Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
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	)	
Revision of Part 15 of the Commission's Rules to Permit Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band	)	ET Docket No. 13-49
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REPLY COMMENTS OF THE ALLIANCE OF AUTOMOBILE MANUFACTURERS, ASSOCIATION OF GLOBAL AUTOMAKERS, INTELLIGENT TRANSPORTATION SOCIETY OF AMERICA, AND DENSO INTERNATIONAL AMERICA, INC.

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EXECUTIVE SUMMARY

The comments in this proceeding underscore the tremendous potential of Dedicated Short Range Communications ("DSRC") to significantly improve safety on our nation's roadways and the need to ensure that operations on all DSRC channels are protected from harmful interference. Consistent with our comments, the comments of others establish that DSRC is no longer in pre-deployment mode, but is being deployed significantly in a number of jurisdictions across the country. These deployments include vehicle-to-vehicle ("V2V"), vehicle-to-infrastructure ("V2I"), and vehicle-to-pedestrian ("V2P") applications and depend on reliable, interference-free use of all DSRC channels, not just the channel limited to V2V communications.

The comments also compellingly demonstrate why, of the two sharing approaches being considered, "detect and avoid" is superior to "re-channelization." Detect and avoid will more likely protect DSRC from harmful interference and will not require any changes to DSRC's system design or the Federal Communications Commission's ("Commission" or "FCC") DSRC rules. Because no changes to the DSRC system, broader DSRC ecosystem, or DSRC rules will be required, implementation of the detect and avoid approach will not delay the roll-out of this important safety technology. Contrary to the assertions of a few parties, including Qualcomm and Broadcom, re-channelization would require a change in DSRC hardware because new filters would likely have to be installed in DSRC devices to avoid emissions and interference from Wi-Fi devices operating in the 5850-5895 MHz band, as well as emissions and interference from more closely-packed DSRC-only operations in the 5895-5925 MHz band. The new hardware would then have to be tested and validated, delaying DSRC deployment by several years.

The parties that assert DSRC channel bandwidth and channel use restrictions can be changed via software updates alone have not been involved in any of the extensive DSRC testing

to date by the Crash Avoidance Metrics Partnership ("CAMP"), U.S. Department of Transportation ("USDOT"), and others. They therefore have no basis on which to claim that the major revisions they tout would not significantly delay the roll-out of DSRC. Data regarding detection of Qualcomm's own 10 MHz DSRC chips submitted into the Institute of Electrical and Electronic Engineers ("IEEE") DSRC Coexistence Tiger Team ("IEEE Tiger Team") process belie Qualcomm's claim that the detection of 10 MHz channel DSRC preambles cannot be reliably achieved by Wi-Fi devices that operate using channels that are wider than 10 MHz.

Parties claiming that re-channelization would better protect DSRC fail to explain how DSRC applications envisioned for the lower 45 MHz of the DSRC band would be better protected. Qualcomm has yet to define the parameters of its proposal to give priority to DSRC in that lower portion, 5850-5895 MHz. What parameters would be used under the Qualcomm scheme to prioritize DSRC traffic in that portion of the band? If DSRC in that portion were required to operate on 20 MHz channels, how would Unlicensed National Information Infrastructure ("U-NII") devices be able to distinguish DSRC signals from U-NII signals? Qualcomm and Broadcom also fail to explain how DSRC-to-DSRC interference would be avoided when the most latency-sensitive DSRC safety communications channel, the higher-powered DSRC control channel, and the highest-powered DSRC channel of all (the public safety channel) are all squeezed together in a contiguous 30 MHz block of spectrum – with no guard bands – at the top of the 5.9 GHz band. They do not explain how such interference would be avoided because their proposal has never acknowledged the likelihood of such interference.

The National Cable & Telecommunications Association ("NCTA") suggests that DSRC communications deserve no priority at all vis-a-vis commercial Wi-Fi in the lower 45 megahertz of the 5.9 GHz band. Acceptance of NCTA's approach would make unreliable and wholly

unworkable the many V2I and V2P deployments that have either already begun or will soon begin throughout the country.

As we have stated, the detect and avoid approach would open up a significant amount of spectrum for new Wi-Fi use, especially indoors. Since 95 percent of all Wi-Fi use is indoors, the detect and avoid approach would greatly satisfy the need for additional Wi-Fi spectrum.

Based on these considerations, the FCC should move forward to test the feasibility of the detect and avoid approach and reject the re-channelization approach as insufficient to protect incumbent DSRC operations and the investment-backed expectations of DSRC stakeholders, and as therefore impractical and unworkable.

We recognize that spectrum is a finite resource and are open to sharing the DSRC band with unlicensed devices to the extent practicable. We also recognize that the DSRC communications that deserve the most interference protection depend upon low-latency and high availability for safety and support of automated vehicle functionality and robustness. As the Commission evaluates the feasibility of spectrum sharing by proceeding with its test plan to consider prototype devices, we have experience and resources available to assist the Commission in ensuring that a full record is developed on this important topic.

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REPLY COMMENTS OF THE ALLIANCE OF AUTOMOBILE MANUFACTURERS, ASSOCIATION OF GLOBAL AUTOMAKERS, INTELLIGENT TRANSPORTATION SOCIETY OF AMERICA, AND DENSO INTERNATIONAL AMERICA, INC.

I. INTRODUCTION.

The Alliance of Automobile Manufacturers ("Alliance"),[1] Association of Global Automakers ("Global Automakers"),[2] Intelligent Transportation Society of America ("ITSA"),[3]

[1] The Alliance is an association of twelve of the world's leading car and light truck manufacturers, including BMW Group, FCA US LLC, Ford Motor Company, General Motors Company, Jaguar, Land Rover, Mazda, Mercedes-Benz USA, Mitsubishi Motors, Porsche, Toyota, Volkswagen Group of America, and Volvo Cars. *See* Alliance of Automobile Manufacturers, *Members*, http://www.autoalliance.org/about-the-alliance/overview.

[2] Global Automakers' automobile manufacturer members include: American Honda Motor Co., Aston Martin Lagonda of North America, Inc., Ferrari North America, Inc., Hyundai Motor America, Isuzu Motors America, Inc., Kia Motors America, Inc., Maserati North America, Inc., McLaren Automotive Ltd., Nissan North America, Inc., Subaru of America, Inc., Suzuki Motor of America, Inc., and Toyota Motor North America, Inc. Its supplier members include: Delphi Corporation, Denso International America, Inc., Robert Bosch GmbH, NXP Semiconductors USA, Inc., and Sirius XM. *See* Global Automakers, *Members*, http://www.globalautomakers.org/members.

[3] Established in 1991, ITSA is the leading advocate for the development and deployment of communications and other advanced technologies that improve the safety, security and efficiency of the nation's surface transportation system – collectively termed "Intelligent Transportation Systems." Its members include private corporations, public agencies, and academic institutions involved in the research, design, development and deployment of ITS.

and DENSO International America, Inc. ("DENSO") respectfully submit these reply comments in response to the *Public Notice* issued by the Commission in the above-captioned proceeding.[4]

As explained below, DSRC is moving towards widespread deployment and promises to make driving and transportation safer and more efficient with safety-related applications. Contrary to the assertions of a minority of commenters, the detect and avoid approach is far superior to re-channelization because it is better suited to protect DSRC from harmful interference and would not require DSRC equipment or applications to be redesigned. The record also demonstrates that the detect and avoid approach would not require extensive re-testing and would allow significant amounts of spectrum in the 5.9 GHz band to be used for commercial Wi-Fi. Meanwhile, commenters broadly agree that the Commission should allow unlicensed use in the 5.9 GHz band only if a sharing approach can be shown to reliably protect DSRC, and they also caution that the FCC's testing plan should prioritize safety over rapid completion of the testing.

II. THE DETECT AND AVOID APPROACH IS FAR MORE LIKELY TO PROTECT DSRC FROM HARMFUL INTERFERENCE.

The comments reflect broad agreement, consistent with DSRC's incumbent and primary licensee status, that the Commission should adopt a 5.9 GHz band sharing approach only if it has been proven capable of protecting DSRC from harmful interference.[5] These comments confirm

[4] *The Commission Seeks to Update and Refresh the Record in the "Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band" Proceeding*, Public Notice, 31 FCC Rcd 6130 (2016) ("*Public Notice*").

[5] *See, e.g.*, Letter from John S. Halikowski, Dir., Arizona Dept. of Transp., to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-49 (July 7, 2016) ("ADOT Comments"); Comments of the Ass'n of Public-Safety Communications Officials-Int'l, Inc., ET Docket No. 13-49, at 2 (July 7, 2016) ; Comments of the State of California Dept. of Transp. , ET Docket No. 13-49,at 9-10 (July 7, 2016) ("Caltrans Comments"); Letter from Stan Low, IT Div. Mgr., ABQ RIDE, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-49, at 3-4 (July 7, 2016) ("Albuquerque Comments"); Comments of the Intelligent Transp. Soc'y, ET Docket No. 13-49, at 10 (July 8, 2016); Letter from Jennifer Toth, Dir. of Transp./Cty. Eng'r, Maricopa Cty., to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-49, at 2-3 (July 6, 2016)

that DSRC has been exhaustively tested in the laboratory and on test tracks, and is in the process of transitioning into real-world deployments. Contrary to the assertions of a small minority of commenters,[6] the detect and avoid sharing approach shows far more promise as a means of protecting DSRC than does the re-channelization approach.[7]

A. The Record Demonstrates the Superiority of the Detect and Avoid Approach.

The detect and avoid approach is designed to work around DSRC operations in a way that is consistent with the FCC's DSRC rules, which were carefully crafted to minimize interference to DSRC.[8] In contrast, the re-channelization approach would undermine DSRC's ability to use the lower 45 MHz portion of the 5.9 GHz band and could eliminate or crowd out

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("Maricopa County Comments"); Letter from Steve Heminger, Exec. Dir., Metro. Transp. Comm'n, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-49, at 2 (July 6, 2016); Letter from Kirk T. Steudle, Dir., Michigan Dept. of Transp., to the Hon. Thomas Wheeler, Chairman, FCC, ET Docket No. 13-49,at 1-2 (July 6, 2016); Mid-Region Metro. Planning Org. Comments at 2; Letter from Paul Patrick, President, Nat'l Ass'n of State EMS Officials et al., to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-49, at 3-4 (July 7, 2016) ("National Association of State EMS Officials et al. Comments"); Comments of the Natl. Public Safety Telecomm. Council, ET Docket No. 13-49, at 4 (July 7, 2016); Letter from Deborah A.P. Hersman, President & CEO, Natl. Safety Council, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-49,at 2 (July 7, 2016); Letter from Charles Remkes, Chief, New Mexico Dept. of Transp. ITS Operations, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-49, at 3-4 (July 5, 2016) ("NMDOT Comments"); Comments of the Port Auth. of New York and New Jersey, ET Docket No. 13-49, at 2 (July 7, 2016); Letter from Huei Peng, Dir., Univ. of Michigan Mobility Transformation Ctr., to the Hon. Tom Wheeler, Chairman, FCC, ET Docket No. 13-49,at 2-3 (July 5, 2016); Letter from Carlos M. Braceras, Exec. Dir., Utah Dept. of Transp., to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-49,at 3-4 (July 7, 2016); Letter from Roger Millar, Acting Secretary, Washington State Dept. of Transp., to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-49, at 2-4 (July 7, 2016) ("WSDOT Comments").

[6] *See, e.g.*, Comments of Qualcomm Inc., ET Docket No. 13-49, at 3-6, 11-13 (July 7, 2016) ("Qualcomm Comments"); Comments of the Wireless Internet Service Providers Ass'n, ET Docket No. 13-49, at 3-4 (July 7, 2016) ("WISPA Comments").

[7] *See, e.g.*, Comments of the Alliance et al., ET Docket No. 13-49, at 25-29 (July 7, 2016) ("Alliance et al. Comments"); Comments of Toyota Motor Corp., ET Docket No. 13-49, at 2-12 (July 7, 2016) ("Toyota Comments"); Further Comments of Cisco Systems, Inc., ET Docket No. 13-49, at 15 (July 7, 2015) ("Cisco Comments"); Comments of the CAR 2 CAR Communication Consortium, ET Docket No. 13-49, at 2 (July 7, 2016) ("C2C Comments").

[8] *See* Alliance et al. Comments at 10-12, 25-29; Comments of Delphi Auto., ET Docket No. 13-49, at 1-4 (July 6, 2016); Letter from Ari Q. Fitzgerald, Counsel, the Alliance, et al., to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-49 (Dec. 22, 2015) ("Alliance et al. Dec. 22 Letter").

important DSRC applications from the three remaining DSRC-exclusive channels.[9] It also does not allow for a guard band between the DSRC-exclusive channels and the remaining lower portion of the commercial Wi-Fi band,[10] which Cisco observes would force the FCC to "confront whether safety-related communications can function with a 'hard' [out-of-band emissions ("OOBE")] limit vis-à-vis U-NII-4 devices in the lower 40 MHz, and vice-versa."[11]

Qualcomm, the main proponent of the re-channelization approach, acknowledges the feasibility of 10 MHz DSRC packet detection by wider bandwidth U-NII devices, which is the mechanism employed under the detect and avoid approach.[12] Indeed, as discussed in more detail below in Section IV, the feasibility of such detection was demonstrated in the IEEE Tiger Team process, which showed detection of signals from 10 MHz DSRC chips manufactured by Qualcomm.[13] It was also demonstrated in the *ex parte* filing last year by the Alliance, Global Automakers, DENSO, and Cisco, which described the results of an initial round of feasibility testing of the detect and avoid approach.[14] The Commission should therefore discount Qualcomm's statements regarding the difficulties associated with developing, testing, and validating detect and avoid capabilities for U-NII-4 devices.[15]

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[9] *See* Alliance et al. Comments at 26-27; Cisco Comments at 9.

[10] *See id*.; Cisco Comments at 9.

[11] Cisco Comments at 9.

[12] *See* Qualcomm Comments at 8 (noting that "simultaneous detection of multiple [801.11] bandwidths is possible").

[13] *See* Brian Gallagher and John Kenney, *DSRC PER versus RSS profiles*, doc. IEEE 802.11-13/1360r0 (Nov. 8, 2013), https://mentor.ieee.org/802.11/dcn/13/11-13-1360-00-0reg-dsrc-per-versus-rss-profiles.pptx ("*DSRC PER versus RSS profiles*").

[14] *See* Alliance et al. Dec. 22 Letter.

[15] *See* Qualcomm Comments at 8 (asserting that additional hardware and testing would be required to equip U-NII devices with detect and avoid capability).

Qualcomm and Broadcom concede that the FCC's recent relaxation of the rules limiting U-NII-3 OOBEs into the 5.9 GHz DSRC band will increase the likelihood of harmful interference to DSRC safety-of-life operations, including V2V.[16] However, contrary to the claims of Qualcomm and Broadcom, the best way to address that issue is not to move DSRC safety-of-life operations to the upper portion of the DSRC band, where they will be vulnerable to interference from other higher-powered DSRC and satellite transmissions, but to instead grant the pending Alliance/Global Automakers petition for reconsideration, which would limit the FCC's newly relaxed U-NII-3 OOBEs to point-to-point U-NII-3 systems.[17] The fact that the FCC has made DSRC safety-of-life operations more susceptible to interference in its recent decision should not serve as a basis for further undermining the reliability of DSRC operations.

B. The Re-channelization Approach Remains Ill-Defined and Untested.

Re-channelization proponents still have not provided critical details regarding this approach, let alone demonstrated its feasibility through testing. For example, Qualcomm has not explained how it would prioritize DSRC in the lower, shared portion of the DSRC band, aside from indicating that it would be easier if DSRC used 20 MHz channels. Qualcomm also has not addressed the tension between its 20 MHz channelization proposal and the current body of DSRC research, which establishes the superiority of 10 MHz channels for latency-sensitive DSRC applications.[18]

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[16] *See id*. at 4; Comments of Broadcom Ltd., ET Docket No. 13-49, at 7 (July 7, 2016) ("Broadcom Comments"); Global Automakers and the Alliance, Petition for Reconsideration, ET Docket No. 13-49 (May 6, 2016) ("Petition for Reconsideration").

[17] *See* Petition for Reconsideration.

[18] *See, e.g.*, Lijian Xu et al., *Communication Information Structures and Contents for Enhanced Safety of Highway Vehicle Platoons*, at 11-12 (Nov. 2014), http://bit.ly/29Edrnh (explaining that using 10 MHz channels for DSRC "brings better wireless channel propagation with respect to multi-path delay spread and Doppler effects caused by high mobility and roadway environments").

After more than three years, we still have almost no information from re-channelization proponents regarding how primary licensed and protected DSRC operations in the 5850-5895 MHz band would be given priority over unlicensed commercial Wi-Fi. Qualcomm merely notes that "existing Quality of Service enhancement mechanisms already in 802.11 standards" could be used, but this glaring lack of specificity makes it impossible to have any confidence that DSRC in the 5850-5895 MHz band would indeed be protected.[19] Broadcom argues that DSRC can be prioritized "through current Enhanced Distribution Channel Access ('EDCA') technologies."[20] However, EDCA is an 802.11 standard-specific prioritization mechanism that may prevent other, non-802.11 communication technologies from sharing the 5850-5895 MHz band on an equal basis with Wi-Fi. Any qualifying traffic prioritization should be technology independent.

Qualcomm and Broadcom also fail to explain how DSRC-to-DSRC interference would be avoided when the most latency-sensitive DSRC safety communications, higher-powered DSRC control channel communications, and the highest-powered DSRC communications of all (public safety communications) are all squeezed together into a 30 MHz block of spectrum (with no guard bands) at the top of the 5.9 GHz band.[21] They fail to explain how such interference

[19] Qualcomm Comments at 7.

[20] Broadcom Comments at 12-13.

[21] *See* Qualcomm Comments; Broadcom Comments.

would be avoided because their plan – unlike many commenters in this proceeding[22] – has never acknowledged the likelihood of such interference.[23]

The re-channelization approach thus raises serious concerns while lacking sufficient specificity for stakeholders to fully understand its potential effects. For example, DSRC channels 172, 178, and 184 have specific use designations under the Commission's current DSRC rules. Would channels 172, 178, and 184 retain their current use designations under the re-channelization approach? How would U-NII and DSRC communications share the U-NII-4 band? Would DSRC radios need to be modified to implement the recommended 5850-5895 MHz band priority mechanism? What would be the maximum power limit allowed for Wi-Fi communications in the UNII-4 band? What parameters would be used to prioritize DSRC traffic? If DSRC in that portion were required to operate on 20 MHz channels, how would U-NII devices be able to distinguish DSRC signals from U-NII signals?[24] The Commission simply must have more information if it is to seek comment on, test, and properly evaluate this approach.

III. DSRC EQUIPMENT WOULD HAVE TO BE EXTENSIVELY REDESIGNED UNDER THE RE-CHANNELIZATION APPROACH.

The record demonstrates that another advantage of the detect and avoid approach is that it would not require DSRC onboard units or roadside units ("RSUs") to be redesigned, whereas

[22] *See, e.g.*, Alliance et al. Comments at 27, 38-41; Letter from Steve Handschuh, President & CEO, Motor & Equipment Manufacturers Ass'n., to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-49,at 3-4 (July 7, 2016) ("MEMA Comments"); National Ass'n of State EMS Officials et al. Comments at 2-3 ("NASEMO et al. Comments"); Comments of the American Ass'n of State Highway & Transp. Officials, ET Docket No. 13-49, at 7 (July 7, 2016).

[23] *See, e.g.*, Qualcomm Comments; Broadcom Comments.

[24] *See Ex Parte* Letter from Ari Q. Fitzgerald, Counsel to the Alliance of Automobile Manufacturers, et al. to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-49 (Apr. 14, 2016). ("Alliance et al. Apr. 14 Letter").

significant changes would be necessary under the re-channelization approach.[25] Qualcomm and Broadcom claim to the contrary that re-channelization "can be achieved without any changes to DSRC chipsets or related hardware."[26] Instead, they claim, "a software modification is all that is required."[27] That is simply not the case.

Contrary to Qualcomm and Broadcom's claims, the re-channelization approach would indeed require a change in DSRC hardware. For example, new filters would likely need to be installed in DSRC devices to avoid emissions from Wi-Fi devices operating in the 5850-5895 MHz band, as well as emissions from more closely-packed DSRC-only operations in the 5895-5925 MHz band. The new hardware would then have to be tested and validated, delaying by several years DSRC deployment.

This means that the changes to existing DSRC-equipped vehicles and roadside units required by re-channelization likely could not be achieved via software updates alone. Instead, a chip-level filtering improvement would likely be required. DSRC-equipped vehicles already on the road would have to be called back for service, possibly including significant hardware replacement. Moreover, the new components that would be required could be more expensive and physically larger than the vehicles' original components, complicating any service updates. In addition, DSRC system architecture and hardware changes might be needed.

Notably, neither Qualcomm nor Broadcom has been involved in the extensive DSRC testing to date by the CAMP, USDOT, and others. Their experience and competence with DSRC systems extend only to the chipsets that such systems may use. They therefore have no basis on

[25] *See, e.g.*, Alliance et al. Comments at 38-42; Cisco Comments at 5-6; Metro. Planning Org. Comments at 1-2; Hyundai Comments at 1-2; Comments of Volvo Group North America, ET Docket No. 13-49, at 3 (July 7, 2016); MEMA Comments at 4-5; Albuquerque Comments at 3.

[26] Qualcomm Comments at 9-11; Broadcom Comments at 9-10.

[27] Broadcom Comments at 9; Qualcomm Comments at 9-11.

which to claim that the major revisions they are touting would not significantly delay the roll-out of DSRC.

A. Entities With Experience Developing DSRC Agree that Re-Channelization Would Require Costly and Time-Consuming Re-Testing, Delaying Deployment.

The commenters who are the most experienced with developing and testing DSRC agree that adoption of the re-channelization proposal would require extensive DSRC re-testing, causing lengthy delays in the deployment of DSRC and squandering the testing and development resources spent to date. Many commenters also agree that if the detect and avoid proposal is adopted, no such delay in DSRC deployment is likely.[28]

Many state and local governmental entities that have been closely involved in the efforts to research and develop DSRC under the existing channelization oppose the re-channelization proposal. Commenters including the City of Albuquerque Transit Department, the City of New York, the Arizona Department of Transportation, and the Maricopa County Department of Transportation explained that millions of dollars have been spent developing DSRC under the current channelization, and the re-testing required under a re-channelization would "nullify the investments already made under the current channelization"[29] and delay the deployment of DSRC to consumers.[30] The Arizona Department of Transportation urged the Commission to protect "5.9 GHz and its current channel plan to capitalize on all the investment (both private and government), research, development, and testing. … Sharing of the spectrum should not be allowed unless it can be positively demonstrated that it will not interfere with or negatively affect

[28] *See, e.g.*, Albuquerque Comments at 2 ("The first passenger vehicle deployments will begin this year with tens of thousands of DSRC-equipped vehicles arriving on the roadways.").

[29] *Id.*

[30] *See e.g.*, Comments of the City of New York, ET Docket No. 13-49 (July 7, 2016); ADOT Comments; Albuquerque Comments; Maricopa County Comments.

the safety of life functions of the spectrum."[31] The City of New York explained that re-channelization would require it to "undertake a re-engineering and retesting effort" before it could deploy any DSRC safety applications, and that such an outcome "would needlessly require our city to abandon past taxpayer investments made in Connected Vehicle equipment technology."[32]

These comments only confirm that re-channelization would seriously delay, if not ultimately frustrate, the public value of DSRC. Automakers, too, have invested significant resources in the deployment of DSRC under the current channel plan. Additional resources would be required for development and testing if the re-channelization proposal were adopted. As explained by the General Motors Company ("GM"), the re-channelization approach "would require years of testing, thereby delaying the rollout of systems that could reduce the number of people injured and killed on the road . . . It also would significantly delay wider industry deployment efforts by requiring a redesign and overhaul of the Commission's existing DSRC rules (including band plan, channelization, and channel use designations), which would upset years of testing and research."[33] GM plans to begin deploying DSRC devices based on the Commission's existing DSRC rules, including the existing channelization requirement, in new GM vehicles as soon as Model Year 2017 (calendar year 2016).[34] Toyota outlined the changes that re-channelization would require in the design of DSRC electronic components, explaining that "the increase in cross-channel interference . . . will almost certainly require tighter filters

[31] ADOT Comments.

[32] City of New York Comments at 2.

[33] *See* Comments of General Motors Company, ET Docket No. 13-49, at 6 (July 6, 2016) ("GM Comments").

[34] *See* Press Release, GM, Cadillac to Introduce Advanced 'Intelligent and Connected' Vehicle Technologies on Select 2017 Models (Sept. 7, 2014), http://bit.ly/1SO5UMR ("GM Press Release").

from DSRC transmitters and receivers." And because of the "level of reliability and certainty expected of motor vehicle safety technology . . . the 're-channelization' concept will require significant re-testing of DSRC."[35] The Commission must heed the warnings of those entities experienced in testing and developing DSRC that the re-channelization approach would require costly and time-consuming re-testing.

B. The Re-Channelization Proposal Would Require Testing to Ensure the Reliability of Crash-Imminent Safety Applications.

If the re-channelization approach is adopted, the extensive research and testing already conducted to develop DSRC will have to be repeated, expending more resources and costing more time.[36] Indeed, this process would likely take the same amount of time and resources going forward as it has already consumed.[37] During this re-testing, consumers will not have access to the potential benefits of DSRC, which is otherwise ready for deployment this year.[38]

Significant testing would need to be conducted to determine whether the currently planned DSRC applications would cause harmful interference to the V2V crash-imminent safety applications when compressed onto adjacent DSRC-only channels. The necessary re-testing would include repeating the V2V crash-imminent safety testing to validate that the applications work reliably and consistently in the new channel structure. Because the re-channelization proposal would change the dedicated DSRC channel assignments and related characteristics, it would require re-testing the DSRC communications reliability for crash-imminent V2V safety applications in the context of congested, high-powered, adjacent DSRC channels, unlicensed radio communications on lower adjacent channels, unknown out-of-band interference from upper

[35] Toyota Comments at 11.

[36] Alliance et al. Comments at 29-30.

[37] *Id.*

[38] *See, e.g.*, GM Comments.

adjacent band usage, and same-channel interference at the upper end of the DSRC band from other incumbent 5.9 GHz users.[39]

Meeting the communications requirements of crash-imminent V2V safety applications may also require a redesign of DSRC channel maximum power limits, physical layer standards, and compliant radio hardware. The National Highway Traffic Safety Administration ("NHTSA") is likely to require positive results from such testing and redevelopment before proceeding to require DSRC capabilities in new vehicles.

The types of testing that were already conducted and would need to be repeated include both laboratory and track testing. The previous laboratory testing included receiver tests, under fading conditions and with interference, as well as transmitter tests. If the laboratory testing shows differences in transmitter or receiver performance as a result of compressing DSRC safety-of-life and public safety communications into only three 10 MHz channels at the upper end of the DSRC band, then new chip sets will need to be developed and integrated. In addition to laboratory tests, field tests would need to be repeated with different characteristics at the new channel settings to determine if crash-imminent safety applications could be supported under the various expected field conditions. The field testing required for the new hardware and with different performance values would include baseline scalability tests, non-baseline static scalability tests, and moving scalability tests.[40]

Finally, the Society of Automotive Engineers ("SAE") DSRC Technical Committee would need time to develop new technical requirements under the re-channelization approach. This committee's performance requirements for the on-board equipment's basic safety message

[39] *See* Alliance et al. Comments at 30.

[40] NHTSA, DOT HS 811 492C, *Vehicle Safety Communications– Applications Final Report: Appendix 2 Communications and Positioning*, at I-1–I-23 (Sept. 2011), http://bit.ly/29h33jR.

("BSM") transmission function took nine years to develop.[41] The committee developed its standards based on its understanding of the technology and the results of hundreds of vehicle hours of dynamic testing on radio signal reception and application-level performance. We expect that under re-channelization, re-testing would be both crucial and costly, both in terms of time and money, and therefore urge the Commission not to adopt this approach.

IV. THE DETECT AND AVOID APPROACH CAN BE IMPLEMENTED.

An important pillar on which Qualcomm's argument for re-channelization rests is found on the third page of its comments:

> In contrast to the detect-and-avoid proposal, rechannelization would have DSRC use 20 MHz channelization in the shared 5.850-5.895 GHz portion of the band because doing so will improve sharing by increasing the probability that unlicensed Wi-Fi equipment, which also uses 20 MHz channels, senses DSRC operations. Commercial Wi-Fi systems have successfully implemented 20 MHz channel sensing for over 15 years, and their performance is proven. Channel sensing in multiple 10 MHz channels simultaneously, which the detect-and-avoid proposal requires across the band, is not even defined in 802.11n, ac, or ax, so U-NII-4 operations under this proposal likely would require new hardware and extensive verification testing.[42]

This argument is severely flawed, as discussed below.

First, it is incorrect to say that Wi-Fi equipment will have an increased probability of detecting 20 MHz DSRC packets compared to 10 MHz DSRC packets. The opposite is true. 20 MHz channels have twice as much noise as 10 MHz channels. Detection of DSRC packets depends on the signal-to-noise ratio, and therefore detection of 10 MHz DSRC packets will be effective at more sensitive signal levels than detection of 20 MHz DSRC packets. This fact is recognized in the IEEE 802.11-2012 standard (Table 18-14, copied below), where required sensitivity levels are 3 dB more relaxed for 20 MHz channels than for 10 MHz channels:

[41] *See* Alliance et al. Comments at 37.

[42] Qualcomm Comments at 3.

Table 18-14—Receiver performance requirements

Modulation	Coding rate (R)	Adjacent channel rejection (dB)	Alternate adjacent channel rejection (dB)	Minimum sensitivity (dBm) (20 MHz channel spacing)	Minimum sensitivity (dBm) (10 MHz channel spacing)	Minimum sensitivity (dBm) (5 MHz channel spacing)
BPSK	1/2	16	32	–82	–85	–88
BPSK	3/4	15	31	–81	–84	–87
QPSK	1/2	13	29	–79	–82	–85
QPSK	3/4	11	27	–77	–80	–83
16-QAM	1/2	8	24	–74	–77	–80
16-QAM	3/4	4	20	–70	–73	–76
64-QAM	2/3	0	16	–66	–69	–72
64-QAM	3/4	–1	15	–65	–68	–71

Second, it is misleading to imply that 10 MHz detection is an immature technology compared to 20 MHz detection. The 10 MHz preamble detection clear-channel-assessment ("CCA") function has been a part of the IEEE 802.11 standard since 2004, long before even the DSRC 802.11p amendment was published. Every DSRC device includes 10 MHz preamble detection functionality. The DSRC stakeholder community provided data to the IEEE Tiger Team showing that DSRC devices can detect DSRC packets with > 90% probability at -95 dBm receive signal strength.[43] Notably, commercial Qualcomm 802.11p chips performed the 10 MHz DSRC detection in those tests. Similar sensitivity has been observed in DSRC devices using 802.11 chips from other manufacturers.

Third, there is no need to modify standards to specify how 10 MHz DSRC detection will be achieved on multiple channels simultaneously. Within a set of 10 MHz DSRC detectors, the

[43] *See* Brian Gallagher and John Kenney, *DSRC PER versus RSS profiles*, doc. IEEE 802.11-13/1360r0 (Nov. 8, 2013), https://mentor.ieee.org/802.11/dcn/13/11-13-1360-00-0reg-dsrc-per-versus-rss-profiles.pptx.

individual detectors are functionally independent, so the specification of 10 MHz packet detection once is sufficient. As noted above, 10 MHz detection has been a part of the IEEE 802.11 standard since 2004. There are many ways to implement DSRC detection on multiple channels simultaneously.

Fourth, Qualcomm places emphasis on the need for a sharing method that requires no changes to existing Wi-Fi hardware.[44] Ironically, Qualcomm is willing to require dramatic changes to DSRC systems and rules in order to try to accommodate commercial Wi-Fi, but is unwilling to accept modest changes to Part 15 commercial Wi-Fi systems to protect a licensed, "safety-of-life" service. While this seems to be turning the relationship between licensed and unlicensed devices on its head, it is also the case that re-channelization actually requires changes to both DSRC and Wi-Fi hardware.

The Commission's draft test plan notes that "to ensure DSRC preferential access, a U-NII device must be capable of detecting an access-contending DSRC signal at energy levels that are equal to, or below, the DSRC receiver sensitivity level on each of the seven DSRC channels."[45] Even if the DSRC preamble detection requirements for the 5850-5895 MHz band shift from four simultaneous 10 MHz channels to two simultaneous 20 MHz channels, the IEEE 802.11ac standard would not specify, and current IEEE 802.11ac hardware would not support, simultaneous preamble detection on even two 20 MHz channels. Indeed, Qualcomm quotes the IEEE Tiger Team's final report on this point, observing that:

> [T]he secondary CCA mechanisms defined in 802.11ac do not comprehend secondary devices using Carrier Sense in multiple channels ...; in the case of DSRC coexistence, secondary CCA at Carrier Sense levels (<-85dBm) would have to be performed in

[44] *See* Qualcomm Comments at 8-9 (stating that "802.11ac Wi-Fi devices would need additional hardware to detect 10 MHz DSRC packets in multiple channels" and that "Rechannelization does not require any hardware changes").

[45] *Public Notice*, Attach. at 14.

> multiple channels simultaneously. This would require changes in the base 802.11 specification and would add complexity to existing 802.11ac chipsets.[46]

Qualcomm mistakenly asserts that this quote stems from the lack of a 10 MHz CCA definition within 802.11ac. In fact, this was a general statement about the lack of multiple-channel carrier sensing in 802.11ac for any channel bandwidth.

As for standardization of 10 MHz CCA, the IEEE Tiger Team's final report also states that the detect and avoid approach "uses standard 802.11 CCA."[47] In other words, the 802.11ac amendment did not need to specify 10 MHz CCA because it was already specified in the base 802.11 standard in 2004. The IEEE Tiger Team's final report, which was co-authored by Qualcomm engineers, further states that one of the objectives of the re-channelization concept is "to allow modified 802.11ac chipsets to be used with 160 MHz bandwidth channels to span from U-NII-3 into the new (shared) U-NII-4 band."[48]

Consequently, IEEE 802.11ac chipsets will indeed require hardware modifications in order to support the re-channelization approach, contrary to Qualcomm's assertions. In fact, re-channelization requires the same sort of modification that Qualcomm claims is only required by the detect and avoid approach (*i.e.*, the support of simultaneous DSRC preamble detection on multiple channels).

Fifth, under re-channelization, it would not even be sufficient for an 802.11ac device to perform preamble detection simultaneously on two channels. And Qualcomm does not mention another significant advantage of 10 MHz DSRC detection over 20 MHz detection. Because DSRC devices are the only devices that use the 802.11 10 MHz protocol in the 5.9 GHz band,

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[46] Qualcomm Comments at 13-14.

[47] IEEE P802.11 1 Wireless LANs, *Final Report of DSRC Coexistence Tiger Team*, doc.: IEEE 802.11-15/0347r0, at 8 (Mar. 2015), https://mentor.ieee.org/802.11/dcn/15/11-15-0347-00-0reg-final-report-of-dsrc-coexistence-tiger-team-clean.pdf.

[48] *Id*. (emphasis added).

the detection of a 10 MHz 802.11 preamble precisely identifies the packet as a DSRC packet. On the other hand, if DSRC were re-channelized to 20 MHz, the DSRC preamble would be indistinguishable between a DSRC packet and a non-DSRC 802.11 packet.

Qualcomm states that the re-channelization approach would allow "802.11ac (and future 802.11ax) devices [to] detect DSRC preambles, decode DSRC packets, and check for bits that identify them."[49] Since detection will no longer identify a packet as a DSRC packet, Qualcomm must prove that such identification is possible. Even if it is possible, the Commission should be very concerned about a re-channelization proposal that requires every unlicensed device to be capable of decoding DSRC packets. In fact, as established above, an 802.11ac system would need to be capable of decoding two DSRC packets simultaneously on channels 173 and 177, not merely detecting their preambles. Decoding a DSRC packet involves significant parsing of multiple protocol layers. This capability is not part of current 802.11ac systems, and indeed potentially goes far beyond the scope of an 802.11 media access control ("MAC") and physical ("PHY") standard. This type of deep packet inspection is likely to be much more expensive in the long run than implementing 10 MHz detectors based on the short training symbols in the PHY protocol. Detection based on decoding DSRC packets would also add significant latency compared to 10 MHz detection, which DSRC devices perform in 8 microseconds. Without the ability to distinguish DSRC packets from non-DSRC packets, the re-channelization proposal has no ability to give priority to DSRC packets in the shared portion of the 5.9 GHz band, as Qualcomm and other commenters recommend.

[49] Qualcomm Comments at 7.

V. DSRC IS POISED FOR WIDESPREAD DEPLOYMENT.

The record shows that private and public entities have relied on the current DSRC rules to conduct extensive research, testing, and deployment of DSRC systems in the 5.9 GHz band.[50] Many of these projects are poised for deployment after years of testing and pilot projects. These deployments include at least 35 public sector applications that are related to public safety.[51] These projects summarized in our initial comments are explained in greater detail in the comments of the public sector entities.

The California Department of Transportation ("Caltrans") noted that DSRC is reaching maturity in deployment and has already demonstrated the potential to save tens of thousands of lives per year.[52] For its part, Caltrans has spent more than $50 million to improve the safety and mobility of vehicles, deploying V2V and V2I communications since the early 1990s.[53] Having spent millions of dollars to build and update a connected car test bed, Caltrans is currently planning to invest another $10 million to expand its size form the current 11 consecutive signalized intersections to about 135 intersections in a corridor of about 30 miles.[54]

Likewise, Washington State has successfully deployed and tested DSRC on I-5 to support Active Traffic Management aimed at reducing accidents in stop-and-go congested traffic.[55] WSDOT is also working with the University of Washington to establish a connected vehicle test

[50] *See, e.g.*, Alliance et al. Comments at 37.

[51] *See, e.g.*, USDOT, *Connected Vehicle Pilot Deployment Program*, http://bit.ly/1wg2Kbq (last visited July 3, 2016) (providing the most recent reports from the New York City, Wyoming, and Tamp, Florida deployments).

[52] Caltrans Comments at 10.

[53] *Id.* at 4.

[54] *Id.* at 5-6.

[55] WSDOT Comments at 1.

bed to advance V2X applications.[56] And the Arizona Department of Transportation, in partnership with the Maricopa County Department of Transportation, is currently working on projects that utilize the DSRC band, including V2I technologies.[57]

Toyota predicts that roll-out of DSRC technologies in the U.S. is imminent, explaining that it has already incorporated DSRC technology in three models in Japan by the end of 2015.[58] As noted in a previous section, GM will deploy DSRC devices, in the U.S. market, based on the FCC's existing DSRC rules – including the existing channelization requirements – in its Model Year 2017 Cadillac CTS.[59] These vehicles will be equipped with FCC-compliant DSRC radios and will be available for purchase during calendar year 2016.[60]

During the next few months, there will be several safety-related DSRC V2I deployments in the U.S. that use DSRC channels other than Channel 172. New York City, Wyoming, and Tampa, Florida, "will receive up to $42 million to pilot next-generation technology in infrastructure and in vehicles to share and communicate anonymous information with each other and their surroundings in real time, reducing congestion and greenhouse gas emissions, and cutting the unimpaired vehicle crash rate by 80 percent."[61]

New York City will deploy 10,000 DSRC-equipped vehicles and 380 RSUs at signalized intersections in Manhattan and Brooklyn corridors to deploy various vehicular safety

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[56] *Id.*

[57] ADOT Comments.

[58] Toyota Comments at 1.

[59] *See* GM Press Release.

[60] *See id.*

[61] *See* Press Release, USDOT, U.S. Department of Transportation Announces up to $42 Million in Next Generation Connected Vehicle Technologies (Sept. 14, 2015), http://www.its.dot.gov/press/2015/ngv_tech_announcement.htm ("USDOT Announces $42 Million").

applications.[62] RSUs will be installed at other locations, including vehicle fleet terminals, river crossings, and airports, for communicating with DSRC-equipped aftermarket safety devices.[63] Separately in New York, approximately 40 RSUs have been installed for urban application and traffic management around the Jacob Javits Center in Manhattan and along the Long Island Expressway.[64]

The Wyoming Pilot will involve applications that use V2I and V2V connectivity to support a flexible range of services that improve safety and mobility, deploying Road Weather Advisories and Warnings for Motorists and Freight Carriers; Weather-Responsive Variable Speed Limit System; Freight-Specific Dynamic Travel Planning; Spot Weather Impact Warning; Situational Awareness; and others to be determined by needs of truck drivers and fleet managers in the corridor.[65]

The Tampa Pilot will deploy a variety of connected vehicle technologies on and within the vicinity of the Lee Roy Selmon Expressway reversible express lanes in downtown Tampa.[66] In addition to the Expressway, the deployment area includes bus and trolley services, high pedestrian densities, special event trip generators, and highly variable traffic demand over the

[62] *See, e.g.*, USDOT Announces $42 Million; New York City Dept. of Transportation, FHWA-JPO-16-299, *Connected Vehicle Pilot Deployment Program Phase 1 ,Concept of Operations (ConOps) – New York City*, at 17-18 (Apr. 8, 2016), http://bit.ly/29tMvUG.

[63] *See id*. at 4.

[64] Comments of the OmniAir Consortium, ET Docket No. 13-49, at 3 (July 7, 2016) ("OmniAir Comments").

[65] *See* ICF Int'l et al., FHWA-JPO-16-288, *Connected Vehicle Pilot Deployment Program Phase 1, Security Management Operational Concept – ICF/Wyoming*, at 8, 54-59 (Mar. 14, 2016), http://bit.ly/29e8uRz.

[66] Booz Allen Hamilton & Tampa Hillsborough Expressway Auth., FHWA-JPO-16-312, *Connected Vehicle Pilot Deployment Program Phase 1, Security Management Operational Concept – Tampa Hillsborough Expressway Authority (THEA)*, at 26 (May 2016), http://bit.ly/29tP2hM.

course of a typical day.[67] It will deploy a variety of V2V and V2I safety, mobility, and agency data applications to create reinforcing benefits for motorists, pedestrians, and transit operators.[68]

Additional DSRC-enabled V2X deployments are being finalized for other parts of the country.[69] The Virginia DoT installed more than 48 RSUs on I-495 and I-66, major highways in Fairfax County.[70] In Orlando, the Florida DoT has deployed 29 RSUs around the Orange County Convention Center for the purposes of interfacing with onboard equipment and connecting with Florida DoT's District Five SunGuide® advanced transportation management system.[71] Also in Florida, Kapsch TrafficCom has worked closely with Lee County's electronic toll collection system "to develop and host North America's first fully integrated 5.9 GHz DSRC open road tolling system with vehicle enforcement," which includes "a high-performance automatic license plate recognition system using both infrared and white light cameras for each lane, as well as a laser vehicle classification system based on FHWA's axle estimation Scheme F."[72] In Novi, Michigan, as many as 50 RSUs have been deployed "specifically designed to support DSRC testing in the 5.9 GHz Band," covering 45 square miles and both signalized and

[67] *See id*. at 19.

[68] *See id*. at iii, 73-97. The applications that will be deployed include: Curve Speed Warning; Intelligent Traffic Signal System; Intersection Movement Assist; Mobile Accessible Pedestrian Signal; and Transit Signal Priority. *See id.* at 75, 87, 93.

[69] *See, e.g.*, Press Release, Colorado Dept. Transp., HERE and Colorado Department of Transportation Announce First of its Kind Connected Vehicle Project in North America (Jan. 11, 2016), http://bit.ly/1ZAxXbO.

[70] Kimley-Horn and Associates, Inc. & ch2m, *I-66 Corridor Improvements Project: Transit and Transportation Demand Management (TDM) Technical Report Draft*, at 1-12 (May 12, 2105), http://bit.ly/29oWRan.

[71] Florida Dept. Of Transp., *FDOT ITS Program Annual Report FY 2013-14*, at 16 (2014), http://bit.ly/29zV68A; OmniAir Comments at 4.

[72] Letter from Suzanne Murtha, Exec. Dir., OmniAir, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-49, at Attach. (Apr. 9, 2014).

un-signalized intersections.[73] Finally, for the PrePass Pilot I-70 Corridor project, "Kapsch, in collaboration with Help Inc., and Xerox, built an escreening Pilot Corridor with the objective of demonstrating the power of automated escreening utilizing 5.9 GHz DSRC [with] six inspection stations equipped with RSE in the I-70 corridor" to facilitate more accurate weighing of trucks traveling across the interstate.[74] Licensees run the gamut from government entities such as the Honolulu Board of Water Supply,[75] to private companies, such as Veniam, Inc.[76]

Some of these deployments may be supported by federal transportation funding provided through the Fixing America's Surface Transportation ("FAST") Act,[77] while others will be supported by state transportation funding.[78] At the same time, the SAE International standards-setting process for V2P operations on Channel 176 is well underway and close to completion, and a DSRC pedestrian protection deployment will be launched in Lower Manhattan, New York

[73] *Id.* at 4-5; *see also* Fran Perry, *Leidos CV Projects: Michigan CAV working Group Meeting*, at 4 (May 28, 2016), http://bit.ly/29n9Aq2.

[74] Letter from Suzanna Murtha, Executive Director, OmniAir, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-49, at Attach. (Apr. 9, 2014).

[75] Honolulu County created the Joint Traffic Management Center, an agency intended to coordinate six other state agencies and oversee the implementation and management of ITS programs for "reduc[ing] traffic congestion on the island of Oahu through the application of current technology in the operations of the county's traffic signal and CCTV systems." *See* City and County of Honolulu, *Hōkū Pa'a Joint Traffic Management Center*, http://www.honolulu.gov/jtmc.html (Feb. 3, 2016); Am. Council of Engineering Companies of Hawaii, *Workshop Registration Form*, http://bit.ly/29p4htf (last visited July 5, 2016).

[76] *See, e.g.*, FCC, *Universal Licensing System*, Call Sign WQXP441, http://bit.ly/29j8s6C (last searched July 6, 2016).

[77] *See* Pub. Law No. 114-94 (signed Dec. 4, 2015).

[78] For example, the Colorado Department of Transportation committed $20 million for 2016 to kick-start its RoadX program, which includes V2I deployment. *See* Colorado Dept. Transp., *Colorado's Vision: RoadX*, at 7, https://www.codot.gov/programs/roadx/roadx-vision (last visited July 1, 2016).

City, next year as part of the connected vehicle pilot activity.[79] These developments are in addition to NHTSA's anticipated mandate.[80]

In June 2016, the USDOT selected Columbus, Ohio as the winner of its inaugural Smart City Challenge ("SCC"), a designation that brings with it $40 million in USDOT funding – as well as up to $100 million in private sector funding – to aid Columbus in "[reshaping] its transportation system to become part of a fully-integrated city that harnesses the power and potential of data, technology, and creativity to reimagine how people and goods move throughout their city."[81] DSRC will play a central role in modernizing the city's transportation system. The city plans to equip 175 intersections throughout 50 miles of roadways with DSRC RSUs.[82] These "smart" intersections will be able to communicate with at least 3,000 DSRC-equipped vehicles, including transit buses, city vehicles, trucks, school buses, and privately-owned vehicles.[83] Numerous V2X safety applications will be deployed, including Stopped Vehicle Ahead Warning, Emergency Electronic Brake Lights, Emergency Vehicle Signal Preemption, School Zone Safety Warning, and Pedestrian Safety Warning.[84] From a security standpoint, both the back-end and the in-vehicle systems will be fully operational to ensure the authenticity and integrity of the data exchange, as well as the overall security and privacy protections of the system. Heavy-duty trucks equipped with DSRC, combined with adjustable

[79] *See* Letter from David Schwietert, Exec. Vice President, the Alliance, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-49 at 2 (Jun. 2, 2016).

[80] *See* NHTSA, *Federal Motor Vehicle Safety Standards: Vehicle-to-Vehicle (V2V) Communications*, Advance Notice of Proposed Rulemaking, 79 Fed. Reg. 49270 (Aug. 20, 2014).

[81] *See* Press Release, USDOT, U.S. Department of Transportation Announces Columbus as Winner of Unprecedented $40 Million Smart City Challenge (June 23, 2016), http://bit.ly/28QqhKz.

[82] *See* City of Columbus, Solicitation No. DTFH6116RA00002, *Beyond Traffic: The Smart City Challenge Phase 2*, at 8 (May 24, 2016), http://bit.ly/29A1fnH.

[83] *See id*. at 15.

[84] *See id*. at 8, 9, 17.

signal phase and timing information gleaned from DSRC-equipped RSUs, will demonstrate the potential safety and efficiency gains to be had through platooning. The Columbus SCC plan involves truck platooning and freight signal priority ("FSP") for trucks in platoon, with both applications using DSRC.[85]

Harmful interference through re-channelization or other means threatens to undermine these DSRC deployments and set DSRC research and development back years, thereby delaying the deployment of critical safety applications.

VI. RE-CHANNELIZATION PROPONENTS MISCHARACTERIZE CONGRESS'S INTENT.

Several re-channelization proponents make arguments that purport to have their foundation in Congressional intent, but in reality have no connection to Congress's goals with respect to DSRC and therefore do not warrant consideration here.[86] For example, NCTA claims that Congress never intended DSRC applications that are not exclusively related to safety-of-life (*e.g.*, "non-crash avoidance DSRC operations") to have a right to operate interference-free under license within the band.[87] This is flatly wrong.

The Intermodal Surface Transportation Efficiency Act of 1991 ("ISTEA")[88] specified broad goals which the Commission should heed in resolving this proceeding. Congress directed the research, development, and operational testing of intelligent transportation systems ("ITS") to, among other things: enhance the "safe and efficient" operation of the nation's highway

[85] Press Release, The White House, Fact Sheet: Obama Administration Announces Columbus, OH Winner of the $40 Million Smart City Challenge to Pioneer the Future of Transportation, (June 23, 2016), http://bit.ly/28OLVji.

[86] *See, e.g.*, Comments of the National Cable & Telecommunications Association, WT Docket No. 13-49 (July 7, 2016) ("NCTA Comments"); WISPA Comments.

[87] NCTA Comments at 2, 12-17.

[88] 105 Stat. 1914, 102 P.L. 240 (1991).

systems; enhance states' efforts to attain air quality goals set by the Clean Air Act; and reduce the "societal, economic, and environmental costs associated with traffic congestion."[89] Congress left no room for doubt that the applications it sought to encourage in passing ISTEA included, but were not limited to, crash avoidance.[90] Crash avoidance is, of course, an essential element of the future of public safety; so too, however, are uses that control the flow of traffic and thereby potentially enhance fuel efficiency, increase traffic flow, and further other national and local goals.

The parties to the original DSRC spectrum allocation proceeding equally understood that "DSRC is indispensable to the widespread deployment of ITS"[91] and that the "ultimate goal" was, and is, "increasing safety and efficiency."[92] The Commission agreed: "The record in this proceeding overwhelmingly supports the use of spectrum to support ITS services to increase the safety and efficiency of the Nation's transportation infrastructure."[93] Indeed, the FCC "believe[ed] it important to propose an allocation sufficiently large to accommodate existing and emerging services plus future development of the full panoply of DSRC applications which have great potential to improve highway safety and efficiency."[94] The Commission thus determined to allocate a "significant amount of . . . spectrum" to "further the goals of the National ITS program and encourage the development of advanced technologies to increase the safety and

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[89] ISTEA at § 6052(b).

[90] *See id*.

[91] *See* Petition for Rulemaking of ITSA, at 10 (May 19, 1997) ("ITSA Petition for Rulemaking").

[92] *Id*. at ii.

[93] *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*, Notice of Proposed Rulemaking, 13 FCC Rcd 14321 ¶ 7 (1998) ("*1998 Notice of Proposed Rulemaking*"); *see also* ITSA Petition for Rulemaking at 34; USDOT Comments, RM 9096, at 3-4 (July 28, 1997).

[94] *1998 Notice of Proposed Rulemaking* ¶ 14.

efficiency of the national transportation infrastructure well into the future."[95] Not only were then-existing DSRC applications considered, but future applications were considered as well.

Efficiency and safety are two interrelated building blocks supporting the foundations of ITS and DSRC. To argue that Congress intended one, but not the other, is to misunderstand the entire premise of ITS and DSRC. NCTA, in arguing to allow priority for DSRC's safety applications within the 5.9 GHz band, while de-prioritizing and separating all other uses and purposes, fails to understand the connectedness of safety and efficiency applications within DSRC. Congress understood these principles when it enacted the ISTEA and TEA-21. The FCC understood these principles throughout the matters before it. The automobile industry has relied upon this understanding in the development and deployment of DSRC technology. There is no valid reason or grounds for changing the basic purposes of ISTEA, TEA-21, or the Commission's policies. The attempts to alter those purposes must therefore be rejected.

VII. MANY ALLEGED "NON-SAFETY" DSRC APPLICATIONS SERVE IMPORTANT VEHICULAR SAFETY PURPOSES AND REQUIRE PRIORITY.

Re-channelization proponents argue that the FCC should not protect "non-crash avoidance DSRC operations."[96] This view ignores the immense potential safety benefits derived from what they deem "non-safety" applications, such as safety applications made possible through V2V and V2I applications aimed primarily at achieving other public benefits. The characterization that such applications are somehow unrelated to vehicular safety is misplaced. Indeed, many of the DSRC applications characterized by re-channelization proponents as "non-safety" in fact do enhance vehicular safety. For example, a number of pilot and research initiatives currently focus on DSRC-assisted truck platooning. DSRC-assisted platooning

[95] *Id.* ¶ 14.

[96] *See, e.g.*, NCTA Comments at 12.

technology electronically couples trucks together, allowing the trucks to accelerate and break together after analyzing the relevant weather and road conditions.[97] DSRC-assisted truck platooning relies on V2V communications and sensor sharing to conserve fuel *and* ensure safety.

Some V2I non-safety applications that depend on sensing vehicles at particular locations on the roadway are likely to depend on latency-sensitive basic safety messages ("BSMs") and additional messages from vehicles to eliminate congestion and provide other benefits that enhance public safety. Applications such as "congestion ahead" warnings serve the dual function of improving mobility and providing potential safety-of-life-and-property and public safety benefits by helping to prevent rear-end collisions. Examples of other band uses include the deployed and soon-to-be deployed connected vehicle sites that are currently using or will be using multiple DSRC channels. The New York City Connected Vehicle Pilot deployment will use Channels 172, 174, 176, and 178 for the traditional V2X safety applications in addition to security-related critical safety information updates.

NHTSA recognizes that "V2V communications represent an additional step in helping to warn drivers about impending danger."[98] V2V communications use on-board DSRC devices to transmit messages about a vehicle's speed, heading, brake status, and other information to other vehicles and receive the same information from the messages, with range and "line-of-sight" capabilities that greatly exceed current and near-term "vehicle-resident" systems.[99] As NHTSA explained, "this longer detection distance and ability to 'see' around corners or 'through' other vehicles helps V2V-equipped vehicles perceive some threats sooner than sensors, cameras, or

[97] Letter from Steve Boyd, Co-Founder & VP External Affairs, Peloton Technology, Inc. to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-49 (July 7, 2016) at 1.

[98] NHTSA, DOT HS 812 014, *V2V Readiness* (Aug. 2014) at xiv, http://bit.ly/1BtNawA.

[99] *Id*.

radar can, and warn their drivers accordingly."[100] Thus, V2V communications that may appear to focus on non-safety related purposes are in fact critical to next-generation crash avoidance features. Indeed, the FCC's rules protect public safety applications in the DSRC band. Section 95.1511 designates several channels in the 5850-5925 MHz band for "public safety applications involving safety of life and property."[101] This is contrary to Qualcomm's re-channelization proposal that would only move safety-of-life applications to the protected upper portion of the 5.9 GHz DSRC band.[102] The Commission should reject assertions that these applications are not worthy of protection simply because they also serve other important functions, such as reducing fuel consumption, congestion, and enabling other forms of vehicle communication.

VIII. DETECT AND AVOID WOULD ALLOW SIGNIFICANT WI-FI USE OF THE 5.9 GHZ BAND.

The record demonstrates that the detect and avoid approach is also promising because it would make significant amounts of 5.9 GHz spectrum available for unlicensed (including Wi-Fi) use where DSRC devices are not operating. For example, Cisco points out that the detect and avoid approach is "particularly suitable for indoor environments, where most Wi-Fi usage occurs."[103] Although some re-channelization proponents argue that the approach may not allow Wi-Fi use in some outdoor areas,[104] this would have a marginal impact on Wi-Fi use of the 5.9 GHz band. As our comments indicated, 95 percent of all Wi-Fi activity occurs indoors.[105]

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[100] *Id.*

[101] 47 C.F.R. § 95.1511.

[102] Qualcomm Comments at 4-6.

[103] Cisco Comments at 6.

[104] *See, e.g.*, Comments of Microsoft Corp., ET Docket No. 13-49, at 8-10 (July 8, 2016) ("Microsoft Comments").

[105] *See* Alliance et al. Comments at 44; Peter B. de Selding, *Europe Mounts Defense of Radar Satellite Spectrum Against Wireless Broadband Incursion*, SpaceNews (Jan. 24, 2014), http://bit.ly/29k8BaH.

Meanwhile, the Wi-Fi industry is divided as to whether the re-channelization approach would make a meaningful amount of spectrum available for unlicensed Wi-Fi use. Some, such as Broadcom, suggest that the approach would better promote Wi-Fi technologies by providing more reliable access to U-NII-4 spectrum.[106] Others, such as Ubiquity, argue that re-channelization would not "make sufficient shared spectrum available for unlicensed service" because it would effectively reduce the amount of usable spectrum for U-NII-4 devices by 40 percent (*i.e.*, the 30 MHz of the 5.9 GHz band that would be reserved exclusively for DSRC).[107]

Some comments suggest for the first time in this proceeding that unlicensed devices should be allowed to operate in the 5.9 GHz band from inside vehicles.[108] However, such a step would dramatically increase the risk of harmful interference to DSRC.[109] If anything, the FCC may want to consider limiting the use of unlicensed devices in the 5.9 GHz band to static, indoor locations. Also, Microsoft claims that eliminating 25 MHz from the U-NII-3 band when a DSRC device is present makes the detect and avoid approach unacceptable,[110] but this is a prudent precaution that will help prevent harmful interference to DSRC operations in the lower channels of the 5.9 GHz band in many cases. The Commission could reduce – though not eliminate – the need to make 25 MHz of the U-NII-3 band unavailable in such cases by correcting the level of OOBE emissions that can occur in the 5.9 GHz DSRC band as requested by the pending Alliance/Global Automakers petition.[111]

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[106] *See, e.g.*, Broadcom Comments at 3

[107] *See, e.g.*, Comments of Ubiquity Networks, Inc., ET Docket No. 13-49 (July 7, 2016)at 6 ("Ubiquity Comments").

[108] *See, e.g.*, NCTA Comments.

[109] *See, e.g.*, Toyota Comments at 27-28 (describing outdoor unlicensed use generally as "broadly compatible with DSRC").

[110] Microsoft Comments at 9.

[111] *See* Petition for Reconsideration.

IX. THE COMMISSION'S TESTING SHOULD INCLUDE UBIQUITY'S PROPOSED SHARING APPROACH AND PRIORITIZE SAFETY OVER SPEED.

Ubiquity proposes a third sharing approach in its comments.[112] This approach is a modified version of Cisco's detect and avoid proposal, under which U-NII-4 devices would be permitted to move to an alternate channel rather than vacate the entire band when a DSRC device is present.[113] Ubiquity's proposal would also limit the outdoor use of U-NII-4 devices to fixed point-to-point deployments.[114]

The Commission's testing should include Ubiquity's proposed approach and any others that might prevent interference to DSRC if the 5.9 GHz band is opened up to unlicensed devices. The detect and avoid approach is by far the most promising of the sharing approaches the FCC has considered thus far.[115] However, we remain open to any other approach that can be proven capable through testing of allowing interference-free sharing between DSRC and unlicensed operations in the 5.9 GHz band without delaying the deployment of DSRC.[116]

Ubiquity's proposal is also notable because it demonstrates that the wireless local area network ("WLAN") community recognizes the difficulties of ubiquitous outdoor fixed point-to-multipoint systems and remains divided as to whether to support the re-channelization concept. For example, as Ubiquity notes, there is significant concern that "the re-channelization approach provides an inadequate amount of shared spectrum for unlicensed devices and hinders DSRC development by causing significant disruption to existing DSRC equipment and component

[112] *See* Ubiquity Comments at 1-2, 8-14.

[113] *See id*. at i-ii, 8.

[114] *See id*. at ii,

[115] *See, e.g.*, Alliance et al. Comments at iv-v.

[116] *See, e.g.*, Alliance et al. Apr. 14 Letter (reiterating the belief that interference-free sharing may be possible and explaining that the pursuit for an industry-led solution continues).

manufacturers."[117] The DSRC Coexistence Tiger Team's final report showed a similar split in 2015, when only 11 of the 50 WLAN stakeholders polled indicated that they supported the re-channelization approach.[118]

Finally, we reiterate that the Commission's testing schedule must allow enough time to appropriately assess the proposed sharing approaches. A number of commenters echoed our concerns that the testing timeline proposed in the Public Notice may be too aggressive.[119] For instance, Ford observes that the Commission's goal of completing testing by January 15, 2017, will be "difficult to achieve,"[120] and the CAR 2 CAR Communication Consortium calls the proposed timeline for testing "not realistic."[121] The Commission should weigh its desire to perform the tests quickly against the public interest in ensuring that the sharing approaches are properly evaluated and, if necessary, modify the proposed timeline to ensure that all three phases of tests are performed properly. As the New Mexico Department of Transportation notes, the testing schedule should "emphasize[] safety, not speed."[122]

The Alliance, Global Automakers, DENSO, and ITSA members have extensive experience and DSRC-related resources available and can assist the FCC in evaluating all proposed spectrum sharing approaches. We support the Commission's desire to reach a timely decision and are open to helping conduct this testing as part of an open process. As noted in our previous comments, we are most familiar with the metrics needed to evaluate application

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[117] *See id*. at ii, 10-14.

[118] *See* Alliance et al. Comments at 42-43; Letter from Ari Q. Fitzgerald, Counsel, the Alliance, et al., to Marlene H. Dortch, Secretary, FCC, ET Docket No. 13-49, at 2 (Mar. 25, 2015).

[119] *See, e.g.*, Alliance et al. Comments at 68-89; Comments of Ford Motor Co., ET Docket No. 13-49, at 4 (July 7, 2016) ("Ford Comments"); C2C Comments at 9; NMDOT Comments at 4; NASEMO et al. Comments at 1-4.

[120] Ford Comments at 4.

[121] C2C Comments at 9.

[122] NMDOT Comments at 4.

performance, such as information age and tracking error, and can assist in assessing the effects of spectrum sharing on these metrics.[123]

X. CONCLUSION.

The record in this proceeding demonstrates DSRC's potential to provide significant road safety, traffic management, and environmental benefits. For the reasons discussed above and in our comments, the Commission should proceed cautiously as it examines proposals to share the 5.9 GHz band. The record demonstrates that the detect and avoid approach is the most promising of the approaches currently being considered, and that the re-channelization approach should be rejected. In any event, the Commission's upcoming testing should rigorously evaluate all viable proposed approaches to determine if they are capable of reliably protecting DSRC and will not delay its deployment.

Respectfully submitted,

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[123] *See* Alliance et al. Comments.