



## Car Communication Comes of Age – C-V2X (Cellular-Vehicle-to-Everything) Explained

By Lynn Walford - October 12, 2020



**🕒 Reading Time: 7 minutes**

In the future, cars may be able to know what is around the corner, when workers are on the side of the road, how long traffic lights will stay green and how traffic will flow. Roadblocks to these capabilities that are slowing up a freeway of communication around the world include technology, networks, regulations, infrastructure and spectrum to enable all the players to communicate.

To deploy Cellular-Vehicle-to-Everything (C-V2X), Audi, Qualcomm, VTTI, Danlaw and others are working on a new ecosystem to make mobile inter-communication possible.

### What is C-V2X and How Does it Work?

C-V2X is the same LTE you have in your phone and probably in your car, says Jim Misener, Senior Director, Product Management at Qualcomm Technologies. C-V2X enables direct communication between the connected devices.

However instead of the cellular bands in the range of wireless carriers such as T-Mobile, AT&T and Verizon—the C-V2X spectrum is expected to be in the 5.9 GHz pipeline. This area of the spectrum was reserved for vehicle safety with a Wi-Fi protocol, called Dedicated Short Range Communication (DSRC).

“C-V2X brings safety communication to the same specification you have in your handset, forward evolution and backward compatibility, just like your phone but it has the additional feature of device-to-device,” says Misener.

C-V2X has the added benefit of wide-area to bring V2I (Vehicle-to-Infrastructure) and V2N (Vehicle-to-Network) all on the same chipset for transportation safety to the same modem you find in cars with telematics devices,” he adds.

For vehicle OEMs, C-V2X is so much more deployable than alternative technologies, says Misener, who notes that at first C-V2X will be deployed at 4G speeds and then 5G later on.

“As far as services, 5G actually transcends safety. It would increase mobility services to allow road operators to work more efficiently. We offer a combination for transportation that allows intersections to be

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operated with direct communication.”



## Why Use 5.9 GHz and Who Rules it in the U.S.?

Presently, the spectrum requested for 5 GHz is allocated to DSRC which is controlled by the Federal Communications Commission (FCC) in the U.S.

The 5.9 GHz current rules invented in 1991 for vehicle-to-vehicle communication using DSRC technology were based on primitive Wi-Fi only. It was not allowed to be used commercially for any other communication, says Dean Brenner, Spectrum Strategy for Qualcomm.

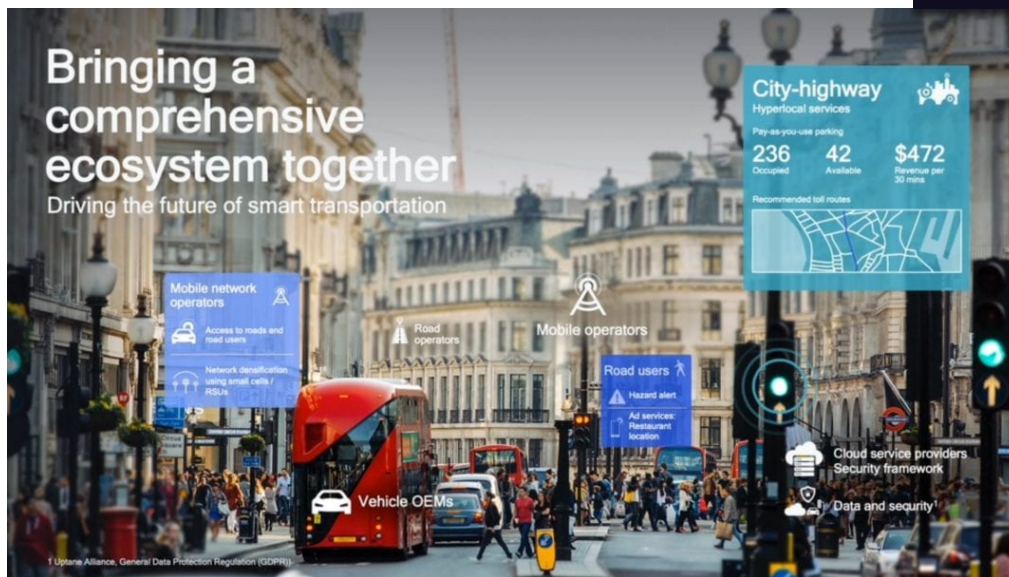
“We are working to get access to the 5.9 GHz as soon as possible. The FCC voted five to nothing to allow NPRM (Notice of Proposed Rulemaking ) documents to change rules in December 2019 to use the upper 20 GHz of 5.9 GHz and invited comments,” says Brenner.

In an NPRM to the commission, Brenner wrote: “C-V2X currently is being deployed in Asia and other overseas markets, and the Ford Motor Company has committed to deploy the technology in all new vehicles in the U.S. in 2022 if and only if the FCC permits it.”

“We’re cautiously optimistic that we will see a final decision out of the FCC in 2020. We are pleased with the fact that all five FCC commissioners on a unanimous bi-partisan basis fully support the reallocation of the top 20 GHz spectrum to C-V2X. 5.9 GHz,” says Brenner

The spectrum is a harmonized band for C-V2X technology. Some state departments of transportations deployed DSRC which is unfortunate because there are not commercially available DSRC cars. Having the infrastructure that can’t connect to cars doesn’t really achieve anything. There are several state departments of transportation that are moving forward with C-V2X pending a final decision from the FCC, says Brenner.

Qualcomm has a variety of C-V2X chipsets, products and resources ready to deploy in the United States. “Qualcomm is building an ecosystem to bring the important players together, road infrastructure, automakers, mobile network operators and all road users,” says Misener, “We can energize the C-V2X ecosystem with multiple paths including states, emergency responders, and wireless carriers.”



## Where is C-V2X Being Tested and What Can it Be Used for?

Recently, Audi of America announced it is working with the Virginia Department of Transportation (VDOT), Virginia Tech Transportation Institute (VTTI) and Qualcomm to research ways to reduce road hazards and fatalities. They are deploying C-V2X to make work zones safer and expand safety use cases on the Virginia Smart Road Corridor.

Audi Q8 test vehicles using the Qualcomm C-V2X-based platform will deliver warnings and alerts to drivers and road personnel about each other's presence on a stretch of highway in Blacksburg Virginia.

"It is an exciting opportunity to address both work zone and traffic light safety," says Pom Malhotra, Director, Connected Services, Audi of America.

VDOT's signal controllers are broadcasting signal status information to the Audi Q8 SUVs that supplement Audi's Traffic Light Information (TLI). C-V2X allows different devices to 'talk' to each other directly such as car On-Board-Units (OBU) with modems, RSU and other devices.

"We provide drivers with advisories about work zones including lane changes, speed zones, traffic signal information and at what speed to drive to avoid red lights," says Mike Mollenhauer, Division of Technology Development and Deployment, Interim Director VTTI.

The cars, signs, roadside units (RSU) and vests broadcast information. The workers wear smart vests that are enabled with two-way communication, with speakers and LED lights. When the driver gets closer to the work zone, detailed messages such as instructions on where to merge at a reduced speed are given. The driver and the worker are warned when they are close to each other.

"We will also have the C-V2X that can send signals to the vehicle to support green light optimisation, speed approaching or GLOSA (Green Light Optimized Speed Advisory) with recommendations for the driver in the application," says Mollenhauer.

The red light warning application is activated when the vehicle senses that the driver has not recognised the red light and it's not planning to stop. A warning is given over the HMI, says Mollenhauer.



## Who Needs C-V2X? Why Are C-V2X Applications Needed for Emergency Responders?

In cases of emergencies such as fires and crashes, the need for fast response time and communication of data is very important to save lives.

“The clock is the severely injured patient’s biggest enemy,” says Dia Gainor, Executive Director of the National Association of State EMS Officials.

C-V2X could compliment two public safety initiatives coming soon to the US, Next Generation 911 (NG911) and FirstNet communications for first responders. Both systems are being upgraded to share richer data such as videos, images, data and text messages.

Gainor notes that there is great data in Automatic Collision Notifications (ACN) and wishes that it could be transmitted to first responders.

Automatic Collision Notifications can provide the location, airbag deployment, crash severity and other information that could inform first responders what kind of medical care and equipment is needed.

“If you could perhaps send the collision information to Next Generation 911 without a third-party telematics service provider then call takers will have more precise information about the vehicle itself and the probability of severe injury,” says Gainor, “The information would be critical in making the difference in someone’s life or death.”

“We have to sadly acknowledge how often emergency response personnel are severely injured and worse yet killed at the scene of roadway related incidents. It is unfortunate but pertinent consideration for where and how C-V2X can help to avoid these types of incidents. It is a travesty and what we hope becomes a high priority for technology solutions,” says Gainor.

## What C-V2X is Being Tested to Avoid Emergency Vehicle Crashes?

To help emergency responders to travel safely and know what is around corners, Danlaw developed the Traffic Signal Preemption Application for emergency vehicles.

The system includes a lighting bar with a C-V2X antenna and electronics that run the warning lights and sirens. When the driver turns on the siren the program is initiated, to notify via C-V2X the roadside units (RSU) that are connected to the traffic light controllers.

“The vehicle requests that the signal stay green and moves through it without worrying about cross traffic. It can also inform the driver of other hazards. The system offers in-vehicle notifications, shows the timing of the traffic signals and other emergency vehicles,” says Andrew Donaldson, Program Manager Connected Vehicles, Danlaw.

He says the system is being tested in Sterling Heights, Michigan where a fire chief was able to save a patient's life using the technology.



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Qualcomm is working with the Hawaii DOT to test Red Light Violation Warning, Pedestrian and Cyclist Collision Warnings, Emergency Vehicle Preemption, Transit Signal Priority, Traffic Queue Warning, the TravelSafely smartphone app, and Signal-Phase and Timing (SPAT).

The California Department of Transportation (Caltrans) is testing the C-V2X deployment for pervasive end-to-end systems for freeway management with integration with its Traffic Management Center (TMC).

China is launching C-V2X on its roads in 2021 in the 5.9 GHz spectrum.

Audi offers **GLOSA and Traffic Light Information (TLI)** as part of its Connect Prime services.

“Traffic Light Information is evolutionary. Eventually, the data will be used to respond and control the vehicle which is part of Audi's strategy,” says Malhotra.

During the news conference for the Virginia Smart Road pilot, Roger C. Lanctot, Director Automotive Connected Mobility, Strategy Analytics was enthusiastic about C-V2X use cases and their effect on mobility.

“These are life-saving applications and they point the way toward future life-saving applications. Suddenly, the wireless connection in the car is implicated in vehicle safety – collision avoidance. This is an extraordinary breakthrough and shifts the focus away from subscription-only strategies emphasizing so-called infotainment,” says Lanctot.

“C-V2X is a true Internet of things application scenario where cars will be able to talk with mobile devices, other cars, and infrastructure. It also gets the industry closer to delivering a product that is ‘less inclined’ or less likely to hit things, such as other cars, pedestrians, and inanimate objects. Ultimately, C-V2X will assist autonomous or semi-autonomous driving systems,” predicts Lanctot.