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

Re: Revision of Part 15 of the Commission's Rules to Permit Unlicensed National Information Infrastructure Devices in the 5 GHz Band, ET Docket No. 13-49

Dear Secretary Dortch:

Qualcomm strongly believes that the rechannelization plan is the best solution to enable the successful growth of DSRC technology while opening a portion of the 5.9 GHz band for unlicensed Wi-Fi operations, as we explained in our Comments and Reply Comments filed in response to the FCC's June 2016 *Public Notice* in this docket.[1] In this letter, Qualcomm responds to various technical claims made by opponents of the rechannelization plan.

Qualcomm wholeheartedly agrees that DSRC can improve safety on our nation's roadways and that it is crucially important to protect latency-sensitive safety-of-life communications from harmful interference. Enabling such DSRC operations while opening up a portion of the 5.9 GHz DSRC band to Wi-Fi is the essence of the rechannelization plan. To the extent DSRC deployments are underway or soon will be, now is the time to investigate the best approach to sharing in this band in order to develop the most viable long-term solution.

Qualcomm understands and appreciates that DSRC systems have undergone extensive performance testing over the past several years.[2] Opponents of rechannelization claim that it would require most, if not all, of this testing to be redone. That is not correct. Rechannelization does not nullify the validity of the performance testing that has occurred under the current DSRC band plan. At the same time, there is no question that testing to assess sharing with Wi-Fi operations will be needed to assess both sharing proposals before the FCC, *i.e.*, rechannelization and detect-and-avoid ("DAA"). And, the fact that DSRC performance testing (which did not involve either sharing proposal) has already occurred is certainly not a reason to implement DAA.

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1 *See* FCC Public Notice, "Commission Seeks To Update And Refresh The Record In The 'Unlicensed National Information Infrastructure (U-NII) Devices In The 5 GHz Band' Proceeding," ET Docket No. 13-49, FCC 16-68 (June 1, 2016) ("*Public Notice*").

2 *See, e.g.*, Appendices to Assoc. of Global Automakers, *et al*., July 12, 2016 letter filing.

Unlike the rechannelization plan, DAA does not counter the OOBE interference from existing U-NII-3 devices into the DSRC band, particularly to the latency-sensitive, safety-of-life operations in DSRC Channel 172 in the 10 MHz portion of the DSRC band closest to U-NII-3 operations.

Also, the amount of performance testing to confirm the viability of operating the safety channel in the upper portion of the band per the rechannelization plan would be minimal. DSRC system performance that has been extensively tested by the U.S. Department of Transportation and the auto industry can be easily shown to still hold. The radio characteristics of DSRC band transmissions are relatively uniform across the 75 MHz-wide DSRC band at 5.850-5.925 GHz. Thus, the radio behavior of Channel 172 is similar to the channels in the upper portion of the DSRC band, and use of an operating frequency that is approximately 50 MHz away (*i.e.*, a 0.7% shift in operating frequency) would have nearly identical propagation and operational characteristics. While some testing may be needed to measure the impact of DSRC traffic in adjacent channels, such measurements likely were already carried out since DSRC always has planned to use the full 70 MHz of the DSRC band.

To summarize, testing will be needed to verify any proposal that involves sharing of the 5.9 GHz band between DSRC and Wi-Fi because it is essential that the introduction of unlicensed operations into the band not cause harmful interference to DSRC.[3] Qualcomm strongly believes that the testing to demonstrate the viability of the rechannelization plan would be much less intensive and time consuming than the testing required to verify the viability of DAA where latency-sensitive safety-of-life communications would continue using channels that Wi-Fi operations also would use. Rechannelization ensures that Wi-Fi will not interfere with latency-sensitive, safety-of-life DSRC communications because it relocates them to spectrum that Wi-Fi devices are not permitted to use.

In the table below, Qualcomm responds to additional technical claims made by opponents of the rechannelization plan.

Rechannelization opponents claim:	**Qualcomm responds**
Rechannelization will delay the rollout of DSRC because it requires a redesign of DSRC equipment.	As a DSRC chipset provider, Qualcomm has explained that rechannelization can be implemented via software changes.
Rechannelization will destroy years and a billion dollars of investment in DSRC technology. *See, e.g.* ITS America Reply Comments at 12-17.	This is not accurate. All of the DSRC performance testing that has been performed to date, as detailed in filings in this docket, would remain valid under the rechannelization plan for the reasons provided above. Rechannelization can be implemented easily and would require much less extensive coexistence testing than DAA because it places latency-sensitive

[3] *See* Reply Comments of ITS America (filed July 22, 2016) at 26 (majority of commenters believe that "regardless of what sharing plan is adopted, substantial planning and testing must come first to ensure that DSRC is not compromised and that vital safety-of-life operations continue to support the ultimate goal — significantly safer roadways for American consumers.").

	DSRC safety-of-life operations in spectrum that remains off-limits to Wi-Fi. DAA, on the other hand, would require extensive testing to ensure successful detection of any DSRC operations throughout the band.
Qualcomm has yet to explain how DSRC would be given priority in the lower, shared portion of the DSRC band.	This is not accurate. Qualcomm has explained that existing Quality of Service enhancement mechanisms in 802.11 standards, such as 802.11e, can prioritize DSRC over Wi-Fi in the lower 40 MHz portion of the DSRC band that Wi-Fi would share under rechannelization.
Placing all latency sensitive, safety-of-life communications in a 30 MHz swath of spectrum will lead to interference from higher-powered public safety communications to the safety communications and control channels.	This interference scenario already exists under the existing DSRC channelization. Today, transmissions in DSRC Ch. 184 will block reception of a BSM message in Ch. 172 (as well as all other DSRC channels). No RF filters exist to isolate Ch. 172 from Ch. 184 transmissions such that Ch. 172 can operate close to its minimum sensitivity level (which is needed for robust support of Ch. 172 BSMs). Some form of time-sharing will be needed to support simultaneous operations in Channel 184 and other DSRC channels if these channels are used by the same device.
DAA will open up substantial amount of spectrum for Wi-Fi operations indoors.	Qualcomm strongly disagrees. Under the DAA proposal, widely-deployed DSRC roadside infrastructure and DSRC-equipped vehicles will prevent Wi-Fi from accessing in a meaningful manner the entire U-NII-4 band (and the upper portion of U-NII-3) inside vehicles, homes, and businesses up to several hundred meters away from DSRC transmissions.
Simultaneous detection of multiple 10 MHz DSRC channels is feasible	Qualcomm agrees that detecting multiple simultaneous 10 MHz transmissions is technically feasible, but doing so introduces an onerous device and system implementation cost that will impact adoption and deployment of Wi-Fi devices that use U-NII-4. Also, as Qualcomm has explained, channel sensing in multiple 10 MHz channels simultaneously, which DAA requires across the band, is not defined in 802.11n, ac, or ax, so U-NII-4 operations under this proposal likely would require new hardware and additional verification testing.

Qualcomm has not addressed the disconnect between its 20 MHz channelization proposal and the current body of DSRC research establishing the superiority of 10 MHz channels for latency-sensitive DSRC applications.	Latency-sensitive safety-of-life DSRC operations will continue to use 10 MHz channelization in the upper portion of the DSRC band that remains exclusively allocated to DSRC. Qualcomm's May 28, 2013 Comments explained that 10 MHz channelization behaves better in larger delay spread scenarios (*i.e.*, at low speeds), but 20 MHz channelization has an advantage in high-speed mobility scenarios. Qualcomm explained that even with difficult channel conditions, 20 MHz operations experience a minor performance loss at lower relative velocities.
The SAE DSRC Technical Committee will need to develop new technical requirements for the rechannelization approach.	Any modifications to SAE DSRC Technical Committee document SAE J2945/1[4] would be modest and, following an FCC ruling that adopts rechannelization, would be implemented expeditiously. SAE J2945/1 is the only standard that dictates use and assignment of ITS band channels. Purported safety applications of other DSRC channels are not defined in any mature standard.
Wi-Fi will not have a harder time detecting 10 MHz channels than it will detecting 20 MHz channels. Detection of 10 MHz DSRC packets will be effective at more sensitive signal levels than detection of 20 MHz DSRC packets. *See* Auto Alliance Comments at 13-14.	Qualcomm explained that 802.11ac Wi-Fi devices (both 802.11ac and future 802.11ax) will more reliably detect and yield priority to DSRC operations that use the same 20 MHz-wide channels. 802.11ac (and future 802.11ax) devices can detect DSRC preambles and decode DSRC packets without any hardware modifications to either Wi-Fi or DSRC when DSRC uses 20 MHz channelization in the lower part of the spectrum. Broadcom also explained that this approach would enable mutual DSRC and Wi-Fi recognition at very low signal levels and avoid scenarios where the DSRC device would attempt to transmit because it believed the medium was idle when in fact there were active Wi-Fi transmissions.

[4] SAE J2945/1 (2016), *On-board System Requirements for V2V Safety Communications On-board System Requirements for V2V Safety Communications*. The affected parameter, *vChannelNumber* that is set at Ch. 172, can be readily revised following an FCC ruling.

No standards changes are needed to specify how 10 MHz DSRC detection will be achieved on multiple channels simultaneously. Individual detectors are functionally independent, so the specification of 10 MHz packet detection once is sufficient. 10 MHz detection has been a part of the IEEE 802.11 standard since 2004. *See* Auto Alliance Comments at 14-15.	IEEE 802.11a/n/ac and ax standards will require modifications under the DAA proposal in order to enable operation in the UNII-4 band. Even though 10 MHz detection is part of the IEEE standard, it is presented in a different context, specifically where two 10 MHz devices are sharing the same channel, not where detection is needed in multiple channels.
Rechannelization requires the same sort of modification Qualcomm claims is only required by DAA, *i.e.*, the support of simultaneous DSRC preamble detection on multiple channels. *See* Auto Alliance Comments at 15-16.	Rechannelization can be implemented without any hardware changes. If the FCC requires simultaneous detection in multiple DSRC channels, under either rechannelization or DAA, hardware changes will be necessary.
Because only DSRC devices use the 802.11 10 MHz protocol in the 5.9 GHz band, the detection of a 10 MHz 802.11 preamble precisely identifies the packet as a DSRC packet. If DSRC is re-channelized to 20 MHz, the DSRC preamble would be indistinguishable between a DSRC packet and a non-DSRC 802.11 packet. Thus, rechannelization offers no ability to give priority to DSRC packets in the shared portion of the band. *See* Auto Alliance Comments at 16-17.	This is only true if the rules state that no system can use the 10 MHz Wi-Fi protocol. Simply detecting a 10 MHz 802.11 packet does not guarantee that the packet is of a DSRC type and should be prioritized. Modern Wi-Fi equipment can decode the "MAC" part of a DSRC packet and verify that the detected packet is indeed DSRC. This would mean all detected packets need to be inspected which only have a slight power consumption impact and does not require hardware modifications.

In conclusion, both the successful deployment of DSRC systems and the release of additional unlicensed spectrum in the 5 GHz band to support the growth of Wi-Fi systems are incredibly important goals, and based upon the technical points covered herein as well as the policy points raised in Qualcomm's Comments and Reply Comments, the rechannelization plan offers the best means of successfully achieving them both.

Respectfully submitted,

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