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Smart Cars and Trucks: Spectrum Use for Vehicle Safety

A November 2020 decision by the Federal Communications Commission (FCC) to reconfigure the 5.9 gigahertz (GHz) spectrum band may change the evolution of U.S. vehicle safety technologies. The decision has implications for domestic spectrum use and vehicle technologies—and their application to international standards for connected vehicles and infrastructure.

The 5.9 GHz band was previously allocated for intelligent transportation systems (ITS)—specifically, for Dedicated Short Range Communications (DSRC) vehicle safety technologies. The FCC split the band, allocating a part to unlicensed use (e.g., Wi-Fi) and reducing the portion available to ITS vehicle safety technology by more than half. The commission assigned that portion exclusively to Cellular Vehicle-to-Everything (C-V2X), which it selected as the U.S. standard for vehicle safety technologies. It eliminated spectrum for DSRC use altogether.

The U.S. Department of Transportation (DOT) opposes this decision. DOT has been funding, testing, and piloting DSRC for more than 20 years, and it says the technology is capable of cutting traffic fatalities now. The FCC asserts that automakers have been slow to deploy DSRC—about 15,000 vehicles have been equipped with it since 2017—and that the 5.9GHz band would be better used to support consumer wireless needs and new vehicle technologies. While some policymakers have applauded the FCC’s decision to increase spectrum for consumer use, the chairman of the House Transportation and Infrastructure Committee has requested that the FCC reconsider its decision, saying it “will undermine roadway safety.”

Background

Increasing the autonomy of cars and trucks is seen as an effective way to reduce the 94% of vehicle-related accidents that involve human error. While some semiautonomous safety technologies, such as automatic braking, are in use today, many autonomous technologies under development would require cars and trucks to communicate wirelessly with one another (vehicle-to-vehicle, or V2V) and with their surroundings (vehicle-to-infrastructure, or V2I). V2V communication is expected to reduce the number of accidents by improving detection of oncoming vehicles and providing driver warnings. V2I communication is expected to help highway operators monitor and manage traffic and provide drivers with information such as weather and traffic conditions.

For vehicles to communicate wirelessly, they need access to radio frequencies. In the United States, the FCC manages commercial use of the radio frequency spectrum, and allocates spectrum for specific uses. V2V and V2I technologies are part of a congressional mandate to advance ITS to improve traffic flow and safety. In response, the FCC set aside 75 megahertz (MHz) of spectrum in the 5.9-GHz band in 1999 specifically for DSRC vehicle safety

technologies. DSRC, one type of ITS technology in the early stages of deployment, is installed in cars and trucks and along roadways to enable V2V and V2I communications that are not reliant on cellular networks. C-V2X, which has emerged as an alternative to DSRC, offers safety features similar to DSRC that are not reliant on cellular networks, but can also connect to those networks. C-V2X advocates assert that it offers better safety features and greater capacity for data throughput.

In 2019, the FCC considered a reallocation of the 5.9 GHz band to expand unlicensed uses such as Wi-Fi access and accommodate the growing number of consumer and commercial wireless devices. It also considered whether the remaining portion of the band should be dedicated to both C-V2X and DSRC or only C-V2X. On November 18, 2020, the FCC adopted rules that would reallocate the lower 45 MHz of the band to unlicensed uses and the upper 30 MHz of the band to ITS, specifically for C-V2X technologies.

The FCC granted unlicensed users immediate access to the lower band and required DSRC licensees operating in the lower band to move to the upper band within one year. It also required users in the upper band to use C-V2X. To accommodate DSRC users, it proposed a timeline (two years) for DSRC users to transition to C-V2X or cease operating. The FCC is seeking comment on the timeline.

DSRC

In 1998, the Transportation Equity Act for the 21st Century (P.L. 105-178) directed the FCC, in consultation with DOT, to consider spectrum needs for ITS, specifically including DSRC technologies, to improve traffic flow and safety. The DSRC standards, including certification test procedures, were issued in 2016. More than \$2.2 billion in federal, state, local and private-sector investments have been made since 2003 in DSRC testing and deployment, including pilots in 27 states, with more than 100 additional testing sites planned. Among its major demonstration sites are *New York City*—where 8,000 taxis, buses, and sanitation vehicles have been outfitted with DSRC to alert drivers to potential crashes and reduce accidents with pedestrians; *Interstate 80 in Wyoming*—where DSRC notifies cars and trucks of disabled vehicles during severe winter weather to prevent crashes; and *downtown Tampa, FL*—where drivers are alerted to reduce speeds when approaching heavy traffic to avoid collisions and where intersections are unsafe.

New Technologies

As DSRC was being piloted and deployed globally, demand for wireless technologies and spectrum for them also increased exponentially.

Wireless Technologies

In 2012, Congress directed the FCC to determine whether the 5.9 GHz band could be shared for unlicensed use, such as mobile phones and Wi-Fi enabled devices (P.L. 112-96,

Title VI, §6406). In response to a 2016 FCC Public Notice, some commenters, including wireless service providers, proposed that users share the entire 5.9 GHz band (75 MHz). DOT and some state transportation agencies, public safety agencies, and some automakers raised interference concerns and asserted that the entire band should remain dedicated to ITS. FCC said its testing showed potential for sharing; however, it decided to split the band instead between unlicensed use and ITS.

C-V2X

Working through the 3rd Generation Partnership Project, a group that coordinates development of wireless standards, some telecommunications and automobile companies developed C-V2X in 2017. C-V2X, like DSRC, can operate independently from the cellular network for V2V and V2I communications, but can also connect to 4G and 5G networks. 5G networks, once fully deployed, are expected to offer high-speed, low-latency (i.e., reduced lag time) services, critical for safety applications and autonomous vehicle operation. The 5G Automotive Association (5GAA), which includes some automakers, technology companies, telecommunication providers, and standards bodies, asserts that C-V2X performs better than DSRC and that its adoption will accelerate the deployment of compatible 5G systems, including traffic lights, traffic control systems, and personal devices. In 2018, 5GAA petitioned the FCC for spectrum in the 5.9 GHz band to deploy 4G-based C-V2X; deployments have been limited to a few cities. In contrast to DSRC, 5G-based C-V2X standards and test procedures have not been finalized.

Policy Considerations

Policy considerations center on spectrum and standards decisions, and U.S. competitiveness in the global automobile and wireless technology industries.

Spectrum Decisions and Interference Concerns

A challenge for Congress is balancing competing spectrum needs. In a letter to the FCC, sent before it made its decision, DOT disagreed with the FCC's proposal to split the band, asserting that 30 MHz is insufficient for safe ITS use. DOT cited industry tests showing interference potential from unlicensed devices operating in the lower band, and argued that the FCC's technical requirements for use of the band do not resolve DOT's interference concerns. Further, DOT stated that the entire band will be needed as autonomous vehicles come into use. The FCC stated that the band is underutilized and it is in the public interest to reallocate a portion for consumer use. During the COVID-19 pandemic the FCC granted wireless providers temporary authority to use the lower segment to provide broadband services. It stated that 30 MHz is adequate for vehicle safety needs, and argued that automakers could use the unlicensed portion of the band for ITS nonsafety features.

Standards Decision

A second issue is the FCC designation of C-V2X as the sole ITS technology that can operate in the band. In effect, the FCC selected C-V2X as the U.S. standard for vehicle safety technologies. This is a departure from past practice, under which the agency has generally refrained from designating a specific technology. The FCC says its selection of C-V2X could spur investment in C-V2X technologies, improve roadway safety, and strengthen U.S. competitiveness in the

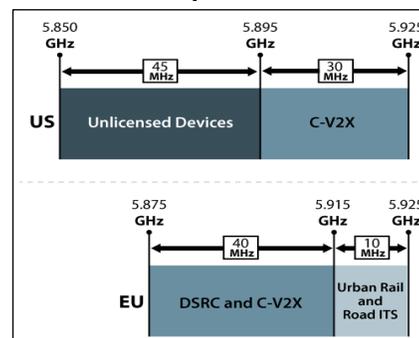
global vehicle safety market. DOT counters that DSRC has been the recognized safety technology in most industrialized countries for more than 20 years, is tried and tested, and should not be abandoned.

U.S. Competitiveness

The third issue focuses on U.S. competitiveness in the global auto technology market. There is no global consensus on a single standard for vehicle safety technologies. Thus, many countries that have tested and deployed DSRC are now assessing C-V2X and exploring options for interoperability and coexistence.

European Union (EU) regulators are encouraging auto and telecommunications companies to decide on a single solution or to find a way to permit interoperability between DSRC and C-V2X. ETSI, a European standards organization, is exploring ways for the two technologies to interoperate or coexist in the same band, with findings expected in 2022. If no technology resolution is found in the next two years, EU regulators expect to choose between DSRC and C-V2X. Until then, EU regulators have chosen to allocate spectrum to both DSRC and C-V2X. Some member countries prefer one over the other, and some cross-border corridors are deploying DSRC (called ITS-G5 in Europe), and others, C-V2X. Volkswagen is selling several vehicles equipped with DSRC, while BMW and Mercedes reportedly favor C-V2X but have yet to install it in their vehicles. The EU allocated 40 MHz for vehicle safety technologies, with an adjoining band of 10 MHz used by urban rail that can also be used for road ITS (**Figure 1**).

Figure 1. U.S. and EU Spectrum Choices



Source: CRS.

Japan and South Korea—other major auto-producing countries that had previously planned on adopting DSRC—have C-V2X testing under way and remain undecided on spectrum allocation and vehicle safety technologies.

A key consideration for the U.S. government is China's decision to make C-V2X mandatory. Industry analysts expect support for C-V2X in China could drive wide-scale deployment there, enabling economies of scale and reducing costs, which could spur C-V2X adoption in other regions. Some analysts say the FCC's selection of C-V2X could give U.S. technology companies a competitive edge in the global C-V2X market, while DOT asserts the FCC has abandoned safety technologies that can save lives now.

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