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In the Matter of

Federal Motor Vehicle Safety Standards: Vehicle-to-Vehicle (V2V) Communications	)	NHTSA-2014-0022

Comments of ITIF

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The Information Technology and Innovation Foundation ("ITIF") appreciates this opportunity to comment on the above captioned proceeding. ITIF is a non-partisan research and educational institute – a think tank – whose mission is to formulate and promote public policies to advance technological innovation and productivity internationally, in Washington, and in the states. Recognizing the vital role of technology in ensuring prosperity, ITIF focuses on innovation, productivity, and digital economy issues.

As indicated in NHTSA's advanced notice and the accompanying research report ("Readiness Report"),[1] vehicle-to-vehicle communication is a potentially exciting development with a number of benefits. However, ITIF is concerned that a mandate of Dedicated Short-Range Communications (DSRC) technology in light vehicles may be premature due to potential changes that may be made to the standard in order to accommodate a valuable expansion of unlicensed spectrum in the 5.9 GHz band. While a mandate or recognition of a standard V2V technology of some kind may be necessary to overcome network effects, it is not clear that DSRC in its current form is that technology. NHTSA should wait until industry agrees upon a coexistence solution for DSRC and unlicensed spectrum in the 5.9 GHz band before imposing a mandate.

V2V technology has the potential to make travel more efficient, safer, environmentally friendly, and effectively priced. Traffic congestion is estimated to have an $87.2 billion annual drain on the economy.[2] Connected cars can reduce this congestion through more effective management of transportation systems and decisions based on real-time information. This data could also potentially improve the pricing of the use of transportation infrastructure from its

[1] Nat'l Highway Traffic Safety Admin., "Vehicle-to-Vehicle Communications: Readiness of V2V Technology for Application, DOT HS 812 014 (Aug. 2014) ("Readiness Report").

[2] U.S. DOT RITA, "Connected Vehicle Research in the United States" (June 2014), http://www.its.dot.gov/connected_vehicle/connected_vehicle_research.htm.

current tax-based model.[3] Connected cars, combined with other technologies, may also reduce fuel consumption and carbon dioxide emissions.[4] As well documented in the Readiness Report, we can expect significant safety benefits if V2V technology is widely deployed.[5] Connected cars will be a boon to our economy and dramatically increase driver safety, and NHTSA is undoubtedly right to encourage their development.

An eventual mandate of V2V technology may be appropriate because, in the words of the advanced notice of proposed rulemaking, "there would not be any immediate safety benefits for consumers who are early adopters of V2V." These sorts of network effects are common in contemporary complex economies, and a government mandate can be certainly an effective method of overcoming them. Experiences from other networked industries show that while network effects can limit the initial adoption rates of a particular platform or technology, they also serve as a positive feedback loop, quickly accelerating adoption as the value increases. Networks effects can also make a particular technology "sticky," shoring up its dominance until a clearly superior technology emerges. This is usually a healthy process that may be unduly affected by a mandate. Network effects are a key feature of dynamic information technology. NHTSA should take caution as these communications platforms are not static like seatbelts or airbags, where only incremental improvements are expected over time. This is a dynamic sector, where we can expect wholly new platforms to emerge.

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[3] *See* Andreas Mai & Dirk Schlesinger, "Connected Vehicles and Government: A Catalyst to Unlock the Societal Benefits of Transportation," Cisco (April, 2011), https://www.cisco.com/web/about/ac79/docs/mfg/Connected-Vehicles_Government.pdf.

[4] Anthony Shaw, "Accelerating Sustainability: Demonstrating the Benefits of Transportation Technology," ITS America (2014), http://digitalenergysolutions.org/dotAsset/933052fc-0c81-43cf-a061-6f76a44459d6.pdf.

[5] *See also*, GAO Report, "Intelligent Transportation Systems: V2V Technologies Expected to Offer Safety Benefits, but a Variety of Deployment Challenges Exist," GAO-14-13 (Nov., 2013), http://www.gao.gov/assets/660/658709.pdf.

Although it is probably wise, once uncertainties related to spectrum are resolved, to initially mandate a V2V technology, NHTSA should also reevaluate the mandate over time as more advanced technology is developed. NHTSA should be careful not to discourage development of, for example, autonomous vehicles – a technology that will have significant benefits beyond those flowing from DSRC.[6]

If NHTSA is to impose a V2V mandate, it should do so only if it is confident that particular technology will remain the best option for years to come. It is not clear that the current incarnation of DSRC is that technology. Although there are a host of challenges that will come with implementation of V2V communications, such as those surrounding privacy and security, ITIF is particularly concerned about unresolved questions about the radio environment DSRC is expected to operate in.

As NHTSA is well aware, the Federal Communications Commission has an ongoing proceeding in which they proposed to open the 5850-5925 MHz band to unlicensed devices. This spectrum is already allocated on a primary basis to Fixed Satellite Services (the "extended C-Band") and Intelligent Transportation Services (ITS) for DSRC use. It is clearly established that any introduction of unlicensed devices into the 5850-5925 MHz band must not cause interference to future DSRC systems (or the C-Band for that matter). What is less clear is how that co-existence will be achieved.

Several companies have proposed different sharing scenarios, and the IEEE, which standardized both 802.11ac and DSRC, has established a "Tiger Team" to evaluate various coexistence schemes, exploring technical solutions to allow Wi-Fi devices in the 5.9 GHz band without interference to DSRC safety applications. Furthermore, Senators Cory Booker (D-NJ)

[6] Autonomous vehicles are currently being developed that rely on a wide range of technologies – DSRC is not necessarily required. For a discussion of autonomous vehicles and their benefits, *see* Robert D. Atkinson, "The Coming Transportation Revolution," The Milken Institute Review (2014), http://assets1c.milkeninstitute.org/assets/Publication/MIReview/PDF/78-87-MR64.pdf.

and Marco Rubio (R-FL) have introduced legislation encouraging the introduction of Wi-Fi to this band. NHTSA should wait until a coexistence solution is agreed upon by industry before moving forward with a mandate.

One of the most valuable expected uses of this unlicensed spectrum is the next-generation standard of Wi-Fi – 802.11ac. Driven by mobile devices such as smartphones and tablets, demand for capacity in mobile networks continues to grow at rapid rates. Wi-Fi is a key network technology in offloading high-capacity wireless data traffic. A premature mandate could stifle the engineering work necessary to find a technical solution to DSRC – Wi-Fi sharing, diverting us from an ideal resolution and robbing us of network capacity when it is increasingly needed. Any mandate that would stunt the entry of Wi-Fi into this band on a non-interfering basis should take that loss into account in cost-benefit analysis (assuming that an effective technical sharing solution can be found).

The 802.11ac Wi-Fi standard will play an important role in meeting the growing demand for Wi-Fi connectivity. Access to the 5850-5925 MHz band would mean 75 additional megahertz available for Wi-Fi. Those 75 megahertz would be especially valuable for 802.11ac because this block is next to additional spectrum already allocated to unlicensed use. Enabling unlicensed use in the 5.9 GHz band on a non-interfering basis would create a contiguous block of 455 megahertz. The 802.11ac standard thrives on large blocks of spectrum, preferably 80 or 160 megahertz – this additional 75 megahertz would make a significant difference in overall capacity of our nation's Wi-Fi networks.

Although ITIF does not now endorse a particular sharing proposal, we do strongly believe that NTSA should be open to the possibility that this spectrum can be safely shared. The two standards share ancestry, both growing out of earlier Wi-Fi protocols, and there are engineers who understand both well and are interested in seeing both succeed. DSRC units are also planned to have a dedicated control channel (channel 178) that operates at significant power (44.8 dBm). This high-power channel could potentially signal Wi-Fi units in range to switch to a

non-interfering channel, similar to the dynamic frequency selection already required to protect federal radars in nearby unlicensed bands. ITIF offers this only as an example of a possible sharing mechanism – it is far from clear that a DFS mechanism is the ideal solution either for Wi-Fi equipment or DSRC.

It is likely that the basic safety messages (BSM) of connected cars will need a dedicated communications technology because of the specific use requirements and the variety of environments it will be expected to operate in. Latency is an incredibly important factor, especially in communicating BSMs. The time division becomes important in quickly relaying BSMs, which prompted engineers to add an additional radio after disappointing field trials. These radios also have to operate in a constantly changing environment, rich with multi-path and noise.[7] Furthermore, scalability presents challenges specific to V2V: in dense traffic patterns, a large number of cars would have to communicate simultaneously without interfering. All this is to say that it is unlikely that a general purpose technology will supplant the key safety application of DSRC – the basic safety messages. BSMs will likely continue to require a dedicated technology that may justify a NHTSA mandate. However, some think that LTE-A or 5G technologies may be able to overcome these engineering challenges,[8] and, again, NHTSA should take care to periodically review any potential mandate in this dynamic sector.

However, several of the applications envisioned for the non-safety service channels may well be better suited for other communications tools, perhaps even Wi-Fi itself. When an incredibly valuable, general-purpose use of spectrum is available in 802.11ac, it is difficult to

[7] For good discussion of some of the difficulties DSRC faces and potential engineering solutions *see* Yunxin Li, "An Overview of the DSRC/WAVE Technology, NICTA, http://www.nicta.com.au/pub?doc=4390].

[8] *See,* e.g., Seiya Kato, et al., "Enabling Vehicular Safety Applications over LTE Networks, AT&T Labs, http://www.research.att.com/techdocs/TD_101260.pdf; Roger Lanctot, "DSRC Confronts a Battle for Relevance at ITS World Congress," Strategy Analytics (Sept., 2014) https://www.strategyanalytics.com/default.aspx?mod=reportabstractviewer&a0=10062.

justify mandating a particular technology for things like drive-through and parking lot payments, video uploads, rental car processing, route planning, and map and music updates.

Unfortunately the most promising use of DSRC, the basic safety messages, is at 5.860 GHz (channel 172). These BSMs are the most important channel to protect from interference from Wi-Fi, but also in the middle of where an additional, contiguous 80 megahertz 802.11ac channel would go. Although it would contribute significant delay in DSRC deployment, a new band plan might be justified to facilitate introduction of next-generation Wi-Fi services.

It is not yet clear what the best solution to sharing this spectrum is, but ITIF is confident that a solution will emerge. NHTSA should wait until the future of DSRC spectrum is clear before imposing a mandate that could cloud the coexistence development process.

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