BEFORE THE
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
WASHINGTON, D.C. 20590

In the Matter of Framework for Automated Driving System Safety	Docket No. NHTSA–2020-0106

COMMENTS OF QUALCOMM INCORPORATED

Qualcomm appreciates the opportunity to provide comments in Docket No. NHTSA-2020-0106, in which the National Highway Traffic Safety Administration seeks input on the development of a framework for Automated Driving System (ADS) safety.

I. INTRODUCTION

Qualcomm is the world's leading wireless technology innovator and the driving force behind the development, launch, and expansion of 5G. Since its founding in 1985 in San Diego, California, Qualcomm has been a leading innovator in the wireless industry and a pioneering developer of 3G, 4G, and 5G cellular technologies, unlicensed technologies such as Wi-Fi and Bluetooth, and GNSS location systems. Qualcomm is the world's largest provider of multi-mode, multi-frequency-band wireless chipsets integrated into today's most advanced smartphones, tablets, and other mobile devices, including vehicles. Qualcomm also broadly licenses its technologies to hundreds of manufacturers worldwide that make network equipment, smartphones, tablets, and wireless modules for incorporation into many devices, including cars, trucks, and other motor

vehicles. We invest about 20% of our annual revenue into research and development (more than $67 billion cumulatively). Through these efforts, we are transforming how the world connects, computes, and communicates.

Our decades-long partnership with the transportation industry began in the late 1980s when we developed the Omnitracs two-way satellite communication system for trucking industry operations across North America. Omnitracs was one of the first mobile data service systems and helped to create the telematics revolution. In 2002, we worked with the automotive industry to introduce CDMA mobile technology. Qualcomm has been a leader in telematics innovation, working closely with our partners, expanding from voice-based connectivity, including emergency-calling and concierge services, to on-demand navigation and Wi-Fi hotspot capability, and over-the-air software updates, remote diagnostics, cloud-based data analytics and gigabit-per-second wireless services.

Qualcomm continues to enable the future of transportation through its innovations in autonomous driving. In January 2020 at the annual Consumer Electronics Show (CES) in Las Vegas, Qualcomm unveiled its Snapdragon Ride™ platform, which aims to accelerate the deployment of high-performance autonomous driving to mass market vehicles.[1] More recently, in January 2021, Qualcomm announced the expansion of its Snapdragon Ride platform.[2] The

[1] https://www.qualcomm.com/news/releases/2020/01/06/qualcomm-accelerates-autonomous-driving-new-platform-qualcomm-snapdragon

[2] https://www.qualcomm.com/news/releases/2021/01/26/qualcomm-announces-expansion-scalable-snapdragon-ride-platform-portfolio

Snapdragon Ride Platform is one of the industry's most advanced, scalable, and customizable ADAS and autonomous driving platforms.

In addition, Qualcomm is working with automotive technology company Veoneer to power next generation ADAS and ADS. This collaboration ties together Veoneer's next-generation perception and driving policy stack with Qualcomm's Snapdragon Ride ADAS/AD scalable portfolio. The result of Qualcomm's work with Veoneer will be an open platform for Tier 1 suppliers and automakers with L1 to L4 systems.[3]

Furthermore, for several years 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. C-V2X uses first 4G and then 5G to enable vehicles to communicate with one another and with roadway infrastructure, such as traffic signals, to enhance safety. C-V2X enables direct vehicle-to-vehicle communication for the most time-critical, latency-sensitive communication for roadway safety use cases, as well as communication through cellular networks for less immediate messaging. Qualcomm and the many companies in the growing C-V2X ecosystem are very excited by the near-term and long-term potential of this technology to save lives through improved roadway safety. Incorporation of C-V2X into ADS has the potential to dramatically improve the safety performance of such systems by enabling autonomous vehicles to communicate on a continuous basis to all other autonomous vehicles and non-autonomous vehicles in their vicinity, including the sharing of

[3] https://www.qualcomm.com/news/releases/2020/08/27/veoneer-and-qualcomm-power-next-generation-adas-and-autonomous-driving

sensor information to improve situational awareness and the communication of intention, *e.g.*, before changing lanes, making turns, coordinating maneuvers, as well as stopping and starting. Standardization work on applications and messages that can be communicated using C-V2X to support cooperative automated driving is well underway in SAE International.

II. NHTSA SHOULD ADOPT A FLEXIBLE APPROACH IN DEVELOPING A FRAMEWORK FOR ADS SAFETY

Qualcomm applauds NHTSA for taking a measured approach in developing a framework for ADS safety. As the ANPRM notes, ADS is in the development phase, with many promising innovations yet to come. It's imperative that this emerging industry be able to explore, develop, and refine new approaches and business models, and that premature regulation not inadvertently stymy a new technology that has substantial potential to save lives through improved roadway safety. An ADS framework must provide sufficient flexibility to address different underlying technologies and business models as they evolve.

Qualcomm is actively participating in the development and testing of technologies that can improve ADS. Following the U.S. Department of Transportation designation of San Diego as one of ten proving grounds to encourage testing and information sharing around automated vehicle technologies,[4] Qualcomm launched a research and testing program in coordination with state and local government agencies.[5] Qualcomm designed the program to facilitate use case

[4] https://www.transportation.gov/briefing-room/dot1717

[5] https://www.qualcomm.com/news/releases/2020/07/21/san-diego-regional-proving-ground-joins-efforts-qualcomm-launch-c-v2x

research and testing for vehicle communications in realistic operating conditions. Learnings from these tests and follow-on research will help inform the development of ADS. Qualcomm looks forward to continuing to lead and participate in such testing and research with government entities and industry partners.

In addition, Qualcomm is leading standards work on sensor sharing and maneuver coordination in the SAE International V2X Advanced Applications technical committee. We are also participating in the SAE International On-Road Automated Driving (ORAD) and Cooperative Driving Automation (CDA) technical committees and are also active in key ISO and IEEE groups.

III. NHTSA SHOULD ENCOURAGE AND ADVANCE C-V2X AS A KEY ENABLER OF EFFECTIVE AND SAFE ADS

Qualcomm is a founding member of the 5G Automotive Association (5GAA), which has grown from an initial eight members to more than 140 today.[6] Qualcomm plays an integral role within 5GAA in advancing C-V2X technology and is actively involved in commercial deployments globally, which continue to accelerate. [7]

C-V2X does not require a connection to the network. Rather, the peer-to-peer mode of C-V2X allows communications to occur directly between vehicles (V2V), infrastructure (V2I) and

[6] *See* 5GAA, www.5gaa.org (last visited Apr. 1, 2021). Visit https://5gaa.org/membership/our-members for a complete list of member companies.

[7] https://www.qualcomm.com/news/onq/2021/01/27/c-v2x-global-market-momentum-continues-accelerate

people and other vulnerable road users (V2P). C-V2X specifications were first included by the global cellular standards group, 3GPP, in its Release 14.

5G-powered C-V2X is well underway. Last year, 3GPP adopted the first 5G standard with C-V2X features, Release 16, and standards work is underway on additional C-V2X features as part of the 3GPP Release 17 for 5G NR. Due to its extreme throughput, low latency and enhanced reliability, 5G C-V2X has the potential to enable dramatic improvements in the safety performance for ADS.[8] Cars enabled with 5G C-V2X will be able to share highly detailed data with other vehicles and road users and incorporate such data into their real-time roadway decision-making. One can think of 5G C-V2X as an additional sensor for ADS, complementing and enhancing its camera, lidar, and radar capabilities. The safety benefits of such capabilities are enhanced as more vehicles are equipped with them. Therefore, it's appropriate for NHTSA to encourage the adoption of 5G C-V2X into ADS so these safety benefits can be fully realized.

[8] https://www.qualcomm.com/news/onq/2020/03/31/how-nr-based-sidelink-expands-5g-c-v2x-support-new-advanced-use-cases.

IV. NHTSA HAS APPROPRIATELY SELECTED THE FOUR CORE ELEMENTS FOR A SAFETY FRAMEWORK; QUALCOMM RECOMMENDS A SEPARATE ELEMENT FOR POSITIONING

The ANRPM seeks comment on whether NHTSA has appropriately selected the four core elements (*i.e*., "Sensing," "Perception," "Planning" and "Control") of a framework for ADS safety.[9] Qualcomm agrees that these four elements are critical in the development of such a framework. Within this framework, NHTSA has included Positioning as a sub element under Perception.[10] Given the critical nature of Positioning to the performance of ADS, Qualcomm recommends that NHTSA include Positioning as a unique core element.

Building on its legacy of decades of work on Positioning for cell phones, Qualcomm has taken a leading role in developing improved Positioning capabilities for the unique requirements of automotive use. For cars communicating with other cars, the infrastructure and other road users, such as pedestrians that change location in real-time, having the most accurate position information is an essential element to avoid collisions and other unsafe movements. Positioning enables ADS to generate a precise pose (position and orientation) for perception, path planning, and control functions. Proper engineering measures and requirements are necessary for the evaluation of Positioning.

While including Positioning as a separate core element, the ADS framework should remain technology neutral with respect to the various approaches, including map-based and perception-

[9] NHTSA ANPRM pg. 59.

[10] NHTSA ANPRM pg. 22.

based approaches. Qualcomm's Vision Enhanced Precise Positioning (VEPP) is one such approach.[11] Other approaches exist or are in development and any regulations should remain technology neutral toward all such approaches.

[11] https://www.qualcomm.com/news/onq/2019/01/09/vepp-more-accurate-and-affordable-automobile-position-location-technology.

V. CONCLUSION

Qualcomm applauds NHTSA for its thoughtful and measured approach toward the development of a framework for ADS safety. Critically important research and testing of ADS is underway and will result in dramatic advancements in roadway safety. Qualcomm is at the center of these efforts. Because Positioning is integral to enabling effective ADS, NHTSA should include it as a distinct, core element of a framework for ADS safety. We look forward to continuing our partnership with NHTSA in these efforts and in working to improve people's lives through the development of groundbreaking wireless technologies.

Respectfully submitted,

QUALCOMM INCORPORATED

By: _____

Dean R. Brenner
Senior Vice President, Spectrum Strategy & Technology Policy

Alice Tornquist
Vice President, Spectrum Strategy & Technology Policy

1730 Pennsylvania Avenue, NW
Suite 850
Washington, DC 20006
202.263.0020

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