

**Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554**

In the Matter of

5GAA Petition For Waiver To Allow Deployment
Of Cellular Vehicle-To-Everything (C-V2X)
Technology In The 5.9 GHz Band

GN Docket No. 18-357

COMMENTS OF QUALCOMM INCORPORATED

Qualcomm strongly supports the 5G Automotive Association’s (“5GAA’s”) Petition for Waiver to allow for the deployment of Cellular Vehicle-to-Everything (“C-V2X”) technology in the uppermost 20 MHz portion of the 5.9 GHz Intelligent Transportation Systems (“ITS”) band.¹ The Commission should expeditiously approve the Petition to enable the deployment of C-V2X technology, so all U.S. cities and states, vehicle manufacturers, and the many millions of American drivers, passengers, and pedestrians can reap the safety benefits of this advanced connected vehicle communications technology as soon as possible. Qualcomm has been working with major vehicle manufacturers and roadway equipment manufacturers to integrate C-V2X technology into production vehicles and roadside units (“RSUs”), and all of us working together in this growing ecosystem are eager to deploy this advanced technology in the U.S.

¹ See 5GAA Petition For Waiver to Allow Deployment of Intelligent Transportation System Cellular Vehicle to Everything (C-V2X) Technology, GN Docket No. 18-357 (filed Nov. 21, 2018); *see also* FCC Public Notice, “Office of Engineering and Technology and Wireless Telecommunications Bureau Seek Comment On 5GAA Petition For Waiver To Allow Deployment Of Cellular Vehicle-To-Everything (C-V2X) Technology In The 5.9 GHz Band,” DA-18-1231, GN Docket No. 18-357 (Dec. 6, 2018); FCC Public Notice, Office Of Engineering And Technology and Wireless Telecommunications Bureau Extend Comment Cycle Deadlines On 5GAA Petition For Waiver To Allow Deployment Of Cellular Vehicle-To-Everything (C-V2X) Technology In The 5.9 GHz Band, DA-18-1310, GN Docket No. 18-357 (Dec. 31, 2018).

INTRODUCTION & SUMMARY

C-V2X technology allows all vehicles traveling on America's highways, byways, and local streets to use state-of-the-art high-speed cellular technology to communicate critical data directly with one another and with roadside infrastructure to improve overall roadway safety and traffic flow, enable fuel-efficient travel, and further environmental sustainability. This new intelligent transportation technology will protect drivers, passengers, and other vulnerable road users, such as bicyclists, motorcycle riders, and pedestrians, and ultimately support the safe and efficient travel of autonomous vehicles, which will increasingly occupy our roadways.

FCC grant of the 5GAA Petition for Waiver is necessary to enable commercial deployment of C-V2X and bring all the corresponding benefits of C-V2X technology to the public. This is the case because current FCC rules adopted decades ago, well before anyone could have imagined the invention of C-V2X, preclude anyone from deploying C-V2X commercially in the U.S.

Nevertheless, multiple major vehicle manufacturers, such as BMW, Ford, and Jaguar Land Rover, are imploring the FCC to grant the Petition as soon as possible because they want to deploy C-V2X technology.² Other major vehicle manufacturers, such as Daimler and Honda, are actively assessing the technology and note that the current regulatory uncertainty is preventing them from deploying it in the U.S.³ As the record of this proceeding currently stands, even before all the comments and replies have been filed, a significant segment of the auto industry is asking the FCC to promptly grant the 5GAA Petition to allow commercial deployment of C-V2X

² See BMW of North America Comments (Jan. 18, 2019); Ford Motor Company Comments (Jan. 24, 2019); Jaguar Land Rover Comments (dated Jan. 18, 2019).

³ See American Honda Motor Company Comments (Jan. 25, 2019); Daimler North America Corp. Comments (Jan. 18, 2019).

to bring substantial benefits to the public. Thus, there already is a more than sufficient public interest basis for the FCC to grant the 5GAA Petition.

Moreover, grant of the requested waiver would be consistent with the underlying purpose of the rules, that is, to enable the 5.9 GHz ITS band to be used for state-of-the-art intelligent transportation services. FCC grant of the Petition also will drive further innovation and investment in important C-V2X applications, ensuring American leadership in this modern ITS roadway communications technology that other countries are rapidly moving to deploy. The FCC should approve the 5GAA Petition expeditiously because it is firmly in the public interest.

Building on our decades of leadership in vehicle telematics technologies, Qualcomm, along with many partners in the U.S. and around the world, has been developing C-V2X chipsets, equipment, applications, and services that support advanced roadway travel use cases to enhance safety for drivers, passengers, and pedestrians.⁴ Qualcomm is working closely with leading carmakers and their suppliers to accelerate the commercial introduction of C-V2X technology using our 9150 C-V2X chipset solution.⁵ Automotive suppliers and ecosystem participants have announced their support for the deployment of C-V2X technology in production vehicles and ITS roadside units (“RSUs”) beginning this year. This follows on the heels of numerous C-V2X field validations with vehicle manufacturers and automotive ecosystem participants in the U.S. and Germany, France, China, Korea, and Japan. FCC approval of the Petition for Waiver is needed to enable this technology to be deployed in the U.S.

⁴ See Qualcomm Cellular V2X Ecosystem website *available at* <https://www.qualcomm.com/invention/5g/cellular-v2x/ecosystem>.

⁵ See Qualcomm OnQ Blog by Maged Zaki, “Growing the C-V2X ecosystem and preparing it for commercial readiness in 2019,” (Feb. 22, 2018) *available at* <https://www.qualcomm.com/news/onq/2018/02/22/growing-c-v2x-ecosystem-and-preparing-it-commercial-readiness-2019>.

Upon FCC approval, Qualcomm expects the adoption of C-V2X technology to occur rapidly, taking advantage of the substantial market penetration of cellular modems in vehicles⁶ and the synergies with both onboard connected vehicle platforms and between cellular infrastructure and RSUs. C-V2X communications capabilities can very quickly serve a foundational role in improving safety on our nation's roadways. The FCC should approve the Petition for Waiver without delay.

DISCUSSION

I. Qualcomm And Its Industry Partners Have Been Actively Developing And Testing C-V2X Technology To Improve Traffic Flow and Roadway Safety

Qualcomm has been closely working with vehicle manufacturers, their equipment suppliers, and roadway equipment manufacturers on the deployment of Cellular Vehicle-to-Everything (“C-V2X”) technology in production vehicles and ITS RSUs.⁷ These efforts are a follow up to the successful C-V2X field validations with vehicle manufacturers and automotive ecosystem participants in the U.S. and elsewhere around the globe.⁸ As the record of this

⁶ See, e.g., Eric Jhonsa, “AT&T's IoT Chief Talks Connected Cars, Partnerships With Cloud Giants,” THESTREET.COM (Jan 15, 2019) *available at* <https://www.thestreet.com/investing/att-connected-device-chief-talks-14833885> (AT&T has over 24 million connected cars on its network and has added over one million cars to its network for 14 straight quarters, and added more than two million in Q318).

⁷ See Section I.B, *infra*.

⁸ 5GAA and its members have demonstrated the capabilities of C-V2X technology across the globe. See, e.g., 5GAA Press Release, 5GAA, BMW Group, Ford and Groupe PSA Exhibit First European Demonstration of C-V2X Direct Communication Interoperability Between Multiple Automakers (July 11, 2018), <http://5gaa.org/news/5gaa-bmw-group-ford-and-groupe-psa-exhibit-first-european-demonstration-of-c-v2x-direct-communication-interoperability-between-multiple-automakers>; 5GAA Press Release, 5GAA, Audi, Ford and Qualcomm Showcase C-V2X Direct Communications Interoperability to Improve Road Safety (Apr. 26, 2018), <http://5gaa.org/news/5gaa-audi-ford-and-qualcomm-showcase-c-v2x-direct-communications-interoperability-to-improve-road-safety-2>; Press Release, 5GAA, 5GAA participates in Testbed Visit in Shanghai (Nov. 16, 2017), <http://5gaa.org/news/5gaa-participates-in-testbed-visit-in-shanghai>; see also GSMA, Cellular Vehicle-to-Everything (C-

proceeding already shows, the companies in the growing C-V2X ecosystem are very excited by the near-term and longer-term potential of this technology and strongly encourage the FCC to grant the Petition so the technology can be widely deployed in the U.S.

A. C-V2X Is An Advanced Technology That Offers A Clear Path To 5G

C-V2X technology supports a multitude of features to improve travel and safety on America's roadways. It integrates two modes of vehicular communications: (1) network mode, and (2) peer-to-peer mode. Network mode, which uses spectrum outside the 5.9 GHz ITS band, enables vehicle-to-network communications to, among other things, communicate with roadside assistance services, such as emergency vehicles and tow trucks, and allow transportation service companies, such as delivery services and private and public buses, to more efficiently manage their fleet operations.

Peer-to-peer mode (known also as PC5 or sidelink), which would initially use the upper 20 MHz of the 5.9 GHz ITS band and would be enabled via approval of the FCC Petition, supports time-sensitive, safety-critical vehicle-to-vehicle direct communications (*e.g.*, sharing of driver intention) to improve traffic flow and avoid collisions, infrastructure-to-vehicle direct communications (*e.g.*, changing traffic lights), and pedestrian-to-vehicle direct communications to protect pedestrians. These V2V, V2I, and V2P direct communication modes collectively are referred to as C-V2X for Cellular Vehicle-to-Everything. None of these peer-to-peer vehicle communications modes requires cellular base stations. Instead, this C-V2X communications mode consists of direct connections between vehicles: cars, trucks, motorcycles, and bicycles in the nearby vicinity, as well as pedestrians entering the roadway, and nearby roadway

V2X) *Enabling Intelligent Transport* (rel. Jan. 2, 2018), https://www.gsma.com/iot/wp-content/uploads/2017/12/C-2VX-Enabling-Intelligent-Transport_2.pdf.

infrastructure. Highly reliable, low latency C-V2X direct connections enable safe and efficient travel by all users of America's roadways and work everywhere vehicles travel, including places where cellular base station signals may be unavailable, such as in sub-basement commercial parking garages.

As noted above, a number of global automakers and their equipment suppliers have been closely evaluating C-V2X technology for its reliability, high-performance capabilities and readiness through rigorous testing, and the results have been outstanding.⁹ Furthermore, C-V2X is the only V2X platform that provides a clear evolution path to 5G, in a backward compatible manner, and is designed to deliver highly reliable performance in common driving scenarios.

The initial version of C-V2X was standardized in 3GPP Release 14 and uses 4G LTE. A second version of C-V2X with certain enhancements has been completed in Release 15, and work on the first 5G-based version of C-V2X is well underway for inclusion in 3GPP Release 16. The basic safety functions of C-V2X, which are the subject of the Petition for Waiver, are included in Release 14. Importantly, vehicles which incorporate 3GPP Releases 15 or 16 will communicate seamlessly with other vehicles and infrastructure using Release 14, as is typically the case for 3GPP-based technologies.

FCC grant of the waiver requested in the Petition will enable commercial deployment of so-called Basic C-V2X in the upper 20 MHz of the 5.9 GHz band. This will allow cars to use state-of-the-art cellular technology for the following use cases developed by public and private stakeholders in the ITS community to enhance roadway safety for drivers, passengers, and pedestrians: V2V and V2I messages such as the Basic Safety Message, Signal Phase and Timing,

⁹ See, e.g., Petition for Waiver, App. B, 5GAA V2X Functional and Performance Test Report; Test Procedures and Results (Oct. 2018).

Emergency Vehicle Alert, Probe Data Management, Probe Vehicle Data, Signal Request Message, Signal Status Message, Map, Traveler Information Message, and others encompassed by the Road Safety Message under development by SAE.

Notably, C-V2X is designed with a focus on security, benefitting from established security transport layers and application protocols defined by the automotive standards communities, such as ISO, ETSI, IEEE, and SAE. And because C-V2X may readily be integrated into wireless modems to support both direct peer-to-peer and network communications, its implementation can be quite cost-effective, which is especially important as automakers are moving to incorporate wireless connectivity in all their vehicles.¹⁰

B. Qualcomm And Its Partners Have Successfully Trialed C-V2X Technology

Many equipment vendors are offering C-V2X equipment, and vehicle manufacturers have committed to deploy the technology in their vehicle fleets. Seven RF module manufacturers including LG, SIMCom, and WNC already have available C-V2X modules for incorporation into vehicles, On-Board Units (“OBUs”), and RSUs.¹¹ A number of other companies have made C-V2X equipment commercially available: Commsignia and Danlaw announced the commercial

¹⁰ See, e.g., Don Butler - Ford Motor Company, “How ‘Talking’ and ‘Listening’ Vehicles Could Make Roads Safer, Cities Better,” (Jan. 7, 2019) *available at* <https://medium.com/@ford/how-talking-and-listening-vehicles-could-make-roads-safer-cities-better-f215c68f376f> (noting Ford’s move to deploy C-V2X technology in all new model vehicles in 2022 builds on its prior commitment to equip every U.S. model with cellular connectivity by the end of this year); Freddie Holmes, “Automakers get on board with in-car Wi-Fi - Where cars and trucks were once accepted as a blackspot, a connection to the internet has become nearly essential for new vehicles today,” AUTOMOTIVE WORLD (Dec. 14, 2018) *available at* <https://www.automotiveworld.com/articles/automakers-get-on-board-with-in-car-wi-fi/>.

¹¹ See, e.g., LG Innotek V2X communication module description *available at* http://www.lginnotek.co.kr/en/itk_product/v2x-communication-module/; WNC C-V2X Module description *available at* http://www.wnc.com.tw/index.php?action=pro_cate_third_close&top_id=106&scid=123&tid=145.

availability of its C-V2X RSUs and OBUs; Kapsch announced the availability of its C-V2X OBUs; and Savari announced that its C-V2X RSUs are now commercially available.¹²

Major vehicle manufacturers BMW, Ford Motor Company, and Jaguar Land Rover, are imploring the FCC to grant the Petition as soon as possible because they want to deploy C-V2X technology.¹³ In fact, Ford Motor Company announced it will equip all of its new vehicles in the U.S. in 2022 with C-V2X capability and reiterated its deployment commitment in comments filed in this docket.¹⁴ Honda and Daimler also called for the FCC to grant the Petition without limitation, pointing to the regulatory uncertainty surrounding C-V2X in light of the FCC's rules adopted two decades ago, which do not provide for C-V2X technology.¹⁵ Finally, GM also calls for a grant of the Petition to make the upper 20 MHz available temporarily as they are still evaluating C-V2X,¹⁶ but commercial deployment by all the auto manufacturers who have

¹² See "Commsignia Launches C-V2X On-Board Units for the US Transportation and Automotive Industry," (Jan. 7, 2019) *available at* https://www.prweb.com/releases/commsignia_launches_c_v2x_on_board_units_for_the_us_transportation_and_automotive_industry/prweb16015383.htm; Danlaw launches new C-V2X on-board and roadside units" (Jan. 11, 2019) *available at* https://taas.news/article/106139/Danlaw_Launches_New_C-V2X_On-board_And_Roadside_Units; "Kapsch Accelerates Commercial Introduction of V2X Communication," (Jan. 8, 2019) *available at* <https://www.apnews.com/152185269f224369ae5eaacde5fe199e>; Savari Announces Continued Worldwide Leadership in C-V2X Technology (Jan. 7, 2019) *available at* <https://www.prnewswire.com/news-releases/savari-announces-continued-worldwide-leadership-in-c-v2x-technology-300773550.html>.

¹³ See BMW of North America Comments (Jan. 18, 2019); Ford Comments (Jan. 24, 2018); Jaguar Land Rover Comments (dated Jan. 18, 2019).

¹⁴ See Don Butler - Ford Motor Company, "How 'Talking' and 'Listening' Vehicles Could Make Roads Safer, Cities Better," (Jan. 7, 2019) *available at* <https://medium.com/@ford/how-talking-and-listening-vehicles-could-make-roads-safer-cities-better-f215c68f376f>; *and see* Ford Comments.

¹⁵ See American Honda Motor Co. Comments (Jan. 25, 2019); Daimler North America Corp. Comments (Jan. 18, 2019).

¹⁶ See General Motors Co. Comments (Jan. 18, 2019).

already decided to deploy C-V2X and any others who ultimately choose C-V2X is only possible if the FCC grants the Petition. Without a grant of the Petition, there is no regulatory path to deploy C-V2X and no way to bring the public the safety benefits of this new technology.

Moreover, C-V2X technology already has been successfully trialed in the U.S., Europe, Japan, Australia, and China. Most recently, the city of Las Vegas, the Regional Transportation Commission of Southern Nevada, Qualcomm, and Commsignia announced a C-V2X technology trial in Las Vegas. Using Commsignia RSUs and OBUs equipped with Qualcomm 9150 C-V2X chipsets, the trial will demonstrate a range of C-V2X technology uses cases.¹⁷

In addition, Audi, Ducati, Ford, and Qualcomm recently announced their continued joint efforts to accelerate commercial deployment of C-V2X direct communications technology for roadside safety, traffic efficiency, and automated driving.¹⁸ At this year's Consumer Electronic Show, Audi and Ford vehicles and Ducati motorcycles successfully demonstrated safe, efficient, and automated driving using C-V2X direct communications enabled by Qualcomm's 9150 C-V2X chipset. The demonstration included safety applications using V2V (*e.g.*, collision prevention), V2P (*e.g.*, the protection of vulnerable road users: pedestrians and cyclists) and V2I (*e.g.*, advanced road work zone warnings) communications, demonstrating both the maturity and

¹⁷ See Qualcomm Press Release, "Qualcomm Teams With the City of Las Vegas, Regional Transportation Commission of Southern Nevada and Commsignia to Implement C-V2X Vehicle Communications Technologies in Las Vegas — Organizations to Implement C-V2X Roadside Units Along Select Roadways, Demonstrating C-V2X's Commercial Readiness for Industry Deployment as Early as 2019," (Jan. 7, 2019) *available at* <https://www.qualcomm.com/news/releases/2019/01/07/qualcomm-teams-city-las-vegas-regional-transportation-commission-southern>.

¹⁸ Audi, Ducati and Ford Host Live Interactive Demos in Las Vegas Using C-V2X Solutions Provided by Qualcomm - Companies Continue Joint Efforts for Roadside Safety, Traffic Efficiency and Automated Driving," (Jan. 7, 2019) *available at* <https://www.qualcomm.com/news/releases/2019/01/07/audi-ducati-and-ford-host-live-interactive-demos-las-vegas-using-c-v2x>.

potential of C-V2X technology. Vehicles equipped with C-V2X technology also demonstrated a cooperative intersection use case, showing how the technology safely and efficiently negotiates the right of way when entering a four-way intersection via the sharing of intention in both line-of-sight and non-line-of-sight conditions.

These demos and trials were appropriately conducted using FCC experimental licenses, but the full-scale commercial deployment to which some vehicle manufacturers have already committed requires a grant of the requested waiver. The C-V2X ecosystem is progressing very rapidly, and the FCC needs to approve the Petition this year, so the technology can begin to be broadly deployed in the U.S., and Americans can experience the many benefits described above.

II. The FCC Should Grant The 5GAA Petition For Waiver So C-V2X Technology Can Be Used On America's Roadways To Improve Traffic Flow and Enable Safer Travel

Grant of the 5GAA Petition for Waiver is needed to allow for deployment of C-V2X technology in the 5.9 GHz band in the U.S. As the 5GAA Petition rightly explains, the current FCC regulations for the 5.9 GHz ITS band are not technology neutral. They are restricted to deployment of a single technology: DSRC, the single ITS communications technology available in 1999 when the FCC initially allocated the ITS spectrum.¹⁹

C-V2X technology, which incorporates much of the non-radio-based standardization work already completed for DSRC, including security standards, is a newer technology that takes advantage of multiple generations of radio technology improvements over the past two decades, and, as detailed above, has been shown to provide a more robust and flexible physical layer communications interface.

¹⁹ See Petition at 2-5.

Grant of the 5GAA Petition will advance both peer-to-peer and network modes of C-V2X communications while ensuring America's global leadership in the progression of this technology. FCC approval will allow for the near-term deployment of this technology and unleash increased investment and innovation in peer-to-peer mode, network mode, and new hybrid C-V2X applications. This investment and innovation will allow consumers to enjoy new and improved services that will advance safety, productivity, mobility, and convenience of travel while also reducing energy consumption.

Grant of the Petition also will help to facilitate America's global leadership in C-V2X. Regulators in China recently adopted an allocation for C-V2X in the 5.9 GHz band, and policymakers in other regions of the world are contemplating similar actions. If the Commission does not permit C-V2X deployment here in the United States, America risks falling behind as this technology continues to progress. Thus, FCC approval of the Petition will help ensure America's leadership in C-V2X.

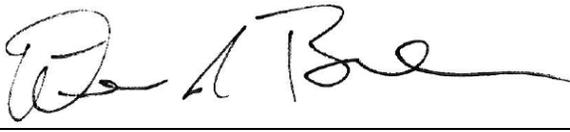
This is particularly true given the recent announcement from Ford Motor Company — America's second largest automotive manufacturer — that it will equip all new vehicle models sold in the U.S. in 2022 with C-V2X capability. Virtually all other major vehicle manufacturers in the U.S.: BMW, Daimler, GM, Honda, and Jaguar Land Rover, are also requesting that the FCC grant the Petition as soon as possible so they too can be permitted to deploy C-V2X technology in the U.S. using the uppermost 20 MHz portion of the 5.9 GHz ITS band.

CONCLUSION

Qualcomm encourages the FCC to move forward to enable the deployment of C-V2X technology in the uppermost 20 MHz portion of the 5.9 GHz ITS band. As the 5GAA Petition for Waiver explains, the performance of C-V2X technology exceeds the performance of DSRC technology, and America's cities and vehicle manufacturers and C-V2X equipment providers should be allowed to deploy the technology that will best enable improved traffic flow and safer roadways. The Commission should grant the Petition for Waiver without delay.

Respectfully submitted,

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