C-V2X Standards Updates

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Agenda

• C-V2X Standards Development
• RSU Standard (NEMA TS-10)
• OmniAir Certification
• Projecting Ahead
SAE International Committee Structure

New Committee Outside of Communications Steering Committee: Connected and Automated Driving (CAD)
C-V2X Technical Committee

Three WIPs

1. Primary: “On-Board System Requirements for LTE-V2X V2V Safety Communications” - J3161/1
   • Final affirmation ballot approved by the committee
   • At Motor Vehicle Council for final ratification and publishing

2. “C-V2X Deployment Profiles” - J3161(/0) - *will describe later*
   • V2I/I2V profile
   • Initial ballot passed - just completed second ballot to resolve remaining comments

3. “Vehicle-Level Validation Test Procedures for LTE-V2X V2V Safety Communications” - J3161/1A
   • Test specification standard - analogous to J2945/1A test spec
   • Initial ballot passed - just completed second ballot to resolve remaining comments
C-V2X in Other Technical Committees

- **Advanced Applications**
  - J3224 - V2X Sensor-Sharing for Cooperative & Automated Driving
    - Expected to go out for ballot soon
  - J3186 - Application Protocol and Requirements for Maneuver Sharing and Coordinating Service
    - Expected to go out for ballot soon

- **Security** - ("Service Specific Permissions and Security Guidelines for Connected Vehicle Applications")
  - Working on Standards Harmonization and SCMS management

- **Tolling Applications**  Work continues on tolling using C-V2X (J3217).

- **Core**
  - J3242 - Systems Engineering process for V2X - draft expected in Q2
  - J2945/7 - enhanced positioning draft in development
V2X in Other Technical Committees

- **Infrastructure/Traffic Signal Applications**
  - J2945/4 Road Safety Applications
  - J2945/A Lane-Level and Road Furniture Mapping for Infrastructure-based V2X Applications
  - J2945/B Recommended Practices for Signalized Intersection Applications
  - J2945/C Traffic Probe Use and Operation
  - J3238 Infrastructure Applications Testing for Interoperability

- **Vehicular Applications**
  - J2945/6 - Performance Requirements for Cooperative Adaptive Cruise Control and Platooning - out for ballot
  - J2945/8 - Cooperative Perception System - in process
  - J2945/D - Road user-to-Road User Courteous Communication - in process

- **On Road Automated Driving (ORAD) Task Force**
  - J3164 - Taxonomy for AV - ongoing
  - Other WID in process

- **Cooperative Automated Driving (CDA) - new committee**
  - Partial USDOT funding

Four Task Forces:
- Architecture and Interfaces TF
- Cooperative Intersection and Traffic Management TF
- Cooperative Perception TF
- Security TF
IEEE 1609 Updates

- **1609.2** Security Services: Revision cycle underway - expected publication date Q2/2022

- **1609.2.1** Certificate Management Interfaces: Published

- **1609.3** Network Services: Approved by IEEE RevCom and into pre-publication processing; likely publication date March 2021.

- **1609.13** Data distribution: underway; expected publication date Q1/2022

- **1609.20** Underway; expected publication date Q1/2022

- Published and not currently under revision
  - **1609.0** Guide
  - **1609.4** Multi-Channel Operation (not relevant to C-V2X)
Traffic Families
Defined in SAE J3161 WIP C-V2X Deployment Profiles

- Critical V2V (example: Event BSM)
- Critical I2V (example: RSM, MAP)
- Essential V2V (example: BSM)
- Essential I2V (example: SPaT)
- Transactional (example: tolling transactions)
- Low Priority (example: TIM)
- Background (example: TCP/IP)

Priorities are assigned to each of these families.

Communication profiles (# subchannels, data rate, retransmission) set for V2V, V2I and I2V

 Allows V2V and V2I services to be delivered by one 20 MHz Radio*

* Opportunity for lower 10 MHz can be used for platooning or other apps
RSU Specifications (NEMA TS 10 and ITE)

ITE Draft Specification Just Released (and not covered here)

• **TS 10:** Designed for Agencies and other transportation infrastructure owner/operators to procure and deploy Connected Vehicle (CV) Roadside Units (RSU)

• Set of gaps covered by NEMA TS 10 specification:
  - Standardizing minimal set of messages via a uniform interpretation for safety applications
  - Standardizes RSU functions needed by vehicles and road users
  - Account for hardware, software, and communications capacity for future needs
  - Harmonizes communication protocols
  - Supports multiple radios

• Considers a minimum level of functionality requirements to support safety applications in a common message format

• NEMA TS10 RSU expected to be published in Q1/2021

• Integrated with OmniAir C-V2X certification program by adding additional RSU tests from NEMA TS10
Overview: OmniAir is Ready to Begin C-V2X Certification

Test Specs, Test Labs, Test Equipment, Standards, and Regulatory in Final Stages

- Certification Operating Council (COC) developed DSRC test specs almost 5 years ago
  - OmniAir inherited all COC test specifications
  - Only organization that does DSRC certification

- Upper layers of DSRC are common with C-V2X
  - e.g., Message sets (J2735), security (1609.2) are the same...as are many others
  - Minimal rewrite required

- Some new tests were needed for the PC5 sidelink radio
  - 3GPP had already written lower level radio tests
  - Needed a few tests for J3161/1, J3161/1A, new Test Controller Interface
  - OmniAir C-V2X sub-WG assembled the suite in about a year
  - >170 tests (RSU & OBU) available for Fall 2020 plugfest

OmniAir has used existing tests from SAE and 3GPP + developed new tests to launch a just-announced C-V2X certification program
Projecting Ahead
5G V2X builds on C-V2X with advanced use cases

- **Safety use cases**
  - C-V2X
    - Rel 14/15 sidelink
    - Broadcast messages

- **Advanced use cases**
  - 5G V2X
    - Rel 16+ sidelink
    - Multicast messages

**Upper layers**

Mapping use cases to transport profile

**5G V2X sidelink**
Thank you

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