PRELIMINARY TECHNICAL ASSESSMENT

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Concerns with Draft FCC NPRM: Use of the 5.850-5.925 GHz Band [ET Docket No. 19-138][1]

Reduction in spectrum for transportation safety

- The draft NPRM presents a dramatic shift in the current rules and the spectrum allocation for transportation use; a loss of 45 MHz of the existing 75 MHz allocation for transportation safety—limiting transportation to 20-30 MHz of spectrum that may or may not be useable based on known adjacent channel interference issues.
- It may reasonably be expected **that the shift defers accident reduction for another 5 years**, given time to develop, standardize, and deploy equipment – either existing concepts in different spectrum or new concepts in existing spectrum.
- Loss of spectrum access may be anticipated to result in lost technology advancements:
  - Loss of life-saving vehicle safety applications -- crash avoidance, vehicle-to-pedestrian applications, coordinated intersection movement, and others.
  - An expected cessation of automated truck platooning at the point when private sector testing is ready to commercialize truck platooning.
  - Loss of broad and significant safety and mobility benefits including system efficiency through vehicle-to-infrastructure communications, road weather notices, transit and freight logistics, and public safety applications.
  - A significant cost to current deployers, licensees, and operations to re-equip or retrench.
  - A curtailing of new connected automation applications, at the point in time when these and other important innovations – edge-computing, machine-to-machine, and artificial intelligence – are emerging.
- An impact on the development of automated vehicles, for which V2X is an important complementary technology that is expected to enhance the benefits of automation.[2]
- With the limitation of a 30 MHz allocation, we note that neither of the two technologies in discussion—Dedicated Short-Range Communications (DSRC) or 4G long-term evolution cellular V2X communications (LTE-CV2X)—may be able to effectively use the 30 MHz allocation, nor can their operations be accommodated together in the band. Additionally, DSRC and LTE-CV2X are not interoperable which means a loss of collision-avoidance opportunities because devices cannot "hear" each other using the different media.

Apparent reliance on a still-maturing technology

- While the USDOT is "technology neutral," the Department cares deeply about safety outcomes and will require proof that a communications technology works in the dynamic and complex of transportation scenarios that are the cause of crashes.

[1] https://docs.fcc.gov/public/attachments/DOC-360940A1.pdf

[2] Preparing for the Future of Transportation: Automated Vehicles 3.0 (AV 3.0), p. 13.

- The draft NPRM relies significantly on a technology still in development, as evidenced by the evolution of the technology design (i.e., recent addition of a second antenna) and recent changes in its standard(s).
- A shift of this nature needs to be based upon independent and objective analysis that includes not only the spectral performance of the technology, but also the safety performance given that it will be applied to safety-of-life applications. This approach is the foundation of the USDOT's existing spectrum test program.

Removal of the safety message priority and public safety use of the spectrum

- In Appendix B of the draft NPRM, USDOT notes two changes that could effectively render useless the cooperative-Intelligent Transportation Systems (ITS) collision avoidance applications.
  - The FCC negates the safety priority and purpose of ITS crash-imminent, safety-of-life communications by fully removing 95.3159 in the OBU section and parts (d) and (e) 90.377 in the Roadside Unit (RSU) section. Removing this language has the effect of requiring that, in densely congested areas, priority basic safety messages wait for other users to finish transmitting, during which time, a crash could occur (USDOT notes that a crash situation development and occurrence can happen in under 3 seconds).
  - Further, by removing this language, FCC fundamentally removes the public safety use of this spectrum, thereby allowing commercial uses. It may reasonably be expected that commercial uses will bear larger and longer message exchanges that will interfere with the much-briefer basic safety messages, suppress V2X transmissions, or otherwise create delays that will result in crashes.
  - There are ambiguous 3GPP[3] references with relation to the LTE-CV2X devices. The draft NPRM cites Release 14 which is comprised of thousands of references that address a wide range of device capabilities, including the PC5 Mode 4 (LTE-CV2X) capability, but also includes networking interfaces, network infrastructure and end user equipment specifications, among others. The reference in section 95.3189 appears to predominantly discuss the Service and System Aspects (SA) as opposed to the radio aspects (from the Radio Access Network or RAN elements of Release 14). This ambiguity could allow any type of Release 14 uses into the 20 MHz channel and raises the risk that different LTE-CV2X manufacturers may develop devices that are not interoperable.

Profound effects on Transportation

Loss of V2I-I2V capabilities

- It is unclear whether one 20 MHz channel can accommodate all V2V/V2I safety applications *and* the breadth of other V2I applications. Given the limits of laws of physics and that DSRC and LTE-CV2X do not perform significantly differently, the USDOT anticipates that the breadth of V2I applications cannot be accommodated in one 20 MHz channel.

[3] The Third Generation Partnership Project, which advances telecommunications standards (https://www.3gpp.org/).

- We might consider a scenario that can be expected during rush hour or peak delivery hours. The results are that channel 172 is predominantly utilized by V2V crash avoidance applications with a small set of V2I safety at intersection (Signal Phase and Timing (SPaT) or intersection MAP) in support of collision avoidance; and the remaining channels are used by V2I applications. Channel 184 is in use for regular V2I, but a large amount is reserved for public safety uses when needed. Similar to Defense industry requirements, **when a crisis is imminent, availability of the spectrum is critical**.

Expected financial impact to current deploying and operating agencies

- Needless deaths and injuries that can be prevented with ITS and cooperative, connected vehicles, remain a concern and costs the Nation billions of dollars annually.
- In addition to the loss of safety benefits, if enacted, this shift could cost the USDOT and the transportation community over $500 Million based on USDOT analysis of existing deployment sites. These costs result from the time needed for all operational sites to "rip and replace"—these changes can take up to 5 years, pausing the progress made over the last few years just as deployment sites have begun operations.
- FCC suggests that the same V2X benefits can be provided through other technologies, citing Waze and current-day sensor suites as examples. USDOT has significant concerns with this statement, especially as applied to crash avoidance and similar safety applications. Notably:
  - Sensor suites and cameras require direct line of sight and cannot provide a 360-degree awareness for the driver/vehicle within a 300-1000 meter range, including when buildings, foliage and other blockers (e.g., a truck blocking a car) are in the way. V2X applications by comparison, are designed to be capable of providing warnings in several scenarios where vehicle-based sensors and cameras cannot (e.g., vehicles approaching each other at intersections).[4]
  - The Waze application is a voluntary, crowd-based traffic app that is not in use by all people driving at the same time; as such, it cannot consistently offer collision-avoidance capabilities. Notably, both Waze and infotainment systems are not as secure as critical vehicle-based safety systems, and critical coverage gaps remain in the cellular network throughout the U.S. outside of major urban centers.

[4] In comments in response to USDOT's 2016 V2V NPRM, industry made observations about V2V capabilities to provide warnings in several scenarios where vehicle-based sensors and cameras cannot (e.g., vehicles approaching each other at intersections):

- Honda Motor Co., Ltd commented, ''. . . the ability of vehicles to directly communicate with one another will greatly assist in the ability to safety and effectively deploy'' higher-level driver assistance and automated technologies.
- Along similar lines, Meritor WABCO and the Automotive Safety Council both mentioned that V2V safety applications with warning capability would enhance current active safety systems.
- Systems Research Associates, Inc. stated that ''it is irrefutable that V2V, V2I, and V2P communications will be absolutely critical to the successful development of self-driving vehicles that can avoid collisions, navigate responsibly, and achieve a transport objective efficiently and in a timely manner.''
- Similarly, IEEE USA commented that V2V provides the trusted map data and situation awareness messages necessary for innovative safety functions, and support the flow of traffic with self-driving cars.

Introducing limitations on future (and near-term) innovations, including Automation

- With this draft NPRM, the FCC appears to be curtailing access to spectrum to support connected-automated-vehicle (CAV) application requirements. The development of automated driving systems (ADS) hold the promise to revolutionize transportation choices and safety for all citizens. While not an absolute requirement for ADS technology, virtually every automotive manufacturer has acknowledged the important role that V2X communications can play in enhancing safety, extending operational design domain, and improving interactions with other vehicles and the infrastructure.[5] For example, V2X can allow ADS vehicles to easily and reliably communicate with emergency response vehicles, with traffic signals, and with other infrastructure messaging (such as location of work zones, temporary lane closures, and numerous other messages that can help an ADS vehicle navigate along its intended path).
- Additionally, V2X messaging is an absolute requirement to support coordinated vehicle movements such as truck platooning applications.
- By limiting available bandwidth to 20 MHz, it appears that the FCC proposal effectively halts innovation in the connected-automated-vehicle area, threatening US leadership in advancing automated vehicle development.

Assumed discontinuation of USDOT spectrum testing

- In the NPRM, the FCC appears to unilaterally abandon testing with USDOT in the middle of Phase 2 unlicensed Wi-Fi testing, which USDOT continues to believe is necessary to determine if spectrum sharing in the 5.9 GHz band is viable.
- If a change in technology is warranted, there are several critical steps that will require a transition period. Having a solid base of verified test data acts both as a means to refine the technology and standards quickly; and as a means of providing deployers with a trusted and transparent rationale for making changes.

Absence of cost-benefit and technical alternatives analyses

- Such a momentous shift in policy should be accompanied by cost-benefit analyses, as a matter of data-driven decision making as the Chairman has called for in the past.[6] In this case, such an analysis should include the following:
  - A rigorous analysis of the economic benefits to the Nation or:
    - Retaining the entire spectrum for transportation safety; or
    - Dividing the spectrum between unlicensed Wi-Fi and giving transportation safety a limited allocation.
  - An analysis of technical alternatives. This includes:
    - Reviewing other technologies that may be capable of achieving the U-NII, Wi-Fi and transportation safety business model goals; and
    - Ascertaining the most efficient use of the spectrum.

[5] https://www.govinfo.gov/content/pkg/FR-2017-01-12/pdf/2016-31059.pdf.
[6] https://www.multichannel.com/news/fcc-gets-ok-for-new-economic-analysis-office.

- In the limited text in this draft NPRM, we find that FCC is reallocating 60 percent of the band for the Wi-Fi industry. A good portion of the rationale for this decision comes from the FCC's reliance on a RAND study that declined to assess and incorporate publicly-available information about transportation public safety costs and benefits.
- The FCC references RAND's estimates in terms of consumer surplus and revenue growth (the same as GDP, fn. 96). At $17.7 billion for 75 MHz, this estimate is much smaller and by implication smaller still for 45 MHz at $10.6 billion ($17.7 billion x 0.6). The NPRM does not adjust any of the estimates down for 45 MHz.
- The NPRM does not make clear that the broadband industry can charge subscription fees for the services on the valuable spectrum that the FCC proposes to allocate to the industry for free. This same spectrum could otherwise deliver transportation safety enhancements worth billions of dollars in savings from collision avoidance [including loss of life, significant injury, and property loss], greater mobility and system efficiency, greater fuel savings, and faster responses to public safety/emergency response situations.
- Additionally, the draft NPRM does not discuss the emergence of Wi-Fi 6, based on IEEE 802.11ax. This new Wi-Fi innovation has the ability to bond non-contiguous bandwidth to produce larger channels—up to 160 MHz channels. With the introduction of these technologies on the market, the USDOT questions the industry's insistence that unlicensed broadband requires large swaths of mid-band spectrum to be reallocated away from current licensed users, which results in a critical impact to their lives, their operations, and their business models.
- The draft NPRM does not address the operational V2X sites that are in existence or the magnitude of the installations across the Nation. The labor and equipment costs to replace with a different technology will be over $500 Million. In addition, there will be a loss of a market for DSRC manufacturers and firms.
- Last, if enacted, this draft NPRM will result in a serious deployment pause or full stoppage of V2X operations, and it will take the Nation a longer time to realize the lifesaving benefits of collision-avoidance and other important public benefits for the public.