5GRAIL paves the way to the Future Railway Mobile Communication System (FRMCS)

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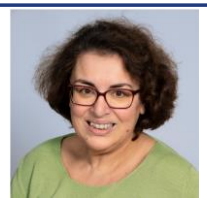

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2. UNIFE (European Rail Supply Industry), 221 Avenue Louise, Brussels 1050, Belgium, City, Country

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TODAY IS GSM-R…TOMORROW WILL BE FRMCS

The railways currently use the GSM-R system for operational communication, a key component of the European Railway Traffic Management System ERTMS. Designed 20+ years ago and completely border-crossing interoperable, GSM-R is deployed on more than 120,000 kilometers of track in Europe and 250,000 kilometers worldwide.

GSM-R is supporting the ''Train Radio'' train driver to signaller voice applications, including the critical Railways Emergency Call (REC) and ETCS (European Train Control System).

The Future Radio Mobile Communication System (FRMCS) is the UIC's response for two elements of strategic importance for the future of the railways.

Firstly, GSM-R is a 2G system, where manufacturers have announced that GSM-R equipment is due to reach the end of its life (around 2030) and will be supported until around 2035.

Secondly, it is also a significant opportunity - to enable and support the Railways Digitalization, and therefore the need to transmit, receive and use increasing volumes of data, which is at the very heart of sustainable transport.

5G Rail

FRMCS
Future Railway Mobile Communication System

-3GPP 5G
-DEDICATED FREQUENCIES IN 1900 AND 900 MHZ
-COEXISTENCE WITH GSM-R
-SUPPORT ERTMS – VOICE, ETCS AND ATO
-BORDER CROSSING INTEROPERABLE
-ENHANCE RAIL TRAFFIC & PERFORMANCE
-ENHANCE SAFETY WITH EVEN MORE IMPROVED RAILWAY EMERGENCY CALL
-AUTONOMOUS TRAINS WITH GOA 2 AND ABOVE
-SUPPORTS TCMS
-ENABLE DIGITALISATION

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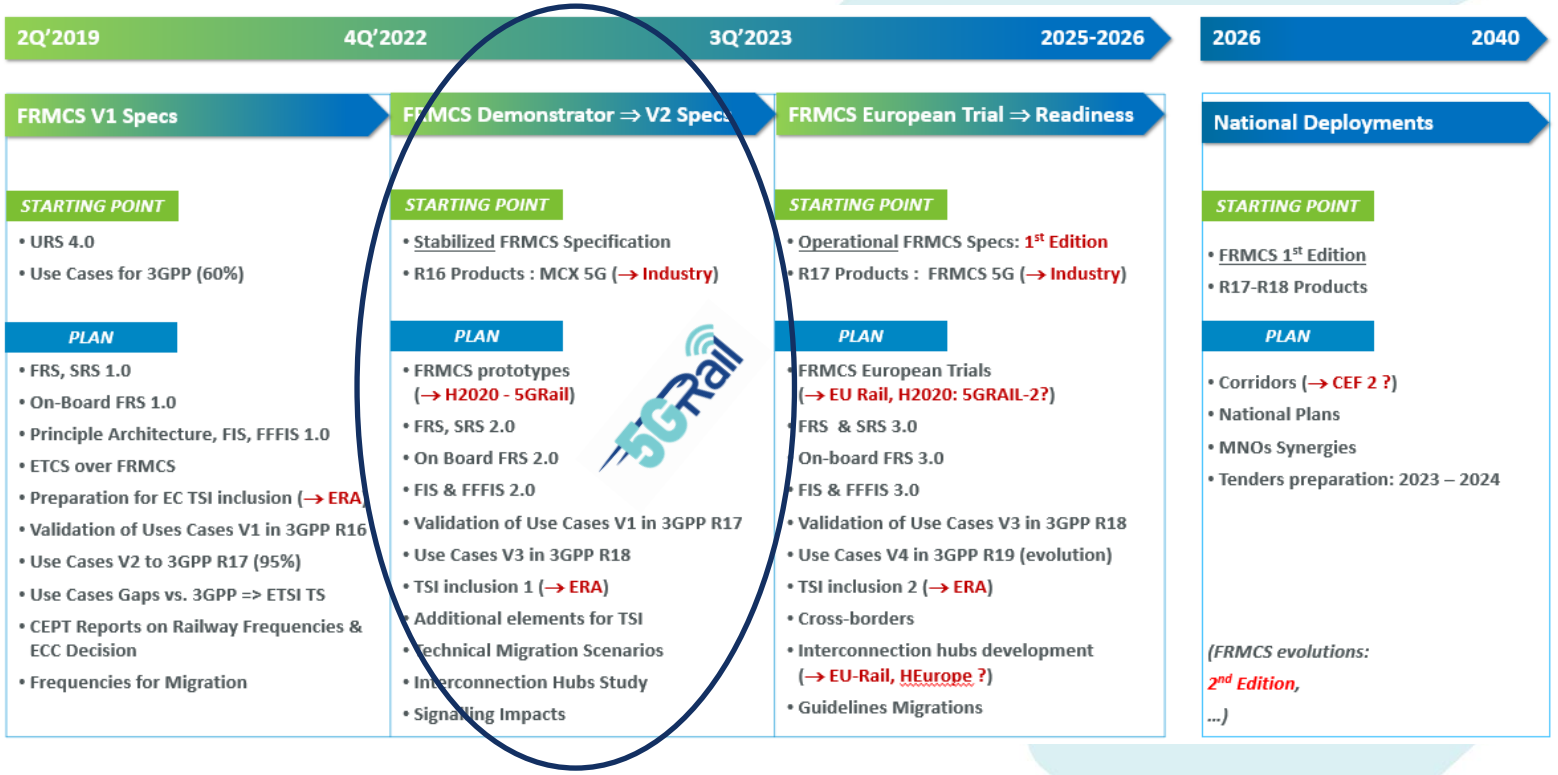
Strategic Plan for FRMCS market introduction in Europe



FRMCS introduction is a European necessity, due to the announced GSM-R obsolescence and moreover to enable railways digitalisation.

The introduction follows the embedded plan, with an aim to make a FRMCS First Edition system available for Railways end 2025, so that National deployments can start.

A crucial step of this plan is building and testing the FRMCS Demonstrators, especially the On-Board FRMCS.

This will be performed through the EU co-funded H2020 ICT-053 5GRAIL project.

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5GRail scope, structure and partners

Elaborate FRMCS prototypes based on the FRMCS V1 specifications, including the new on-board equipment (TOBA) additionally prototypes of the critical applications Voice, ETCS, ATO and performance applications TCMS, CCTV/Video;

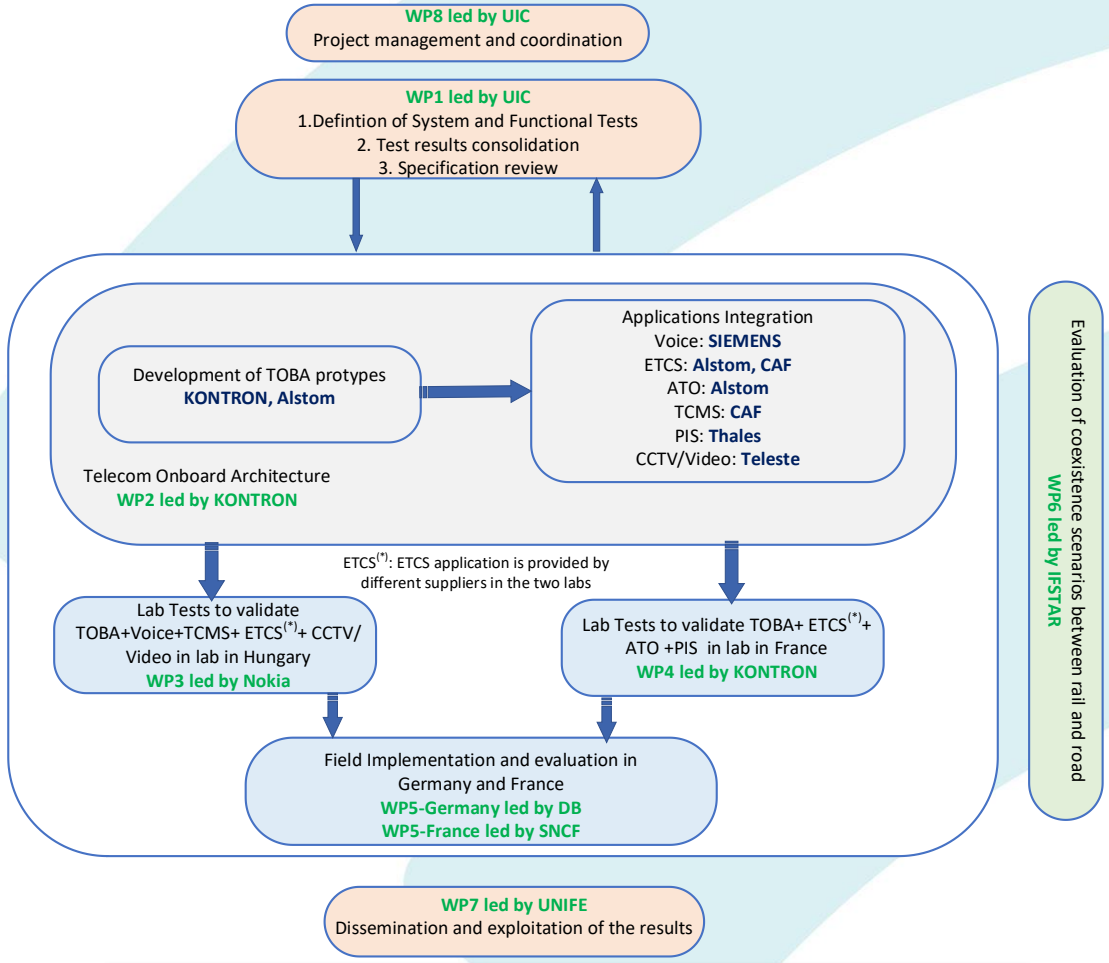
Define the relevant functional end-to-end tests required to verify the compliance of the prototypes with the FRMCS V1 specifications;

Execute these tests in lab environment firstly, and then in railway environment with train runs. Consider emulated cross-border conditions.

Prepare a performance measurements methodology, based on field activities, to apply on further 5G FRMCS operational deployment;

Define and emulate coexistence scenarios between railway and roads;

Analyze the outcomes of these tests to loop back on FRMCS V1 specification, to amend or modify those, and then obtain a finalized version of FRMCS V2 specification for sector regulation.



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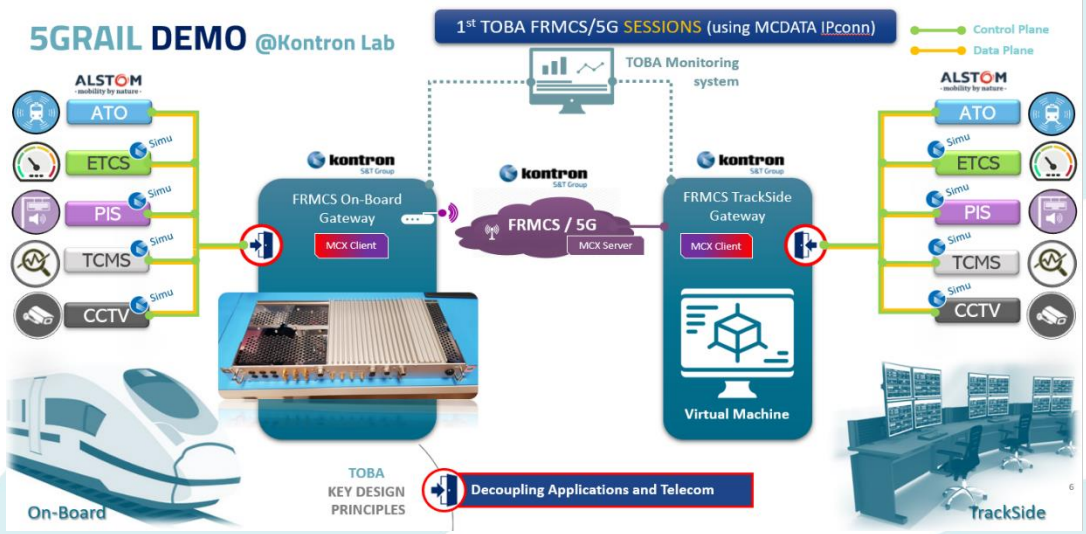
5GRail Status and Plans

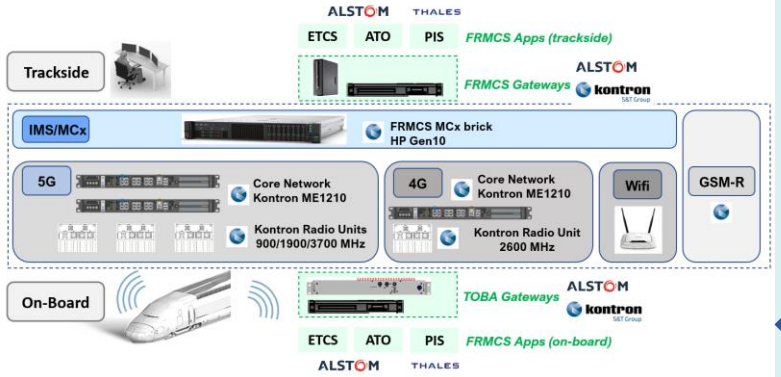
Achievements:

- TOBA (Telecom On-Board Architecture) v1 readiness
- Applications prototypes OBapp/TSapp compatible, as expected by FRMCS V1 specifications
- Elaboration of Test plan with more than 114 test cases
- Labs in Germany and France have successfully integrated partners' equipment and applications. Testing has started in a complete FRMCS ecosystem, to execute the test plan. Various bearers are available for validation of FRMCS features
- 1st data FRMCS call, aligned with TSI 2022, was achieved in WP4 Lab with Alstom ATO and Kontron TOBA
- Selection of test cases to repeat during field activities. Testbed preparation is in progress.
- Emulation of selected Road and Rail coexistence scenarios is well progressing
- Dissemination activities with organization and participation to conferences, publications in scientific magazines, social media

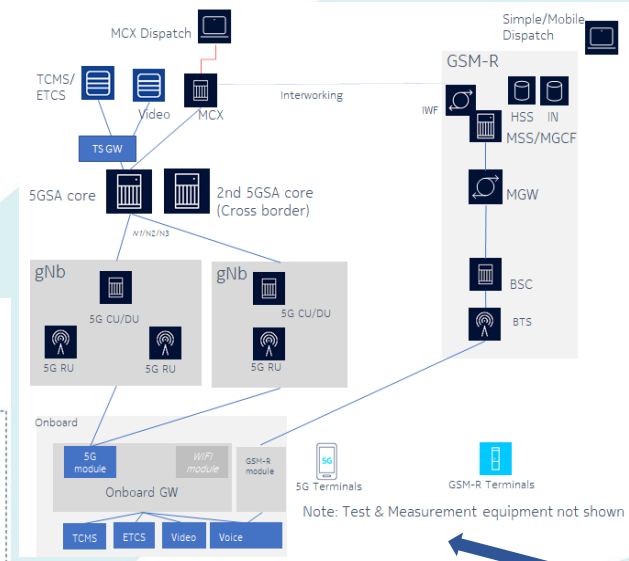
Next steps:

- Delivery of additional TOBA features: Ressource sharing with QoS management, multiconnectivity using different radio bearers
- Validate FRMCS V1 specifications compatibility with all applications
- Perform tests using 1900MHz FRMCS modem prototype
- Execute the whole test plan
- Field testbeds readiness
- Analyse outcomes from lab and field testing to provide feedback to the FRMCS V1 specifications





WP4 lab configuration



WP3 lab configuration

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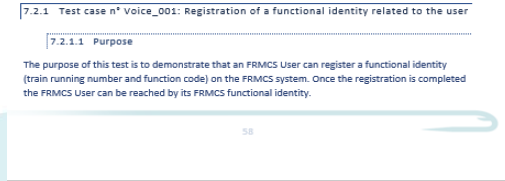
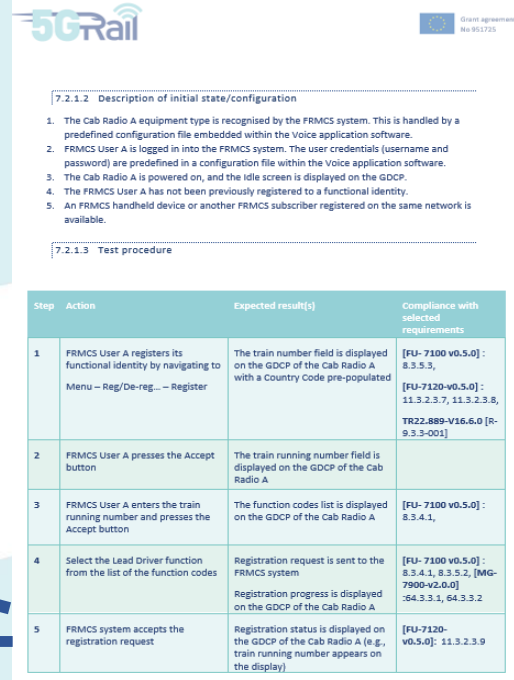


7.2.1 Test case n° Voice_001: Registration of a functional identity related to the user

7.2.1.1 Purpose

The purpose of this test is to demonstrate that an FRMCS User can register a functional identity (train running number and function code) on the FRMCS system. Once the registration is completed the FRMCS User can be reached by its FRMCS functional identity.



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7.2.1.2 Description of initial state/configuration

1. The Cab Radio A equipment type is recognised by the FRMCS system. This is handled by a predefined configuration file embedded within the Voice application software.
2. FRMCS User A is logged in into the FRMCS system. The user credentials (username and password) are predefined in a configuration file within the Voice application software.
3. The Cab Radio A is powered on, and the Idle screen is displayed on the GDCP.
4. The FRMCS User A has not been previously registered to a functional identity.
5. An FRMCS handheld device or another FRMCS subscriber registered on the same network is available.

7.2.1.3 Test procedure

Step	Action	Expected result[s]	Compliance with selected requirements
1	FRMCS User A registers its functional identity by navigating to Menu – Reg/De-reg… – Register	The train number field is displayed on the GDCP of the Cab Radio A with a Country Code pre-populated	[FU- 7100 v0.5.0] : 8.3.5.3, [FU-7120-v0.5.0] : 11.3.2.3.7, 11.3.2.3.8, TR22.889-V16.6.0 [R-9.3.3-001]
2	FRMCS User A presses the Accept button	The train running number field is displayed on the GDCP of the Cab Radio A	
3	FRMCS User A enters the train running number and presses the Accept button	The function codes list is displayed on the GDCP of the Cab Radio A	[FU- 7100 v0.5.0] : 8.3.4.1,
4	Select the Lead Driver function from the list of the function codes	Registration request is sent to the FRMCS system Registration progress is displayed on the GDCP of the Cab Radio A	[FU- 7100 v0.5.0] : 8.3.4.1, 8.3.5.2, [MG-7900-v2.0.0] :64.3.3.1, 64.3.3.2
5	FRMCS system accepts the registration request	Registration status is displayed on the GDCP of the Cab Radio A (e.g., train running number appears on the display)	[FU-7120-v0.5.0]: 11.3.2.3.9

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