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March 1, 2019

Mr. Finch Fulton
Deputy Assistant Secretary for Transportation Policy
U.S. Department of Transportation
1200 New Jersey Ave., S.E. W12-140
Washington, DC 20590

RE: Notice of Request for Comments: V2X Communications
[Docket No. DOT-OST-2018-0210]

Dear Mr. Fulton:

The Motor & Equipment Manufacturers Association (MEMA) represents vehicle suppliers that manufacture components and systems for use in passenger cars and heavy trucks.[1] MEMA appreciates the opportunity to provide feedback to the U.S. Department of Transportation's (DOT) request for comments on vehicle-to-everything (V2X) communications. Improving vehicle safety and saving lives are top priorities of our members.

- Suppliers lead the way in developing and deploying a wide range of advanced, transformative technologies like advanced driver assistance systems (ADAS), automated driving systems, V2X and vehicle-to-vehicle (V2V) communications, and other critical safety innovations.
- Suppliers are deeply invested in and prepared for a connected vehicle environment.
- Suppliers are ready and able to support deployment of these technologies into the U.S. fleet.

Connected vehicle technologies are needed to allow automated vehicles to reach their full potential. Care must be taken to ensure that the technologies are safely and appropriately deployed. As such, the industry needs the right kinds of balanced public policies in place, fostering technology development and innovation while also providing certainty via guidelines and standards. The potential for V2X communications is vast – enabling the real-time exchange of critical data between the vehicle and surrounding road infrastructure, intersections, pedestrians, and other communication networks. The primary aim of these V2X communications is to enhance the utilization of these messages to improve vehicle safety, reduce congestion, decrease crashes, and – ultimately – save lives. As with V2V, we believe the DOT and its agencies can play a key role in developing policies that support the safe and efficient deployment of V2X services.

Low-latency V2X communication is a fundamental element of an integrated, modern transportation ecosystem enabling and enhancing vehicle automation and other mobility service demands. The U.S. DOT must be one of the key architects creating a policy framework that is objective and data-driven. Furthermore, the policies must concurrently encourage technology development as well as provide reasonable parameters. More importantly, these

[1] MEMA represents its members through four divisions: Automotive Aftermarket Suppliers Association (AASA); Heavy Duty Manufacturers Association (HDMA); Motor & Equipment Remanufacturers Association (MERA); and, Original Equipment Suppliers Association (OESA). Suppliers are the largest employers of manufacturing jobs in the United States, directly employing over 871,000 workers with a total employment impact of 4.2 million jobs.

policies are needed to establish more certainty – which is critically important for our industry's long production cycles.

Currently, our industry is facing multiple challenges and uncertainties that are impacting vehicle communications technology deployment. For example, MEMA supported the 2017 proposed rule from DOT's National Highway Traffic Safety Administration (NHTSA) to require V2V communications via dedicated short-range communications (DSRC). Although there has not been any further progress on that rulemaking to date, MEMA believes that the Department can play an important role to establish reasonable, practical, performance-based safety standards to provide certainty and ensure a level playing field for the industry. MEMA supports DOT's adoption of a technology-neutral approach to V2X technology to ensure that U.S. vehicle manufacturers (OEMs) can select the technology best suited for their platforms. At the same time, a technology-neutral approach has opened some uncertainty vis-à-vis interoperability. Therefore, MEMA urges DOT to consider ways to ensure V2V- and V2X-enabled vehicles can seamlessly communicate with other vehicles and infrastructure. Additional uncertainty comes from the Federal Communications Commission's continued evaluation of the fate of the 5.9 GHz radio spectrum and whether it can be shared with unlicensed devices without interference of the basic safety message for V2V communications.

The U.S. DOT must be a leader in creating policies that lead to a fully connected transportation network providing more certainty and enhancing vehicle safety and personal mobility. This approach will help sustain the ability of the U.S. vehicle industry to lead the world as we enter a new era of technology development.

Attached are MEMA's responses to the questions presented in the DOT's "Notice of Request for Comments: V2X Communications." For your additional reference, MEMA has submitted comments to NHTSA and FCC on the related subjects of V2V and the 5.9 GHz spectrum, respectively.[2],[3] MEMA would welcome an opportunity to meet with you and your team to discuss the integral role suppliers play in the development of connected vehicle communications and other innovative vehicle technologies. In the interim, if you have any questions or need more information, please do not hesitate to contact me at bdaugherty@mema.org or 248-430-5966 or my colleague Leigh Merino, vice president of regulatory affairs at lmerino@mema.org or 202-312-9249.

Regards,

Brian Daugherty
Chief Technology Officer
MEMA

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[2] National Highway Traffic Safety Administration; Notice of Proposed Rulemaking; Federal Motor Vehicle Safety Standard; Vehicle-to-Vehicle Communications; Docket No. NHTSA-2016-0126
MEMA Comments: (2017) https://www.mema.org/sites/default/files/resource/MEMA-Comments-V2V-NPRM_FINAL_April-12-2017.pdf

[3] Federal Communications Commission; Proposed Rule; Unlicensed National Information Infrastructure (U-NII) Devices in the 5 GHz Band; ET Docket No. 13-49, FCC 16-88
MEMA Comments: (2016) https://www.mema.org/sites/default/files/resource/MEMA-Comments-to-FCC-re_U-NII-Devices-5GHz-Band_FINAL_July-7-2016.pdf (2018) https://www.mema.org/sites/default/files/resource/MEMA%20Letter%20to%20FCC%20re%205-9%20GHz%20Spectrum%20June%207%202018%20FINAL.pdf

MEMA Responses to U.S. DOT Questions

1. In light of these developments, the Department is interested in learning more about recent developments in V2X technologies. In particular, the Department wants to hear from stakeholders, and the public generally, whether focusing on DSRC as the primary means of V2V communications is consistent with recent technological developments, as well as with the Department's general desire to remain technologically neutral and avoid interfering with the many innovations in transportation and telecommunication technologies. If technological developments support the use of alternatives to DSRC, the Department would also need to know how to ensure that these alternative technologies are interoperable with each other and DSRC.

As a general rule, MEMA does not typically favor one available technology over another. In the case of V2V and V2X technology, as it stands today, the DSRC (802.11p) is a proven, vetted technology that is currently available. C-V2X, which is based on proven LTE wireless technology (PC5 Mode 4) developed by 3GPP, has been proposed as an alternative choice. Currently there is no evidence based on real data measurement that one technology will outperform the other one. Both technologies promise a path to 5G for high-bandwidth, low-latency communications using direct communication between vehicles, infrastructure, pedestrians. The IEEE 802.11 "Next Generation V2X" (NGV) study group is developing improvements to the 802.11p standard, and 3GPP is developing a 5G new radio technology. Both hold promise for speed and latency improvements for direct communication.

DSRC is a mature and tested technology that is available commercially today and able to support all V2X applications, and it is the only technology currently allowed to utilize the 5.9 GHz band by the FCC. Significant investments have been made over the years by the vehicle industry and federal/state/local governments to thoroughly test, validate, and utilize the DSRC technology for V2V/V2X. As a result, DSRC has been launched by GM on one Cadillac model and Toyota announced plans to deploy DSRC on U.S. vehicles starting in 2021.[4] Volkswagen Group will have DSRC-equipped vehicles in Europe beginning this year in 2019.[5] Additionally, several states and localities have begun deploying DSRC as part of connected vehicle pilot programs and in collaboration with the U.S. DOT's ITS Joint Program Office.

Recently, the 5G Automotive Alliance (5GAA) petitioned the FCC for a waiver to deploy C-V2X on the same 5.9 GHz spectrum currently allocated by the Commission for use by DSRC for intelligent transportation systems (ITS). Ford Motor Company recently committed to deploy C-V2X in all new vehicle models beginning in 2022[6]and other OEMs have demonstrated C-V2X-

[4] See: Toyota and Lexus to Launch Technology to Connect Vehicles and Infrastructure in the U.S. in 2021, available at: https://toyota.us/2Nvfdd4

[5] *See*: Volkswagen Group Assumes Pioneering Role in Rapid Road Safety Improvement, available at: https://bit.ly/2EEFpNs

[6] *See*: How 'Talking' and 'Listening' Vehicles Could Make Roads Safer, Cities Better, by Don Butler, executive director, Ford Connected Vehicle Platform and Product, available at: https://ford.to/2XoETu1

equipped vehicles.[7] 5GAA provided test reports on LTE C-V2X for direct vehicle-to-vehicle (V2V) communication. MEMA urges DOT to ensure that C-V2X can support all V2X applications.

Currently, radio interoperability between C-V2X and DSRC is not feasible and this could, unfortunately, lead to a divided and incompatible fleet, which would be a very counterproductive result. But lack of policy certainty vis-à-vis interoperability and the spectrum may impede future progress and deployment.

2. Of the V2X communications technologies previously discussed, at present only DSRC is permitted to be used in the 5.9 GHz spectrum band for transportation applications. If that allocation were to be changed to allow any communication technology for transportation applications, could DSRC and other technologies (e.g., C-V2X, 5G or any future technology) operate in the same spectrum band or even the same channel without interference? Why or why not? If there are any technical challenges to achieving this goal, what are they and how can they be overcome?

The continuing development of V2X technology will accelerate the innovation our nation needs to improve vehicle safety and address highway capacity limits. The challenges of sharing the 5.9 GHz spectrum band with technologies other than DSRC are not trivial and will require significant care and analysis to ensure that harmful interference will not occur. The 5GAA proposed a frequency separation of DSRC and C-V2X, by petitioning the FCC for a waiver to use the upper 20 MHz of the 5.9 GHz band exclusively. While channel separation of the two technologies can prevent harmful interference from occurring, it does not provide a solution for interoperable V2V communications.

DSRC is advancing in the IEEE 802.11 "Next Generation V2X" (NGV) study group, which is expected to amend the 802.11p standard and provide a backward compatible future upgrade path for DSRC technology. This approach ensures that existing DSRC systems – both on vehicles and on roadside installations – continue to remain effective as technology improvements are made.

3. To what extent is it technically feasible for multiple V2X communications technologies and protocols to be interoperable with one another? Why or why not? Can this be done in a way that meets the performance requirements for safety of life applications, as they were discussed in the V2V NPRM? What additional equipment would be needed to achieve interoperability or changes in standards and specifications? What is the projected cost of any necessary changes? How soon can these changes and equipment prototypes be available for testing?

It is important to clearly define what is meant by interoperability. MEMA's understanding of interoperability as the capacity for any V2X technology to communicate with one another. It is paramount for safety-related applications that interoperability be available from the very beginning of deployment. For an interoperability solution to be realistically valid, it needs to always be available and meet the low-latency requirements for safety-related applications.

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[7] *See*: 5GAA, BMW Group, Ford and Groupe PSA Exhibit First European Demonstration of C-V2X Direct Communication Interoperability Between Multiple Automakers, available at: https://bit.ly/2tIKLRy

Unfortunately, the different technologies (DSRC, LTE-V and 5G New Radio) are not interoperable at the physical layer. If multiple technologies coexist, the only solution is to build communication devices with several radio technologies included, such as is common in today's consumer cellular phones. Having multiple radios may also increase the cost of deployment in the vehicle. The message protocols themselves are quite similar and require implementation only in software.

As mentioned above, another critical aspect is maintaining backward compatibility with existing systems. Any approach that does not do this results in incompatible systems, a divided fleet that reduces overall system safety effectiveness, and stranded capital investments.

4. To what extent is it technically feasible for different generations of the same V2X communications technologies and protocols to be interoperable with one another? Why or why not? Can this be done in a way that meets the performance requirements for safety of life applications? What additional equipment or changes in standards and specifications would be needed to achieve interoperability? What is the projected cost of any necessary changes?

Again, as with the previous question, it is important to first define interoperability and distinguish between *radio* interoperability at the PHY/MAC (physical and medium access control) layers or *message* interoperability. Because C-V2X and DSRC use a different radio protocols, radio interoperability is not currently feasible. Message interoperability at the application layer is achievable today between DSRC and C-V2X, because both reference the SAE J2945/1 standard. This standard allows roadway operators to communicate with OBUs using either DSRC or C-V2X RSUs.

MEMA urges DOT to focus on ensuring message interoperability is maintained.

DSRC plans to extend in a fully compatible way. DSRC is advancing in the IEEE 802.11 "Next Generation V2X" (NGV) study group, which is expected to amend the 802.11p standard and provide a backward compatible upgrade path for all DSRC systems. That means that messages used for existing "Day-1" use cases stay the same and messages for future use cases can be added with no detrimental impact on existing systems.

5. Even if they are interoperable across different technologies and generations of the same technology, would there be advantages if a single communications protocol were to be used for V2V safety communications? What about other V2X safety applications, such as those involving V2I and V2P communications?

DSRC and C-V2X already support V2I capability. Mobile phones (i.e. those carried by pedestrians, children, or bicyclists) are already equipped with WiFi and LTE capabilities, so DSRC or C-V2X could be easily added to future phones for V2P capability. Additionally, V2P communication could be established as V2N2P providing additional information via future 5G in cases where low latency communication is not needed. Requiring a single radio protocol could impose opportunity costs on the U.S. ITS ecosystem and limit the potential for deploying new technologies that would offer greater safety benefits.

6. How would the development of alternative communication technologies affect other V2I and V2P communications, such as those supporting mobility or environmental applications? Do these applications have the same or different interoperability issues as

V2V safety communications? Do different V2X applications (e.g., platooning) have different communication needs, particularly latency?

The overarching goal should be to enable all roadway users with interoperable V2X systems in order to maximize the benefit. V2I and V2P also have very low latency requirements, which is the reason that the 5.9 GHz band is ideal for V2X. The lower the latency, the better from a safety application standpoint. However, different V2X applications have different communication needs and may use different service channels. For example, both DSRC and C-V2X can support platooning applications in heavy trucks.[8] The operation of commercial truck platooning requires low latency, but also requires the use of a specific service 10 MHz channel.

Current V2I deployments show that both DSRC and C-V2X protocols may be supported in a single RSU. These RSUs V2I applications support message interoperability, providing the same information to inform the road operator's situational awareness. An RSU might act as an intermediary bridge between vehicles for applications not requiring low latency.

7. Do different communication technologies present different issues concerning physical security (i.e., how to integrate alternative communication technologies into vehicle systems), message security (i.e., SCMS design or other approaches), or other issues such as cybersecurity or privacy? Would these concerns be affected if multiple but still interoperable communication technologies are used rather than one?

Physical, message, and application security are all vital components of V2X architecture and should be addressed with similar requirements so that functional interoperability can be assured. The Security Credential Management System ("SCMS") can be used by both DSRC and C-V2X equipment, and DOT should encourage this uniformity. The SCMS provides security objectives including privacy, authenticity, integrity and confidentiality regardless of the communication technology.

8. How could communications technologies (DSRC, C–V2X, 5G or some other technology) be leveraged to support current and emerging automated vehicle applications? Will different communication technologies be used in different ways? How?

V2X will complement and aid automated driving systems with many use cases. These are infrastructure-based (e.g. messages from traffic signals/intersections) as well as V2V use cases such as cooperative maneuvers (e.g. lane merge) and collective perception (e.g. exchange of detected objects). In addition, updated, real-time high definition maps are a typical vehicle-to-network (V2N) application for autonomous driving. Tele-operated driving is another potential V2N application for autonomous driving that has higher functional safety requirements. As stated above V2N can be used to connect with other vehicles, bicyclists, and pedestrians (including children) via mobile phones or imbedded backpack devices.

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[8] Some examples of platooning are noted in these online articles:

- http://wardsauto.com/industry/bridge-truck-platooning-test-deemed-flawless
- http://www.fleetowner.com/autonomous-vehicles/auburn-university-tardec-conduct-live-truck-platooning-demo
- http://ocm.auburn.edu/newsroom/news_articles/2017/10/auburns-samuel-ginn-college-of-engineering-contributes-key-technology-to-public-demonstration-of-autonomous-vehicles.htm

MEMA agrees with the findings of DOT's Automated Vehicle 3.0 report, which noted that: "Communication both between vehicles (V2V) and with the surrounding environment (V2X) is an important complementary technology that is expected to enhance the benefits of automation at all levels. Cooperative automation allows automated vehicles to communicate with other vehicles and the infrastructure to coordinate movements and increase efficiency and safety."[9] It is important to the future of transportation innovation that the technology and solutions provided by V2X in the 5.9 GHz band are able to evolve.

The U.S. DOT should encourage the deployment of future technologies both by establishing certainty that the 5.9 GHz band will be retained for ITS applications and by allowing new and upgraded vehicle communications technologies to be deployed.

9. How could deployments, both existing and planned, assess communications needs and determine which technologies are most appropriate and whether and how interoperability could be achieved?

The experience from the OEMs will determine which technology is most appropriate and which one they will commit to implement. As it stands today, what we do know is that the automotive industry defined, tested, and validated DSRC technology. Deployment has been slow in ramping up, but that is partially the result of the uncertainty of future interoperability created by policies that are in limbo. DSRC is a mature, commercially available technology that is being deployed today. C-V2X promises to support both direct V2V/V2I communication and to integrate seamlessly with V2N and future 5G communication, but it does not yet have the same level of comprehensive testing and maturity as DSRC.

MEMA urges U.S. DOT to continue to engage robustly with key communities – the vehicle industry, telecommunications industry, and road operator sectors – to conduct real-world testing of evolving V2X technologies and to set a national goal to achieve nationwide deployment of interoperable V2X systems.

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[9] U.S. Dept. of Transportation, *Automated Vehicles 3.0: Preparing for the Future of Transportation*, at 13, 16 (Oct. 4, 2018), *available at* https://www.transportation.gov/av/3.