

Trends in US V2X and Cooperative Automation

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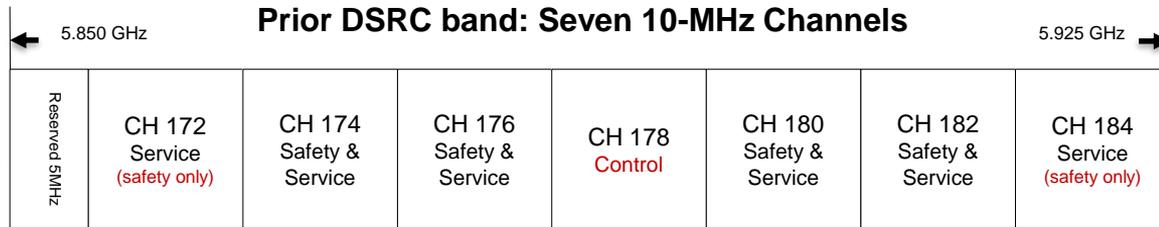
SIP-adus Workshop, November 2021

Outline

- FCC Actions for US V2X Spectrum
- Deployment implications
- US Standards Update

FCC 5.9 GHz Rulemaking

From this ...



2004-2020



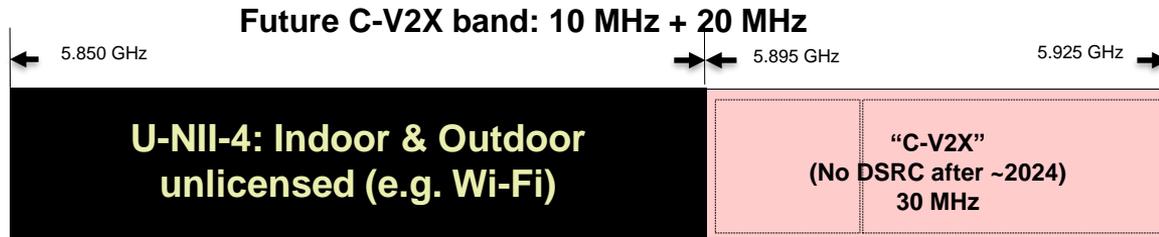
... to this



NOW
1st FCC R&O



... to this



Proposed
After 2nd R&O
and transition

First and Second FCC R&Os

First Report & Order (effective July 2, 2021)

1. Split the band. 45 MHz U-NII-4 & 30 MHz ITS
2. U-NII-4 indoor interference limits – very loose
3. Indicated transition to C-V2X in a 2nd Report & Order

“Further NPRM” for Second Report & Order

- Timing to complete 2nd R&O unknown (2022?)
- Transition from DSRC to C-V2X
 - How quickly?
 - How is C-V2X defined?
- Allow outdoor U-NII-4 (interference risk, but also V2X spectrum option)
- Other issues: Reimbursement? Additional spectrum?

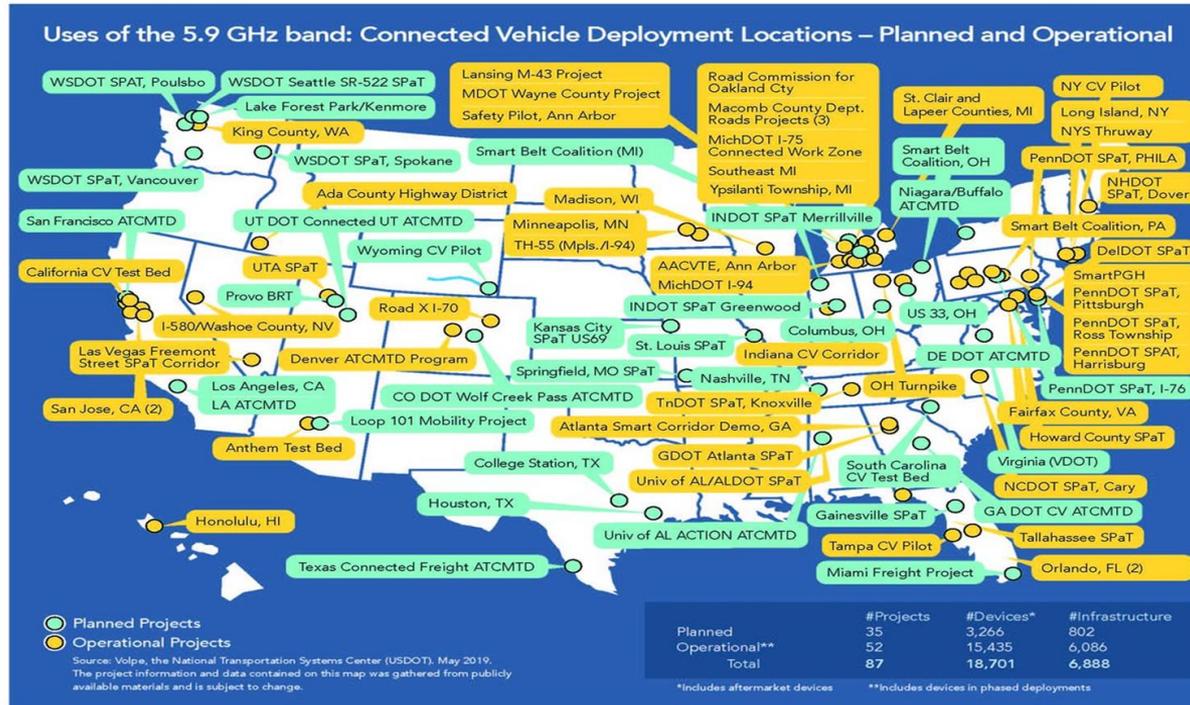
Legal challenge to FCC 1st R&O

ITS America/AASHTO Lawsuit against FCC 1st R&O

- Filed in D.C. Circuit Court of Appeals (June 2021).
- Challenges the reduction from 75 MHz to 30 MHz and the OOB limits
 - Does not seek to reverse the LTE V2X decision
- Grounds:
 - Congress intended USDOT to share ITS decision making with FCC
 - FCC ignored relevant facts (arbitrary and capricious)
- If successful, FCC will make a new decision, with constraints from court
 - If unsuccessful, 1st R&O remains in effect
- Schedule:
 - 2021: Brief filing
 - 2022: Oral arguments (likely spring)
 - **2022: Decision (likely by summer)**



Deployment Implications



July 5, 2022: Tens of thousands of DSRC devices must either turn off or move temporarily to upper 30 MHz

Deployment Uncertainties

- 2nd R&O completion timeline, and final decision details
- Timeline for transition of technology
- Interference risk
- Potential improvement of 5G NR V2X over LTE V2X
- Automaker deployment plans
 - In 2019 one Automaker announced 2022 LTE V2X deployment
- Infrastructure Owner Operator (IOO) Plans
 - A few states have announced plans to deploy some LTE V2X

Application Implications: What fits?

Industry discussions indicate likely applications for 30 MHz:

Applications probably supported	Applications probably not supported
V2V: Basic Safety Message I2V: Signal state/Map Signal preemption Road conditions GPS corrections	Pedestrian safety (P2V) Platooning (V2V) Collective perception/sensor sharing (V2V, I2V) Cooperative maneuvers (V2V, I2V) Other advanced applications

See also ITS America Webinar on the Future of V2X:

<https://itsa.org/event/the-future-of-v2x-30-mhz-application-map-webinar/>

US Standards: lower layers

IEEE

- DSRC+ (IEEE 802.11bd, Next Generation V2X)
- Backward compatible with DSRC
- More important in Europe and other regions than in US
- Completion scheduled end of 2022

3GPP 5G New Radio V2X

- Initial standard: Rel. 16 (June 2020)
- Enhancements - Rel. 17 (December 2021)
- Further enhancements - Rel. 18 (starts January 2022)
- Not backward compatible or coexistent with LTE V2X

US Standards: upper layers (SAE)

V2I Applications

- J2945/4 V2I Road Safety
- J2945/A new mapping message
- J2945/B Intersections (preemption/priority)
- J2945/C Traffic Probe

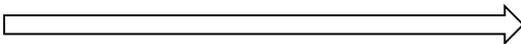
V2V and Advanced Applications

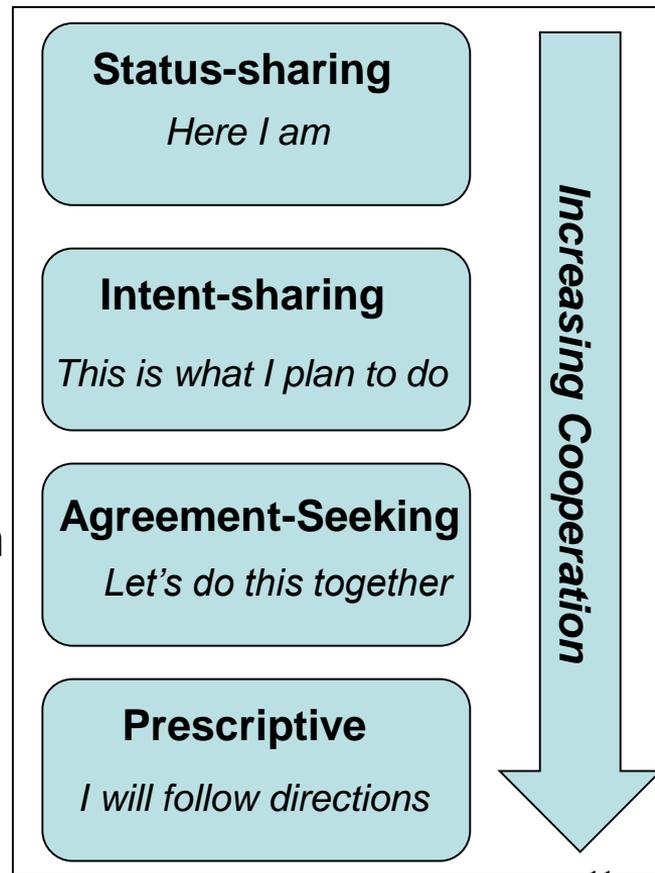
- J2945/6 C-ACC & Platooning
- J2945/8 Cooperative Perception (Proxy BSM)
- J3224 Sensor Data Sharing (like ETSI CPM)
- J3186 Cooperative Maneuver

SAE is working on
all of these

Many will likely
not be deployed
until more
spectrum is found

SAE Automation Standards

1. V2X TCs (see previous slide)
2. ORAD TC: On Road Automated Driving
 - Source of J3016: Famous 5 levels of AD
 - Source of J3216: Taxonomy of Cooperative Driving Automation 
- New!** 3. CDA TC: Cooperative Driving Automation
 - J3251: Jaywalking Pedestrian Collision Avoidance
 - J3252: CDA Use case testing
 - J3253: Infrastructure-based Prescriptive Cooperative Merge



Summary

FCC Decisions and Proposals: major changes for US V2X spectrum and technology

US V2X deployment is uncertain for many reasons

IEEE and 3GPP next gen V2X standards are being developed

US standards for V2X apps and Cooperative Driving Automation are being developed