5G FRMCS Training

The **FRMCS over 5G** course offers a comprehensive technical journey into the evolution of railway communication systems as they transition from legacy GSM-R to a future-ready, 5G-based architecture. This training is designed to equip telecom professionals, railway engineers, and system integrators with the knowledge needed to understand, plan, and implement the **Future Railway Mobile Communication System (FRMCS)** in alignment with 3GPP standards and industry requirements.

The course begins with a strategic overview of why the shift from GSM-R is essentialhighlighting the growing needs for **high-speed connectivity**, **low-latency communication**, and **scalable services** in modern rail operations. Participants are then guided through the **end-to-end FRMCS system**, with a strong focus on **5G architecture**, **QoS mechanisms**, and **service-based interactions** that enable mission-critical communication in fast-moving railway environments.

Duration : 6 hours duration

Module 1: Reimagining Railway Communications – From GSM-R to FRMCS

- What is FRMCS
- Limitations of GSM-R: spectrum constraints, CS dependency, and limited data capacity.
- Drivers for change
- FRMCS Standardisation Timeline
- Key 5G FRMCS use cases
- Global FRMCS Deployment Status

Module 2: 5G FRMCS end to end Architecture

- 3GPP update and 5G capabilities
- 5G FRMCS end to end Architecture
- 5G Core network transformation
- 5G Core Architecture with FRMCS
- FRMCS architecture based on IMS and MCS

Module 3: FRMCS UE Registration, Session Management, and QoS

- Detailed registration signaling flow for train-mounted UEs.
- How PDU sessions are set up for FRMCS
- Deep dive into 5QI values, ARP levels, and GBR/non-GBR mapping for rail services.
- FRMCS Multi-Layered Security Architecture
- Network slicing tailored to rail functions: operational, safety, and passenger slices

Module 4 : 5G FRMCS Radio layer design & Spectrum Strategy

- FRMCS Spectrum Evolution and Standardized Railway Bands
- FRMCS Bandwidth Options, FDD/TDD and Duplex Planning
- Coverage vs Capacity Strategy (n100 and n101 Deployment Model)
- 5G Numerology, PRBs and Radio Resource Structure
- GSM-R Coexistence, Spectrum Refarming and Migration Planning

Module 5 : FRMCS Multi Layer Service Architecture, Interworking and Migration Strategy

- FRMCS Multi layer Service Layer Architecture
- Roaming Models: Cross-Operator Continuity
- FRMCS Reference Points (Onboard, Trackside and Application Interfaces)
- FRMCS Migration Architecture – Phase 1: Strategic Transition Framework
- FRMCS Migration Architecture – Phase 2: Operational and Regulatory Integration

Module 6 : MCX services, devices and common Architecture

- Architecture of MCx services and how they fulfill railway safety requirements.
- Setup of group communication for emergency and daily operational calls.
- Proximity-based communication using ProSe in tunnel and rural conditions.
- Multicast and broadcast (MBS) to disseminate information to multiple rail subsystems.
- MCX Common Architecture and Service Functions
- FRMCS MC Device and Network Reference Points

Module 7 : FRMCS MCX Operational considerations and Call Control

- MCX Identities and User Profiles
- Network Access & MC Authentification
- IMS Registration & Third-Party MC Registration
- MC Service Authorization and Configuration
- MCPTT Call Types and Group Variations
- MCPTT Group Call Signaling and Floor Control