EUROPEAN UNION AGENCY FOR RAILWAYS

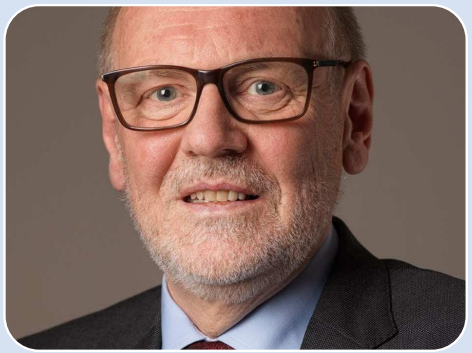
webinars

First Steps Towards the Future Railway Mobile Communication System

27 October 2022

12.00 [CEST]

Speakers



Josef Doppelbauer

Executive Director

François Davenne

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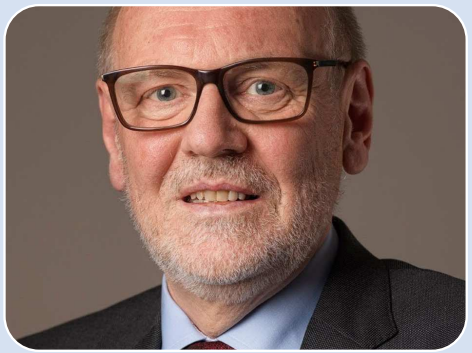
Thomas Chatelet

Project Officer

Dan Mandoc

Head of FRMCS

Speakers



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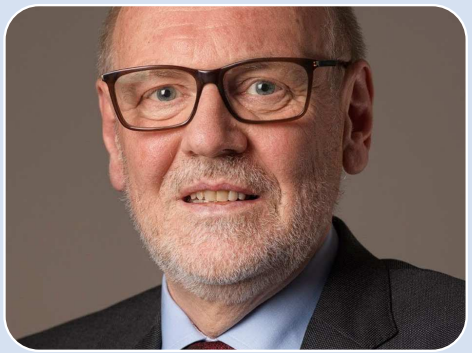

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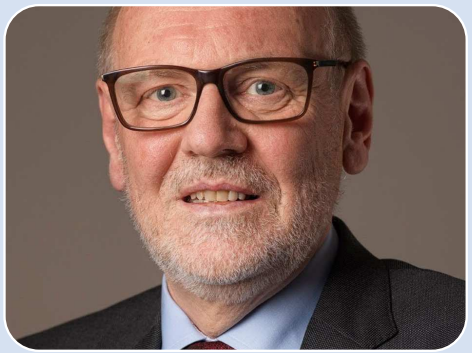

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Need for FRMCS introduction in CCS TSI

Enhancement/innovations introduced in ERTMS Specifications linked to 'Digital and Green rail'

European Specifications in CCS TSI 2022	Link with strategic objectives
Automated Train Operation Grade 1 and 2 (ETCS over ATO)	ATO provides significant capacity benefits and reduced energy consumption (green rail).
ETCS/ATO Readiness for FRMCS	GSM-R (2G) will become obsolete between 2035-2040 and shall be replaced by FRMCS (5G). Further digitalisation of rail as 5G opens many possibilities.
Digital ETCS reducing trackside assets	Hybrid Train Detection: Train integrity allows capacity increase and/or reduced trackside train detection systems. ETCS over DAC readiness: Supervised shunting allows safety increase and when using digital automatic coupling will allow to get rid of shunting signals
Additional enhancements to further optimise capacity, safety & security, cost reductions	The ERTMS specifications are further optimised - capacity: braking curve optimisation - safety & security: cyber-security - cost: reduction of number of balises to be installed in specific configurations

→ Regulatory objective: European specifications included in the CCS TSI avoids different national systems being deployed for these functionalities (interoperability and single market).

CCS TSI Status for FRMCS – Draft body text 1/2

- Chapter 2: Subsystem definition and scope
  - Railway Mobile Radio concept is introduced:

  "*RMR comprises two radio class A systems: GSM-R and FRMCS (Future Railway Mobile Communication System) that may be implemented both at the same time or each of them independently*"

- Chapter 4: Characterisation of the Subsystems
  - "RMR" used as a generic terms for radio class A systems
  - "GSM-R" and "FRMCS" used in the subsequent sections for interface description
- Chapter 5: Interoperability Constituents
  - Table 5.1 List of Interoperability Constituents for FRMCS updated to include
    - FRMCS On-board Voice Application
    - On-board FRMCS
    - FRMCS profile (equivalent to GSM-R SIM card)

CCS TSI Status for FRMCS – Draft body text 2/2

- Chapter 7: Implementing the TSI Control-Command and Signalling
  - Section 7.3 RMR specific implementation rules

"7.3.1.2 GSM-R may only be taken out of operation when the following conditions are fulfilled:

- *Condition 1: minimum 7 years after publication in the CCS TSI or in an ERA Technical Opinion of the FRMCS on-board specifications in Appendix A; AND*
- *Condition 2: minimum notification period of 5 years where GSM-R services shall be stopped. This notification shall be done within the RINF and these changes in RINF shall be listed in the Network Statement as part of article 27 of the Access Directive 2012/34/EU; AND*
- *Condition 3: FRMCS is in service"*

  - Start of the "7 years counter" directly related to the publication of the full set of on-board specifications

"The timeframe of 7 years starts when the FRMCS on-board Interoperability Constituent's' specifications, as listed in Table 5.1 and Appendix A, are completed and published in an Agency Opinion or in an amendment of this CCS TSI which will allow the tendering of the complete FRMCS on-board equipment"

- Note on Radio Class A systems
  - GSM-R continues to be a Class A system, without end-date
  - Introduction of FRMCS is not yet mandatory for new/upgraded lines or new/upgraded vehicles

CCS TSI Status for FRMCS – Draft Annex A

- Introduction of FRMCS related specifications (see next slide):
  - FRMCS and TOBA FRS
  - FRMCS SRS (incl. TOBA) / FIS / FFFIS
  - other FRMCS related specifications (e.g. Subset-037-1/2/3, Subset-148)
  - other non FRMCS related specifications (e.g. Subset-146, Subset-147)
- Notes on the applicability for CCS TSI 2022 are added
  - For FFFIS and FIS

    "*These specifications, as regards to ETCS and ATO on board equipment, shall be fully implemented*"
  - For FRMCS FRS, FRMCS SRS and TOBA FRS

    "*These specifications, in their current version, as regards to FRMCS on-board equipment, are not considered complete for the purpose of tendering the on-board equipment*"

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Status of FRMCS related specifications

Document	Description	Approved
FRMCS FRS	Functional requirements for FRMCS System	✓
FRMCS SRS	System requirements for FRMCS System (including on-board FRMCS)	✓
FRMCS FFFIS	Technical requirements on Obapp interface (between FRMCS and ETCS+ATO)	✓
FRMCS FIS	End to End requirements for FRMCS System (voice and ETCS+ATO)	✓
TOBA FRS	Functional requirements for on-board FRMCS	✓
SS-037-1	EuroRadio interface description for GSM-R (including coordination function)	✓
SS-037-2	EuroRadio interface description (Safety Module)	✓
SS-037-3	EuroRadio interface description for FRMCS	✓
SS-146	End to End security layer for ETCS/ATO	✓
SS-147	CCS consist network communication layers interface description	✓
SS-148	Communication systems description for ATO (GSM-R, FRMCS, other)	✓

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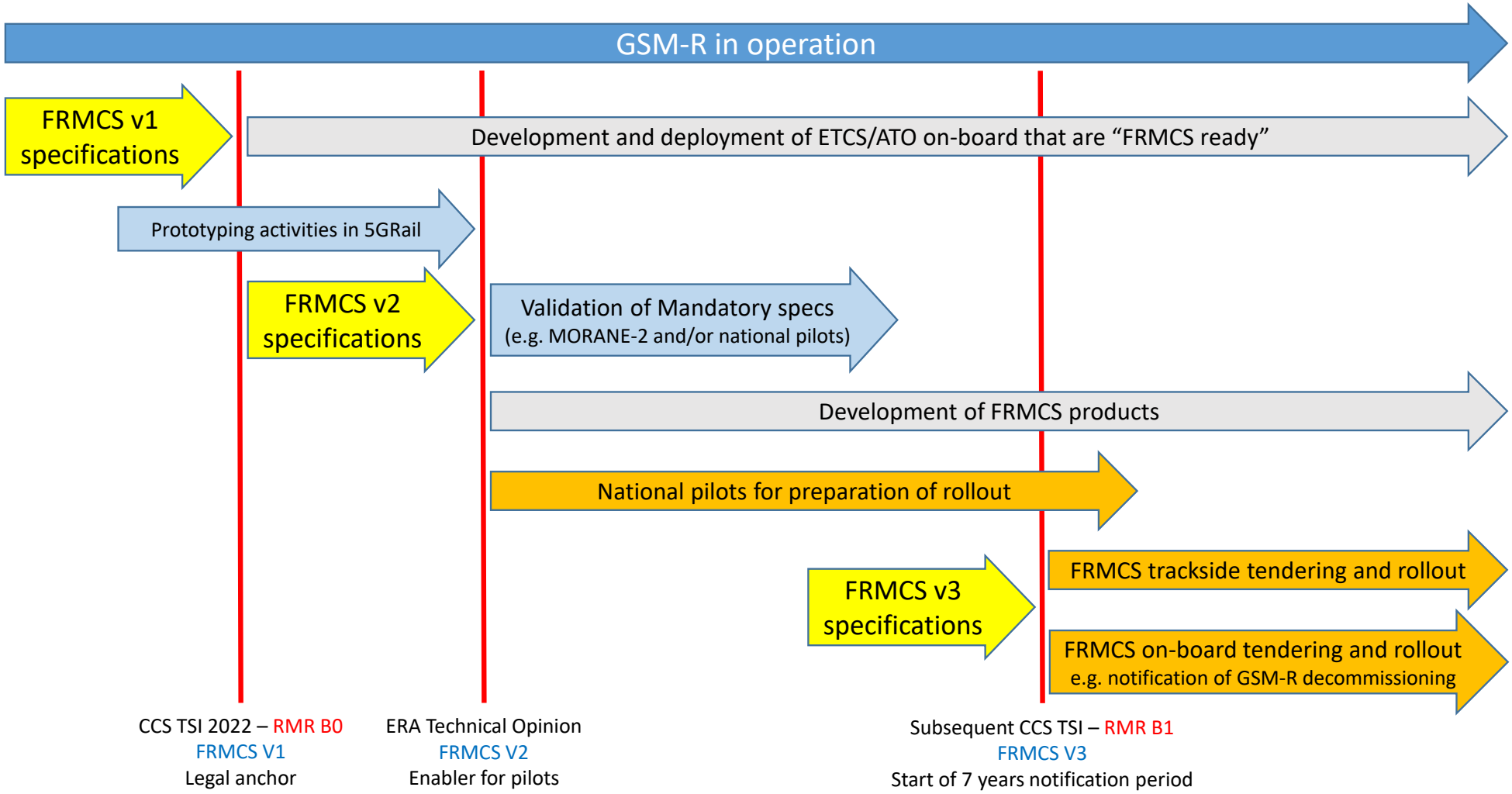
ERA perspective on CCS TSI Roadmap



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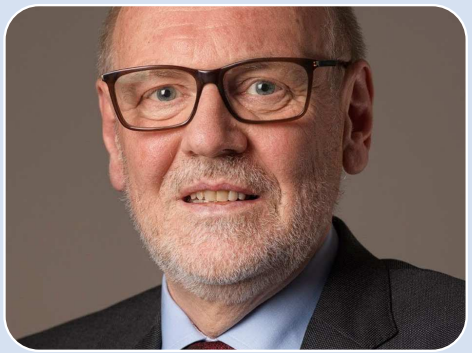
Next FRMCS challenges

- Development of FRMCS v2 specifications
  - UIC to prepare a detailed plan - Input needed for ERA Change Control Management
  - Feasibility study on the use of public (terrestrial) networks, as required by EIM and CER
    - Very relevant for an interoperable design of the on-board (antenna, spectrum)
- Development of Technical Standards
  - 5G/3GPP existing building blocks to be re-used
    - ETSI planning to be aligned on FRMCS specifications
- Test and validation of FRMCS specifications
  - Activities on-going or planned in several projects (e.g. 5GRail, Digitale Schiene Deutschland, Europe's Rail) - Pending analysis of what needs to be tested and validated
  - Funding of an EU trial considered as a trigger for FRMCS market

Speakers



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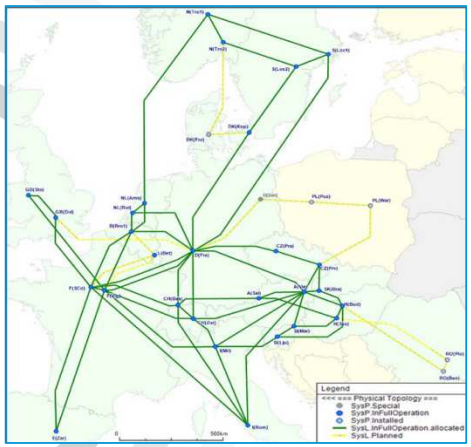
OF RAILWAYS

FRMCS Introduction
Status and Plans

Dan Mandoc

UIC, Head of FRMCS

FRMCS – the GSM-R successor



European GSM-R networks are interconnected via two hubs (and not via point-to point connections)

- **Railways currently use the GSM-R system for operational communication, as a key component of the European Railway Traffic Management System ERTMS. Designed 20+ years ago by UIC and completely border-crossing interoperable, GSM-R is deployed on more than 130,000 kilometers of track in Europe and 210,000 kilometers worldwide.**
- **GSM-R is supporting the train driver to signaller voice communications including the Railways Emergency Call (considered to be the best method to avoid a train accident when all the other system has failed) and ETCS (European Train Control System).**
- **The Future Radio Mobile Communication System (FRMCS) is the Railways response for two elements of strategic importance for the future of the railways:**

➢ **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. The lack of a suitable, harmonized and timely replacement will heavily impact the train system in Europe.**

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

GSM-R:
2G
NATION-WIDE
CONNECTIVITY
BX INTEROPERABLE
IMPROVE SAFETY
ENABLE:
RAILWAY EMERGENCY CALL
ETCS

FRMCS
5G MCX
AS GOOD AS GSM-R
ALLOWS ATO, TCMS, IOT

IMPROVE PUNCTUALITY
IMPROVES SAFETY

ENABLE DIGITALIZATION

INTERNATIONAL UNION
OF RAILWAYS

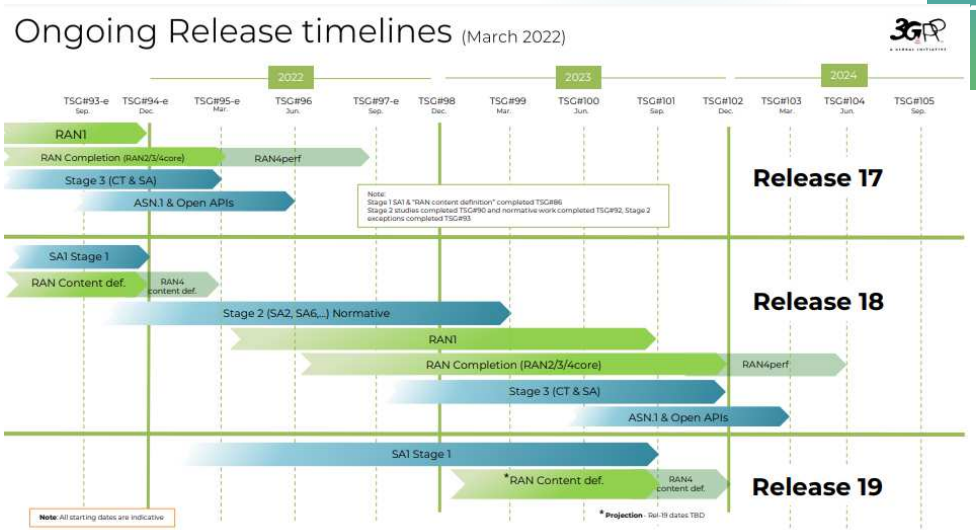
What is FRMCS
FRMCS Challenges

FRMCS is based on 3GPP 5G MCX - 1/3

The FRMCS 1st Edition, planned to be available for implementors second half of 2025, is a 3GPP 5G R17 & R18, MCX system.

UIC is working to ensure that the necessary 3GPP 5G and MCX (Mission Critical) services that are needed to meet the operational expectation (see embedded list) are included in the R17, 18 and some elements in R19.

The FRMCS system will continue to evolve with more services in R18, 19 and beyond.



URS Ref.	Application	Use	Type	applications to be considered for the migration phase
5.1	On-train outgoing voice communication from the train driver towards the controller(s) of the train	Critical	Comms	Y
5.2	On-train incoming voice communication from the controller towards a train driver	Critical	Comms	y
5.3	Multi-Train voice communication for drivers including ground user(s)	Critical	Comms	y
5.4	Banking voice communication	Critical	Comms	y
5.5	Trackside Maintenance Voice communication	Critical	Comms	y
5.7	Public emergency call	Critical	Comms	Y
5.8	Ground to ground voice communication	Critical	Comms	Y
5.9	Automatic Train Protection communication	Critical	Comms	Y
5.10	Automatic Train Operation communication	Critical	Comms	Y
5.11	Data communication for Possession Management	Critical	Comms	Y
5.12	Trackside Maintenance Warning System communication	Critical	Comms	Y
5.13	Remote control of Engines	Critical	Comms	Y
5.14	Monitoring and control of critical infrastructure	Critical	Comms	Y
5.15	Railway Emergency Communication	Critical	Comms	Y
5.16	On-train safety device to ground communication	Critical	Comms	Y
5.19	Voice recording and access	Critical	Comms	Y
5.20	Data recording and Access	Critical	Comms	Y

URS Ref.	Application	Use	Type	applications to be considered for the migration phase
10.1	Billing information	Business	Support	Y
5.24	On-train outgoing voice communication from train staff towards a ground user	Critical	Comms	Y
5.25	On-train incoming voice communication from a ground user towards train staff	Critical	Comms	Y
5.27	Critical real time video	Critical	Comms	Y
5.27	Critical real time video in case of ATO GoA3/GoA4 operation	Critical	Comms	Y
8.1	Assured voice communication	Critical	Support	Y
8.2	Multi user talker control	Critical	Support	Y
8.3	Role management and presence	Critical	Support	Y
8.4	Location services	Critical	Support	Y
8.5	Authorisation of communication	Critical	Support	Y
8.7	Authorisation of application	Critical	Support	Y
8.8	QoS class negotiation	Critical	Support	Y
8.9	Safety application key management communication	Critical	Support	Y
8.10	Assured data communication	Critical	Support	Y
8.11	Inviting-a-user messaging	Critical	Comms	Y
8.12	Arbitration	Critical	Comms	Y

FRMCS is based on 3GPP 5G MCX - 2/3

FRMCS will be based on 3GPP 5G technology.

Below some 5G principles that we will follow to define, build and implement FRMCS:

-5G SA (Stand Alone) Architecture

-5G New frequency bands (FRMCS 900 and 1900 MHz)

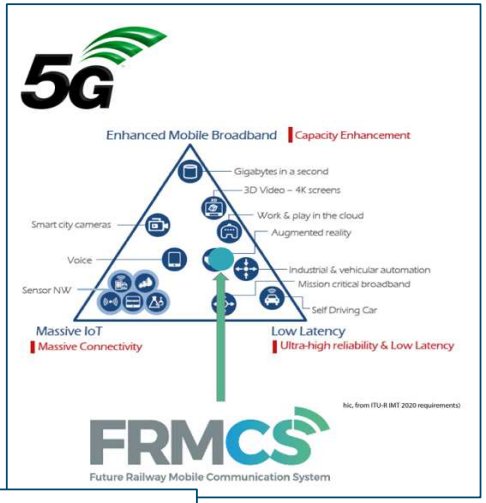
-Performance enhancements for 5G in High-Speed Mobility scenario

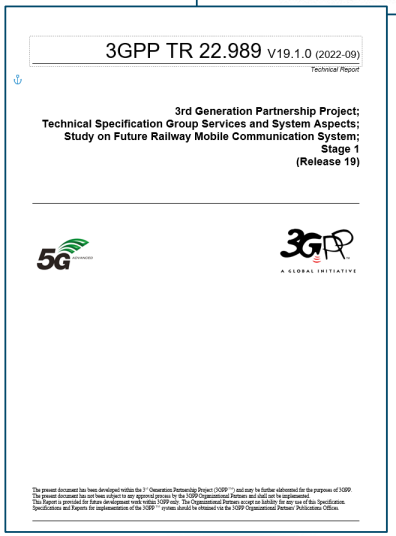
-Critical communications (5QI QoS flows mechanism)

-Mission Critical (MC) Services

The FRMCS Use Cases and Requirements are part of 3GPP 5G service requirements:

https://portal.3gpp.org/desktopmodules/Specifications/SpecificationDetails.aspx?specificationId=3109




3GPP TR 22.989 V19.1.0 (2022-09)

Technical Report

3rd Generation Partnership Project;
Technical Specification Group Services and System Aspects;
Study on Future Railway Mobile Communication System;
Stage 1
(Release 19)

FRMCS is based on 3GPP 5G MCX - 3/3

3GPP is working on standardizing **Mission Critical Services** (MC), based on requirements from different sectors of the global critical communications industry.

MC Services were introduced since 3GPP Rel-13 by Public Safety (before 2016)

The MC Services enablers will allow specific:

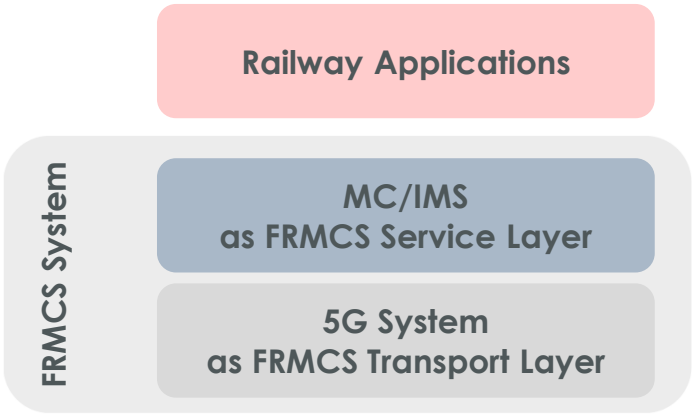
- Functionalities e.g. voice,
- Architectures (e.g. Gateway UE),
- Quality of Service,

to be introduced for enabling a fit-for-purpose FRMCS.

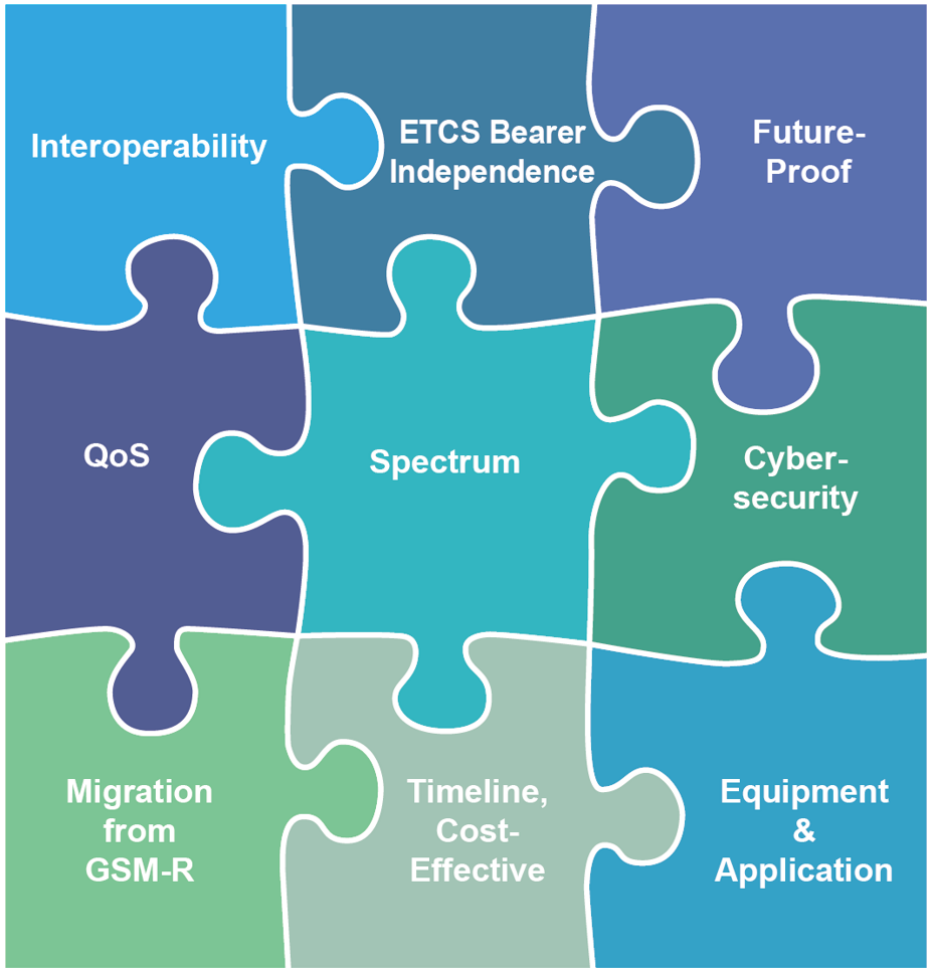
3GPP MC Services functionalities as part of FRMCS:

- MC over 5G System
- MC CoRe: emergency communications, group communications…
- MC Push-To-Talk or MCPTT (voice floor control)
- MC Data (data), mainly MCData IP connectivity
- MC Video (video)
- Functional alias (role management)
- Multi-user talker control (multi-user Push-To-Talk)
- Supplementary services for MC (call forward & call transfer for MC)
- Security for MC
- MC Interconnection and migration
- …

A number of functionalities have been specified, other are under specification within 3GPP R18 and 19; this work will continue.



THE FRMCS CHALLENGES



FRMCS Introduction:

INTERNATIONAL UNION OF RAILWAYS

1. Frequencies
2. Migration Principles
3. Specification Map
4. First Prototypes
5. V1
6. 5GRail
7. Global Introduction Plan

FRMCS Frequencies
ECC and EC Implementing Decision

In Europe, ECC have allocated supplementary dedicated frequencies to FRMCS:

- **The ECC Decision (20) 02**

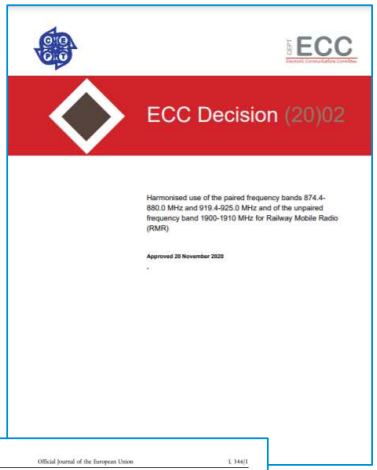
''Harmonised use of the paired frequency bands 874.4- 880.0 MHz and 919.4-925.0 MHz and of the unpaired frequency band 1900-1910 MHz for Railway Mobile Radio (RMR)''
have been approved in November 2020

- **1.6 MHz have been added to Railways existing 5 MHz allocated in 900 MHz for GSM-R.**
- **Additional 10 Mhz (TDD) have been allocated to Railways in 1900 MHz (1900 – 1910 MHz)**

- **The ECC decision was followed by the EC Implementing Decision (EU) 2021/1730**

''on the harmonised use of the paired frequency bands 874,4-880,0 MHz and 919,4-925,0 MHz and of the unpaired frequency band 1 900-1 910 MHz for Railway Mobile Radio''

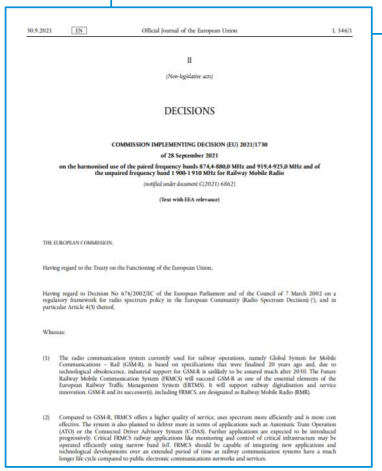
Once the ECC Decision was published, we have submitted these requirements to 3GPP. Currently, bands n100 and 101 have a;ready been created for the two FRMCS frequency bands, and the specifications is ongoing.


ECC

ECC Decision (20)02

Harmonised use of the paired frequency bands 874.4-880.0 MHz and 919.4-925.0 MHz and of the unpaired frequency band 1900-1910 MHz for Railway Mobile Radio (RMR)

Approved 20 November 2020


30.9.2021 EN Official Journal of the European Union L 346/1

II

(Non-legislative acts)

DECISIONS

COMMISSION IMPLEMENTING DECISION (EU) 2021/1730

of 28 September 2021

on the harmonised use of the paired frequency bands 874.4-880.0 MHz and 919.4-925.0 MHz and of the unpaired frequency band 1 900-1 910 MHz for Railway Mobile Radio

(notified under document C(2021) 6862)

(Text with EEA relevance)

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

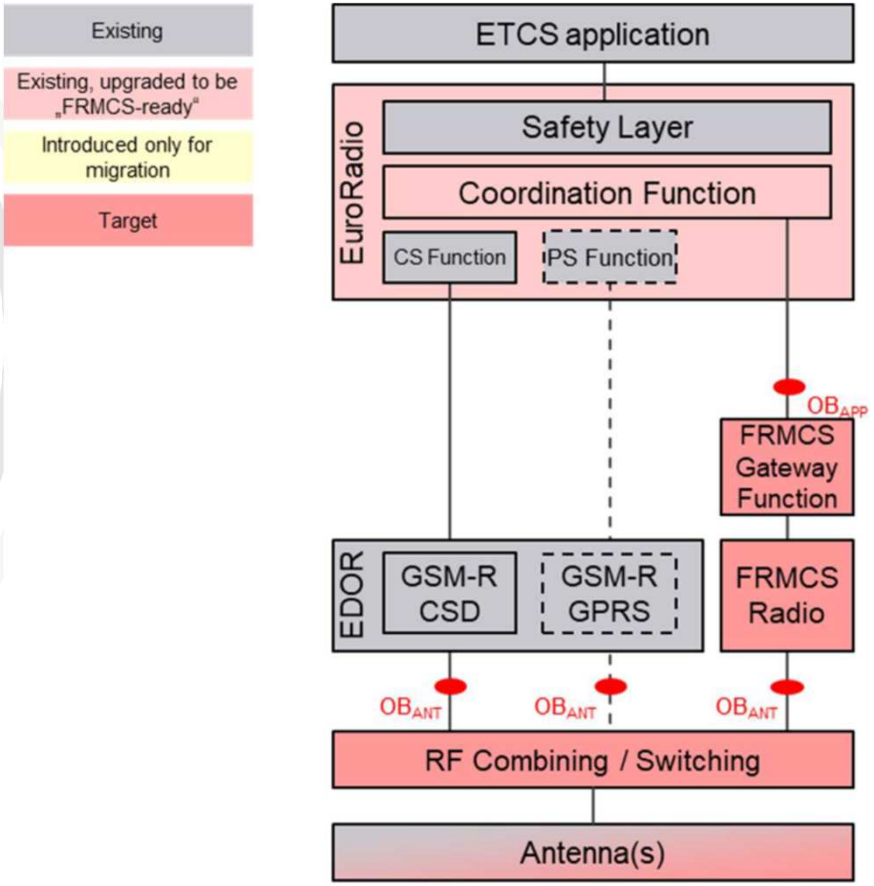
Having regard to Decision No 676/2002/EC of the European Parliament and of the Council of 7 March 2002 on a regulatory framework for radio spectrum policy in the European Community (Radio Spectrum Decision) (1), and in particular Article 4(3) thereof,

Whereas:

(1) The radio communication system currently used for railway operations, namely Global System for Mobile Communications – Rail (GSM-R), is based on specifications that were finalised 20 years ago and, due to technological obsolescence, industrial support for GSM-R is unlikely to be assured much after 2030. The Future Railway Mobile Communication System (FRMCS) will succeed GSM-R as one of the essential elements of the European Railway Traffic Management System (ERTMS). It will support railway digitalisation and service innovation. GSM-R and its successor(s), including FRMCS, are designated as Railway Mobile Radio (RMR).

(2) Compared to GSM-R, FRMCS offers a higher quality of service, uses spectrum more efficiently and is more cost effective. The system is also planned to deliver more in terms of applications such as Automatic Train Operation (ATO) or the Connected Driver Advisory System (C-DAS). Further applications are expected to be introduced progressively. Critical FRMCS railway applications like monitoring and control of critical infrastructure may be operated efficiently using narrow band IoT. FRMCS should be capable of integrating new applications and technological developments over an extended period of time as railway communication systems have a much longer life cycle compared to public electronic communications networks and services.

ETCS migration towards FRMCS



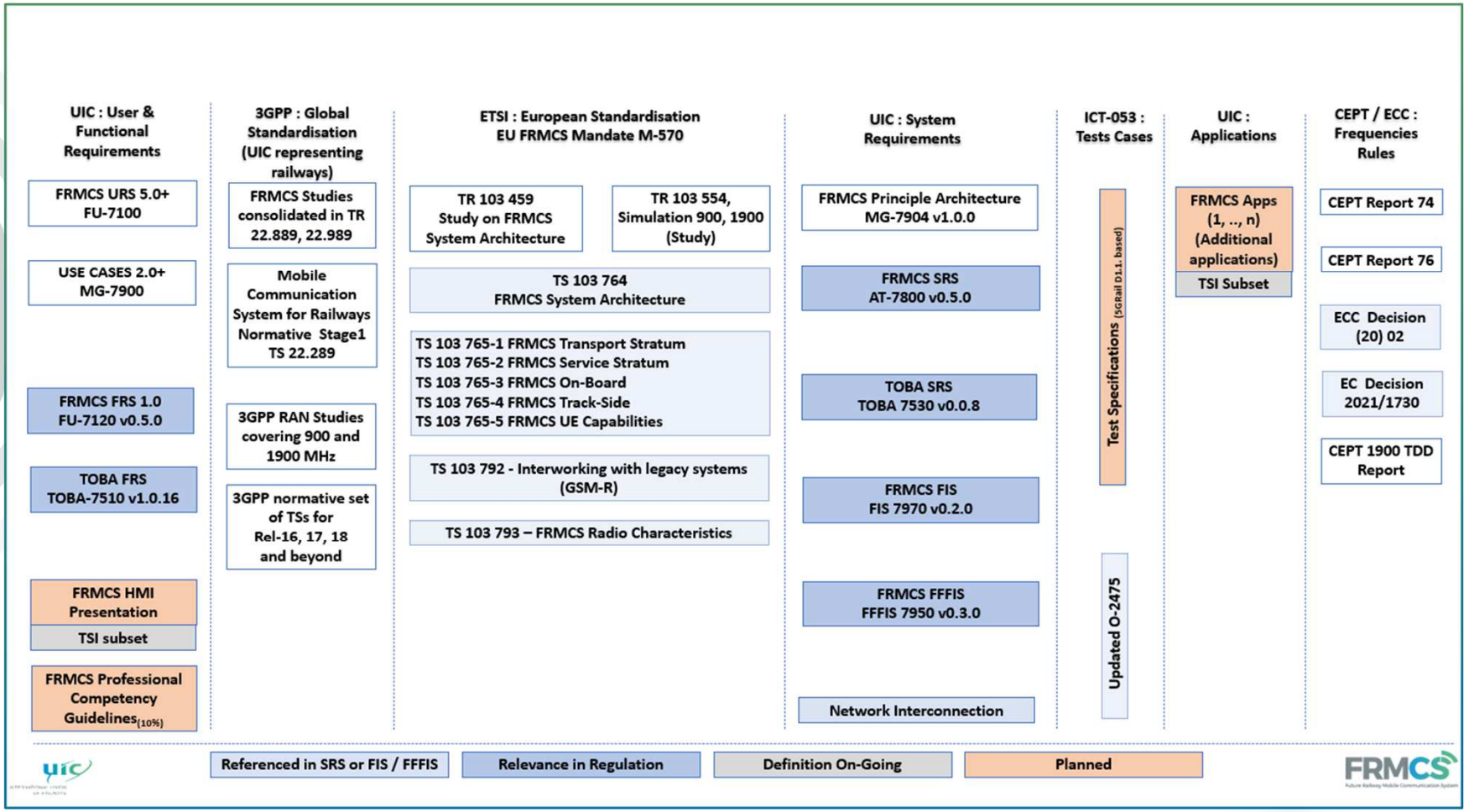
Based on UIC TOBA 7515 v1.0.0. document, ERA and Stakeholders have agreed the best option for ETCS migration to FRMCS (see embedded).

TSI 2022 already incorporates a restructure of the ETCS telecom interface based on a 'ETCS readiness'' concept, which allow:

- functioning of ETCS over FRMCS, in a reliable and future proof way

- future changes of the telecom system (e.g. 6G) will not affect the ETCS core application and safety layer.

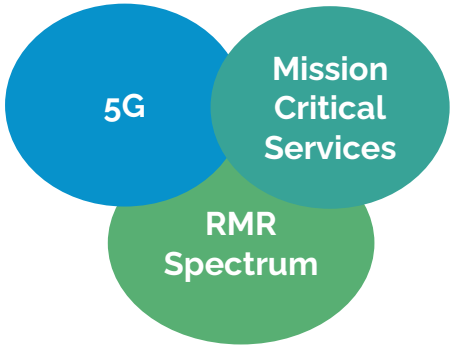
UIC FRMCS Global map for Specifications & Standardization



FRMCS V1 Specifications: high-level scope

The high-level scope of FRMCS V1 Specifications is:

- Restricted to the following applications:
  - ERTMS data applications (ETCS, ATO, KMS)
    - This however could cover also some of the future train performance Loose Coupling Data applications (e.g. TCMS)
  - Train Radio voice applications
- Restricted to MCX Loose Coupling (ERTMS data applications) and Tight Coupling (Voice and REC) application regimes
- Based on 5G System (limited to RMR spectrum + 5G NR RAT) and MCX (limited to MCData IPCon and MCPTT)
- Restricted to On-board FRMCS (no handhelds, no ground-to-ground communications)
- Based on ETSI specific TS “Interworking with GSM-R”



Roadmap to FRMCS V1 Stable Drafts

FRMCS FRS

FRMCS TOBA FRS

FRMCS SRS

FRMCS TOBA SRS

FRMCS FFFIS

FRMCS FIS

MG-7904

FRMCS TOBA 7515

...

October 20

... | 2019 | Q2 2020 – Q3 2022

Creation → **S2R Consortium Review** → **EECT Review** → **V1 Specifications Included in CCS TSI**

UIC stable drafts endorsed by "S2R ERTMS MoU Consortium" (UNISIG, EUG, UNITEL, UIC)

ERA Extended Core Team (ERA, UNISIG, CER, UNITEL, UIC). V1 UIC FRMCS Specifications final draft approved within EECT. Last steps are final editorial and the TSI categorization. V1.0.0 of the five remaining specifications are expected by end November 2022.

RISC vote

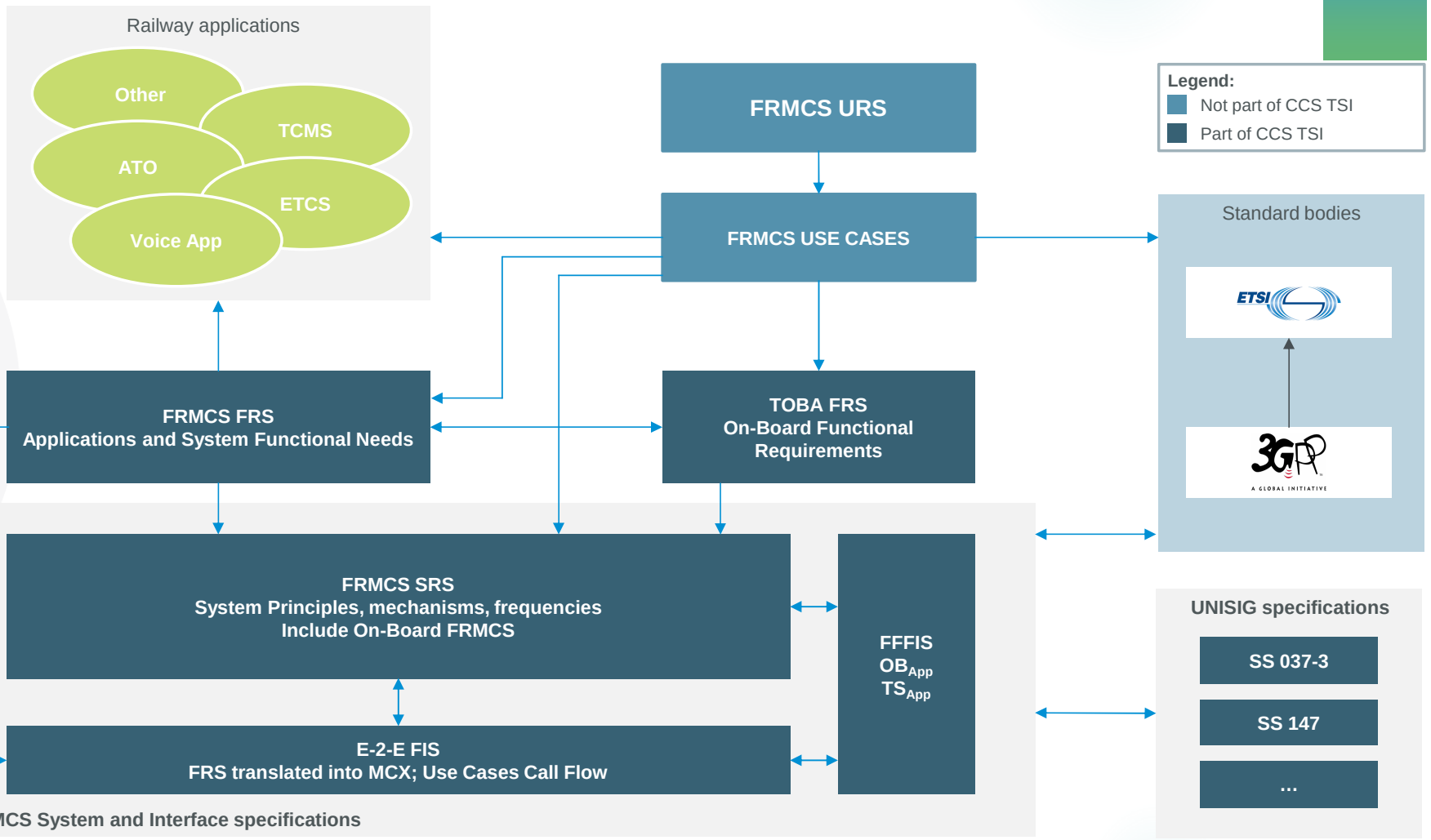
Specification	UIC Code
Studies, including for frequencies	
FRMCS Migration Variants for existing ETCS	TOBA 7515
FRMCS Principle Architecture	MG 7904
FRMCS V1 Planning	MG 7905
UIC FRMCS Specs Drafts for review	

Specification	Current Version	Date
FRMCS FRS	FU-7129 v0.4.0	13 Oct 21
TOBA FRS	TOBA 7510 v1.0.16	01 July
FRMCS SRS	AT-7800 v0.4.2	21 Jan 22
TOBA SRS	TOBA 7530 v0.0.9	21 Jan 22
FIS	FIS 7970 v0.2.0	21 Jan 22
FFFIS	FFFIS 7550 v0.4.0	24 Jan 22

Specification	Current Version	Date
FRMCS FRS	v0.8.0	30 September
TOBA FRS	v1.0.21	30 September
FRMCS SRS	v0.6.0	07 October
TOBA SRS*	v0.0.11	07 October
FIS	v0.7.0	07 October
FFFIS	v0.9.0	18 October

** TOBA SRS is be merged with FRMCS SRS*

FRMCS V1 Hierarchy & Dependencies (CCS, ETSI, 3GPP)



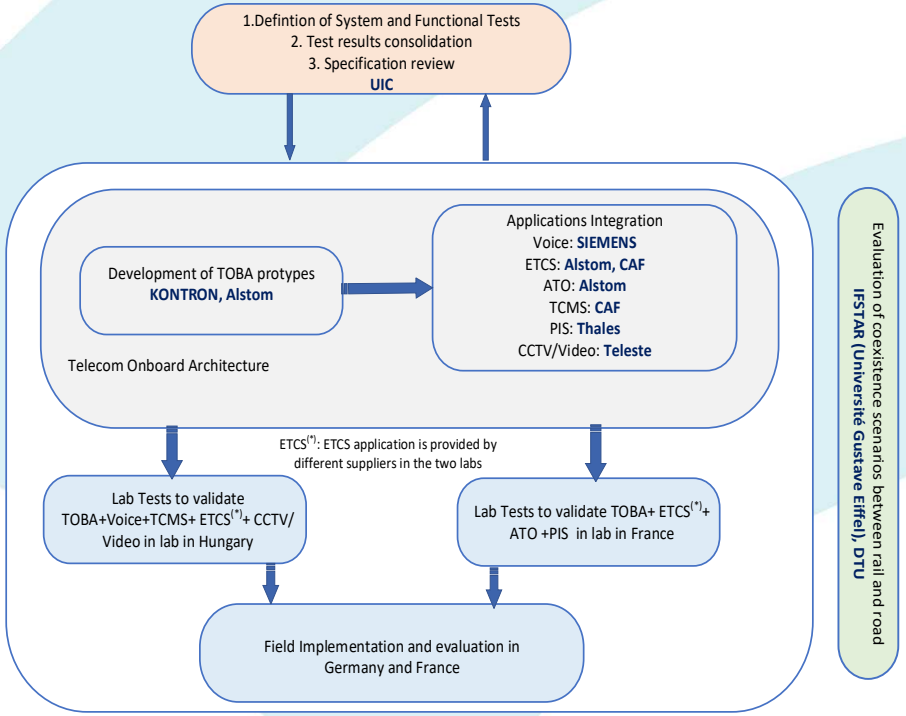
5GRail
Delivering the first FRMCS prototypes
Scope and Achievements

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 951725.

5GRAIL Scope, Structure and Partners

5GRAIL scope is to:

- **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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5G Rail P1 (M1 – M18) Status

Achievements:

- Elaboration of Test plan with 127 test cases (currently)
- TOBA prototypes available
- Applications prototypes are OBapp/TSapp compatible
- The two labs in Germany and France have successfully integrated partners' equipment and applications. Testing have started
- Cybersecurity will consider the ATO and ETCS applications. We are considering some enhancement e.g. rupture of protocol
- A n39 experimental modem type working in the RMR 1900 MHz radio conditions (31 dB !) is being made available via one of the top chipsets supplier. This adds to existing n8 (900 MHz) and n78 (3800 MHz) 5G modems, that equips the TOBA.
- Testbed preparation is in progress.

These activities were done in remote meetings. When we reached the activities that needed human presence, especially related to equipping the Laboratories and starting the integration tests, we encountered Pandemia related difficulties, with repercussions in equipment availability and delivery, as well as physical presence in the labs. To mitigate this delay we have requested a 36 months extension, which is being processed.

Next steps:

- Delivery of additional TOBA features: localization, QoS management, multiconnectivity (using different radio bearers)
- Finalise few remaining application
- Execute the test plan
- Field testbeds readiness
- Analyse outcomes from lab and field testing to provide feedback to the FRMCS V1 specifications

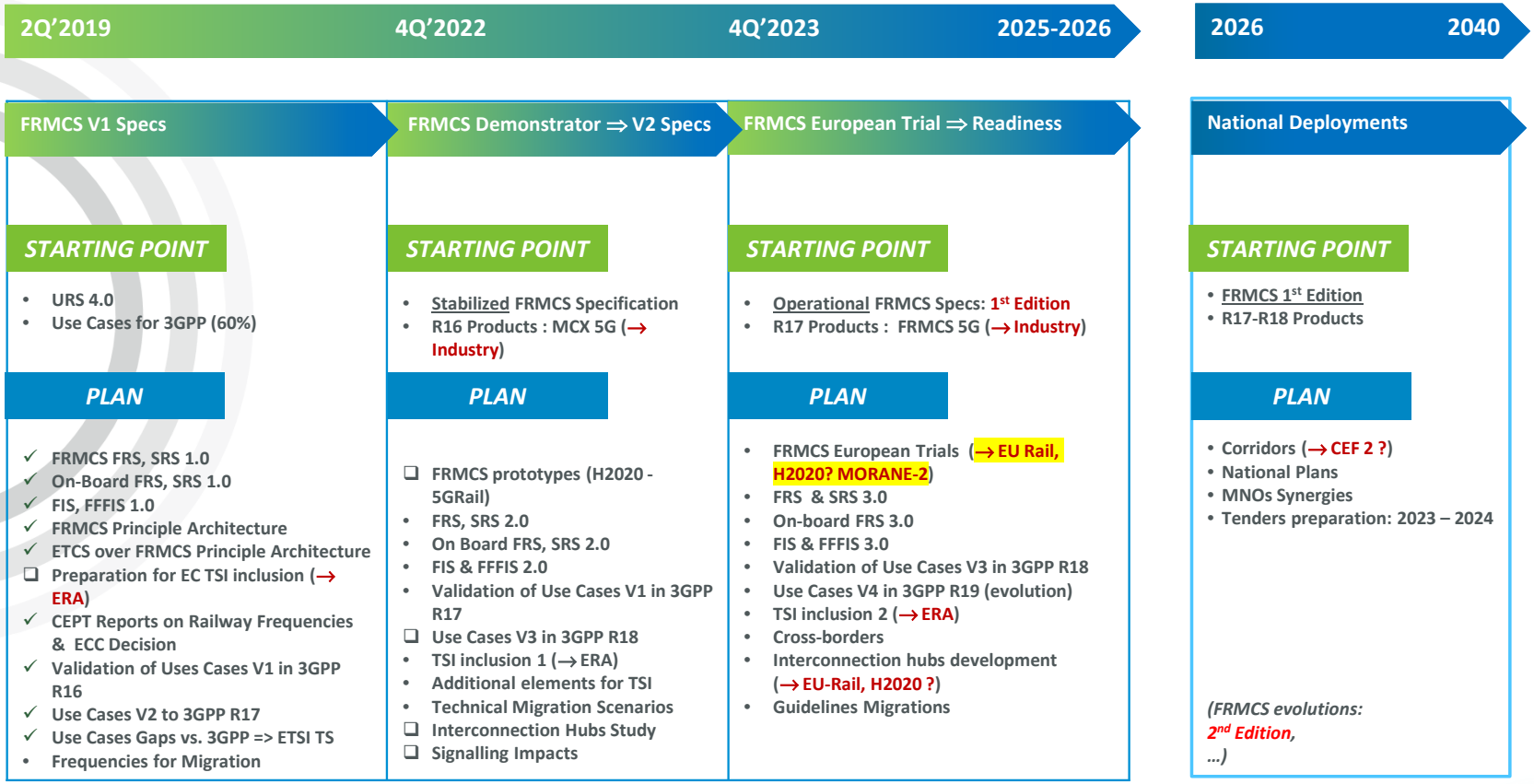
5GRail Use Cases (Figure 1) are a subset of FRMCS Use Cases (Figure 2)

URS Ref.	Applications
5	Critical Communication Applications
5.1	On-train outgoing voice communication from the train driver towards the controller(s) of the train
5.2	On-train incoming voice communication from the controller towards a train driver
5.3	Multi-Train voice communication for drivers including ground user(s)
5.9	Automatic Train Protection communication (ETCS)
5.10	Automatic Train Operation communication (GoA2 ATO)
5.13	Remote Control of Engines
5.14	Monitoring and control of critical infrastructure
5.15	Railway Emergency Communication
5.27	Critical real time video
5.28	Critical Advisory Messaging services- safety related
6.9	On-Train Telemetry communications (TCMS)
6.11	On-train remote equipment control (TCMS)
6.20	Transfer of data (TCMS)
6.22	Transfer of CCTV archives

URS Ref.	Application	Use	Type
5.1	On-train outgoing voice communication from the train driver towards the controller(s) of the train	Critical	Comms
5.2	On-train incoming voice communication from the controller towards a train driver	Critical	Comms
5.3	Multi-Train voice communication for drivers including ground user(s)	Critical	Comms
5.4	Banking voice communication	Critical	Comms
5.5	Trackside Maintenance Voice communication	Critical	Comms
5.7	Public emergency call	Critical	Comms
5.8	Ground to ground voice communication	Critical	Comms
5.9	Automatic Train Protection communication	Critical	Comms
5.10	Automatic Train Operation communication	Critical	Comms
5.11	Data communication for Possession Management	Critical	Comms
5.12	Trackside Maintenance Warning System communication	Critical	Comms
5.13	Remote control of Engines	Critical	Comms
5.14	Monitoring and control of critical infrastructure	Critical	Comms
5.15	Railway Emergency Communication	Critical	Comms
5.16	On-train safety device to ground communication	Critical	Comms
5.19	Voice recording and access	Critical	Comms
5.20	Data recording and Access	Critical	Comms

URS Ref.	Application	Use	Type
10.1	Billing information	Business	Support
5.24	On-train outgoing voice communication from train staff towards a ground user	Critical	Comms
5.25	On-train incoming voice communication from a ground user towards train staff	Critical	Comms
5.27	Critical real time video	Critical	Comms
5.27	Critical real time video in case of ATO GoA3/GoA4 operation	Critical	Comms
8.1	Assured voice communication	Critical	Support
8.2	Multi user talker control	Critical	Support
8.3	Role management and presence	Critical	Support
8.4	Location services	Critical	Support
8.5	Authorisation of communication	Critical	Support
8.7	Authorisation of application	Critical	Support
8.8	QoS class negotiation	Critical	Support
8.9	Safety application key management communication	Critical	Support
8.10	Assured data communication	Critical	Support
8.11	Inviting-a-user messaging	Critical	Comms
8.12	Arbitration	Critical	Comms

FRMCS Introduction Plan



UIC and railways plan is to make available together with partner suppliers and authorities a FRMCS 1st Edition, end 2025, to start the national trials. It will be based on 5G, 3GPP R17 and 18, MCX products.

To reach that the embedded plan is followed.

We currently are in full execution of this plan, with dedicated frequencies being allocated by EC, Version 1 FRMCS Specifications being finalized for the 2022 CCS TSI, and first prototypes starting being tested.

We are working with ERA and the EC to identify the suitable framework that will allow MORANE-2 the FRMCS European Trials.

We will keep pursuing this plan aiming to deliver the 5G FRMCS system that will mitigate the European GSM-R obsolescence risk, and will enable railways digitalization.

Thank you for your kind attention

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UIC FRMCS Project on YouTube

FRMCS V1 Stable Drafts roadmap & status

FRMCS FRS

FRMCS TOBA FRS

FRMCS SRS

FRMCS TOBA SRS

FRMCS FFFIS

FRMCS FIS

2019 | Q2 2020 – Q3 2022 | October 20

Creation → **S2R Consortium Review** → **EECT Review** → **V1 Specifications Included in CCS TSI**

Stable drafts endorsed by "S2R ERTMS MoU Consortium"
(UNISIG, EUG, UNITEL, UIC)

ERA Extended Core Team (ERA, UNISIG, CER, UNITEL, UIC). All UIC FRMCS Specifications final draft approved within EECT. Last steps are final editorial and the TSI categorization. V1.0.0 of the five remaining specifications are expected by end November 2022.

RISC vote

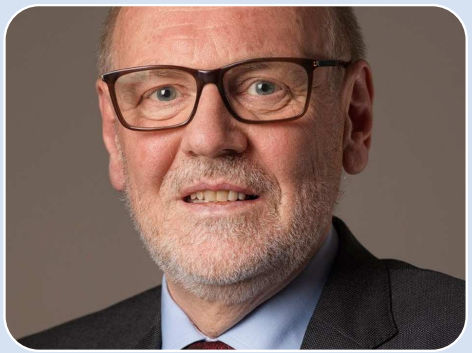
Specification	UIC Code
Studies, including for frequencies	
FRMCS Migration Variants for existing ETCS	TOBA 7515
FRMCS Principle Architecture	MG 7904
FRMCS V1 Planning	MG 7905

Specification	Current Version	Date
FRMCS FRS	FU-7129 v0.4.0	13 Oct 21
TOBA FRS	TOBA 7510 v1.0.16	01 July
FRMCS SRS	AT-7800 v0.4.2	21 Jan 22
TOBA SRS	TOBA 7530 v0.0.9	21 Jan 22
FIS	FIS 7970 v0.2.0	21 Jan 22
FFFIS	FFFIS 7550 v0.4.0	24 Jan 22

Specification	Current Version	Date
FRMCS FRS	v0.8.0	30 September
TOBA FRS	v1.0.21	30 September
FRMCS SRS	v0.6.0	07 October
TOBA SRS*	v0.0.11	07 October
FIS	v0.7.0	07 October
FFFIS	v0.9.0	18 October

** TOBA SRS is be merged with FRMCS SRS*

Speakers



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