EUROPEAN
UNION
AGENCY
FOR RAILWAYS

Moving Europe towards a sustainable and
safe railway system without frontiers.

OPINION

ERA/OPI/2024-10

OF THE EUROPEAN UNION AGENCY FOR RAILWAYS

for

THE EUROPEAN COMMISSION

regarding

version 2 of Future Railway Mobile Communication System
(FRMCS)specifications

Disclaimer:

The present document is a non-legally binding opinion of the European Union Agency for Railways. It does
not represent the view of other EU institutions and bodies, and is without prejudice to the decision-making
processes foreseen by the applicable EU legislation. Furthermore, a binding interpretation of EU law is the
sole competence of the Court of Justice of the European Union.

Contents

1.   General Context

1.1.   Introduction

The European Union Agency for Railways (hereinafter "the Agency" or "ERA") received from the European Commission a request[1] for a technical opinion in accordance with Article 6 of Directive (EU) 2016/797.

The request was to complete the Commission Implementing Regulation (EU) 2023/1695 on the technical specification for interoperability relating to the control-command and signalling subsystems of the rail system in the European Union (CCS TSI), as it contains the first, incomplete, version of the specifications of the Future Mobile Railway Communication System (FRMCS).

The request notably asks for an ERA opinion regarding the FRMCS specifications version 2, including the set of FRMCS specifications v2.0.0 endorsed by ERA/EECT, a comparison with the expected scope as described in the System Pillar FRMCS report, and the identification of open points that need to be addressed in view of completing the V3 set of FRMCS specifications.

The request also calls for an analysis on broader considerations in the context of new radio and data communication (e.g. spectrum), and about possible risks related to the timely delivery of the V3 set of FRMCS specifications.

This document contains ERA's opinion in response to the European Commission's request. It is summarising the status of FRMCS specifications version2, and formulating recommendations on the next steps towards the finalisation of the V3 set of FRMCS specifications in view of their adoption as part of the subsequent CCS TSI revision.

1.2.   References

Reference	Name of document/presentation	Title of document
[1]	FU-7120-v2.0.0	Functional Requirement Specification
[2]	TOBA-7510-FRS-v2.0.0	On-Board FRMCS Functional Requirements
[3]	AT-7800-v2.0.0	System Requirement Specification
[4]	FIS-7970-v2.0.0	Functional Interface Specification
[5]	FFFIS-7950-v2.0.0	Form Fit Functional Interface Specification
[6]	Subset-037-3-v4.1.2	EuroRadio FIS FRMCS Communication Functional Module

---

[1] Letter signed on 31.10.2024 from Brussels MOVE.DDG2.C/KS to the Executive Director of the Agency with reference Ares (2024)7753905 -31/10/2024 – See Annex 1

1.3. Abbreviations

Abbreviation	Description
ATO	Automatic Train Operation
CCS	Control Command Signalling
EC	European Commission
EECT	Extended ERA Core Team
EECT RMR	Extended ERA Core Team Railway Mobile Radio
EIRENE	European Integrated Railway Radio Enhanced Network
ERA (or the Agency)	The European Union Agency for Railways
ERTMS	European Rail Traffic Management System
ETCS	European Train Control System
EU-RAIL	Europe's Rail Joint Undertaking
FRMCS	Future Railway Mobile Communication System
GSM-R	Global Communication System for Railways
IM	Infrastructure Manager
KMS	Key Management System
PKI	Public Key Infrastructure
FRS	Functional Requirement Specification
TOBA	Telecom On-Board Architecture
FIS	Functional Interface Specification
FFFIS	Form Fit Functional Interface Specification
OBapp	On-Board application
PMNO	Public Mobile Network Operator
RAT	Radio Access Technology
RU	Railway Undertaking
SRS	System Requirement Specification
TSI	Technical Specifications for Interoperability
UIC	Union Internationale des Chemins de fer
UNISIG	Union industry of signalling
UNITEL	Union industry of telecom

2. Legal references

Article 6 (1) Directive (EU) 2016/797 sets out that "*If, after its adoption, it appears that a TSI has a deficiency, that TSI shall be amended in accordance with Article 5(11)*".

Article 6 (2) Directive (EU) 2016/797 sets out that "*Pending the review of a TSI, the Commission may request an opinion from the Agency.*"

Innovative solutions can also be assessed, as specifically referred to in Article 11 of Commission Implementing Regulation (EU) 2023/1695 (CCS TSI).

3. Objective and timeline of this Technical Opinion

The objective of this Technical Opinion is to reply to the EC's request in relation to the following elements:

- › EECT RMR process for FRMCS V2
- › Status of FRMCS specifications v2.0.0 endorsed by ERA/EECT RMR
- › Comparison with the expected scope as described in the System Pillar FRMCS report
- › Identification of open points that need to be addressed in view of completing the V3 set of FRMCS specifications
- › Broader considerations in the context of new radio and data communication (e.g. spectrum)
- › Risk identified for the timely delivery of the V3 set of FRMCS specifications

Considering that the CCS TSI contains the first, incomplete, version of the specifications of FRMCS, there is a need for further development of those specifications. This is also referred to in the Article 10 of the Commission Implementing Regulation 2023/1695, where it is stated that manufacturers and early implementers shall use the draft specifications that may be contained in an Agency opinion for their pilots, and they and shall inform the Commission and the Agency about each pilot at its beginning, keeping them informed of the progress of those pilots.

It is on this basis that the Agency should provide an opinion regarding the FRMCS specifications version 2.

This Technical Opinion also aims at providing recommendations on the next steps towards the finalisation of the V3 set of FRMCS specifications, including actions needed beyond the scope of EECT RMR e.g. on governance and collaboration of all railway stakeholders for FRMCS.

According to the points listed above, it must be noted that this Technical Opinion does not serve the purpose of developing FRMCS products or tendering projects by RUs/Ims. It shall also neither be used for conformity assessment of FRMCS Interoperability Constituents before placing them on the market nor for EC verification of subsystems before placing them on the market/in service. This Technical Opinion rather captures the needs for Test & Validation activities and offers a snapshot of the intermediate V2 milestone towards finalisation of the V3 set of FRMCS specifications.

This Technical Opinion, for the reasons explained in EECT RMR process for FRMCS V2 will be delivered in two steps:

a) the present publication presenting the available v2.0.0 set of FRMCS specifications together with v4.1.2 Subset-037-3, complemented with Open Points and recommendations post EECT RMR process for FRMCS V2, and

b) as a second step, an addendum to be published in April 2025 referring to the v2.1.0 set of FRMCS specifications for practical and harmonised use in any FRMCS Test & Validation activity at EU level (e.g. MORANE-2) or National level (pilots).

4. Analysis

4.1. EECT RMR process for FRMCS V2

In anticipation of GSM-R obsolescence, a new radio class A system (FRMCS) is being defined and will be deployed in Europe as a successor to GSM-R. In the CCS TSI 2023/1695, FRMCS was partially introduced focusing mainly on the OBapp interface between the ERTMS/ETCS on-board and the ERTMS/ATO on-board, and the FRMCS on-board, enabling the specification of the ETCS and ATO on-board interfaces to the future FRMCS and the development of the associated components.

On 5 July 2023, the railway stakeholders collaborating in the System Pillar Steering Group agreed on a timeline and scope of the work on the FRMCS specifications and issued the EU-RAIL System Pillar FRMCS report[2]. Based on the agreed timeline, UIC delivered to the Agency the draft V2 set of FRMCS specifications at the end of March 2024 as an input to the ERA Extended Core Team on Railway Mobile Radio. Since April 2024, the experts appointed by the representative organisations in EECT RMR for FRMCS V2 have worked on assessing and completing where necessary the V2 set of FRMCS specifications.

EECT RMR process for FRMCS V2 therefore aimed at reviewing and validating the following specifications:

› Functional Requirement Specification (input: FRS v1.1.0)
› On-Board FRMCS Functional Requirements (input: TOBA FRS v1.1.0)
› System Requirement Specification (input: SRS v1.1.0)
› Functional Interface Specification (input: FIS v1.1.0)
› Form Fit Functional Interface Specification (input: v1.1.0)
› Subset-037-3 (Euroradio protocols for FRMCS, input: v4.1.0)

Although the V2 set of FRMCS specifications is complementing the v1 set[3], substantial modifications were performed, notably on refining feature requirements in FRS/TOBA FRS and on further definition of system requirements in SRS/FIS/FFFIS.

As the V2 set of FRMCS specifications was drafted by UIC Working Groups (with the support of Industry for FIS and FFFIS), versions v1.1.0 were discovered by EECT members in April 2024. The number of comments received per specification varies, yet the statistics below highlight the effort made by reviewers to understand the requirements or propose modifications, and by UIC editors of the specifications to resolve those comments:

› FRS: circa. 250 pages documents, 4 versions reviewed, more than 700 comments out of which approximately 500 accepted
› TOBA FRS: circa. 50 pages documents, 4 versions reviewed, more than 600 comments out of which approximately 400 accepted
› SRS: circa. 160 pages documents, 4 versions reviewed, more than 850 comments out of which approximately 500 accepted
› FIS: circa. 110 pages documents, 5 versions reviewed, more than 200 comments out of which approximately 150 accepted
› FFFIS: circa. 50 pages documents, 4 versions reviewed, more than 250 comments out of which approximately 170 accepted

---

[2] https://rail-research.europa.eu/wp-content/uploads/2023/08/20230718-FRMCS-report-final.pdf EU-RAIL JU System Pillar Report on FRMCS V2 and V3 Scope and Planning
[3] "*FRMCS V2 is reputed to be in the majority of the cases a completion of the V1*", EU-RAIL SP FRMCS report

› Subset-037-0: circa. 25 pages documents, 2 versions reviewed, more than 130 comments out of which approximately 60 accepted

ERA organised, from April to December 2024, 35 EECT meetings to allow for a thorough review of all inputs, mobilising 3 FTEs from ERA and an estimation of 10 FTEs on EECT experts' side.

The planning for those meetings was very dense, with a minimum of 2 meetings per month, and an even denser number of meetings close to the finalisation of the review. EECT members remarked that experts' availability to be adequately represented in every meeting, especially in the finalisation period, was quite challenging.

The rationale for keeping such a strict deadline for the Technical Opinion publication was also questioned, as some EECT members believed that longer review time would have been beneficial for improving the quality of the specifications.

Additional concerns were voiced during the EECT process, and UNIFE notably expressed it in a position paper[4] on the "*completeness, anticipated content, and quality of the draft FRMCS V2 specifications*", resulting in " *extensive comments being received by involved stakeholders and too many points remain open and subject to extensive discussion*".

ERA took note of those comments from EECT members and acknowledges that EECT RMR process for FRMCS V2 could have been more efficient in terms of planning with a more accurate anticipation of workload. ERA also noted that a higher maturity level of inputs to EECT would have helped, as EECT has sometimes been used as a forum for detailed technical discussions that should have happened before EECT, delaying the overall approval process.

EECT RMR process for FRMCS 3 will need to be adapted to achieve efficiency gains (see also Risks identified for the timely delivery of the V3 set of FRMCS specifications).

4.2. Status of V2 set of FRMCS specifications endorsed by ERA/EECT RMR

4.2.1. Categories of requirements in V2 set of FRMCS specifications

In the V2 set of FRMCS specifications, categorisation of requirements is being used to differentiate on one hand the specifications needed for the UIC FRMCS 1st Edition (UIC naming) / RMR Baseline 1 (ERA naming) (i.e. the V3 set of FRMCS specifications) and on the other hand those specifications needed for a later version set. The different categories of requirements are defined as follows:

› "*Indications (M), (O) and (I)[5] are used for clauses within the scope of the V2 specification, which is the minimum set of requirements for validation;*
› *Indications (M-V3), (O-V3) and (I-V3) are used for clauses within the scope of the V3 specification. The V3 series of specification are the target version to be included in the TSI, allow migration from the GSM-R system to the FRMCS system (FRMCS 1st edition). The V3 clauses are to be considered for information for V2;*
› *Indications (M-Vx), (O-Vx) and (I-Vx) are used for clauses for a later version of the specification. These clauses are kept in the specification for readability and consistency purposes*"

---

[4] https://www.unife.org/wp-content/uploads/2024/09/UNIFE-Paper_Achieving-FRMCS-in-TSI-2027_170924.pdf
[5] (M) means Mandatory for the System; (O) means Optional for the system; (I) means Information

From ERA's perspective, the indication that only V2 requirements are needed for validation before V3 is not sufficient: Every M-V3 requirement requires a verification in a Test & Validation activity before being published in the V3 set of FRMCS specifications, and also some of the O-V3 requirements. ERA has consistently explained in EECT and in communications towards railway stakeholders that missing a verification in a Test & Validation activity for a M-V3 requirement would imply that either the requirement is withdrawn from the V3 set of FRMCS specifications, or that an operational workaround for this lack of verification would be needed.

As there is a close relationship between M-V3 requirements and the features needed for GSM-R replacement and basic functionality expected from FRMCS, having untested M-V3 requirements creates the risk of UIC FRMCS 1st Edition / RMR Baseline 1 not being functionally equivalent to current GSM-R or not operationally ready.

4.2.2. Interoperability related requirements

The verification of interoperability related requirements was discussed during the EECT RMR process for FRMCS V2, in anticipation of FRMCS deployments. The discussion included: Which requirements have an impact on interoperability and therefore would need to be verified by the Notified Bodies after the publication of the V3 set of FRMCS specifications for the placing on the market of FRMCS Interoperability Constituents or placing on the market/placing in service of the FRMCS related part of subsystems.

As per EIRENE specifications already referenced in the CCS TSI mandatory specifications, those interoperability related requirements are referred to as "Mandatory for Interoperability" ("MI") requirements. In EIRENE, "MI" requirements are a subset of "M" requirements. In the V3 set of FRMCS specifications, "MI" requirements will be a subset of "M/M-V3" requirements.

UNISIG and UNITEL remarked that several functional requirements might prove to be difficult to comply to or be redundant as further technically detailed in corresponding system requirements are missing. ERA recognises that a correct identification of "MI" requirements would support a quicker and more cost-effective deployment of FRMCS in terms of verification and supports the idea to limit the need for Notified Bodies to perform checks of functional requirements whenever those are adequately traced to system requirements.

In addition to those requirements that are mandatory or optional for the system and for a specific version of the FRMCS specifications, ERA proposed a list of _candidate_ interoperability related requirements (i.e. "MI" requirements).

EECT RMR process for FRMCS V2 was not able to conclude until December 2024 on a definitive list of interoperability related requirements for each specification, mainly because of non-consensual viewpoints between EECT experts on what is functionally needed for GSM-R replacement (e.g. M-V3/M-Vx)[6], therefore delaying an agreement on a list of _candidate_ system interoperability related requirements. This is a planned activity for the addendum to be published in April 2025 that will be enabled by the mapping tables of functional to system requirements delivered by UIC and validated in EECT. A proposal for the _candidate_ functional interoperability related requirements is nevertheless already present as an annex of FRS and TOBA FRS v2.0.0 specifications available with this Technical Opinion, which has been discussed in EECT.

ERA recommends in addition, pursuing the activity of mapping of functional to system requirements until the finalisation of V3 set of FRMCS specifications, to be ready to deliver a _final_ and fitting list of interoperability related requirements to be verified by Notified Bodies: all relevant system requirements + residual functional system requirements not already covered by a system requirement.

---

[6] A summary of the status of V3/Vx requirements in v2.0.0 FRS is available in Annex 3

4.2.3. *Output of EECT RMR process for FRMCS V2*

As the main objective of this Technical Opinion is to provide a reference for Test & Validation activities, the output of the EECT RMR on FRMCS V2 is focusing on the M and M-V3 requirements defined in the five UIC FRMCS specifications + one ETCS Subset related to communication over FRMCS.

A brief description of each specification is provided below, complemented by an ERA appreciation on the level of completeness for use in a Test & Validation[7] activity:

› Functional Requirements Specification -FU-7120 v2.0.0

End to End functional definition of telecom railway applications enabled by FRMCS

→ FRS is almost complete for the definition of functions needed for GSM-R replacement; additional features could be considered in later versions, e.g. M-Vx requirements

› On-Board FRMCS Functional Requirements Specification - TOBA-7510 v2.0.0

Functional requirements of On-board FRMCS equipment, including OBapp interface towards ETCS/ATO applications

→ TOBA FRS is almost complete for the definitions of necessary On-board features; Railway Undertakings in the TOBA WG expressed a strong willingness to further define additional features related to radio modularity and Operation & Maintenance aspects (features not strictly related to railway interoperability nor to GSM-R replacement, but to basic functionality expected from FRMCS)

› System Requirements Specification - AT-7800 v2.0.0

Definition of mechanisms, parameters and configurations of elementary functions and system blocks of FRMCS system, including On-board FRMCS

→ SRS is not as complete as FRS/TOBA FRS; several technical Open Points are currently undefined or lacking harmonised technical solution for Test & Validation activity

› Functional Interface Specification - FIS-7970 v2.0.0

End-to-end flows, e.g. telecommunication service primitives to be used by Mission Critical client application (covering voice and ETCS/ATO call flows)

→ FIS requirements being mostly a consequence of FRS and SRS requirements, its level of completion should be appreciated in the light of the respective FRS and SRS completion

› Form Fit Functional Interface Specification - FFFIS-7950 v2.0.0

Detailed specification for OBapp and TSapp interfaces (respectively between the On-Board Applications and the On-Board FRMCS and between the FRMCS Trackside Gateway and the Trackside Applications)

→ FFFIS is almost complete for the definition of the protocols, the messages and the format of the information exchanged over the OBapp and TSapp interfaces; some technical dependencies on SRS could require further refinement of requirements.

› Subset-037-3 v4.1.2 EuroRadio FIS FRMCS Communication Functional Module

---

[7] i.e. whether all the M and M-V3 requirements in the specifications are completely defined so that they can be used in a harmonised way for a Test & Validation activity

CFM for data transmission over FRMCS without safety responsibility

→ SS-037-3 is almost complete, results from testing (e.g. IP configuration parameters) are needed to refine the requirements, a few technical Open Points are currently lacking harmonised technical solution for Test & Validation activity

UIC FRMCS specifications are also complemented by a set of ETSI specifications pointing to 3GPP Building Blocks to be considered together with the V2 set of FRMCS specifications for the Test & Validation activities. However, ETSI specifications are not in scope of EECT RMR process for FRMCS V2[8].

Based on the above appreciation on the level of completeness, it seems that there is a discrepancy between the objectives of the EU-RAIL SP report on FRMCS, e.g "*The FRMCS V2 is reputed to be in the majority of the cases a completion of the V1, with the main objective to have a technically defined FRMCS to execute an ad-hoc industrial project (Morane 2) for the finalisation of the industrial FRMCS ecosystem*" and the actual completion of requirements in the V2 set of FRMCS specifications.

However, it needs to be noted that it was already anticipated that functional and system requirements in the V2 set of FRMCS specifications would need to be refined based on Test & Validation activities, i.e. M-V3 and O-V3 requirements are subject to further modifications, especially taking into consideration test results from MORANE-2 and other national pilots.

Concerning the functions and requirements needed in the scope of the V3 set of FRMCS specifications, EECT RMR process for FRMCS V2 was not able to conclude in December 24 on a definitive (clause-by-clause) list of M-V3 requirements for the FRMCS specifications, mainly because of non-consensual viewpoints between EECT experts on what is functionally needed for GSM-R replacement (e.g. M-V3/M-Vx). This would need to be continued in the timeframe from January to April 2025 in view of publishing an addendum to this Technical Opinion.

In summary, good technical progress was made thanks to EECT RMR process for FRMCS V2, and v2.0.0 version of the FRMCS specifications could be used as a solid basis for Test & Validation activity. However, consensual view on category of requirement and a way forward for the Open Points are still missing. According to the Article 10 of the Commission Implementing Regulation 2023/1695 where "*manufacturers and early implementers shall use those specifications in their pilots*" ERA recommends for any Test & Validation activity on FRMCS to start the planning using the documents provided in this Opinion, but to wait for the start of the practical testing until the addendum to be published in April 2025 to take into consideration the version 2.1.0 of the FRMCS specifications.

---

[8] Some of the relevant ETSI specifications were not published at the moment of the publication of FRMCS v2; there is an Open Point on the way UIC specifications refer to ETSI specifications

4.3. Comparison with the expected scope as described in the System Pillar FRMCS report

As captured in the EU-RAIL System Pillar FRMCS report, the main objective of the V2 set of FRMCS specifications was to have a technically defined system to perform Test & Validation activities (MORANE-2) later to be included in a V3 set of FRMCS specifications supporting an industrial FRMCS ecosystem. The V2 set of FRMCS specifications was also considered as baseline for the identification of the interoperability related requirements.

The tables below have been produced based on EU-RAIL System Pillar FRMCS report. They contain ERA's view on the state of completeness of requirements in the V2 set of FRMCS specifications as an input for Test & Validation activities: Complete for T&V/Almost complete for T&V/Not in scope for T&V. This indicates if the feature can be tested in a harmonised manner in a Test & Validation project, or if missing elements would be needed to complement the feature in the V3 set of FRMCS specifications. IMPORTANT NOTE: The tables of this report are not the same as those within the EU-RAIL System Pillar FRMCS reports. ERA has made the following modifications: while the first two columns are identical, the third one has been renamed "V2 scope" for readability (i.e. was the Work Item scheduled for V2 in the report), and the fourth one contains ERA's view on the state of completeness.

ERA's assessment between the expected scope of FRMCS V2 and the actual specification status (as per v2.0.0) is further detailed in the Identification of open points that need to be addressed in view of completing version 3.

4.3.1. *Table 1: FRMCS V2 Content – Applications*

Building block	Work item	V2 scope	ERA view on state of completeness
Railway Application	**ATP/ETCS L2**	Yes	Complete for T&V
Railway Application	**ATO GoA1-2**	Yes	Complete for T&V
Railway Application	**ATO GoA3-4**	No	Not in scope for T&V
Railway Application	**Key Management System**	Yes	Almost complete for T&V
Railway Application	**Public Key Infrastructure**	Yes	Almost complete for T&V
Railway Application	**Voice Application**	Yes	Almost complete for T&V
Railway Application	**Railway Emergency Call**	Yes	Almost complete for T&V[9]
Railway Application	**Messaging**	Yes	Not complete for T&V
Railway Application	**Shunting**	Yes	Almost complete for T&V
Railway Application	**TCMS**	Yes	Almost complete for T&V
Railway Application	**CCTV**	Yes	Not in scope for T&V
Railway Application	**Remote control of engines**	Yes	Not complete for T&V[10]
Railway Application	**C-DAS**	Yes	Not in scope for T&V
Railway Application	**Passenger Information System**[2]	Yes	Not complete for T&V
Railway Application	**Critical real-time video**[2]	Yes	Not in scope for T&V

---

[9] ONLY REC-Alert & REC-Voice; REC-Data and REC-Alert alone not in scope for T&V
[10] Although agreed for V2, application currently tagged as Vx, see Annex 3

4.3.2. *Table 2: FRMCS V2 Content - Reference Points*

Building block	Work item	V2 scope	ERA view on state of completeness
On-Board FRMCS	OB_{APP}	Yes	Complete for T&V
FRMCS Trackside Gateway	TS_{APP}	Yes	Complete for T&V
FRMCS Multipath Function	FS_{MPM}	Yes	Almost complete for T&V
Interconnection, roaming and border crossing	FS_{NNI}	Yes	Almost complete for T&V
Interworking with External systems	FS_{IWF}	Yes	Complete for T&V
Interworking with External systems	FS_{ONI}	No	Not complete for T&V
OAM	FS_{OMR}	Yes	Not complete for T&V
On-Board FRMCS	OB_{OM}	Yes	Almost complete for T&V
On-Board FRMCS	OB_{RAD}	Yes	Not in scope for T&V[11]
On-Board FRMCS	OB_{ANT}	Yes	Not in scope for T&V[11]

---

[11] From ERA standpoint, building block not needed for T&V as not related to interoperability

4.3.3. Table 3: FRMCS V2 Content – Capabilities

Building block	Work item	V2 scope	ERA view on state of completeness
FRMCS Service Domain	**Functional addressing/Role management**	Yes	Almost complete for T&V
FRMCS Service Domain	**Multi-user talker control**	Yes	Almost complete for T&V
FRMCS System	**Location & Positioning for voice applications**	Yes	Complete for T&V
FRMCS Service Domain	**Authorisation of communication**	Yes	Almost complete for T&V
FRMCS System	**QoS and priority**	Yes	Complete for T&V
Railway Application	**Arbitration**	Yes	Almost complete for T&V
FRMCS System	**Identification and addressing**	Yes	Almost complete for T&V
FRMCS System	**Interconnection, roaming and border crossing**	Yes	Almost complete for T&V[12]
Transport Domain	**Network slicing**	No	Not in scope for T&V
FRMCS System	**Cybersecurity**	Yes	Complete for T&V[13]
FRMCS System	**Subscriber configuration**	Yes	Not complete for T&V
FRMCS System	**"Best Effort" Applications Regime**	Yes	Not in scope for T&V[14]
FRMCS System	**Voice Function**	Yes	Almost complete for T&V
On-Board FRMCS	**Auxiliary Function**	Yes	Complete for T&V
FRMCS Handheld	**Requirements**	No	Not in scope for T&V
FRMCS System	**Recording**	Yes	Almost complete for T&V

---

[12] Almost complete although an Open Point on technical realisation of Network Transition Trigger exists
[13] A cybersecurity risk assessment based on V2 specifications is pending
[14] From ERA standpoint, building block not needed for T&V as not related to interoperability

4.3.4. *Table 4: FRMCS V2 Content - Spectrum and RAT*

Building block	Work item	V2 scope	ERA view on state of completeness
Transport Domain	**FRMCS 900MHz: 5G NR FR1 FDD n100/PC3 UE**	Yes	Complete for T&V[15]
Transport Domain	**FRMCS 900MHz: 5G NR FR1 FDD n100/PC1 UE**	Yes	Complete for T&V[12]
Transport Domain	**FRMCS 1900MHz: 5G NR FR1 TDD n101/PC3 UE**	Yes	Complete for T&V
Transport Domain	**FRMCS 1900MHz: 5G NR FR1 TDD n101/PC1 UE**	Yes	Complete for T&V
Transport Domain	**FRMCS 900MHz: CBW<5Mhz**	Yes	Not in scope for T&V
Transport Domain	**White Space**	Yes	Not in scope for T&V
Transport Domain	**RF QoS/coverage quality**	Yes	Almost complete for T&V
Transport Domain	**Migration scenarios**	Yes	Not in scope for T&V
Transport Domain	**Multi access**	Yes	Almost complete for T&V
Transport Domain	**FRMCS Dual Connectivity**	Yes	Almost complete for T&V
Transport Domain	**FRMCS Carrier Aggregation**	Yes	Not in scope for T&V
Transport Domain	**European MNOs (5G bands + coexistence with FRMCS)**	Yes	Almost complete for T&V[16]
Transport Domain	**Bands outside EU**	No	Not in scope for T&V
FRMCS Handheld	**Spectrum bands/RAT for Handhelds**	No	Not in scope for T&V
Transport Domain	**Unlicensed spectrum/ Wi-Fi**	No	Complete for T&V
Transport Domain	**Satellite (legacy NT RAT)**	No	Not in scope for T&V
Transport Domain	**Satellite (5G NR NT)**	No	Not in scope for T&V

---

[15] ERA is of the opinion that coexistence studies between FRMCS and GSM-R spectrum need to be available before concluding on V3 set of specifications
[16] Almost complete although an Open Point on innocuity of PMNO bands exists

4.4. Identification of Open Points that need to be addressed in view of completing the V3 set of FRMCS specifications

As requested by the European Commission, a list of Open Points needs to be defined to understand what remains to be completed in the V3 set of FRMCS specifications to enable procurement of FRMCS products.

ERA understands that those Open Points should list the functions and requirements defined in the V2 set of FRMCS specifications for which the completely defined solution is not yet available for testing.

That list of Open Points aims at raising the attention of the test and validation projects, in view of testing their proposed technical solutions related to those Open Points; the results of this testing will have to be analysed in order to include the best solution amongst the validated ones in the V3 set of FRMCS specifications. This view was consensual amongst EECT members, especially from Industry, to avoid interpretation on requirements leading to non-harmonised FRMCS products.

ERA proposed in EECT RMR process for FRMCS V2 a list of Open Points composed of 3 different types:

› **Functional Open Point**: e.g. an empty or not fully defined functional requirement in FRS or TOBA FRS, or a functional requirement not being mapped onto a completely defined system requirement.
› **System Open Point**: e.g. SRS/FIS/FFFIS requirements indicated as to be "refined", "under investigation", "not in scope of FRMCS V2"
› **Implementation Open Point**: e.g. the realisation of a function is currently considered in the V2 set of FRMCS specifications with two (or more) different implementations, but after test and validation project, the requirement will be reduced to only one harmonised implementation.

All Open Points listed are not, strictly speaking, related to interoperability, but they are all M or M-V3 requirements. M-Vx requirements are not in scope for this version of Open Points list. All Open Points have not the same level of criticality: while some simply need verification from Test & Validation activity (e.g. Quality of Service parameters), some need further detailed analysis and refinement of requirements (e.g FRMCS Profile). This list should therefore be understood as a complete exercise for the identification of requirements that need to be validated before publication of the V3 set of FRMCS specifications, and not as an evaluation of the completeness of the V2 set of FRMCS specifications.

The list of Open Points, validated in EECT RMR process for FRMCS V2 can be found in ANNEX 2.

ERA would like to highlight a specific Open point that emerged from EECT RMR process for FRMCS V2 on the connectivity needs towards ERTMS Key Management Services. The necessary technical solution and configuration for a FRMCS Network to offer connectivity to PKI and KMS services is only partially defined[17] in the V2 set of FRMCS specifications and needs to be tested and validated in MORANE-2 or in other pilots.

EECT members expressed their willingness to assess the critically and effort needed to close each of the Open Points. ERA supports this idea: this assessment needs to be a planned activity until the addendum to be published in April 2025.

ERA would also like to improve the visibility and the tracking of the critical Open Points that needs to be solved before publication of the V3 set of FRMCS specifications. ERA therefore recommends that this further

---

[17] The technical resolution was supposed to be part of a Work Package 4 of the EU-RAIL Specific Contract 3.1.

validated list of Open Points is used as a basis for a tracking mechanism to be used in the discussions under the Change Control Management Procedure[18].

4.5. Broader considerations in the context of new radio and data communication

4.5.1. Spectrum policy objective

ERA, in coordination with the European Commission, has supported during the EECT RMR process for FRMCS V2 the provision of requirements enabling the support of public frequency bands (e.g. Public Mobile Network Operator) in the On-board FRMCS. From ERA/EC standpoint, it was needed to ensure that the legal framework supports interoperability of the railway system in the EU and that technical requirements should support this objective.

This objective was supported by EECT members, as some PMNO scenarios are being considered by Infrastructure Managers: "Full PMNO", "Partial PMNO", "Backup PMNO". While those scenarios do not require the same level of service from third-party supplier, they all rely on the fact that the On-board FRMCS needs to support PMNO frequency bands to have access to the service. ERA therefore proposed to add in SRS provisional requirements (M-V3) to support a restricted list of PMNO bands, on the assumption that the definition of those MNO bands is not introducing interference risks for simultaneous usage with RMR spectrum. It was also proposed to leave some flexibility on Trackside for implementation, as maybe not all Infrastructure Managers will consider PMNO scenarios.

UIC and Industry expressed some concerns on the identification and validation of those PMNO bands, highlighting the risk of mandating the support of a frequency band that could cause some interference issues. ERA agrees that this validation is needed and recommends that studies should be performed on the innocuity of PMNO bands before confirmation of their mandatory support for On-board FRMCS in the V3 set of FRMCS specifications.

4.5.2. Impact assessment of Mandatory features to be supported by On-board FRMCS

Some new features introduced by the V2 set of FRMCS specifications raise the question of their mandatory support, and on the management of vehicles equipped with On-board FRMCS on lines where those features might be used or not. As an example, the use of PMNO radio resources from a third-party supplier or the use of Multipath capability at trackside is only feasible when also supported by the On-board FRMCS. At trackside, it is an implementation choice for the Infrastructure Manager to use this feature or not, but for On-board FRMCS the corresponding requirements need to be mandatory.

During the EECT RMR process for FRMCS V2, EECT members raised concerns on the induced cost of such features for vehicles not expected to run on any lines supporting those optional features. EECT members also

---

[18] https://www.era.europa.eu/content/change-control-management

See point 2.1.3.2. *The CCM process defined is baseline independent, i.e. it is valid for any step made in the lifetime of a given baseline. Therefore, change requests shall be applicable, starting from the last legal release of the previous baseline to the first draft release, the consolidation release(s), the first legal release and the further maintenance release(s) (see example in Figure 1).* This means that change requests are required to capture all changes within the mandatory specifications in Table A2 of the CCS TSI 2023/1695 including changes to the FRMCS specifications v1 (in particular for those changes which might impact the ETCS/ATO requirements).

raised the question about the feasibility of declaring on a line by line basis that On-board FRMCS shall support this or that feature.

ERA recognises the need for a deeper study on those aspects, to be able to demonstrate the added value of supporting specific features on-board, the need to reflect the granularity of FRMCS usage in Registers of Infrastructure (RINF), or the possibility to consider non-application of CCS TSI in very specific cases. ERA recommends that the ERA Impact Assessment scheduled for the recommendation on referencing the V3 set of FRMCS specifications in the next CCS TSI update should cover those aspects.

ERA also recommends that the EU-RAIL Deployment Group on FRMCS should provide advice on those aspects.

4.6. Risks identified for the timely delivery of the V3 set of FRMCS specifications

4.6.1. New timeline for post EECT RMR process for FRMCS V2

With the conclusion of the EECT RMR process for FRMCS V2 in April 2025, and the execution of the main Test & Validation activity for FRMCS (MORANE-2), EECT RMR will be paused for some time. As indicated by the European Commission in several communications, an ERA recommendation[19] is expected by end of 2026 to be able to have a new CCS TSI referencing the V3 set of FRMCS specifications voted in RISC and a publication is expected in 2027. ERA remarks that the objective of validating the V3 set of FRMCS specifications in time for the European Commission expectation, taking into account the timeline for MORANE-2 execution (and not counting on further information about other national pilots) is extremely challenging.

ERA also remarks that some milestones of the agreed timeline in the EU-RAIL System Pillar FRMCS report are not valid anymore:

› *Start of the Morane 2 project by mid-2024*
› *Duration of the Morane 2 project of 27 months,*
› *Completion in parallel by UIC FRMCS Program of the FRMCS V3, as explained in the previous sub-chapter, to be delivered by 3Q 2026 to ERA for EECT process*
› *In parallel to the development of the FRMCS V3 specifications, preparation by the EECT group of the corresponding ERA technical documents to be included in the CCS TSI*

MORANE-2 did not start by mid-2024; duration of the project to be confirmed when the Grant Agreement on MORANE-2 will be signed; delivery of V3 set of FRMCS specifications in Q3 2026 to be confirmed; execution of EECT RMR process for FRMCS V3 in 3 months not seen as possible under the same conditions as for EECT RMR process for FRMCS V2.

ERA recommends that a new timeline for FRMCS V3 should be agreed at sector level, possibly captured in a new EU-RAIL System Pilar report on FRMCS V3, including:

1. A commitment from UIC on a detailed program and timely delivery of the draft V3 set of FRMCS specifications ready for EECT RMR process.
2. An agreed and sustainable period for the EECT RMR process for FRMCS V3, considering the sector needs.

---

[19] European Commission Request for recommendations on Multi-annual TSI revision framework with reference Ares (2024)5949473 -21/08/2024

4.6.2. Planning of activities prior to EECT RMR process for FRMCS V3

As indicated in EECT RMR process for FRMCS V2, ERA notes that the EECT discussions have sometimes been used as a technical forum to resolve key issues that should have been pre-discussed prior to the EECT. ERA also notes that the discovery of the V2 set of specifications by EECT reviewers led to longer review period overall. A pre-review by Industry of the input to EECT RMR process for FRMCS V2 or a higher involvement in the drafting of the input would have prevented many of those discussions.

Would EECT RMR process for FRMCS V3 be a replication of EECT RMR process for FRMCS V2, ERA believes that there is a very high risk of inefficiency of the process leading to, in the worst-case scenario, an unpredictable period for validating V3 set of FRMCS specifications, to be translated into a delay of the CCS TSI publication.

ERA recommends, as mitigation measures, that before the EECT RMR process for FRMCS V3 starts:

1. Integration of Testing & Validation results into the draft V3 set of FRMCS specifications is agreed by the sector; taking into account the list of Open Points
2. Industry is involved in the drafting of the V3 set of FRMCS specifications
3. A maturity check is performed by EECT before committing resources and a timeline to approve the V3 set of FRMCS specifications

4.6.3. Acquisition of relevant validation information from other T&V activities

Currently, only MORANE-2 project seems relevant as Test & Validation activity. ERA is not aware/in contact with any other Test & Validation activity. There might be however some useful tests done at e.g. national level or in dedicated projects (e.g. Digitale Schiene Deutschland, or 5GRACOM). There is the risk of a loss of useful information if those projects do not communicate their relevant results to UIC and/or ERA for being considered as an input to the V3 set of FRMCS specifications.

ERA recommends that any Test & Validation activity gaining relevant results for the validation of requirements in scope of the V3 set of FRMCS specifications should communicate these results to ERA.

5.   The Agency's opinion and recommendations

5.1.   Status of FRMCS specifications v2.0.0 endorsed by ERA/EECT RMR

The V2 set of FRMCS specifications validated during the EECT RMR process for FRMCS V2 is described in §
4.2.3.

Despite the good technical progress in v2.0.0 version of the FRMCS specifications, a consensual view on
category of requirement (e.g. M-V3/M-Vx) is still missing. ERA's opinion on the need for consolidation
requires continuation of work from January to April 2025, in view of publishing an addendum to this Technical
Opinion.

Recommendation #1

Any Test & Validation practical activity on FRMCS should be based on the addendum to be published in April
2025 to take into consideration the version 2.1.0 of the FRMCS specifications.

ERA's opinion on the interoperability related requirements is described in § 4.2.2.

A correct identification of the scope of Notified Bodies verification for the placing on the market of FRMCS
products would support a quicker and more cost-effective deployment of FRMCS.

Recommendation #2

A final and fitting list of interoperability related requirements to be verified by Notified Bodies is necessary
and should be delivered by ERA in parallel with the finalisation of V3 set of FRMCS specifications.

5.2.   Comparison with the expected scope as described in the System Pillar FRMCS report

ERA's opinion on the state of completeness of requirements in the V2 set of FRMCS specifications in
comparison to the agreed V2 scope in EU-RAIL System Pillar FRMCS report is provided in § 4.3

5.3.   Open Points which need to be addressed in view of completing the V3 set of FRMCS specifications

A list of Open Points, validated during EECT RMR process for FRMCS V2, is provided in Annex 2.

Visibility and tracking of the critical Open Points to be solved before publication of the V3 set of FRMCS
specifications needs to be established.

Recommendation #3

The expected April 2025 validated list of Open Points should be used as a basis for a tracking mechanism in
the discussions under the Change Control Management Procedure.

5.4.   Broader considerations in the context of new radio and data communication

ERA's opinion on Spectrum Policy objective is provided in § 4.5.1.

To cover PMNO scenarios considered by Infrastructure Managers in the context of interoperability of the
railway system in the EU, mandatory support of non-interfering PMNO bands is needed in the On-board
FRMCS.

Recommendation #4

Studies should be performed on the innocuity of PMNO bands before confirmation of their mandatory support for On-board FRMCS in the V3 set of FRMCS specifications.

There is the need for a deeper investigation on the added value of supporting specific mandatory features by On-board FRMCS, the need for granularity of FRMCS usage in Registers of Infrastructure (RINF), and the possibility to consider non-application of CCS TSI in very specific cases for On-board FRMCS (see § 4.5.2).

Recommendation #5

ERA's Impact Assessment scheduled for the recommendation on referencing the V3 set of FRMCS specifications in the next CCS TSI update should cover the aspects above.

Recommendation #6

EU-RAIL Deployment Group on FRMCS should provide advice on the aspects indicated in Recommendation #5.

5.5. Risk identified for the timely delivery of the V3 set of FRMCS specifications

ERA identified three main risks for the timely delivery of the V3 set of FRMCS specifications.

§ 4.6.1: FRMCS V3 milestones of the agreed timeline in the EU-RAIL System Pillar FRMCS report are not valid anymore.

Recommendation #7

New timeline for FRMCS V3 should be agreed at sector level, possibly captured in a new EU-RAIL System Pilar report on FRMCS V3, including:

1. A commitment from UIC on a detailed program and timely delivery of the draft V3 set of FRMCS specifications ready for EECT RMR process
2. An agreed and sustainable period for the EECT RMR process for FRMCS V3, considering the sector needs.

---

§ 4.6.2: without planning of activities prior input to EECT RMR process for FRMCS V3 there is a very high risk for an inefficient process, delaying the CCS TSI publication.

Recommendation #8

As mitigation measures, before starting the EECT RMR process for FRMCS V3:

1. Integration of Testing & Validation results into the draft V3 set of FRMCS specifications is agreed by the sector; taking into account the list of Open Points
2. Industry is involved in the drafting of the V3 set of FRMCS specifications
3. A maturity check is performed by EECT before committing resources and a timeline to approve the V3 set of FRMCS specifications

---

§ 4.6.3: Acquisition of relevant validation information from other Test & Validation activities than MORANE-2 might not reach ERA.

Recommendation #9
Any Test & Validation activity gaining relevant results for the validation of requirements in scope of the V3 set of FRMCS specifications should be communicated to ERA.

Valenciennes, 19 December 2024

Josef DOPPELBAUER
Executive Director

ANNEX 1

Original request from European Commission

Ref. Ares(2024)7753905 - 31/10/2024

EUROPEAN COMMISSION
DIRECTORATE-GENERAL FOR MOBILITY AND TRANSPORT

Directorate C – Land
The Director

Brussels
MOVE.DDG2.C/KS

NOTE FOR THE ATTENTION OF MR J. DOPPELBAUER EXECUTIVE DIRECTOR –
EUROPEAN UNION AGENCY FOR RAILWAY

Subject: Request for technical opinion to the Commission pursuant to Article 6
of the Interoperability Directive (EU) 2016/797 on the version 2 of
FRMCS specifications

Article 6 of the Interoperability Directive (EU) 2016/797 allows that if a deficiency is
identified in legislation containing technical specification for interoperability (TSI), the
Commission may request an opinion from the Agency on the subject matter and ask for
solutions.

On this legal basis, innovative solutions can also be assessed, as specifically referred to in
article 11 of the Commission Implementing Regulation 2023/1695 on the technical
specification for interoperability relating to the control-command and signalling
subsystems of the rail system in the European Union (CCS TSI).

The 2023 regulation containing the control-command and signalling technical
specifications for interoperability (CCS TSI) contains the first, incomplete, specifications
of the Future Mobile Railway Communication System (FRMCS). After the adoption and
entry into force of CCS TSI on 28 September 2023, the work on FRMCS specifications
continued to progress under the umbrella of the UIC and the EU Rail JU.

On 5 July 2023, the railway stakeholders collaborating in the System Pillar Steering Group
agreed the timeline and scope of the work on the FRMCS specifications and issued the
EU-RAIL System Pillar FRMCS report ([1]). Based on the timelines agreed, UIC has
delivered to the Agency draft FRMCS specifications at the end of March this year. Since
April 2024, the sector experts worked in the Agency Extended Core Team to assess and
complete where necessary the FRMCS specifications, version 2.

The Commission hereby requests the Agency for an opinion regarding the FRMCS
specifications version 2. The opinion should include:

([1]) https://rail-research.europa.eu/wp-content/uploads/2023/08/20230718-FRMCS-report-final.pdf

Commission européenne/Europese Commissie. 1049 Bruxelles/Brussel. BELGIQUE/BELGIË – Tel. +32 22991111
Office: DM28 04/110 – Tel. direct line +32 229-61616

Kristian.Schmidt@ec.europa.eu

- The FRMCS specifications version 2, revised and completed by the Agency as appropriate, which should be

  o consistent with the expected scope as described in the System Pillar FRMCS report; alternatively, the Agency should highlight necessary deviations of its version 2 and justify why they will be necessary.

  o stable and complete to enable a comprehensive testing and validation processes under the following conditions:
    ▪ the result of the testing validates version 2. It could identify necessary but limited adjustments or corrections, which can be integrated in a version 3;
    ▪ version 3, should be the basis for an amendment of CCS TSI (following EECT review) and be sufficiently complete and mature to enable product development.
    ▪ the validation process for version 2, should not jeopardise readiness to start testing and demonstrator activities, and cannot put at risk the feasibility and viability of product development, on the basis that minor adjustments might be included later.

- In addition, the Agency's opinion should provide a clear identification of open points that need to be addressed in view of completing version 3.

- The Agency is invited to discuss and agree with relevant stakeholders if necessary and clarify which further issues must be verified after its opinion is issued.

- In case the Agency identifies serious deviation from the scope established by the System Pillar FRMCS report, or from the provision of a stable and complete set of specifications within the timeline, the opinion should include an initial feasibility analysis of upgrading the FRMCS system specifications and the systems built upon it, at later stages.

- If applicable, the Agency should stress in its opinion any broader considerations in the context of new radio and data communication and raise any issue of importance relating to the development and deployment of FRMCS in the future.

- The Agency should highlight, to the extent possible, any risk identified, including the risk of timely delivery of version 3 specifications and propose improvements to the process to mitigate such risk.

Given the dawning obsolescence of GSM-R and thus, the need to start deploying new radio equipment in the first half of the 2030-ties, a timely adoption of FRMCS specifications version 2 in CCS TSI, is undisputed.

At this stage, the Commission counts on the Agency to provide stakeholders with a mature version for testing and validation of projects at EU and national level. This process will lead to the finalisation of version 3 of FRMCS specifications that based on the Agency's recommendation planned for end of 2026, the Commission will integrate into CCS TSI. The first complete set of FRMCS specifications will allow the industrial production and deployment of new radio equipment for train communication between drivers and infrastructure staff.

The Commission is aware of the complexity of the opinion for version 2, what its asks for and of the need to address numerous comments from stakeholders on the incomplete specifications proposed by UIC under its contract with the Commission.

2

Nevertheless, considering the agreed calendar for the FRMCS specification versions, the work of ETSI and the upcoming availability for EU facilities to fund testing and validation of projects, the Commission ask the Agency to prepare the technical opinion before the end of 2024 at the latest.

Electronically signed

Kristian SCHMIDT

c.c.:   ERA Pio Guido, Jo De Bosschere, Begona Domingo, Maria-Jose Garcia-Prieto, Thomas Chatelet, Wouter Malfait
DG MOVE Matthias Ruete, Christof Schoser, Keir Fitch, Sandy Zaehringer, Fidel Santiago

3

Electronically signed on 31/10/2024 11:22 (UTC+01) in accordance with Article 11 of Commission Decision (EU) 2021/2121

ANNEX 2

FRMCS V2 list of Open Points

Index	Title	Topic/feature	Description/Comments	Impact in functionality/applications	Type of open point
1	Addressing	IP layer model and IP address ranges	H2H for tight coupled application. How to address the call to the receiver.	H2H in Tight Coupled	System
		IP addressing for H-2-N	IP addressing process for H2N involving MCx not defined yet. Needed to contact KMC and PKI outside MCx domain.	H2N applications, like PKI or KMC	System
		Support to IPv4 by OB/TR Gateways	Support to IPv4 in Obapp (and Tsapp) is needed for migration. Requirements in SRS are O. The OB Applications and TS Applications can be in local networks using IP ranges from IPv4 or IPv6. Coexistence of IPv4 and IPv6 in an interoperable manner is not yet specified.	ETCS/ATO	System
2	Agent definition	Connecting hosts via plain IP with TR Gateway	The definition of the Agent (required for the superloose applications) is not included. Application regime doesn't include the PKI applications, therefore the agent in the FRMCS Trackside Gateway would need to be implemented.	ETCS/ATO/Others	System
3	Application categories	Application communication category	In SS-037 it is expressed the need to be able to assign certain categories to the communications applications; placeholder in SRS is needed to take into account the category declared by the application and the mechanisms to handle it.	all	System
4	Authorisation of Applications	Definition of the metadata for "Authorisation of applications"	The definition of the metadata to be used by the applications is missing. This is to support the applications structure in FRMCS architecture.	All	Functional
5	Bearer flexibility	Multipath protocols	Choice of one or more MP-protocols. If more than one, specification of FSmpm required Multipath Data Path quality evaluation.	All	System

Index	Title	Topic/feature	Description/Comments	Impact in functionality/applications	Type of open point
6	Cybersecurity / TLS	Cybersecurity requirements	Service/Transport Stratum Security requirements may need to be revisited/complemented after risk assessment of FRMCS v2 specifications.	All	System
		TLS requirements for OB$_{APP}$/TS$_{APP}$ missing	Connection to PKI before the local binding. How to bring in operation a system only using on-line KMC. Clarification of the cypher suites.	ETCS/ATO	Implementation
7	Data transmission	Functional description of Data Transmission for different applications	Point to point data transmission between OB and TR is included in v2 but point to multipoint is missing. e.g. used for virtual coupling, Critical Advisory Messaging	Data	Functional
8	DSD application	DSD alarm transmission	Need to define the functional requirements (if different from a data pipe) and, if needed, structure of the message to be used. Need to define also the system requirements. Even if the application itself will not be harmonised, the interface that it should use to communicate the data shall be OBapp.	DSD application	Functional/system
9	ETCS related	Incoming end of session notification to ETCS	It needs to be clarified if and how ETCS OB receives incoming End of Session from TR. The OB application could face a situation where the trackside entity receives a new connection request while the first one is not yet closed.	ETCS	System
		Redundancy of OB FRMCS and TR Gateway	Lack of definition of RAM requirements for OB FRMCS and TR Gateway as required from ETCS/ATO applications.	ETCS/ATO	Implementation
10	Functional Requirements	Functional description is missing for some functions	Lack of functional description for some functions needed for v3 set of specifications. Some examples: Messaging services, critical advisory messages, passenger information	Some applications/functions needed for v3	Functional
11	Handhelds	Handheld terminals requirements	Neither functional nor system requirements are available yet. Needed for migration.	Voice	Functional/system
12	HMI	HMI	Functional and technical definition still missing.	Voice application/Voice Function/Group calls/REC	Functional/system

Index	Title	Topic/feature	Description/Comments	Impact in functionality/applications	Type of open point
13	Identities	Role based identification scheme	Criteria Field is missing; e.g. for LDA target_user . Application identifiers for trackside to onboard communication are missing.	All	System
		Role management	Technical requirements missing. Criteria for usage of Functional Alias(es)FA across multiple FRMCS domains are missing.	Voice applications/others	System
		Authorization based on Functional Identities	Technical specification missing.	Voice application/ETCS/ATO	System
		Subscriber identity	In FRS, the use of subscriber ID described in the flow, while in SRS it is not available.	Applications outside MCx	Functional/System
14	Location and positioning	Missing location & positioning features	Some features regarding Location &positioning are still missing: • Usage of more than one location sources by the On-Board FRMCS • GNSS additional performance requirements • GNSS Security requirements • How to link GNSS position OB with group call areas • How to derive head of the train and distance travelled	Voice, group calls, REC	System
15	MNO parameters	Isolation requirements for OB antennas	Isolation requirements for simultaneous operation of RMR and MNO services are missing.	All	System
		Innocuity of PMNO bands to be supported On Board	Studies should be performed on the innocuity of PMNO bands before confirmation of their mandatory support for On-board FRMCS in the v3 set of FRMCS specifications.	All	System

Index	Title	Topic/feature	Description/Comments	Impact in functionality/applications	Type of open point
16	Network transition	Network Transition Trigger	Obtention of Train's location information and additional information at the entity generating the Network Transition Trigger (NTT) prior to trigger decision (e.g. knowledge that the train is going to cross the border or Target FRMCS Transport Domain) is not defined. Mechanism for transfer of Network Transition Trigger (NTT) to the On-Board FRMCS is not defined. Manual trigger is not acceptable, at least for ETCS/ATO.	all, mainly ETCS/ATO	System
		Network Transition for KMC & PKI	Inter-FRMCS-Domain Transition for KMC & PKI applications is missing.	KMC & PKI applications	System
		Inter-FRMCS-Domain Transition with only one OB Radio Module	Possibility to use 1 or 2 Radio Modules (UE) for Network Transition for ETCS is not defined. Choice to be made after testing. To be investigated if two UEs are needed for redundancy. Solution with 2 UEs is available in v2.	ETCS/ATO	Implementation
		Inter FRMCS transition at service layer (for MCx)	MC Migration. 3GPP specifications are available but they have not been tested yet in any environment.	All	System
		Border crossing in eSIM subscription roaming mode	Border crossing in eSIM subscription or eSiM roaming mode.	All	System
17	Operation and Maintenance	Operation and maintenance of the On-Board FRMCS	Definition of protocols on O&M interfaces, OBOM/FSOMR. Matrix of recommended access for O&M User rights related to FRIOP. Need to clarify the role of OB$_{OM}$ / FS$_{OMR}$ in FRIOP upload and upgrading and what needs to be standardise in this case, if any.	All	System
18	Profiles: exchange of info, content and credentials	Profile exchange / provisioning	Application profile not available (i.e. VAS FRIOP) Role of FS$_{OMR}$ and mechanisms for provision, exchange, upgrades, etc. are missing.	All	System
		SIM profile	Detail content of SIM profile and format are missing.	All	System

Index	Title	Topic/feature	Description/Comments	Impact in functionality/applications	Type of open point
		Certificates (Local Binding, MCX…)	Provisions for exchange of certificates, update &store, how to handle MCx credentials when BCx are missing.	All	System
19	QoS	Quality of Service: KPIs	All target KPI values to be confirmed by tests. QoS measurement procedures are not defined.	All	System
		TCP Parameter settings for ETCS/ ATO and support functions	Characteristics of FRMCS to be found out by field tests. Measurements needed to be able to discuss and propose proper TCP parameter settings.	ETCS/ATO/Others	System
20	Recording	Recording of data related to REC participation	No functional requirements available yet in V2. For the functionality of confirmation of participation in REC: registration of this data and further access to it are missing.	Voice function and Data	Functional/System
		Recording of data	Mechanisms and details for recording data not yet defined. System requirements missing. Pointer to ETSI/3GPP specifications is not included in V2. Need to define what needs to be recorded both OB and TR.	Voice function and Data	System
21	References	Version of the ETSI TS referenced in the FRMCS specifications	The link to the ETSI specifications detailing how to implement the technical solutions described in the SRS was found not to be complete during the EECT RMR process for FRMCS v2, while this should be done for FRMCS v3.	All	System
22	Registration and deregistration of functional identities (avoid duplication)	Reg/De-reg scenario's during migration.	Scenarios for registration and deregistration during migration, including Border Crossing are missing.	Voice/others	Functional
		IWF GSM-R / FRMCS (unique Train ID)	Not foreseen yet in IWF.	Voice/others	System
23	SH	Shunting/banking voice communication	Functional requirements not complete in V2; system requirements also missing. This includes the "assured voice communication" and "assured data communication" signals.	SH and banking	Functional/system
24	Technical requirements	Interconnection (MOCN) versus subscription versus roaming	Technical requirements for interconnection (MOCN) versus subscription versus roaming are missing.	All	System

Index	Title	Topic/feature	Description/Comments	Impact in functionality/applications	Type of open point
	for accessing MNO resources	Transition scenarios from RMR to PMNO	Transition scenarios from RMR to PMNO are missing.	All	System
25	Time service	Distribution of synchronised time	Clarifications about the Time Services are needed, from functional and system point of view.	All	Functional/system
		Missing Time Service features	Definition of the interface between GNSS Receiver and Time service (time service derived from Location&positioning OB GNSS) is missing. FRMCS Time Service performance and security requirements are missing.	All	System
26	Voice Functionality	Inviting-a-user	Functional requirements not completely defined in V2; system requirements also missing. Used to include additional controllers in voice calls (e.g. REC-voice)	Voice function	Functional/system
		On-train voice communication; Voice to intercom	No functional requirements available yet in V2. This includes also outgoing call from train staff towards a ground user and incoming call from a ground user to train staff.	Voice Function	Functional/system
		Voice communication towards passengers (Public Address)	Functional requirements not complete in V2; system requirements also missing. This includes on-train originated calls and coming from the controller.	Voice Function	Functional/system
27	Voice: multitalker floor control	Multitalker floor control	Additional capabilities related to multitalker floor control, like negotiation or priority scheme, may be needed to be defined in FRS and later in SRS.	Voice	Functional
		Multitalker floor control	Multitalker floor control for voice/REC. Technical elements may be already available in 3GPP R18 that could be sufficient for the migration, but they do not cover the functionality as described in FRS.	Voice application/Voice Function/Group calls/REC	System
28	Voice System	Call Arbitration and Queuing	Features for call Arbitration are missing. Call Queuing is missing. Merging of two calls is missing.	Voice application/Voice Function	System
		Missing features for voice calls	Definition of parameters for voice applications (group calls, number of simultaneous talkers, etc) is missing. Definition of areas for group calls other than with Cell Ids is missing.	Voice application/Voice Function/Group calls/REC	System

Index	Title	Topic/feature	Description/Comments	Impact in functionality/applications	Type of open point
		Notification to other users after leaving the REC Voice	Notification mechanism to other participants for User leaving an on ongoing REC alert/REC voice	REC	System
		VAS Controller equipment: TS_{CTRL}	TS_{CTRL} for voice dispatcher specification missing. To be confirmed if TS_{APP} is to be used for voice.	Voice Function	System/Implementation

ANNEX 3

Categorisation of Functional requirement in FRS v2.0.0

This annex is providing a view on which features are expected to be part of V3 set of FRMCS specifications (tagged as "V3" in the following tables) and which are considered to be part of a later set of specifications (tagged as "Vx" in the following tables). The table is a reformatted extract of FRS v2.0.0. The features are separated in FRMCS Common Functions and FRMCS Applications, the latter making use of the first ones. A colour code is used to discriminate between functionalities completely defined in FRS (green colour) and those not yet fully defined (orange colour).

It needs to be noted (refer to EECT RMR process for FRMCS V2) that the final categorisation of "V3" Functional requirements, on a clause-by-clause level, still need to be validated in EECT RMR for FRMCS V2 in January 2025. Based on this final categorisation to be captured in FRS v2.1.0, "V3" System requirements will be derived, using the functional to system mapping tables. Complete categorisation of "V3" Functional and System requirements should be available in the v2.1.0 set of FRMCS specifications, to be used as an input for Test & Validation activities.

Common Functions

FRMCS Common Function	FRS clause	Target version
Assured voice communication	8.2.2	V3
Multi user talker control	8.2.3	V3
Role management and presence	8.2.4	V3
Location services	8.2.5	V3
Authorisation of communication	8.2.6	V3
Authorisation of application	8.2.7	V3
QoS and priority	8.2.8	V3
Assured data communication	8.2.9	Vx
Inviting-a-user	8.2.10	V3
Arbitration	8.2.11	V3
Distribution of synchronised time	8.2.12	V3
Billing information	8.2.13	Vx
Recording	8.2.14	V3

Table A3-1 Target version of FRMCS Common Functions

Applications

FRMCS application	FRS clause	Target version
Generic voice communication	10.2	V3
Generic data communication	11.2	V3 (optional)
Generic video communication	12.2	Vx
Role management and presence	11.3	V3
On-train outgoing voice communication from the train driver towards the controller(s) of the train	10.3	V3
On-train incoming voice communication from the controller towards a train driver	10.4	V3
Multi-Train voice communication for drivers	10.5	V3
Banking voice communication	10.6	V3
Trackside Maintenance Voice communication	10.7	Vx
Shunting Voice Communication	10.8	V3
Public emergency call	10.9	Vx
Ground to ground voice communication	10.10	V3
Automatic Train Protection communication	11.4	V3
Automatic Train Operation communication	11.5	V3
Data communication for Possession Management	11.6	Vx
Trackside Maintenance Warning System communication	11.7	Vx
Remote control of engines communication	11.8	Vx
Monitoring and control of critical infrastructure	11.9	V3 (optional)
Railway Emergency Communication	10.11	V3[20]
On-train safety device to ground communication	11.34	V3
Public train emergency communication	10.13	Vx
Working alone	10.14	Vx
Access to recording of communications	11.10	Vx
Data recording and Access	11.11	Vx
Shunting data communication	11.12	Vx
Train integrity monitoring data communication	11.13	Vx

[20] REC-Alert with REC-Voice targeted for V3; REC-Data and REC-Alert alone targeted for Vx

FRMCS application	FRS clause	Target version
Public emergency warning	11.14	Vx
On-train outgoing voice communication from train staff towards a ground user	10.15	V3
On-train incoming voice communication from a ground user towards train staff	10.16	V3
Railway staff emergency communication	10.17	Vx
Critical real time video	12.3	Vx
Critical Advisory Messaging services- safety related data communication	11.15	V3
Virtual coupling data communication	11.16	Vx
Train Parking Protection	11.17	Vx
Key Management System data communication	11.18	V3
Urgent On-train outgoing voice communication from the train driver towards the controller(s) of the train	10.18	V3 (optional for trackside)
Urgent Multi-Train voice communication for drivers	10.19	V3 (optional for trackside)
Multi-Train voice communication for drivers excluding ground user(s)	10.20	Vx
On-train voice communication	10.21	V3 (optional)
Lineside telephony	10.22	Vx
On-train voice communication towards passengers (Public Address)	10.23	V3 (optional)
Station Public Address	10.24	Vx
Communication at stations and depots	10.25	Vx
On-Train Telemetry communications	11.19	V3 (optional)
Infrastructure Telemetry communications	11.20	Vx
On-train remote equipment control	11.21	Vx
Monitoring and Control of Non-Critical Infrastructure	11.22	Vx
Non-critical real time video	12.4	Vx
Wireless on-train data communication for train staff	11.23	Vx
Wireless data communication for railway staff on platforms	11.24	Vx

FRMCS application	FRS clause	Target version
Train driver advisory -train performance data communication	11.25	Vx
Train Departure data communications	11.26	Vx
Messaging Services	11.27	V3 (optional for trackside)
Transfer of data	11.28	V3 (optional)
Record and broadcast of information	11.29	Vx
Transfer of CCTV archives	11.30	Vx
Non-critical real time video communication	12.4	Vx
Augmented reality data communication	11.31	Vx
Real time translation of speech data communication	11.32	Vx
Passenger Information System data communication	11.33	V3 (optional)
Information Help Point for public	Note 1	Vx
Emergency Help Point for public	Note 1	Vx
Wireless internet on-train for passengers	Note 1	Vx
Wireless internet for passengers on platforms	Note 1	Vx

Table A3-2 Target version of FRMCS Applications

Note1: clause not yet available in FRS v2.0.0; under consideration as a valid Use Case is already available

ANNEX 4

Impact Assessment Note

Issued as per Art. 8(1) of Regulation (EU) 2016/796 and the Impact Assessment procedure adopted by the ERA Management Board (Decision n.290, 16/03/2022)

1. Context and assessment of impacts
1.1. The context and the CRs in subject
The first set of FRMCS specifications V1 is referenced in CCS TSI 2023. This set was assessed in a Light Impact Assessment for the Agency recommendation for CCS TSI 2023 (see link). The following Agency Technical Opinion refers to a successor of this set of specification (V2) which is the base for further FRMCS testing and was already announced in Art. 10 of CCS TSI 2023. However, it is not the final version of specifications to be used for the roll-out of FRMCS.
1.2. Analysis performed
The Agency received from UIC the proposal for an updated FRMCS specification (V2) end of March 2024. This proposal was technically reviewed by ERA and the railway sector in several meetings according to the EECT RMR process for FRMCS V2. The result of this review led to the specifications which are referenced in this Technical Opinion.
1.3. Assessment of impacts
Compared to FRMCS V1 specifications, the following specifications V2, which are part of this Technical Opinion, will provide a more robust and more complete set of specifications compared to V1 It allows FRMCS Test & Validation activity at EU level (e.g. MORANE-2) or National level (pilots) and therefore is a pre-requisite to implement FRMCS prototype (test) networks in a number of Member States (e.g. Spain, Germany, France and Sweden). The return of experience gained from these tests will lead to a more developed set of FRMCS specifications V3 which will be part of a revised CCS TSI and be the basis for the trackside and on-board roll out.
1.4 Quantitative assessment of impacts (optional)
At this stage, a quantitative assessment is not necessary as the impacts for the railway sector are minor only impacting the testing phase of FRMCS. The light impact assessment done in 2022 of the recommendation for CCS TSI 2023, where FRMCS V1 is already considered remains valid. Major impacts are expected for FRMCS V3 which will be the base for the trackside and on-board FRMCS roll out. This set of specification is expected to be available for assessment in 2027.

1.5. Stakeholders affected

Railway undertakings (RU)	☒	Member States (MS)	☐
Infrastructure managers (IM)	☒	Third Countries	☐
Manufacturers	☒	National safety authorities (NSA)	☐
Keepers	☐	European Commission (EC)	☐
Entity Managing the Change (EMC)	☐	European Union Agency for Railways (ERA)	☐
Notified Bodies (NoBo)	☐	Shippers	☐
Associations	☐	Other (Please specify) …	☐

The technical opinion mainly impacts all railway stakeholders involved in test runs and lab testing for FRMCS with the aim to establish a final set of specifications (V3) for the roll out of FRMCS.

2. Preferred option

2.1. Recommendation

There are no options. Therefore, the recommendation is to proceed with the usage of technical specifications as set out in the ERA Technical Opinion for FRMCS test and validation activities.