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Railways

From GSM-R to FRMCS: planning coexistence, interworking and migration

Summary

- FRMCS, based on 5G and 3GPP mission-critical services, will replace GSM-R. The two networks will have to coexist until around 2035.
- In July 2026 the European MORANE-2 project started testing in three laboratories (Ericsson, Nokia, Kontron) and published the first unified set of system test cases based on the FRMCS v2.2 specifications.
- At the ETSI Plugtests in October 2025, 95.5% of interoperability tests passed, but GSM-R interworking, interconnection and migration were barely tested.
- The Cyber Resilience Act also applies to railway equipment: since 11 September 2026 manufacturers must report exploited vulnerabilities to ENISA.

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Context

For an infrastructure manager the biggest risk is not the new network but the period when both networks coexist: group and emergency calls crossing the interworking function, trains with different radios, borders between countries, ETCS that must stay available.

Decisions need data: measurement campaigns comparing both networks on the same line, repeatable interworking tests, and line-by-line migration plans. Without them, migration is planned on assumptions.

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Regulatory framework

Regulation or standard	What it requires	Dates
CCS TSI – Regulation (EU) 2023/1695	Interoperability framework for control-command and signalling, including FRMCS	In force
UIC FRMCS specifications (v2 → v3)	Functional requirements, on-board and trackside interfaces	V3 expected at the end of MORANE-2
3GPP MCX – TS 23.280, TS 23.379, TS 24.379	Mission-critical voice, data and video; functional aliases	Release 18 used at the Plugtests
ETSI TS 103 564	MCX and FRMCS interoperability test scenarios	Over 400 test cases
Cyber Resilience Act – Regulation (EU) 2024/2847	Reporting of exploited vulnerabilities; product security requirements	From 11/9/2026; full from 11/12/2027
CLC/TS 50701	Cybersecurity for railway applications	Technical reference

This document is for information only and is not legal advice. Regulatory dates and obligations must be checked against official texts at the time of application.

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Reference architecture

Applications voice and emergency calls · ETCS · ATO · TCMS · video	L5
Services MCX servers · interworking function to GSM-R	L4
Core and cloud 5G core · management · security	L3
Radio access n100 (900 MHz) · n101 (1900 MHz) · public networks	L2
On-board and trackside cab radio · on-board gateway · dispatcher · existing GSM-R	L1

Each layer has its own performance, security and management requirements: acceptance testing is done layer by layer and end to end.

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Use cases

Use case	Technology	KPIs to measure
Group and emergency calls through interworking	MCPTT + IWF	Setup time, success rate
ETCS over FRMCS	5G with QoS	Latency, availability, fallback to GSM-R
Radio coexistence on the same line	Measurement campaigns	RSRP and SINR, RxLev and RxQual
ATO and on-board video	5G	Throughput, continuity
Line-by-line migration	Planning and simulation	Service continuity

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Getting started in 90 days

- 1 Analyse coexistence on a pilot line using existing campaign data.
- 2 Map GSM-R/FRMCS interfaces and interworking.
- 3 Prepare a test plan aligned with MORANE-2 and ETSI TS 103 564 test cases.
- 4 Run a measurement campaign and KPI analysis.
- 5 Write the migration plan with risks and expected fallbacks.

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How Conection works

Conexion supports public bodies and companies as independent engineers: we write measurable requirements and specifications, check suppliers' designs, run field acceptance tests and train staff. We do not sell equipment, so we can stay on the side of the people who use the network.

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Sources

UIC – Rail goes 5G: FRMCS introduction test (luglio 2026) –

<https://www.uic.org/com/enews/article/rail-goes-5g-european-rail-launches-major-frmcs-introduction-test>

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<https://www.globalrailwayreview.com/article/230600/frmcs-rail-communication-testing/>

UIC – FRMCS – <https://uic.org/rail-system/telecoms-signalling/frmcs>

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