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June 2, 2021

Ms. Marlene H. Dortch, Secretary
Office of the Secretary
Federal Communications Commission
445 12th Street SW
Washington, DC 20554

SUBJECT: ET Docket No. 19-138, Federal Communications Commission (FCC) *Further Notice of Proposed Rule Making* (*FNPRM*) with Regards to the Use of the 5.850-5.925 GHz Band, issued May 3, 2021.

Dear Ms. Dortch:

The Utah Department of Transportation (UDOT) offers the following comments in response to the Federal Communications Commission's (FCC's) *Further Notice of Proposed Rulemaking* referenced above, issued May 3, 2021. This *Further Notice* address issues remaining to finalize the restructuring of the 5.9 GHz band, described in a Final Rule (*First Report and Order*) repurposing the lower 45 megahertz of the band for unlicensed operations issued the same day.

UDOT is committed to a transportation system that is safe, efficient, and serves the public need. In fact, safety, specifically reducing roadway fatalities, injuries and crashes to zero, is one of our primary goals. We fully support the premise that connected vehicle technology, coupled with advancements in vehicle automation, is the primary path to meeting that goal. As we have expressed in past comments, UDOT continues to oppose the reduction of spectrum available for Intelligent Transportation Systems (ITS), and is disappointed that the FCC has decided to diminish our capabilities to save lives in favor of faster internet. In light of this action, it is vitally important that the FCC work closely with the transportation safety community to ensure that the remaining 30 MHz is protected, viable, and functional. It is to that end that we offer our comments.

For over ten years, UDOT has invested effort and resources to plan, develop and deploy connected vehicle systems, the primary focus of ITS technologies envisioned for the 5.9 GHz spectrum. Our first deployments became operational in 2017. We currently have 131 intersections and 102 fleet vehicles with Dedicated Short Range Communication (DSRC) equipment installed and operating, 69 intersections with dual-mode (DSRC &

Cellular Vehicle-to-Everything (C-V2X)) Roadside Units (RSUs), and 15 vehicles with C-V2X On-board Units (OBUs).[1] These are not pilot deployments or tests, but are in a fully operational, permanent environment. The majority of our DSRC installations are initially facilitating transit signal priority applications for buses and signal preemption for snow plows, the latter of which is a safety-related application. These systems are producing measured, positive results every day. The dual-mode RSUs and associated OBUs, all operating with security credential management systems, are providing Basic Safety Message (BSM)-based insights on road weather conditions, potential crash situations, and other congestion conditions. These installations also support spot weather information and curve speed warning applications today, with additional applications in development. Additional dual-mode RSUs and C-V2X OBUs will be installed over the next year as we expand our geographic coverage and develop new applications. All of these installations are in anticipation of equipped production vehicles.

Since 2015, UDOT has invested $2.3 million in the deployment of DSRC systems in the 5.9 GHz band. We have existing contracts underway, valued at $15.0 million, to develop and deploy additional roadside and onboard hardware, application software, and cloud-based analytics and artificial intelligence software. In the coming two fiscal years, another $10.1 million is scheduled for system expansion. These funds have been designated, committed and approved for system expansion, not maintenance or replacement.

UDOT is demonstrating that connected vehicle technology is a real solution to a serious problem, and is committed to making use of this technology over the long term. We are building a network in preparation for the production vehicles that the automakers have committed to produce. Our focus and goal is safety.

In light of that background, experience, and intent, UDOT offers the following comments and detailed information in response to several of the specific questions posed by the FCC in the *FNPRM*. While our comments address a number of issues, the four key points that UDOT would like to emphasize are:

- The two-year transition time to replace existing DSRC installations with C-V2X, following the *Second Report and Order*, is adequate but not excessive. A shorter transition time is not acceptable.

[1] We note that UDOT holds 244 FCC permits for DSRC RSU installations. Some of these permits are for locations where RSUs are not currently installed. Others represent permits for two types of DSRC units at the same location, enabling evaluation of compatibility between vendors; no dual-RSU installations exist at the present time. A total of 200 DSRC RSUs operate in our system today.

- Incumbent users of DSRC must be compensated for the cost of replacing those systems with C-V2X. The FCC has a responsibility to enable that compensation. Manufacturers and users who will benefit and profit from the use of unlicensed technologies in the 45 MHz formerly reserved for ITS should pay the transition costs incurred by incumbent users.

- Interference issues need to be addressed to ensure that life-safety ITS systems are effective. The provisions outlined in the *FNPRM* have not been demonstrated to be adequate to meet this need.

- The reduction of spectrum will diminish our capabilities to realize the full potential of ITS safety benefits, especially for pedestrian safety, intersection movement and cooperative automation. The FCC needs to find and dedicate additional bandwidth to accommodate those functions.

We will address these four key issues first, followed by our comments on a number of other issues raised in the *FNPRM*. Each topic is referenced to the applicable paragraph in the *FNPRM*, as published in the Federal Register.

Timeline for Transition (Paragraphs 5 and 6)

The FCC proposes that incumbent DSRC users either convert to C-V2X or cease operations within two years after the effective date of the *Second Report and Order*. UDOT believes that a two –year transition time is reasonable and adequate for most public agencies, but not excessive, and encourages the FCC to retain this timeframe. As outlined below, a shorter timeframe is not acceptable.

UDOT has carefully evaluated our DSRC-based system and has developed a plan for converting this system to C-V2X, in response to the FCC decision. There are a number of sequential steps in this transition. We have begun the process and have tangible experience with a realistic approach and timeline. In response to the FCC's request to comment on this timeline, we provide a detailed description of the process and time constraints.

As noted above, UDOT has a DSRC-based system which consists of 131 RSUs and 102 OBUs in two counties. The following steps and timelines will be involved in the conversion of these DSRC radios to C-V2X:

- Hardware procurement process: The C-V2X hardware we have in our system today was provided by a contractor; we did not have contract authority to purchase C-V2X hardware directly. Suspecting that FCC action would require

replacement of our DSRC hardware, we decided in mid-2020 to move ahead with a procurement process to enable eventual C-V2X purchase capability by the agency. The procurement process involved entering into a consultant contract to prepare the procurement documents (2 months), researching the technical requirements and creating the specification for bidding (2 months), gaining approval to issue bid documents (which involves two state agencies because this is electronic equipment), preparing a bid package (1 month), advertising the bid (1 month), reviewing the vendor proposals, vendor selection, and contract negotiation (4 months). The total time for this process was 10 months.

- Purchase a few units for compliance testing and verification: We purchased units from several successful vendors and are testing them in our lab to verify that they meet our requirements. This process is underway, and is expected to require 6 months.

- Order and receive the number of units required for field replacement: Vendors indicated lead time of 8 to 16 weeks for delivery of units, depending on vendor and quantity. Currently this lead time is negatively impacted by global chip shortages and may be longer. Anticipated timeline without the shortage impact is 4 months.

- Software / Firmware updates and system configurations: Although standardized messages, like Signal Phase and Timing (SPaT), Map Data (MAP) and BSM can be transmitted by either DSRC or C-V2X, the underlying mechanisms to prepare and send the messages are different. For instance, DSRC uses a Wireless Access in Vehicular Environments (WAVE) protocol and C-V2X does not. In order to transition use case applications from one platform to the other, software and firmware alterations are needed. In addition, networks need to be configured for the new devices and IP addresses need to be planned in the network and assigned. Each RSU and OBU needs to be provisioned with appropriate application software and tested before installation. Based on the work tasks involved, the timeline for this set of tasks is 1 month.

- Installation: The duration of installation is contingent on the number of locations, whether replacement is done in phases or all at once, whether the RSUs are over live traffic (requiring lane closures), and how accessible the OBU-equipped vehicles are. Since the wiring, power supply, RSU attachment hardware and OBU antennas will not need to be replaced, the installation process is limited to replacing the RSU and OBU and integrating the new hardware into the system. UDOT's RSU locations are not over live traffic and the vehicles are fleet vehicles which can be accessed in central locations at night. Ten RSUs can be replaced per

week. General system testing is needed after installation, including field burn-in tests, verification of operations and message transmission, and corridor test drives, followed by necessary adjustments and retesting. For our system, with 131 RSUs and 102 OBUs, the timeline for this task is 4 months.

In summary, the total time for procurement, testing and installation, based on our actual experience, is approximately 25 months. The cost of this conversion is discussed in a subsequent section of our comments.

Along with these sequential procurement, testing and installation tasks, two other parallel efforts are necessary: project planning and identifying available funding. Agencies with DSRC installations need to consider whether they will transition to C-V2X, transition to other communication modes, maintain the same use cases, and alter agreements with partners. Some agencies have made commitments to federal or local agency partners, vendors, and private partners to expand their systems using certain technologies and have entered into contracts; those partners are also impacted by these decisions. Some of these project planning tasks must precede the procurement tasks, but others can happen concurrently.

More critical to the timing of this transition process is the funding issue. Whether agency funds or grant funds were used to install the systems, those funds are no longer available for hardware replacement. New funds will be needed. Similar to most government agencies, UDOT project budgets are established on an annual cycle. Funding requests need to be proposed in August for funding the following July – an 11-month cycle. This assumes that funds can even be found within the agency. As we describe in a subsequent section, UDOT believes that the responsibility for funding this transition should not fall to the incumbent users, but if it does, this timeline needs to be considered as part of the transition process.

The 25-month timeline for procurement, testing and installation, coupled with project planning and a lengthy funding process that may not be completely parallel, results in a likely timeline of at least 30 months. If a two-year transition time is provided by the FCC, agencies need to start this process before the *Second Report and Order* is issued in order to meet the deadline. Clearly, a transition time shorter than two years is not acceptable or practical.

Compensation for Relocation (Paragraph 28)

The FCC seeks comment on potential compensation for costs incurred by transition to this new band plan, including which costs are appropriate for compensation. UDOT

believes that incumbent licensees should be compensated for the costs of transition incurred by this unilateral decision and that the FCC should enable a reimbursement mechanism to provide this compensation, funded by users who will benefit from the new spectrum made available to them.

While the FCC argues (*First Report and Order*, paragraph 36) that this new band plan will not "meaningfully interfere with the ability of incumbents to provide the same types of safety-related services that they are currently offering", it is clear that this change imposes costs on those incumbents to maintain those services. These costs are being imposed on the incumbent licensees over our objection and without any associated advantages or benefits. Specifically, these costs include: 1) the cost to modify current DSRC operations from multiple channels in the full 75 MHz band to the newly designated 30 MHz band, and 2) the cost to replace DSRC facilities with C-V2X systems.

As noted above, UDOT has a mature, operational DSRC system. To maintain these operations, in light of the FCC ruling, UDOT has developed plans and budgets to execute both a channel transition and a full replacement. The paragraphs below offer detailed costs for both of these activities. In addition, UDOT offers practical insights on which costs are appropriate for compensation, how those costs could be documented, a process for compensation, and other actions which would aid the successful transition to this new band plan.

Modify DSRC operations to operate in a single channel: Similar to many other agencies, UDOT currently broadcasts standardized messages in multiple DSRC channels, specifically 172, 178 and 184. In the *Notice of Proposed Rulemaking* published Feb 6, 2020, paragraph 14, the FCC proposed to move all DSRC operations into the 5.895-5.905 GHz band, or Channel 180. Subsequently, the FCC stopped issuing licenses for DSRC operations outside of Channel 180. Following the FCC approval of the *First Report and Order* on November 18, 2020, UDOT executed a contract with our primary DSRC system integrator to modify our existing multi-channel system to operate only in Channel 180. That work, which is currently underway, involves reconfiguring the software to modify message transmission from their current channels to Channel 180, laboratory testing of the changes, updating each of the DSRC RSUs OBUs in our system, and performing on-road system testing and validation. The cost for this work is $52,640, a relatively small amount because we have made similar channel migrations in past years as we developed our system, and because our OBU-equipped fleet vehicles are available to our technical staff in a finite number of locations at night. Other incumbents without this experience or with more disbursed fleets will likely experience higher costs, even with smaller numbers of deployed units.

This transition cost should be compensated because it was brought about solely as a result of the change in the band plan. The incumbent gains no benefit from this move; in fact, the impact is detrimental because of the constrained bandwidth. Further, since a full transition to C-V2X cannot reasonably be accomplished in 12 months (as described in our comments on Timeline for Transition, paragraph 5, above), UDOT and many other incumbents will be required to transition our DSRC operations to Channel 180 temporarily in order to maintain functionality before making the complete transition to C-V2X.

We should note that we have dual-band DSRC/C-V2X RSUs and associated DSRC OBUs which do not need to have channel alterations made because they were deployed more recently and were designed for the DSRC to operate only on Channel 180. These devices operate independently from our older DSRC system in different geographical areas with different use cases.

Transition from DSRC to C-V2X: The efforts involved in a full transition from DSRC to C-V2X are described in our comments on Timeline for Transition, above. Given the lengthy process required for transition, UDOT began planning for the transition last year and has tangible costs and draft proposals to execute many of the necessary tasks. The costs anticipated are as follows:

- Planning and management: $82,400
  Internal costs to plan, oversee, manage, and participate in the project during its full duration.

- Hardware procurement, testing and verification: $91,800
  Develop and execute the procurement, purchase a few RSU and OBU devices for testing and verification, execute testing.

- RSU and OBU hardware: $878,500.
  Purchase 131 C-V2X RSUs ($4,195 each) and 102 OBUs ($3,225 each), for a complete replacement of our DSRC radios, including some associated hardware, but not including mounting hardware and wiring that is already in place. We note that C-V2X hardware is significantly more expensive than DSRC hardware.

- Software / Firmware updates and testing: $70,200
  Modify our existing software and firmware to process and broadcast the standardized messages using the C-V2X protocol.

- Installation, integration, and verification: $389,100
  Labor ($359,800) and charges for equipment use and mileage ($29,300) to replace the existing RSUs at signalized intersections and OBUs in our fleet vehicles, to integrate all of those devices into local and network systems, and perform testing to verify reliable operations.

Grand Total of all transition costs for UDOT's DSRC system: $1,512,000.

As noted in this discussion, the sunk costs in our existing systems, including original software development, system design and testing, wiring, mounting systems, vehicle antennas, etc., do not need to be replaced and are not included in the replacement costs shown. In addition, improvements to our system that can be instituted along with the conversion are not included in these costs because they constitute a betterment. It would be reasonable to discount the hardware costs slightly to reflect the spent portion of useful life of existing hardware; we have not included those deductions. UDOT believes that Vehicle-to-Everything (V2X) hardware has an expected life of 10 years, similar to other electronic components in our traffic management system.

Practical Considerations Relative to Compensation: Several practical considerations should be considered as a compensation scheme is developed. We offer these considerations in response to the FCC request for comment on "any other actions. . . that would be helpful to ITS licensees with respect to these transition matters." First, many agencies cannot enter into contracts to purchase equipment or hire consultants and contractors without having the funding in hand. In these cases, it is impractical for agencies to execute these changes to their DSRC systems, spend the money, and then seek reimbursement. A useful cost reimbursement plan should provide funds in advance. Since the funds are based on easily-definable existing deployments, and agencies can provide proof of the modifications to verify the expenses, this approach is reasonable.

Second, all development and deployment costs related to the interim modification of DSRC channels and the ultimate replacement of DSRC with C-V2X should be included in the compensation plan. UDOT and many other agencies will need to take both steps because of the defined timetable. Incumbent users will incur costs for modifications that were imposed over our objection and which bring no additional benefit relative to the existing DSRC systems we operate.

Third, compensation should not consider the source of funds used for the original installation of DSRC systems. UDOT and other agencies invested significant resources – effort and public funds – to deploy a technology that is now being made obsolete by the FCC's decision. At the time of installation, we had a reasonable expectation that our licenses would remain intact. Irrespective of the source of those original funds,

modification and replacement of the system will require funds not budgeted or anticipated. If those funds must be found within the agency's budget, the use of those public funds diminishes from other planned, needed projects that provide direct public safety and benefit. It is not reasonable that UDOT or other public agencies should spend public funds to replace these existing systems.

Fourth, although UDOT and other agencies have begun using C-V2X in some of our deployments, this does not justify a denial of compensation for transition of existing DSRC systems. The FCC suggests that since some agencies are already deploying C-V2X devices, "the transition to C-V2X is already ongoing" (*First Report and Order*, paragraph 59). UDOT rejects the this general conclusion as inaccurate. UDOT began deploying some dual-mode RSUs (DSRC and C-V2X) in April 2020 to understand the functionality and capability of C-V2X as compared to DSRC. We felt that unbiased C-V2X performance data was not available. Since it was clear that the FCC was considering allowing C-V2X to operate in the spectrum and some automotive companies were favoring C-V2X, it was prudent for us to begin the learning and evaluation process with this new technology. The dual-mode capability allowed us to maintain our core DSRC capabilities. This activity did not, in any way, reflect a desire or intention to replace our DSRC system. DSRC continues to be our preferred system. It is entirely appropriate to compensate incumbent users, like UDOT, for the cost of transition to C-V2X without regard to whether C-V2X deployments are underway.

Precedent and Plan for Compensation: A number of examples exist to support the precedent for the FCC ensuring that displaced incumbents are compensated for the cost of relocation. Possibly the most applicable example is the compensation of microwave licensees in the 2 GHz band that were displaced in the mid-1990's to clear spectrum for broadband Personal Communications Services.[2] In this instance, a third party was authorized to manage the transition. They assessed and collected fees from product manufacturers to pay for the cost of the relocation. In the case of the 5.9 GHz relocation, it would similarly be reasonable to assess predetermined fees on the manufacturers that provide equipment that will utilize the lower 45 MHz of spectrum and on the Wireless Internet Service Providers (WISPs) that benefit from the availability of this spectrum. The FCC has repeatedly argued that unlicensed use of the spectrum will yield significant monetary benefits (*First Report and Order*, paragraph 43). UDOT believes it is reasonable and fair that those new users, who will profit from the availability of the spectrum, provide compensatory funds for the incumbent users, particularly those that are public agencies using the spectrum for non-profit, public safety and efficiency purposes.

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[2] *Amendment to the Commission's Rules Regarding a Plan for Sharing the Costs of Microwave Relocation*, WT Docket No. 95-157, *First Report and Order and Further Notice of Proposed Rulemaking* (1996).

UDOT further believes that the FCC has the responsibility to establish such a plan and has established precedent to support that action.

Out-of-Band-Emission (OOBE) Limits to Protect ITS Operations (Paragraph 44)

ITS technologies for traffic safety applications require high-speed, low-latency communications to allow vehicles to communicate with other vehicles, infrastructure, and other travelers to avoid crashes, injuries and fatalities. To be effective, it is necessary to ensure that adjacent wireless operations do not interfere with these critical communications. The FCC proposes to adopt OOBE limits for outdoor U-NII-4 access points suggested by Wi-Fi proponents, who are not harmed by interference to ITS operations, but rejects stricter limits proposed by ITS proponents, who support their proposal with results from testing. In describing this approach, the FCC states, "We believe that these limits will protect adjacent-band ITS operations from harmful interference due to unlicensed operations. . . ", but fails to provide definitive evidence to support this position. UDOT urges the FCC to work closely with the USDOT and the transportation industry to ensure that the 30 MHz reserved for life-safety ITS operations is free of harmful interference, and to base the final OOBE limits on tangible, reliable test results with deference to those users who will be harmed by limits that are too relaxed.

UDOT also urges the FCC to reconsider the allowance of outdoor client-to-client operations in the U-NII-4 band. Outdoor use of these devices, in places like parking lots and stadiums, pose the potential for interference by their proximity to the roadway without the buffering influence of building walls and other barriers. Any potential interference with life-safety ITS operations should be treated skeptically and resolved based on thorough testing and close coordination with transportation experts.

Allocating Additional Spectrum (Paragraph 51)

The FCC seeks comments on whether additional spectrum should be allocated for life-safety ITS applications. UDOT continues to disagree with the FCC's conclusion that 30 MHz of spectrum is adequate for these safety purposes and believes that the FCC should find and allocate spectrum to replace the capabilities lost by removing 45 MHz from the 5.9 GHz band.

In light of the FCC's proposal to reallocate the majority of the spectrum reserved for ITS operations, ITS America established a Future of V2X Working Group to evaluate the potential effect of the reduction of spectrum on the types of messages and applications that could be deployed. UDOT was an active participant in that group. The group

evaluated numerous applications based on spectrum requirements of the messages needed to support those applications and the frequency and size of the message packets. Consideration was given to the spectral efficiency and channel utilization for these applications. After considerable analysis, the Working Group drafted a preliminary application map that attempts to show the message types and applications that can likely be accommodated in the limited 30 MHz spectrum (assuming harmful interference is prevented), and the message types and applications that will likely be lost.[3]

While most of the currently used message types (BSM, SPaT, MAP, Traveler Information Message (TIM), Signal Request Message (SRM), etc.) appear to fit within the new spectrum, a few important messages will likely be not fit in this reduced band. These include the Personal Safety Message (PSM), which is critical to applications that protect vulnerable road users, like pedestrians and bicyclists. Individualized messages in pedestrian applications will improve crosswalk safety for travelers who are outside a vehicle's line of sight (and, therefore, also not detectable by on-board sensors). These PSM-enabled applications also promise to improve safety for visually-impaired pedestrians. Pedestrian fatalities have increased in recent years; these ITS applications promise to reduce these tragic events. Another message that will likely not fit in the reduced band is the Intersection Collision Avoidance (ICA) message. This message is a key component in Intersection Collision Warning, Blind Merge Warning, Left Turn Assist and other key applications that prevent crashes at intersections. In urban areas, intersections crashes are the most common types of crashes. Since these vehicle movements often involve hazards that are not in the line of sight of the vehicle, on-board sensors like LiDAR are not effective in preventing these types of crashes. ITS solutions are the primary method to improve safety in these scenarios. Two newer messages under development that will likely not be accommodated in the 30 MHz band are the Collective Perception Message (CPM) and Maneuver Coordination Message (MCM). As we move toward cooperative automation, where automated vehicles leverage the power of connected vehicle information, these two messages allow vehicles to communicate information gained from their on-board sensors, enabling vehicles to act collectively rather than individually, bringing us closer to full situational awareness on the roads. Considerable harm is done to the future of highway safety when messages such as these are marginalized due to lack of available spectrum.

The FCC states that "the record supports 30 MHz of spectrum as sufficient to provide basic safety functions of ITS currently deployed and under consideration" (paragraph 50). This evaluation performed by ITS America demonstrates that conclusion to be inaccurate. The FCC should find and allocate spectrum to restore the capacity for complete road safety systems which has been lost by the removal of 45 MHz from the 5.9 GHz band.

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[3] https://itsa.org/wp-content/uploads/2021/01/ITS-America-30-MHz-Application-Map-1-27-21.pdf

State of Development of C-V2X Equipment (Paragraph 6)

The FCC notes that C-V2X manufacturers have had some time to prepare for the possible entry into the band and seeks comment on the state of development and availability of C-V2X equipment. UDOT's experience is that this equipment is becoming available, is benefitting from maturing standardization and certification efforts, but has yet to be broadly field tested.

As noted in our discussion on the transition timeline, UDOT began a procurement process for C-V2X equipment in mid-2020. As a result of that process, we now have contracts with five vendors who offer that equipment. We are cuurently testing some of their devices for conformance to our requirements. We know of at least 15 other vendors of C-V2X equipment, some of whom have limited offerings or markets. When we began acquiring DSRC devices in 2015 it became clear that those devices did not completely meet published specifications and were not interoperable between vendors without some effort. We suspect that similar discoveries will be made with C-V2X equipment over the next few months. Recent standardization and certification efforts have aided the maturity of C-V2X devices but haven't yet been fully integrated into the manufacturing process. With increased testing and use of this equipment and the applications of lessons learned during DSRC deployments, we believe that C-V2X equipment will mature quickly. It remains to be seen how effectively the manufacturers will be able to respond to these insights and a surge in demand for large quantities of devices. It is unknown how long the global chip shortage will continue to hamper device availability.

In addition to our current laboratory testing, UDOT has previous experience with C-V2X RSUs from one vendor and OBUs from a different vendor, as supplied by a contractor. These devices function well within our system, but that functionality is the result of significant efforts by the contractor and vendor in some prior installations to overcome various challenges.

Number of Licensees That Will Operate DSRC During the Transition (Paragraph 6)

The FCC suggests that some licensees who have begun planning for the C-V2X transition may immediately begin such operations without implementing interim DSRC operations and seeks comments about how many will make that decision. UDOT believes that it is unlikely that many agencies will be able to transition to C-V2X in time to avoid the interim DSRC channel conversion process. As noted in our transition timeline discussion, a reasonable transition time is 25 months. We began this process in mid-2020 but have

neither the funding nor sufficient progress in the process to accomplish a transition of our DSRC installations before July 2022. We have software modifications underway for the conversion of our DSRC multi-channel operations and plan to execute that conversion before the deadline. Subsequent replacement of DSRC hardware will be delayed until funding is available and the remainder of the timeline is accomplished. We suspect that most other agencies will need to respond to these timing constraints similarly by executing both the channel modification step and the ultimate replacement step.

Final Treatment of DSRC OBUs (Paragraph 7)

The FCC seeks comment on how DSRC OBUs should be treated at the end of the transition period. As noted above, UDOT has 102 DSRC OBUs in vehicles owned by UDOT or our partner agencies. It is not possible for us to remotely turn off these units, but, more importantly, it is not acceptable to do that. Our OBUs operate in a functional connected vehicle system and need to remain in operation. Before the end of the transition period, we will replace these DSRC OBUs with C-V2X OBUs. All of our OBUs are installed in vehicles owned by UDOT or our partner agency; we will be able to access these vehicles at night when they are out of service.

Simultaneous DSRC and C-V2X Operations (Paragraph 10)

In an effort to facilitate the smooth transition of new C-V2X uses within the band, the FCC seeks comments on various technical considerations, including the simultaneous DSRC and C-V2X operations in the band, the authorized use of C-V2X before the final transition date, and information yielded by current C-V2X testing. UDOT believes that incumbent users should be given adequate time to transition their DSRC systems, as proposed in this *FNPRM*, but that developers of C-V2X systems, specifically automakers, should be encouraged and enabled to move forward quickly with deployment of their systems.

The full potential of ITS systems for transportation safety will only be realized when automakers deploy significant numbers of vehicles with V2X capabilities and our roadside systems are broadly deployed and compatible with those production vehicles. We have been working consistently with the auto manufacturers to understand how to bring about that complete vehicle-infrastructure system. We are anxious for the automakers to move forward with their commitments to install these important systems on their vehicles. A primary motivator for our deployments in Utah is to be ready for those equipped vehicles.

It is imperative that UDOT and other incumbent users be given adequate time to transition our systems from DSRC to the newly mandated C-V2X technology. As stated earlier, we believe that the one-year transition for channel realignment is adequate and a subsequent two-year timeframe for full conversion is adequate but not generous. Given that that the vehicle manufacturer product cycles are about two years long (paragraph 6), we believe that the potential for conflict in the 30 MHz band is minimal; by the time new vehicles with C-V2X capabilities begin to use our roadways our transition will be well underway. The overlap between these systems should only be about one year. Further, in those early months, the number of C-V2X equipped vehicles will be small. Introduction of a small number of C-V2X-equipped vehicles will also be an important opportunity to further verify that our roadside systems are fully compatible with those vehicles. UDOT is anxious for that opportunity.

As noted earlier, UDOT has a number of dual-mode RSUs consisting of both DSRC and C-V2X radios. Recent firmware updates allow us to operate both DSRC and C-V2X simultaneously. We recently conducted a set of range-of-reception field tests with these installations. The tests measured the maximum distance from which an RSU can receive BSMs from vehicle-mounted OBUs. Tests included line of sight and non-line of sight corridors in an urban area and a mountain corridor along an interstate. In the urban area, two RSUs were involved in the testing. Along the interstate corridor, 32 RSUs were involved. These tests were executed for DSRC, C-V2X, and for simultaneous operation of both technologies. In these tests, DSRC was operating in Channel 180 and C-V2X was operating in the 20-MHz Channel 183. The finding from these tests that is most relevant to technology transition issues contemplated by this *FNPRM* is that range of reception for both DSRC and C-V2X were not diminished when they were operating simultaneously. Specifically, when we compared the maximum range of reception for each technology in single-mode operation to the range when they were operating simultaneously, there was no statistically significant reduction in that range. We use those results to argue that the introduction of C-V2X technology by auto manufacturers will not significantly impair our operation of DSRC, as long as we are using Channel 183 and Channel 180, respectively. Admittedly, our test involved only two vehicles and one message, BSM. Performance degradation might occur if there were many more vehicles and multiple messages being transmitted, but during the two-year transition period it is unlikely that a significant number of equipped vehicles will be present in the locations where DSRC installations exist.

Some sites that use DSRC might choose to transition their operations, temporarily, into all three 10 MHz channels in the 30 MHz band. As described in a subsequent section, the *First Report and Order* appears to allow that option. This scenario might pose additional challenges for deployers of C-V2X technology. Agencies deploying fixed-location C-V2X RSUs will need to coordinate those activities to avoid interference with incumbent

DSRC systems. Vehicle-based C-V2X OBUs may result in some interference, but as argued above, those vehicles will likely emerge in the final transition year, will not be in large quantities, and will not always be traveling in the same areas as the DSRC installations. We believe these conflicts will be minor.

UDOT believes that a reasonable transition time can be afforded to incumbent DSRC users, like us, while still encouraging auto manufacturers to aggressively deploy their new C-V2X systems. The time period where these overlaps will occur will be relatively short, the number of new vehicles will be relatively small, and, if we use Channel 180 for DSRC and Channel 183 for C-V2X, our tests have indicated that simultaneous operation will not degrade performance. We are encouraged by the enthusiasm of the auto industry to move forward with these life safety applications and believe this plan will offer them a stable environment for their systems while incumbent users transition.

Configuration of the Band Plan (Paragraph 11)

In an effort to minimize disruption and simplify the transition, the FCC seeks comment on the configuration of the channels within the 30 MHz band. UDOT believes that the plan should continue to accommodate combining two channels for a single 20 MHz channel for C-V2X.

The initial *Notice of Proposed Rulemaking* (*NPRM)*, published in the Federal Register on February 6, 2020, designated a single 20-MHz channel (5.905-5.3925 GHz, Channel 183) for C-V2X (*NPRM*, paragraph 11) and proposed the remaining 10-MHz channel (5.895-5.905 GHz, Channel 180)) for use by either DSRC or C-V2X (*NPRM*, paragraph 14). Over the past year, the FCC has only permitted new DSRC operations in Channel 180. The current *First Report and Order* does not prescribe those same channel assignments but allows DSRC to operate, during the interim period, in all three channels in the 30 MHz band (*First Report and Order*, paragraph 89). Since the issuance of the *NPRM*, UDOT and many other agencies have focused our new DSRC operations on Channel 180, and C-V2X operations (which are designed to transmit on a 20MHz channel) on Channel 183. To minimize disruption of existing DSRC and C-V2X installations, UDOT urges the FCC to define Channel 183 as the primary C-V2X channel. Other configurations will cause additional confusion and require further disruptive modifications to current deployments. A clearly defined band plan will also provide added certainty to encourage the auto industry to move forward with C-V2X deployments.

Retaining Message Priority Schemes (Paragraph 14)

The FCC seeks comment on whether to maintain the current message priority scheme, specifically giving safety of life communications highest priority, followed by public safety, then non-priority communications. UDOT prioritizes safety in our operations and believes this scheme reflects the intended purposes of ITS for safety enhancement. We urge the FCC to maintain this scheme.

Updates About DSRC and C-V2X Projects (Paragraph 27)

The FCC seeks updates on the status of DSRC deployments, C-V2X projects, and funding grants that have been provided. As indicated earlier in these comments, UDOT has several deployments in operation, using both DSRC and C-V2X. None of these deployments are pilot deployments or tests, but all operate in a permanent environment. While we learn from these deployments and improve our operations over time, all of these deployments were considered permanent installations from the beginning. We are expanding our system and building new applications to improve operations within Utah and to prepare for suitably equipped production vehicles. The installations involving C-V2X use dual-mode RSUs so that these devices will not need to be replaced as the regulations change. These are in a different geographical area than our older DSRC installations. Our use cases include transit signal priority for buses, signal preemption for snow plows (and soon for emergency vehicles), curve speed warning, spot weather impact warning, and the collection and analysis of a broad set of operational insights shared by the vehicles.

The majority of our DSRC and C-V2X installations to date have been funded by state funds. Some installations were funded through an Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) grant from the USDOT. The next phase of expansion in our system will be funded by a second ATCMTD grant. Some future expansions will use federal Congestion Mitigation and Air Quality (CMAQ) and Surface Transportation Program (STP) funds administered through our local Metropolitan Transportation Organization. The ATCMTD funds were approved and granted based on a specific proposal for system expansion using transportation technologies. These funds cannot be redirected for different purposes, including replacing systems that are already functional. The CMAQ and STP funds, by definition, are restricted to adding new capabilities; they cannot be used to replace existing systems.

As indicated earlier in our comments, any use of state funds for replacement of an operational ITS system will divert those funds from other programmed, vitally important DOT priorities. Federal grant funds being used for system deployments are approved

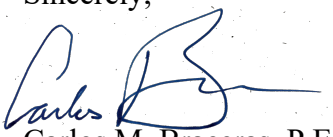
specifically for those expansions and can also not be diverted for transition-based replacements. UDOT reiterates our position that the FCC should establish a reimbursement fund for incumbent licensees and provide reasonable compensation for the transition costs caused by a decision that we oppose and will gain no benefit from. Incumbent users should not be required to bear the cost of these changes.

Conclusion

UDOT appreciates the opportunity to share our insights and comments on *the Further Notice of Proposed Rulemaking* on the Use of the 5.850-5.925 GHz Band. Many of our comments are intended to assist the FCC as it guides the transition of ITS deployments. UDOT affirms our opposition to the recent changes in the use of the band. In light of these changes, UDOT reiterates our position that a reasonable transition time, at least two years, is necessary for the conversion of DSRC systems to C-V2X, that the FCC has the responsibility to enable compensation for the costs incurred by incumbent users, that efforts need to be taken to protect life-safety ITS systems from harmful interference from adjacent unlicensed use, that these interference efforts should be informed by studies undertaken by transportation users who are at risk from this interference, and that the FCC needs to find additional bandwidth to accommodate the full potential of life-saving applications that will be excluded from the narrowed 5.9 GHz band.

If you would like to discuss any of the issues raised in this letter, please contact me, or Blaine Leonard, P.E., F.ASCE, UDOT's Transportation Technology Engineer, at bleonard@utah.gov or (801) 887-3723.

Sincerely,



Carlos M. Braceras, P.E.
Executive Director