5G V2X Training

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.

Audience

Knowledge on 5G Technology

Duration : 2 Days with 5 hours per day

Content of the Training:

1) 5G 3GPP update and 5G architecture

- 3GPP update Release 18
- 5G New technologies
- 5G End to End architecture
- Standalone Vs Non standalone architectures

2) Introduction to 5G Core architecture

- 5G Architectures and 5G Options
- Main principles of 5G Core network transformation (CUPS, SBA …)
- 5G Slicing attributes
- 5G SBA Network function details (SMF, UPF,NRF, AUSF ….)
- Network function to be used in V2X

3) V2X (Vehicle-to-Everything):

- V2X High Level Goals.
- Intelligent Transport Systems.
- V2X Terminology.
- V2X Communication Standards.
- DSRC vs C-V2X.

4) ITS Architecture:
- Sensors.
- LiDAR and RADAR.
- ITS Stations.
- ITS Station Layers.

5) 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

6) V2X Services and Use Cases:

- V2X Telematics.
- Autonomous Vehicles.
- 3GPP Use Case Groups.
- 5GAA Use Cases.

7) Safety and Vehicle Management Use Cases:

- Safety - Cooperative Traffic Gap.
- Safety - Interactive VRU Crossing.
- Vehicle Operations Management – Software

8) Convenience Use Cases :

- Automated Valet Parking.
- Awareness Confirmation.
- In-Vehicle Entertainment.
- Obstructed View Assist.
- Vehicle Decision Assist.

9) Autonomous Driving Use Cases :

- Automated Intersection Crossing.
- Autonomous Vehicle Disengagement Report.
- Cooperative Manoeuvres of Autonomous Vehicles for Emergency Situations.
- Coordinated, Cooperative Driving Manœuvre
- Tele-Operated Driving.
- Remote Automated Driving Cancellation.
- Tele-Operated Driving for Automated Parking.

10)   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.

11)   NR-V2X Registration:

- Initial Requirements.
- 5G Registration Procedure.
- PCF Authorization.

12)   V2X PDU Session and 5G QoS:

- 5G QoS
- 5G PDU Session for V2X.
- QoS Flows.
- 5G V2X QoS.
- PDU Session Establishment Procedure

13)   NR-V2X PC5:

- Identifying PC5 Configuration.
- Direct Communication Modes.
- 5G V2X Bands.
- NR-PC5 Protocols
- PC5-S Procedures.

DAY 2

14)   NR-PC5 Communication Examples:

- Broadcast.
- Groupcast.
- Unicast.

15)   NR-V2X QoS and Network Slicing :

- V2X Uu and PC5 QoS.
- PC5 5QI.
- QoS Sustainability for V2X.
- V2X Network Slicing and Network Slice Operation.

16)   5G V2X Synchronization:

- Types of Synchronization.
- NR-V2X Uu and PC5 Synchronization.
- NR-V2X Synchronization Priority Levels.

17)   5G V2X Mobility and Roaming:

- Xn Handover.
- N2 Handover.
- V2X Handover Considerations.
- Interworking and Roaming

18)   MEC Deployment

- Overview.
- MEC Application Functions.
- MEC Example Scenario

19)   MEC Key Concepts

- Connectivity Models.
- Local Access to the Data Network.
- Standardization of MEC

20)   ETSI MEC Framework and Architecture

- ETSI MEC Framework.
- ETSI MEC Reference Architecture.
- 5G and ETSI MEC Integration.

21)   MEC Supporting V2X

- Overview.
- MEC Traffic Routing.
- MEC Applications.
- Multi-Operator Support.

22)   5G use cases in automotive industry

- 5G Private networks advantages
- KT and Hyundai trials
- Ericsson and Telefonica trials
- Softbank trials

23)   5G and Satellite

- Definition of Non Terrestrial Network
- NTN categories
- NTN Backhaul and Connectivity
- Evolution from NTN to 5G NTN
- NTN frequencies

24)   5G NTN architecture and terminologies

- 5G NTN System architecture
- Transparent NTN NG-RAN architecture
- Regenerative NTN NG-RAN architecture
- Inter-satellite link (ISL)
- 5G NTN quality of service