi-Fi (watch the trademarks in general). It was also suggested that this maybe move to the introduction.~~

## IEEE 802.11 support of exisiting worldwide ITS frequency bands

The IEEE Std 802.11-2016 OCB functionality (802.11p) and ongoing work in the IEEE P802.11 TGbd provide technical capabilities for ITS in the defined ITS band in multiple regulatory domains around the world, not just in the USA. The ITS band has been thoroughly studied at previous World Radio Conferences. IEEE Std 802.11-2016 OCB functionality (802.11p) are being deployed in various regions around the world in the 5.9 GHz ITS band. Technological innovations such as those currently being developed in the IEEE P802.11 TGbd task group will bring in next generation V2X functionality in this 5.9 GHz ITS band, while maintaining backward compatibility with IEEE Std 802.11-2016 OCB.

} need to add about upgrading to next generation, and last sentence is awkward. see above - done

In summary, IEEE 802.11 is continuing to evolve the radio technology for various applications including WLAN connectivity and ITS in all regions around the world.

~~} whether the NPRM results in 10MHz for the DSRC Service, 30MHz for the DSRC Service or maintains the 75MHz for the DSRC Service.~~

~~} this needs further discussion and needs to be agreed. This does not seem to adhere to the agreement made in 802.18 at the F2F meeting in Jan 2020, that this document would remain silent on how the 75 MHz is or is not partitioned.~~

~~} need to review from point of view of 802.11 in general to support general partitioning from the FCC? considering for all of 802.11.~~

~~} can we just be silent on the 75MHz partitioning overall?~~

~~} text was meant to by the whole 75MHz for 802.11 in general. can edit some.~~

# Comments on “… the transportation and vehicular safety related applications that are particularly well-suited for the 5.9 GHz band as compared to spectrum outside of the 5.9 GHz band, and how spectrum outside the 5.9 GHz band can be used efficiently and effectively to provide transportation and vehicular safety-related applications.” [2], paragraph 9

## On the spectrum needs for achieving the full benefit of traffic safety technologies:

Over the past decade, a lot of effort has been dedicated to validating the spectrum requirements and needs to guarantee that the full potential of traffic safety goals is met in order to save more lives. The US Department of Transportation (DoT) in its latest report “*Preparing for the Future of Transportation*” [[3](https://www.transportation.gov/av/3/preparing-future-transportation-automated-vehicles-3)] has highlighted the need for sufficient spectrum to enable V2X communications throughout the US. Moreover, an in-depth assessment made by the Car2Car Communication Consortium [[4](https://www.car-2-car.org/fileadmin/documents/General_Documents/C2CCC_TR_2050_Spectrum_Needs.pdf)] has estimated the needs for V2X, regardless of the communication technology in the US.

IEEE 802 believes that further splitting the 30 MHz as proposed in the NPRM between two incompatible ITS technologies will maximize the damage to existing deployments and diminish the benefits from deploying ITS services in the band.

} 14feb: good discussion, above it good to move fwd. done

}14feb: will review [4] and can relate back to FCC/USA… (off-line)

~~} the above is indicating all 75MHz for ITS, not following the silence on partitioning of the entire 75 MHz. {so, will look at some editing in here.}~~

~~} how does this keep safety as part of the final plan?~~

~~(discussion was on fatalities, e.g. RR crossing and all)~~

~~} what about other bands to bring up, e.g. 4.9GHz.~~

## Harmonization of International frequency bands for ITS applications

ITU-R has studied harmonization of international frequency bands for the current and future ITS applications according to Question ITU-R 205-5/5. The ITU-R working group study, Recommendation M.2121 [5], provides guidance on how to harmonize ITS frequency bands and recommends that “… Administrations should consider using the frequency band 5850-5925 MHz, or parts thereof, for current and future ITS applications”. Recommendation M.2121, also recommends that current frequency usage for evolving ITS within Regions 1, 2 and 3, “… should be taken into account for regional harmonized ITS frequency bands …” and “that when using harmonized frequency bands for ITS, potential coexistence issues between ITS stations and other applications of the mobile service and/or other services should be taken into account.”

IEEE 802 also believes that harmonization of international frequencies bands for current and future ITS should be a goal.

} do we need a summary/closing sentence how the FCC should take this into account? yes, see above. done

# Comments on “… on available technical studies on C–V2X that could inform its consideration of C–V2X, including any recent studies that provide information about how C–V2X would operate in the 5.9 GHz band.” [2], paragraph 12.

}14feb: should find another question on how we can promote 802.11p/bd and how they are designed for this.

}14feb: have volunteer to review find a couple of places for: connectivity and how we fit in the different connections e.g V2V 2) V2P;

## 5G connectivity benefits should not be coupled to C-V2X:

It is often wrongly assumed that the anticipated benefits of 5G connectivity are uniquely associated with the PC5 (direct communications between vehicle and other devices) side link interface of C-V2X. Furthermore, the capability of 5G in terms of Vehicle-to-Network (V2N) communication achieved through the (Uu-logical interface between the User Equipment and the base station) communication interface is widely confused with C-V2X using PC5 for Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I). It is important to clarify that the V2N capability is a distinct function using separate frequency resources, usually in the spectrum below 3 GHz. We agree that cellular V2N connectivity could complement V2V and V2I to enable additional services when the vehicles are inside the coverage area of a cellular network. However, these benefits of V2N can be achieved regardless of whether the V2V and V2I communications are based on C-V2X or DSRC. The SCOOP project with a fleet of 3000 vehicles already demonstrates that cellular 4G connectivity for V2N can be successfully and efficiently combined with DSRC for V2V [6]

## Vehicle-to-Pedestrian Communications (V2P)

In its waiver request, the 5GAA states that “C-V2X enables direct, peer-to-peer mode communications […] between vehicles and pedestrians, cyclists and other vulnerable persons (“V2P”) […]”. This statement is false: C-V2X would not “enable” V2P, but instead make V2P vastly more complex and expensive compared to existing DSRC technology. Mobile phones of cyclists or pedestrians are not compatible with the C-V2X PC5 sidelink interface for direct peer-to-peer communication with vehicles at 5.9 GHz. Despite strong similarities, the cellular 4G/5G interface and the C-V2X PC5 interface cannot be integrated into a single radio interface because most pedestrians would not be willing to sacrifice all cellular data connectivity in order to receive V2P messages. Therefore, a second radio interface for C-V2X PC5 will be required. We anticipate that such additional hardware will only be integrated into expensive, high-end mobile phones, which would not be affordable to many children or elderly persons, i.e., to the most vulnerable road users.

} 14feb: we should not talk to costs we can not back that up as a SDO and would not pass the EC.

} 14feb: focus the .11p and .11bd can enable V2P and P2X, etc. are there demonstrations to support?

} 14feb: both technologies can do P2X, and do these answer anything in the NPRM, it came from 5GAA ex parte**. focus on what .11p and .11bd can do for these applications. no mention of C-V2X.**

} Editor’s note: Is the use of “all” the correct statement to make here? While there is a cost trade-off of having dual radios in a mobile phone – many mobile phones do have more than one radio and adding an additional radio while not “free” may not be “cost prohibited”. We may want to state this. This argument does hold for a single radio mobile phone. Note the following paragraph is all about adding a second radio to a phone (an 802.11 radio) to provide V2P communication. Also note it is possible that the user may not be any happier about giving up their Wi-Fi connectivity to provide V2P communication. While the Wi-Fi radio approach is likely significantly “lower cost” it is not “zero cost”.

On the contrary, DSRC enables V2P communications at significantly lower cost: Most mobile phones are now equipped with IEEE 802.11ac/ax WiFi modules, which currently support channels up to 5835 MHz and could be easily expanded up to 5925 MHz. As DSRC is based on IEEE 802.11 protocols, minor changes to existing WiFi designs will enable direct communication between DSRC-capable vehicles and mobile phones of pedestrians and cyclists. Furthermore, DSRC-based V2P and regular WiFi can reside on the same radio interface, which can be switched to V2P mode on the road and to regular WiFi connectivity at home. Thus, DSRC technology will in the future allow direct V2P communications using inexpensive mobile phones without the need for additional hardware.

~~} need to define Uu~~

} more editing will be looked at. e.g. C-V2X is not the only technology. with 5G.

} need to watch not to promote 5G, need to soften more.

# Comments on “The Commission proposes to modify existing DSRC licenses to allow operation in only the 5.895–5.925 GHz sub-band to the extent that licensees want to operate a C–V2X system or only in 5.895–5.905 GHz to the extent this sub-band is retained for DSRC systems and the licensees want to continue their DSRC operations.” [2], paragraph 20

## V2X Channel Needs

The currently proposed NPRM cites preliminary studies submitted by the 5GAA claiming that a single 20 MHz channel provides sufficient throughput for many anticipated V2X features. However, we strongly disagree that a single channel can provide sufficient throughout for both basic safety messages (BSMs) and non-safety-critical messages. Despite the use of intelligent prioritization of BSMs, there is a possibility that BSM suffer from interference by hidden nodes, i.e., vehicles and RSUs that did not understand that a BSM is being transmitted, which can ultimately lead to traffic collisions. The probability for such interference will only increase with increasing market adoption of V2X. Therefore, non-safety critical messages must not be allowed to transmit on the same channel as BSMs.

IEEE 802’s position is aligned with the Commission’s statements that “vehicle-to-vehicle collision avoidance and mitigation applications are exceptionally time-sensitive and should not be conducted on potentially congested channels” and “shared use of a time-critical DRSC channel could be literally life-threatening in the context of collision avoidance.” [19]

On the other hand, non-safety critical messages may constitute the major economic driver for market adoption of V2X. For example, platooning of trucks on highways was shown to improve average fuel efficiency by up to 13% for the involved vehicles [7], potentially leading to billions of dollars in savings for the trucking industry and thus providing a major investment incentive. However, it was shown that the involved vehicles must exchange information at very a high rate of up 30 messages per second [4, p. 14] in order to maintain speed and distance, thus creating frequent potential interference of BSMs.

We conclude that a single channel will be insufficient to support both safety critical V2X communication as well as V2X features that accelerate market adoption. Instead, we anticipate that at least 2 or 3 different parallel channels will be required for successful adoption of V2X, regardless of whether these channels will use C-V2X or DSRC technology.

} [4,14] Multiple platooning project such as AutoNet have shown that for reaching best performance CAM rates of up to 30Hz are expected. done.

~~} Editor’s note: A comment was received suggesting moving this section to be section 3.2, moving the current 3.2 to 3.3, but I have left this here as if we move it there will be no content in section 5. This should be discussed. If the content is moved new content would have to be added or will drop out. – author okay to leave this section here.~~

**~~OOB performance/requirements:~~**

~~} need contribution text for this section or will drop out.~~ no contributions so passing on this. done

# Comment on “… on the extent to which its proposals would make ITS based technologies either more or less effective.” [2] paragraph 48

## Need for common V2X safety format/broadcast type:

### DOT position on interoperability and robust safety/public safety

Quoted from [10]: “We note that DOT envisions DSRC units in every new motor vehicle for life-saving communications. To ensure interoperability and robust safety/public safety[[1]](" \l "_ftn1) communications among these DSRC devices nationwide, we adopt the standard supported by most commenters and developed under an accredited standard setting process (ASTM E2213-03 or “ASTM-DSRC”).”[[1]](" \l "_ftnref1)

We refer herein to “safety/public safety” communication interchangeably because DSRCS involves both safety of life communication transmitted from any vehicle, *e.g.,* vehicle-to-vehicle imminent crash warnings, as well as communication transmitted by public safety entities, *e.g.*, infrastructure-to-vehicle intersection collision warnings.

Fair coexistence, backward compatibility, and interoperability are required characteristics of the Next Generation V2X amendment under development in IEEE 802.11. There are two aspects of V2X communication that argue for these requirements:

a) V2X is ad hoc communication; devices communicate directly with one another, and there are no base stations or access points to translate between protocols or between generations of the same protocol; and

b) Vehicle safety features must work throughout the lifetime of the vehicle, which can be expected to span several generations of wireless technology.

We note that the fourth and fifth generations of cellular V2X sidelink technology (i.e. Release 14 and 16) do not have any of these characteristics: same-channel coexistence, backward compatibility, or interoperability.  The Commission should not allocate scarce ITS spectrum to 4G LTE-V2X technology that cannot evolve to 5G. Societal interests in the spectrum are better served if it remains allocated to the IEEE 802.11 family of V2X protocols, which will provide a seamless technology evolution path into the future.

**~~Need for compatibility/backwards compatibility:~~**

~~} need contribution text for this section or will drop out.~~ see contributions above, all are good. done.

# Comments on “… how to evaluate the benefits and costs of its proposal given the evolving nature of transportation and vehicular safety related technologies, both within and outside of the 5.9 GHz band.”, [2] paragraph 48

## IEEE 802 vision of V2X technology evolution:

The IEEE 802 vision for V2X technology evolution is documented in the approved Project Authorization Request for the IEEE P802.11bd amendment [16], which requires that:

“This amendment shall provide interoperability, coexistence, backward compatibility, and fairness with deployed OCB (Outside the Context of a BSS) devices.”

In other words, IEEE 802 next generation V2X technology (IEEE P802.11bd) will have fair same-channel coexistence with DSRC and will be interoperable and backward compatible with DSRC.

Furthermore, this vision is extensible to further generations. A future extension of IEEE Std 802.11p and IEEE P802.11bd will also be able to achieve fair, same-channel co-existence, interoperability, and backward compatibility with previous generations. Backward compatibility across generations of IEEE 802.11 technology is fundamentally based on use of a common packet preamble and channel access mechanism.

The IEEE 802 vision of V2X technology evolution ensures that investments in DSRC are protected over the long lifetimes of automotive on-board units (OBUs) and roadside units (RSUs). This protection is critical for encouraging DSRC deployments today and in the near future. By contrast, any proposals that threaten to impair these investments will discourage deployment and delay the realization of societal benefits from this spectrum.

## 3GPP vision of V2X technology evolution:

By contrast, the 3GPP vision for technology evolution appears to be that none of these attributes will apply between two V2X technologies or two generations of the same technology. LTE V2X PC5 has been specified in a way that it does not achieve fair same-channel coexistence with incumbent DSRC technology, nor does it interoperate with DSRC, nor is it backward compatible with DSRC.

3GPP is now specifying a new generation of cellular V2X (i.e. New Radio, NR). The study item phase of NR V2X PC5 is complete and the terms for the specification phase have been agreed. It is now clear that NR V2X PC5 will fail to achieve any of these key evolution characteristics not only with DSRC but also with the previous generation cellular V2X (LTE V2X PC5). To be clear, NR V2X PC5 will not be able to coexist in the same channel, interoperate, or be backward compatible with LTE V2X PC5.

## Implications of different evolution models:

The 3GPP V2X technology evolution model implies a high societal cost, a cost that is completely avoided in the IEEE 802 V2X evolution model. The 3GPP model implies that V2X spectrum must be fragmented into sub-bands associated with every different V2X technology.

Band fragmentation carries significant costs. First, it disrupts the Commission’s vision of uniformly interoperable communication among all V2X devices based on a single technology family. With multiple non-interoperable technologies operating in different sub-bands, some devices will not be able to communicate with others. For example, if two automakers choose different technologies and different sub-bands for sending Basic Safety Messages (BSMs), vehicle collisions that could have been prevented if those BSMs were successfully exchanged will not be prevented, leading to unnecessary loss of life and property. Many vehicles are already equipped to send BSMs with DSRC. Allowing some automakers to send BSMs using only DSRC, LTE V2X PC5 or NR V2X PC5 will cause a loss of interoperability and attendant increase in road fatalities is a direct result of the fragmentation evolution model. This also extends to all other use cases supported by DSRC and by non-interoperable cellular V2X technologies. V2X evolution under the IEEE 802 model does not suffer this cost. Every vehicle will be interoperable with every other vehicle, whether the vehicles are DSRC-capable or IEEE P802.11bd-capable.

## Implications of different access models:

Contrary to DSRC protocols, which are able to manage the access to the wireless channel in a distributed manner without requiring a central coordination entity, the C-V2X PC5 sidelink generally uses GNSS (Global Navigation Satellite System) signals like GPS to meet strict time synchronization requirements when accessing the channel [14]. The studies cited by the 5GAA Waiver Request [17], as well as studies conducted by the 3GPP [18], all assume that ideal time synchronization is provided by GNSS signals. Even though this demand for GNSS does not lead to any additional costs because V2X systems already require GNSS systems for positioning, GNSS signals cannot be received in deep tunnels, which could lead to a loss of time synchronization, which could in turn reduce the efficiency and reliability of C-V2X systems in tunnels. The 3GPP or 5GAA have not provided any studies to address such concerns.

However, it is paramount for any V2X technology to provide reliable communication of safety messages in tunnels. On several past occasions, fires that resulted from traffic collisions in tunnels have spread rapidly and led to catastrophic loss of life. DSRC systems do not require time synchronization on a microsecond level and are therefore not impaired by the lack of GNSS reception in tunnels.

We note here that the lack of GNSS reception will not entirely prevent positioning. The vehicle’s position inside the tunnel could still be estimated by combining dead-reckoning systems, RADAR, LIDAR, and camera data. We acknowledge that positioning could be further improved by installing additional road-side units, which would also provide the time synchronization that is necessary for C-V2X. Nevertheless, it remains unclear whether public authorities will have sufficient funds to install these units.

} 18feb: will bring up again wed, if further inputs are received, other wise will accept above.

} Editor’s comment: Should there be a more positive statement on the nature of DRSC’s distributed control and access? Should it also be clearly stated what the level of GNSS dependence is required for DRSC, if any.

## V2X communication technology standards

ITU-R also have studied on radio interface standards of vehicle to vehicle and vehicle to infrastructure two-way communications for the current and planned ITS applications considering Recommendation M.2121. Recommendation M.2084 provides information on V2X standards and technical specifications which have developed by SDOs such as ETSI, IEEE, ARIB, TTA, IMDA, CCSA, 3GPP and ATIS [9]. It states that V2V/V2I communication technologies for ITS applications should apply industrial standards.

# Comment on IEEE 802.11 standards referencing

# }need to find an NPRM reference to tie this comment to}

} the published NPRM [2] refers to the IEEE 802.11 standars as listed below:

1. “Institute of Electrical and Electronics Engineers (IEEE) standard” ([2] paragraph 26)
   * *This appears to be ok*
2. “IEEE 802.11 family of standards” ([2] paragraph 27)
   * *This appears to be ok*
3. “the IEEE 802.11p” ([2] paragraph 28)
   * *This seems to be a correct historical reference.*
4. “IEEE 802.11 standards for DSRC operation” ([2] paragraph 28)
   * *This seems to address our comments below and seems ok.*
5. “IEEE 802.11p-2010” ([2] note in table in paragraph 21, in PART 2 – Frequency allocations and radio treaty matters, General Rules and Regulations)
   * *This reference for the table values. Should this change?*
6. “… must comply with the technical standard Institute of Electrical and Electronics Engineers (IEEE) 802.11p-2010.” ([2] paragraph 23, in PART 2 – Frequency allocations and radio treaty matters, General Rules and Regulations)
   * *Are we ok with this reference? We may want to comment on this.*
7. “(1) 802.11p-2010, IEEE Standard for Information technology—Local and metropolitan area networks—Specific requirements—Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications Amendment 6: Wireless Access in Vehicular Environments (2010)” ([2] paragraph 23, in PART 2 – Frequency allocations and radio treaty matters, General Rules and Regulations)
   * *This is the reference on where to find the above specification, so if 6 is ok, then this is ok, if 6 changes then this should change.*
8. “(b) DSRCS out-of-band emissions limits are specified in the IEEE 802.11p-2010 standard (See section 95.3189 of this part)” ([2] paragraph 37, in PART 2 – Frequency allocations and radio treaty matters, General Rules and Regulations)
   * *Are we ok with this reference? We may want to comment on this.*
9. “(a) DSRCS On-Board Unit (OBU) transmitter types operating in the 5895–5905 MHz band must be designed to comply with the technical standard Institute of Electrical and Electronics Engineers (IEEE) 802.11p–2010. ([2] paragraph 39, in PART 2 – Frequency allocations and radio treaty matters, General Rules and Regulations)
   * *Are we ok with this reference? We may want to comment on this.*
10. “(1) 802.11p-2010, IEEE Standard for Information technology—Local and metropolitan area networks—Specific requirements—Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications Amendment 6: Wireless Access in Vehicular Environments (2010)” ([2] paragraph 39, in PART 2 – Frequency allocations and radio treaty matters, General Rules and Regulations)
    * *This is the reference on where to find the above specification, so if 9 is ok, then this is ok, if 6 changes then this should change.*

} Therefore, this comment could be tied to any or all of the above.

## Incorporation by reference to IEEE 802.11 standards

In Paragraph 44 the FCC seeks comment on the proposed change to the incorporation by reference from ASTM E.2213-03. The NPRM proposes changing that to IEEE Std 802.11p-2010.

We respectfully request that the reference not be made to the superseded IEEE Std 802.11p-2010 standard, but instead to the current IEEE 802.11-2016. In addition, we suggest not incorporating the entire standard, but only the relevant RF performance aspects that are applicable. A reference to IEEE 802.11-2016 Annex D.2 and D.5 would be appropriate to cover radio regulations for IEEE Std 802.11p and IEEE 802. This suggested change will cover the necessary technical aspects of the IEEE Std 802.11p radio, as well as be inclusive of the IEEE P802.11bd radio design and potential future backwards compatible IEEE 802.11-based ITS radio designs.

IEEE 802.11 Working Group has a long history of innovation and we expect the same principles of backwards compatibility and same-channel coexistence can be applied in the 5.9 GHz ITS band starting with IEEE Std 802.11p and continuing with IEEE P802.11bd and future amendments as technology evolves.

}18feb: will add to second paragraph where 80211p-2010 should be updated to IEEE 802.11-2016 Annex D.2 and D.5.

} still open on best reference to use. we do have questions on how to answer the NPRM and where we want the FCC to go.

} backward compatible vs. co-existence and interoperability.

in earlier filings we have text on this, we should consider.

co-existence is not the term to use, since not equivalent services, safety/Wi-Fi

in this context it was 11p to 11bd, then it is valid.

} general input was they will only publish a specific std, not and all future updates.

or does IEEE 802 internally request to keep the old stds current, after a rollup.

# Comments on: “… the state of DSRC-based deployment and the extent to which existing licensees currently operate on some or all of the existing channels in the 5.9 GHz band.” [2] Paragraph 9

## Choosing LTE-V2X as a V2X technology does not address the slow market adoption of V2X:

While it is true that the adoption of DSRC did not move as quickly as it was originally anticipated, we believe that the reasons for this were related neither to the technological aspects of DSRC nor to its maturity for mass deployment. On the contrary, the US-DoT pilot programs, of which many have already started their operation phases, provide increasing evidence to show that the technology is ready for mass market rollout. In fact, GM, Toyota, and other automotive manufacturers [[11], [12], [13] made prior commitments to mass deployment of DSRC based system across their respective brands. It is in our belief that the slow adoption of DSRC in the past was more related to the lack of incentive and motivation from road operators scaling up their deployments as well as a reluctance of automotive manufacturers to voluntarily invest in a technology whose benefits to customers are only now becoming more evident as a more significant level of penetration of the technology is being reached.

Furthermore, we believe that the uncertainty that would be created by the proposed switch from already tested and deployed DSRC technology to C-V2X technology without significant deployments would significantly slow down investments and market adoption of V2X technology in general.

**Conclusion:**

Thank you for consideration of this information.

}need additional content for the conclusion

Regards,

By: /ss/ .

Paul Nikolich

IEEE 802 LAN/MAN Standards Committee Chairman

em: p.nikolich@ieee.org

**References:**

[1] “In the Matter of: Use of the 5.850-5.925 GHz Band, ET Docket No. 19-138, NOTICE OF PROPOSED RULEMAKING”, Released: December 17, 2019, FCC 19-129 <https://www.fcc.gov/ecfs/search/filings?proceedings_name=19-138&sort=date_disseminated,DESC>

[2] “FEDERAL COMMUNICATIONS COMMISSION, 47 CFR Parts 2, 15, 90, and 95, [ET Docket No. 19–138; FCC 19–129; FRS 16447], Use of the 5.850–5.925 GHz Band” as published in the Federal Register/ Vol. 85, No. 25/ Thursday, February 6, 2020 / proposed Rules, starting on page 6841. <https://www.govinfo.gov/content/pkg/FR-2020-02-06/pdf/2020-02086.pdf>

[3] “Preparing for the Future of Transportation: Automated Vehicles 3.0 (AV 3.0)”, U.S. Department of Transportation, October 2018, <https://www.transportation.gov/av/3/preparing-future-transportation-automated-vehicles-3>

[4] “Road Safety and Road Efficiency Spectrum Needs in the 5.9 GHz”, CAR 2 CAR Communications Consortium, 21 February 2018, <https://www.car-2-car.org/fileadmin/documents/General_Documents/C2CCC_TR_2050_Spectrum_Needs.pdf>

[5] Recommendation ITU-R M.2121-0, 01/2019, “Harmonization of frequency bands for Intelligent Transport Systems in the mobile service”, <https://www.itu.int/dms_pubrec/itu-r/rec/m/R-REC-M.2121-0-201901-I!!PDF-E.pdf>

[6] Connected vehicles and cooperative ITS <http://www.scoop.developpement-durable.gouv.fr/en/IMG/pdf/scoop_f_-_presentation_5_april_2018.pdf>

[7] “Influences on Energy Savings of Heavy Trucks Using Cooperative Adaptive Cruise Control”, SAE International, 03 April 2018, <https://www.nrel.gov/docs/fy18osti/70868.pdf> (copy link into browser)

[8] Recommendation ITU-R M.2121-0, Harmonization of frequency bands for Intelligent Transport Systems in the mobile service, January 2019. <https://www.itu.int/rec/R-REC-M.2121-0-201901-I/en>

[9] Recommendation ITU-R M.2084, Radio interface standards of vehicle-to-vehicle and vehicle-to-infrastructure two-way communications for Intelligent Transport System applications, November 2019. <https://www.itu.int/rec/R-REC-M.2084/en>

[10] The REPORT AND ORDER, adopted: December 17, 2003, Released: February 10, 2004,

In the Matter of: Amendment of the Commission’s Rules Regarding Dedicated Short-Range Communication Services in the 5.850-5.925 GHz Band (5.9 GHz Band), Amendment of Parts 2 and 90 of the Commission’s Rules to Allocate the 5.850-5.925 GHz Band to the Mobile Service for Dedicated Short Range Communications of Intelligent Transportation Services, WT Docket No. 01-90, ET Docket No. 98-95, RM-9096 [https://ecfsapi.fcc.gov/file/6515782773.pdf](https://ecfsapi.fcc.gov/file/6515782773.pdf" \t "_blank)

[11] “Cadillac to Expand Super Cruise Across Entire Lineup”, GM Corporate Newsroom, 06 June 2018 <https://media.gm.com/media/cn/en/gm/news.detail.html/content/Pages/news/cn/en/2018/June/0606_Cadillac-Lineup.html>

[12] “Toyota, Lexus Commit to DSRC V2X Starting in 2021”, Innovationdestination Automotive, 16 May 2018, <https://innovation-destination.com/2018/05/16/toyota-lexus-commit-to-dsrc-v2x-starting-in-2021/>

[13] “Project Scoop connected vehicles and roads” a pilot project for the deployment of cooperative intelligent transport systems, 13 April 2018,  [http://www.scoop.developpement-durable.gouv.fr/en/general-presentation-a9.html](http://www.scoop.developpement-durable.gouv.fr/en/general-presentation-a9.html" \t "_blank).

} This link seems to be missing in the contributed material. (TBS) – updated – Done.

~~} Editor’s note: this link needs to be checked out~~

[14] “5G and Automotive, Cellular Vehicle-to-Everythign (C-V2X), Qualcomm, March 2017, <https://www.unece.org/fileadmin/DAM/trans/doc/2017/wp29grrf/S2_P2._QC-5G-ConnectedCars.pdf>

} Editor’s note: Is reference [14] an adequate reference for C-V2X system’s requirement of GNSS time?

[15] “TGbd agreed terminology and requirements,” IEEE 802.11 document 11-19-0202/r1, January 2019, which can be found at: <https://mentor.ieee.org/802.11/dcn/19/11-19-0202-01-00bd-tgbd-definitions-and-requirements.pptx>

[16] “P802.11bd Project Authorization Request”, December 2018, <https://development.standards.ieee.org/get-file/P802.11bd.pdf?t=99204200003>

} editor’s note: this link needs updating so not behind UN/PW and up to date.

[17] 5GAA Petition for Waiver, GN Docket No. 18-357,[https://ecfsapi.fcc.gov/file/11212224101742/5GAA%20Petition%20for%20Waiver%20-%20Final%2011.21.2018.pdf](https://urldefense.proofpoint.com/v2/url?u=https-3A__ecfsapi.fcc.gov_file_11212224101742_5GAA-2520Petition-2520for-2520Waiver-2520-2D-2520Final-252011.21.2018.pdf&d=DwMFaQ&c=pqcuzKEN_84c78MOSc5_fw&r=z8R-nWJ8GIxwjOjNKhEFByb-tZ6XE3GZXWSggNdVo-w&m=Ls0tA-EFLsLwUejciX7cBMNuKukyYXwxblKytRl332E&s=BYHXDhd_bAZi8WMXusqf69JqoRPqe1oKr28wN9BF8-8&e=)

[18] 3GPP, "TR 36.885: Study on LTE-based V2X Services; (Release 14), V14.0.0", June 2016 [http://www.3gpp.org/ftp/Specs/archive/36\_series/36.885/36885-e00.zip](http://www.3gpp.org/ftp/Specs/archive/36_series/36.885/36885-e00.zip" \t "_blank)

[19] “Memorandum Opionion and Order,” paragraph 16, FCC 06-110, July 20, 2006

<https://www.fcc.gov/document/amendment-commissions-rules-regarding-dedicated-short-range>

1. This document solely represents the views of the IEEE 802 LAN/MAN Standards Committee and does not necessarily represent a position of either the IEEE, the IEEE Standards Association or IEEE Technical Activities. [↑](#footnote-ref-1)