



Thank you! Looking forward to other detailed sessions on 5G in the future.



Watch our course intro video.



5G V2X for Automotive

Course Description

This course introduces 5G V2X (Vehicle to Everything) and its relationship to various ITS (Intelligent Transport Systems) standards. In so doing, V2X use-cases related to 3GPP and 5GAA are discussed. The course then examines 5G V2X procedures including Registration, V2X Provisioning, PDU Session Establishment and VAE (Vehicle Application Enabler) Registration. Finally, various operational aspects are examined, such as NR-PC5 Quality of Service, device synchronization, mobility, roaming and the use of Network Slicing and MEC (Multi-access Edge Computing) in a V2X environment.

Prerequisites: 5G System Engineering or equivalent knowledge.

1

day
(LiveOnsite,
LiveOnline)

6

hours
learning
(OnlineAnytime)

6

CPD Learning
Credits



Level: 2
(Intermediate)

This course will contain the following sections:

1. 5G V2X Standardization and Architecture

Topic areas covered include:

- V2X (Vehicle-to-Everything):
 - V2X High Level Goals.
 - Intelligent Transport Systems.
 - V2X Terminology.
 - V2X Communication Standards.
 - DSRC vs C-V2X.
- ITS Architecture:
 - Sensors.
 - LiDAR and RADAR.
 - ITS Stations.
 - ITS Station Layers.
- 3GPP NR-V2X Architecture:
 - V2X Application Layer.
 - Key 5G Nodes for V2X.
 - V2X Application Layer.
 - 5G V2X RSU (Road Side Units).
 - Multicast Broadcast Service Architecture.

2. 5G V2X Use Cases

Topic areas covered include:

- V2X Services and Use Cases:
 - V2X Telematics.
 - Autonomous Vehicles.
 - 3GPP Use Case Groups.
 - 5GAA Use Cases.
- Safety and Vehicle Management Use Cases:
 - Safety - Cooperative Traffic Gap.
 - Safety - Interactive VRU Crossing.
 - Vehicle Operations Management – Software.
- Convenience Use Cases - Part 1:
 - Automated Valet Parking.
 - Automated Valet Parking (Wake Up).
 - Awareness Confirmation.
 - Cooperative Curbside Management.
- Convenience Use Cases - Part 2:
 - Cooperative Lateral Parking.
 - In-Vehicle Entertainment.
 - Obstructed View Assist.
 - Vehicle Decision Assist.
- Autonomous Driving Use Cases - Part 1:
 - Automated Intersection Crossing.
 - Autonomous Vehicle Disengagement Report.
 - Cooperative Lane Merge.
 - Cooperative Manoeuvres of Autonomous Vehicles for Emergency Situations.
 - Coordinated, Cooperative Driving Manoeuvre.

1

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6

**CPD Learning
Credits**



**LiveOnsite, LiveOnline,
OnlineAnytime**

5G V2X Use Cases (cont.)

- Autonomous Driving Use Cases - Part 2:
 - High-Definition Map Collecting and Sharing.
 - Infrastructure Assisted Environment Perception.
 - Tele-Operated Driving.
 - Tele-Operated Driving Support.
- Autonomous Driving Use Cases - Part 3:
 - Infrastructure-Based Tele-Operated Driving.
 - Remote Automated Driving Cancellation.
 - Tele-Operated Driving for Automated Parking.
 - Vehicles Collects Hazard and Road Event for AV.
- Platooning, Traffic Efficiency and Society Use Cases:
 - Vehicles Platooning in Steady State.
 - Bus Lane Sharing Request / Revocation.
 - Continuous Traffic Flow via Green Lights Coordination.
 - Group Start.
 - Accident Report.
 - Patient Transport Monitoring.

3. 5G V2X Initial Procedures

Topic areas covered include:

- NR-V2X Registration:
 - Initial Requirements.
 - 5G Registration Procedure.
 - PCF Authorization.
- V2X PDU Session and QoS:
 - 5G PDU Session for V2X.
 - QoS Flows.
 - 5G V2X QoS.
- 5G V2X PDU Session Establishment:
 - PDU Session Establishment Procedure.
- VAE Registration:
 - VAE Procedures and Services.
 - VAE Identities.
 - VAE Registration.

4. 5G V2X Operation

Topic areas covered include:

- NR-V2X PC5:
 - Identifying PC5 Configuration.
 - Direct Communication Modes.
 - 5G V2X Bands.
- Communicating over NR-PC5:
 - NR-PC5 Protocols and Bearers.
 - NR-PC5 Protocol Stacks.
 - Example V2X Application Messages.
 - PC5-S Procedures.
- NR-PC5 Communication Examples:
 - Broadcast.
 - Groupcast.
 - Unicast.
- NR-V2X QoS and Network Slicing:
 - V2X Uu and PC5 QoS.
 - PC5 5QI.
 - QoS Sustainability for V2X.
 - V2X Network Slicing.
 - V2X Network Slice Operation.
- 5G V2X Synchronization:
 - Types of Synchronization.
 - NR-V2X Uu and PC5 Synchronization.
 - NR-V2X Synchronization Priority Levels.
- 5G V2X Mobility and Roaming:
 - Xn Handover.
 - N2 Handover.
 - V2X Handover Considerations.
 - Interworking and Roaming.
- MEC Supporting V2X:
 - Overview.
 - MEC Traffic Routing.
 - MEC Applications.
 - Multi-Operator Support.

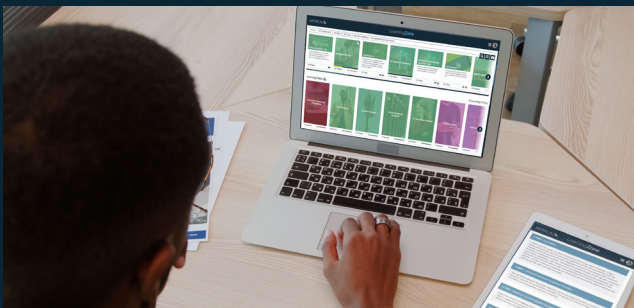


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