EU-RAIL JU System Pillar

Report on FRMCS V2 and V3 Scope and Planning

Version 2.4 (October 2025)

Document status		
Revision	Date	Description
01	14/03/2025	Version 2.0
02	07/05/2025	Version 2.1
03	04/07/2025	Version 2.3
04	24/10/2025	Version 2.4

Project funded from the European Union’s Horizon Europe Research and Innovation Programme		
Dissemination Level		
PU	Public	X
CO	Confidential, restricted under conditions set out in Model Grant Agreement	

REPORT CONTRIBUTORS

	European Commission	
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NB: all SP-STG Members[1] had the opportunity to further contribute

DISCLAIMER

The majority of the information contained in this document is sourced from the ERA Technical Opinion[2] and associated process, based on the specifications provided by the UIC FRMCS Program.

[1] https://rail-research.europa.eu/system-pillar-governance/system-pillar-steering-group/

[2] Opinion ERA/OPI/2024-10 of the European Union Agency for Railways regarding version 2 of Future Railway Mobile Communication System (FRMCS) specifications, https://www.era.europa.eu/content/opinion-eraopi2024-10-european-union-agency-railways-regarding-version-2-future-railway

1. SUMMARY

The current rail telecommunication system, based on 2G technology, is approaching the end of its lifecycle in the early 2030s. In response, the sector, under the leadership of UIC, initiated the transition to a new state-of-the-art telecommunication system in 2014 with the initial aim to have specifications legally adopted by 2022. This new system, based on 5G technology, is designed to support future developments and aligns with global telecommunication standards.

The development of the specifications, including the necessary testing and validation, is on the critical path to the deployment of FRMCS.

Delays in the finalisation of specifications translate directly into delayed FRMCS deployment and GSM-R replacement. This shows the urgency of providing the complete and mature FRMCS specifications as quickly as possible.

The first System Pillar report on FRMCS V2 and V3 timing and scope, agreed in July 2023, set out the consensus of the railway sector, suppliers, ERA and DG MOVE on the timing and scope for FRMCS Version 2 (V2) and Version 3 (V3) specification delivery and testing.

The original planning was for a final draft V2 version by June 2024, to be validated through the ERA EECT (Extended ERA Core Team) process, including UIC and the representative associations to be concluded by the publication of an ERA Technical Opinion by October 2024.

In practice for the first draft FRMCS V2 specifications, the EECT found that

- a large number of substantial comments were raised by EECT reviewers and those comments lead to substantial modifications of the input specifications;[3]
- there remained significant open points in the specification;
- the V2 scope as defined in the initial System Pillar report was not fully delivered (see section 3).

Compared to the expectations on scope and timing set out in the 2023 System Pillar report there are significant delays in the specification delivery by the UIC FRMCS programme – a completed V2 specification estimated by November 2026 compared to the original estimation of June 2024 – alongside a significant scope reduction.

The delayed V2 specifications will have an impact on testing and validation, then on V3 completion and finally on deployment considerations.

The ERA Technical Opinion also contained a number of recommendations linked to the process to completion of the V2 and V3 specifications, including that the delay compared to the initial planning requires the sector to rethink the ambitions and the timing of the next steps in the development of the system.

As a result of the ERA Technical Opinion and the sector's call to accelerate the development of specifications, there has been a review of the overall scope for the FRMCS specifications V2 and V3, resulting in a revised and reduced scope proposed by the EECT.

[3] ERA/OPI/2024-10: "*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.*"

DG MOVE has requested the EU-Rail System Pillar to update the 2023 report, supporting the sector, ERA, and DG MOVE, to align on a revised scope and timeline up to the adoption of the CCS TSI revision that would include the mature FRMCS specifications.

Through the approval of this report

- the SP-STG members agree the scope of the V3 FRMCS specifications based on a reduced set of functionalities focussed on a stable minimum viable product for implementation (section 3), noting that UNIFE currently do not agree that the defined scope can be delivered in the timeline proposed by UIC. The SP-STG notes that UNIFE and UIC need to find an agreement on the timeline proposed by UIC as well as the scope. The SP-STG has agreed to strongly encourage the two associations to elaborate a proposal without delay (in coordination with ERA, as needed), to be validated by the rail sector in the SP-STG.
- the SP-STG members note the proposed timing (section 4)
- the SP-STG members agree the proposed governance arrangements, and will through their members work to facilitate these in order to support timely delivery of the specifications at the correct level of quality (section 5)
- the SP-STG members note the risks to delivery, and where relevant the mitigations and will address risks and mitigation measures in the stakeholder alignment meetings (section 6).
- the SP-STG members agree the next steps to be implemented (section 7).

An unchanged approach and associated delays pose operational and financial risks for Member States, operating companies, and infrastructure managers, with potential consequences for passenger and freight operators. Operational risks include the unavailability of obsolete 2G-based systems, the declining expertise in legacy technology, and reduced industry support for 2G maintenance. Financial risks could arise from the need to re-contract GSM-R system support and maintain outdated systems.

To note: this report focusses on the FRMCS specifications scope and timing and is not covering the many other issues linked to a successful FRMCS deployment, for example topics which are covered in the EU-RAIL Deployment Group.

2. CONTEXT

The GSM-R technology, based on 3GPP 2G, is becoming obsolete, and the railway telecom manufacturers have made clear that GSM-R networks, components and support will start to be life-expired by 2030, making their maintenance more and more costly, complex and then carrying operational and financial risks for railway operations.

Aware of this inevitable reality, the European railways explored the concept from 2013 onwards and, as a consequence, have put in place in 2014 through UIC a specific program to define a new railway mobile system based on 3GPP 5G, the UIC FRMCS Program. This Program has the ambition to facilitate, in addition to GSM-R replacement, the modernization and digitalization of the railway operations, by making possible the introduction of new systems and applications, such as ATO GoA1/2/3/4, TCMS, video services and more generally essential services requiring telecom quality, flexibility and capacity. The initial aim was to have specifications for this new system legally adopted by the Commission by 2022.

FRMCS specification finalisation is on the critical path for FRMCS deployment

The development of the specifications, including the necessary testing and validation, is on the critical path to the deployment of FRMCS. Delays in the finalisation of specifications translate directly into delayed FRMCS deployment and GSM-R replacement. This shows the urgency of providing the complete and mature FRMCS specifications on time.

The critical final milestone to enable suppliers to develop products is the adoption within the CCS TSI of the FRMCS specifications.

This requires the delivery of mature, tested and validated complete specifications by the UIC FRMCS programme to ERA, who then validate the specifications (with a full representative set of railway stakeholders) ahead of providing a recommendation to DG MOVE, followed by a positive vote at the RISC, and the formal adoption of the text by the European Commission.

Currently, the critical element driving the timeline is the finalisation of mature and complete specifications by the UIC FRMCS Specification programme.

State of play compared to previous assumptions

The first System Pillar report on FRMCS V2 and V3 timing and scope, agreed in July 2023, set out the consensus of the railway sector and suppliers on the timing and scope for FRMCS specification delivery. This first report is provided in the Annex 3 for reference.

The original planning for V2 was

- that a stable V2 draft would be produced by March 2024,
- a final draft version by June 2024,
- a finalised V2 specification validated through the EECT process, including publication of a Technical Opinion by October 2024,
- Testing and validation of the V2 specifications through the EU-RAIL Flagship Project 2 MORANE 2 project.

In practice for the first draft FRMCS V2 specifications submitted in March 2024, the EECT found that

- a large number of substantial comments were raised by EECT reviewers because the draft V2 specifications were seen for the first time by a number of EECT members (for example there had been no prior involvement of suppliers in drafting of the functional specifications). Those comments led to substantial modifications of the input specifications.[4]

- there remained significant open points in the specification. The ERA Technical Opinion on the V2 specifications stated that in the specifications the Functional Requirement Specification (FRS) were almost complete for the definition of functions needed for GSM-R replacement but not for additional features (as in the original scope), and the System Requirement Specifications were not complete[5].
- the V2 scope as defined in the initial System Pillar report was not fully delivered (see section 3).

Given the lack of maturity of the V2 specifications, the ERA Technical Opinion was published in December 2024 and an addendum in May 2025.

There remain open points within the V2 specification, for which there is an estimated completion date of November 2026 (as all open points will be closed only in V3p)[6].

Therefore, compared to the expectations on scope and timing set out in the 2023 System Pillar report there are significant delays in the specification delivery by the UIC FRMCS programme – a completed V2 specification estimated by November 2026 compared to the original estimation of June 2024 – alongside a significant scope reduction.

Next steps

The delayed V2 specifications will have an impact on deployment considerations.

The EU-RAIL System Pillar, through the System Pillar Steering Group, provides a forum for the EU railway sector and suppliers, EC, ERA and EU-RAIL, to discuss, align and agree on issues relevant to the development of the European railway system.

DG MOVE has requested that the EU-RAIL System Pillar updates the report taking into account all sector inputs to enable a revised assessment of the scope and timing of the delivery of the specifications.

This report will take also into account the recommendations from the December 2024 ERA Technical Opinion linked to the process of completion of the V2 and V3 specifications, in particular

- The delay compared to the initial planning requires the sector to rethink the ambitions and the timing of the next steps in the development of the system.
- There should be sufficient visibility and tracking of the resolution of V2 open points.
- There should be a mechanism agreed on how to translate the results of testing and validation (both Morane 2 and other testing and validation projects) into V3 specifications.
- Industry should be involved in drafting the V3 specifications before the EECT process more actively than it has been the case for V2 specifications.

[4] ERA/OPI/2024-10: "*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.*"

[5] ERA/OPI/2024-10: "*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*"

[6] V2.2 specifications that will be ready in Febraury 2026 at the latest will be subject to a number of notable open points (see section 3).

- Stakeholders developing FRMCS V3 specifications should ensure a maturity check before the specifications are submitted to the EECT.

The report is structured as follows:

- in section 3, a revised scope of FRMCS specifications as provided by the EECT (agreed scope at EECT level in January 2025) based on a reduced set of functionalities focussed on a stable minimum viable product for implementation.
- in section 4, a comparison of the past timeline with a potential timeline based on current estimates of the remaining steps, based on a new timing proposal from UIC.
- in section 5, a proposed future governance based on sector input
- in section 6, a list of identified risks and (where possible) mitigation measures
- in section 7, the proposed next steps.

To note: this report focusses on the FRMCS specifications scope and timing and is not covering the many other issues linked to a successful FRMCS deployment, for example topics which are covered in agreement with the sector in the EU-RAIL Deployment Group or topics related to alignment with ETCS discussed in ERA or Commission relevant groups. These topics include among others:

- Railway stakeholders' ambition and intention to complement onboard FRMCS with new functionalities over time in a simplified manner (compared to current practice in relation to GSM-R equipment).
- Railway stakeholders request to have from suppliers means to upgrade existing GSM-R equipment to FRMCS (e.g. adding an FRMCS modem card).
- Railway stakeholders' interest in having an affordable ETCS version compatible with FRMCS, including an affordable upgrade of ETCS Baseline 3. Both issues are discussed in a relevant forum/group

3. REVISED FRMCS SPECIFICATION SCOPE

This report refers to the FRMCS versions V2, V3 and VX with the following meaning:

- V2 – a stable and complete set of draft FRMCS specifications ready for testing and validation prior to inclusion in V3[7]
- V3 – the target set of FRMCS specifications that enable products to be developed and placed on the market (also called "system 1st edition")
- Vx – additional requirements for a later backwards compatible version(s) of the specifications

It is crucial that there is an agreed and stable baseline for V3.

The future FRMCS version Vx should target further long-term enhancements of the FRMCS system.

This version or future versions should fulfil the following conditions:

1. Vx features do not require an On-Board -FRMCS upgrade requiring a reauthorisation OR Vx features do not require an upgrade of already installed V3 On Board FRMCS
2. OR required upgrades occur only after a stability period for OB-FRMCS deployment of at least a decade AND with a thorough impact assessment to qualify the added-value of features compared to OB-FRMCS upgrade costs

In the initial EU-RAIL SP Report on FRMCS, the section 5.4 presented the FRMCS V2 Detailed Content in 4 tables: applications, reference points, capabilities and spectrum. As set out in section 2, the FRMCS V2 draft specifications submitted in March 2024 were of reduced scope compared to the original vision in the initial EU-RAIL SP Report.

Further, given the

incompleteness of the submitted specifications, the ERA Technical Opinion recommended a further revision to the scope of the FRMCS specifications to allow a faster delivery.

This scope revision has been taken forward in the context of the EECT process, by ERA, EIM, CER, UNISIG, UNITEL, and UIC. The proposed scope has been reduced compared to the original ambition, with the V2 and V3 scope now more focussed on GSM-R replacement plus certain additional functionalities.

At the end of January 2025, EECT agreed on a final categorisation of all FRS functions (see Annex 1): which ones should be included in V3, which ones could be postponed to an enhancement version of the FRMCS (i.e. Vx).

EECT reached a consensual view with the exception of UNITEL, who argued that some features are not needed for GSM-R replacement and that a later version of FRMCS specifications could introduce those functions (e.g. FRMCS V4). ERA, CER, EIM and UIC on the contrary argued that OB-FRMCS

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[7] As per the System Pillar Report the "V2 Specifications, whose main objective is to define all the FRMCS Specifications for an industrial European trial, code name "Morane 2", focused on validating an ecosystem of specifications for a safe migration of GSM-R networks in Europe. An additional focus of this European trial should be to validate the FRMCS requirements relevant for interoperability in the European Union.

equipment that will be installed on the basis of V3 and the CCS TSI update should be sufficiently stable so that they are not required to be updated for at least a decade, and therefore should include all features to replace GSM-R plus the planned new features needed for railway digitalisation. For example it is stated by CER that the agreed scope "is the absolute minimum viable product for the operational users….".

UNIFE continues to request a refocus on the scope and delivery of the FRMCS V2 and V3 specifications, implying that the combination of scope (as in Annex 1) and timing is almost impossible to achieve.

Comparison of scope from V1 report to V2 report

The Table 1 focuses on applications to compare the original ambition and the new proposed scope (i.e first SP report versus new scope agreed by EECT), including a consideration of where the open points remain, requiring continued V2 specification development prior to testing and validation. This is to illustrate the proposed scope change and the current status of development of the V2 specifications.

The descriptions in the column "New scope after EECT V2" of Table 1 mean the following

- V2 (to be validated in T&V) – the specifications are currently sufficiently mature to enter into the testing and validation process, and then be considered finalised for V3
- V2 (Open Point to be solved) - there are still remaining open points in the specification development as published in the ERA Technical Opinion which require finalisation, before they can be tested and validated, and subsequently being finalised for V3
- Vx – not included in the scope of V2 and V3

V3 specifications should contain all V2 items: both the ones already mature enough to be tested and the ones that still have open points to be resolved.

Building block	**Work item**	Original scope in 2023 SP Report	New scope after EECT V2
Railway Application	**ATP/ETCS L2**	V2	V2 (to be validated in T&V)
Railway Application	**ATO GoA1-2**	V2	V2 (to be validated in T&V)
Railway Application	**ATO GoA3-4**	Not V2	Vx
Railway Application	**Key Management System**	V2	V2 (Open Point to be solved)
Railway Application	**Public Key Infrastructure**	V2	V2 (Open Point to be solved)
Railway Application	**Voice Application**	V2	V2 (to be validated in T&V)

Railway Application	**Railway Emergency Call**	V2	REC-Alert with REC-Voice: V2 (to be validated in T&V); REC-Data and REC-Alert alone: Vx
Railway Application	**Messaging**	V2	V2 (to be validated in T&V)
Railway Application	**Shunting**	V2	V2 (Open Point to be solved)
Railway Application	**TCMS**	V2	TCMS in home FRMCS domain: V2 (to be validated in T&V); TCMS in roaming FRMCS domains: Vx
Railway Application	**CCTV**	V2	Vx
Railway Application	**Remote control of engines**	V2	Vx (FRS 11.8 Remote control of engines communication)
Railway Application	**C-DAS**	V2	Vx (FRS 11.25 Train driver advisory -train performance data communication)
Railway Application	**Passenger Information System**	V2	V2 (to be validated in T&V)
Railway Application	**Critical real-time video**	V2	Vx (FRS 12.3 12.3 Critical real time video)

Table 1 – Applications agreed for V2 in 1st SP Report versus new scope

Current status of specifcation development

In the current plan submitted by UIC (refer to Table 2 in §4), the functional requirements will be refined through a dedicated V2.2 EECT process, leading to the creation of V2.2.0 versions of functional specifications (TOBA FRS and FRS), allowing for testing and validation within FP2-MORANE2 project. The completion of specifications including both fucntional and system requirements approved by EECT will be effectively reached in V3p and will deliver on the intended objective of the original V2 as used in the table above.

Given this status, there remain risks in the current scope definition process (further detailed in §6)

- Incomplete functional requirement specifications validated through EECT process requiring update at V3p. These additional elements (for example shunting) will need to be tested outside of FP2 MORANE 2.

- The system requirement specifications[8] (SRS) will not be validated by EECT, until november 2026/V3p completion. Therefore, the tests in MORANE 2 may not be fully valid for the SRS.

Stakeholder Alignment Meetings on FRMCS Standardisation (see chapter 5 governance for more detail) will among other check progress on the completion of the scope of the specifications.

ERA will also check that the scope of the specifications has been delivered and will confirm

- That there has been no further limitation of substantial functional content
- all open points have been closed in a complete manner and that there should not be, for example, a deferring of FRS requirements that do not have mapped requirements in SRS

[8] System reuqirements specifications define the technical how to implement the generic (technology neutral) functional requirements.

4. REVISED FRMCS SPECIFICATION TIMING

The timing of certain steps in the initial EU-RAIL SP Report are now considered unrealistic based on experience to date, for example, due to the need to complete current V2 open points (below "OP"), and the requirement for sufficient time in the EECT process, depending on the maturity of the delivered specifications.

The timing for delivery of the final specifications, and inclusion in the CCS TSI, therefore needs to be revised given the current status of delivery.

The Table 2 below compares the original ambition and a new proposed timing put forward by UIC, in response to the request by the railways to achieve CCS TSI adoption not later than 2028.

The most important factor in the timing is the delivery of mature and complete specifications from the UIC FRMCS programme – completion of V2, and finalisation of V3.

- Testing within FP2-MORANE2 cannot happen until the finalisation of the relevant V2 specifications (i.e. V2.2), and there is a clear dependency between the process for testing and validation and completion of the specifications.
- Testing of open points outside of the FP2-MORANE2 also needs to be completed within the required timeframe.
- Further, the time for validation of the specifications by the EECT is directly dependent on the level of maturity and completeness of the provided specifications. Proposals from stakeholders to enhance EECT performance are depending on the level of maturity of delivered specifications, therefore the need to perform Maturity Check Points to provide accurate visibility on expected EECT duration.

Overall, the proposed timing by UIC in its V3 plan (Annex 2) is understood as challenging and associated with significant risks (see section 6).

Considering the current status of planning and risk mitigation the following should be noted for the adoption of the TSI:

- complete and high quality specifications are needed for rapid EECT process; these criteria can be demonstrated through the maturity check.
- Broad sector consensus and a complete ERA recommendation would be required for a swift RISC process.

In the table 2 below it is shown a comparison on the main milestones from the two versions of this report:

	Initial SP Report	Current estimate planning	Comment
UIC delivers stable draft of FRMCS V2	Mar 2024	Mar 2024 * (see comment in the column on the right)	First draft provided was not mature or complete (see section 2)

ERA Technical Opinion FRMCS V2	Sep 2024	Dec 2024 May 2025	Requirement for further industry consultation, V2 not fully complete for T&V resulting in necessity for longer EECT process than originally planned
Morane 2 start	Jun 2024	Dec 2024	Consequence of the previous delays
V2.2 functional specifications (OP closure)	N/A	Sep 2025	
ERA EECT – Functional OP closure	N/A	Oct-Dec 2025	EECT review per OP, using tags and change marks, is a pre-requisite for efficient EECT
V2.2 system specifications (OP closure)	N/A	Feb 2026	Final draft of V2 including closure of all OP needed for T&V in FP2-Morane 2 (it does not necessarily include all OP for T&V) Remark: not validated by EECT
V3p specifications	N/A	Nov 2026	EECT review per OP, using tags and change marks, is a pre-requisite for efficient EECT
EECT Maturity Check Point for V3p	N/A	Nov 2026	
ERA EECT – V3p	N/A	Dec 2026 – Sep 2027	EECT V3p duration estimate (depending on the MCP and completeness of V3p). If specification changes are required as a result of the EECT check, the timing may be further adversely affected.

Morane 2 end of testing	Sep 2026	Sep 2027	Revised date as per the current grant agreement. If specification changes are required as a result of the EECT check, the timing may be adversely affected.
V3.0 specifications	N/A	Sep 2027	EECT review per OP, using tags and change marks, is a pre-requisite for efficient EECT If specification changes are required as a result of the EECT check, the timing may be adversely affected.
Any other input to EECT V3 (including results of a study on MNO frequencies innocuity and any necessary additional testing beyond MORANE 2)	N/A	Sep 2027	At present the planning and timing of any necessary additional tests is unclear
EECT Maturity Check Point for V3	N/A	Sep 2027	
ERA EECT – V3	N/A	best case: Sep-Dec 2027 or worst case Sep2027-Sep 2028	Timeline highly dependent on complete and mature specifications being delivered by FRMCS programme (see risk in section 6) EECT V3 duration estimate (depending on the MCP 3-12 months)
ERA Recommendation to the Commission (if needed standalone)	Dec 2026	best case: Dec 2027 or worst case Sep 2028	

RISC discussions	Q1 2027	best case: Dec 2027 -Mar 2028 or worst case Sep 2028 - Mar 2029	Overall process takes between 3 to 6 months after recommendation.
CCS TSI amendment adoption	Q2 2027	best case: Jun 2028 or worst case Jun 2029	Process takes up to 3 months after RISC vote.

Table 2 – Timeline agreed in 1st SP Report versus new estimate timeline

5. GOVERNANCE UPDATE

The validation in EECT of the specifications of FRMCS V2 took more time than planned, mainly due to the level of development of the specifications.

As mentioned in section 2, to ensure that the drafting of specifications of FRMCS V3 can be accomplished more efficiently, in particular through:

- the development of a more detailed program for the timely delivery of V3 specifications (including transparent tracking of the Open Points),
- a clear mechanism to be provided to integrate testing and validation results into V3 specification drafting,
- a mechanism to be provided to involve industry more directly in the drafting of the specifications, and
- a maturity check of the specifications in advance of the EECT process.

More detailed project management of the drafting of FRMCS specifications is asked by the sector representatives: more detailed planning, more frequent reporting, a dedicated project manager, more quality management and a more comprehensive governance.

The governance of the specification's development at the UIC relies on a reinforced alignment between the European Radio Implementer's Group (ERIG) and the sector's needs:

- For the purpose of ensuring alignment, enhancing the sector's understanding of key challenges, providing full transparency on FRMCS standardisation progress and better integrating sector needs into standardization, regular *Stakeholder Alignment Meetings on FRMCS Standardisation* will be established. The alignment will improve the visibility of work on FRMCS specifications, support the identification and management of any deviations from the plan, and foster coordinated collaboration among railways – either represented in ERIG or not-, supply industry, regulatory bodies, and the European Commission.
- To guarantee effective oversight and transparency of the FRMCS specifications work the *Stakeholder Alignment Meetings on FRMCS Standardisation* will be organized by the SP-STG in close collaboration with ERIG and aligned with ERIG's meeting schedule. Where necessary, existing ERIG meetings will be supplemented with additional (virtual, depending on decision of the stakeholder alignment meeting) *Stakeholder Alignment Meetings* held between regular ERIG sessions.
- For the purpose of the *Stakeholder Alignment Meetings*, the SP-STG will nominate FRMCS stakeholders from ERA, CER, EIM, UNIFE, EU-RAIL, and AERRL/Allrail/ERFA and fully integrate ERIG members. For operational efficiency, the SP-STG will authorise designated managers to prepare, moderate, and lead the *FRMCS Stakeholder Alignment Meetings* on its behalf, integrating ERIGs regular reporting on FRMCS standardisation progress to stakeholders. In case of fundamental disagreements, the SP STG will be informed immediately to take action to solve such situations swiftly.

The governance at strategic level will be at the System Pillar Steering Group to ensure the effective representation of all stakeholders of the European Railway Sector, given the limits of UIC membership:

- Adjustments to the activities agreed in this report (consensus of the sector) would need to be agreed by the System Pillar Steering Group.
- Adjustments to the scope of the FRMCS specifications that change the scope agreed at the EECT would need to be validated by the EECT.

Broader governance issues related to the links with the deployment of other technologies will be discussed in the EU-RAIL deployment group. Issues related to the necessary input into technical specifications for interoperability will be discussed in the relevant ERA working parties and for final validation in the European Commission's Railway Interoperability and Safety Committee.

At project management level the governance of UIC specifications development would involve:

- The establishment of a project manager at the UIC.
- The delivery by the project manager of a project plan for the next two years (with intermediate milestones and monthly report).
- The project manager would identify responsible persons for each action point and clearly allocate tasks needed to implement the plan among the experts provided by Railway Telecom Stakeholders (from infrastructure managers, railway undertakings, telecommunication suppliers, railway suppliers, vehicle owners, ERA, EU-RAIL).
- Ensuring the project manager can request directly experts from UIC members and other rail stakeholders (UNITEL, ERA, other infrastructure managers or railway undertakings) that provide experts to the FRMCS working groups (establishing a direct link between the project manager and responsible persons).
- The project manager will pro-actively identify and assess the risks regarding this work plan and apply mitigation measures.
- The development of specifications will ensure the consistency of all the documents. It will either rely on the use of compliance matrixes (when available) and/or dependency checking software.
- Access to all the specification documents and, if needed, the involvement of industry in the drafting of them
- Mixed teams for specification drafting (UIC + relevant rail stakeholders) for all documents, with mixed allocation of tasks (Open & Action Points) per individual persons
    - Every OP / AP is resolved by stakeholder's agreement, especially UNITEL-UIC.
    - ERA arbitration would be used if no agreement can be reached
    - Authoring authority: UIC
- Providing a quality benchmark by ERA EECT for UIC to do an initial quality assessment of V3p specifications. The same quality assessment should also be used for V2.2 specifications.
- ERA EECT will validate the quality check of the UIC on the V3p specifications, before they are sent to EECT for actual analysis. A similar process may be implemented already for V2.2.
- ERA EECT will work on V3p specifications in parallel to MORANE2 field testing with the intention of saving time. The UIC project manager will provide a detailed planning of the Morane2 work on clusters of technical items related to identified open points and the proposed planning on work of the EECT on the same open point.

6. RISKS TO SPECIFICATION DELIVERY

The following are identified risks to specification delivery and overall completion of FRMCS readiness

- FRMCS scope finalization
    - The proposed scope for V2 and V3 has been significantly reduced given the delays in specification development.
    - The EECT has defined in January 2025 a revised scope for the FRMCS V2 and V3 functional specifications, reflected in the system specifications in May 2025. As set out in the scope chapter, this scope represents the EECT view on the minimum level of specification to enable products to be developed, which are then stable and do not require short term upgrades. This is endorsed by CER and EIM.
    - However, as is illustrated by the UNIFE comments, there remain dissenters to the proposed scope, and whether it can be delivered in the defined timescale.
    - To enable as rapid as possible progress, there should be full sector alignment and agreement on the proposed scope for V2 and V3 specifications.
    - SUMMARY: High risk of misalignment between stakeholders; residual risk remains high, though stakeholder alignment meetings should help identify a common position.
- FRMCS V2 and V3p completion
    - FRMCS V2 is not yet complete; there remain several significant open points and substantial work is required to complete FRMCS specifications V2 despite the reduced scope.
    - Some open points are postponed to being finalised in V3p.
    - There is a high risk that the open points will not be complete in the proposed time; for example, it is stated by suppliers/UNIFE that the timeline proposed by UIC can only be delivered by reducing the scope. Particular attention should be paid to FRS requirements without mapped requirements in SRS and/or FIS (Functional Interface Specifications).
    - Any delay will have a direct impact on the overall timeline, including delays to the testing and validation.
    - A main priority is therefore in the governance and monitoring of the closure of the open points, and the provision of adequate resources and expertise (from all relevant stakeholders) to address and close the open points.
    - SUMMARY: Very high risk; mitigations proposed address some elements, so residual risk remains high.
- Potential need for additional testing and validation activities in addition to FP2 MORANE 2
    - Validation at V2.2. EECT milestone is only partial.
    - FRMCS V2 will be complete upon the closure of all open points (i.e. V3p)
    - At present according to UIC planning in order to save time and resources
        - only the functional V2.2 specifications are checked and validated by EECT, not the system part,

        - there remain open points in the functional specifications at V2.2 (for example banking and shunting)
        - it is proposed that full EECT validation will be done in parallel with testing and validation.
    - Using non-EECT validated system specifications in FP2-MORANE2 creates the risk of divergence in the set of requirements i.e. V3p requirements being different from those used in FP2-MORANE2 (V2.2).
    - Resolution of some functional open points will continue to be closed after the V2.2 EECT milestone. The additional delta foreseen from V2.2 to V3p is still unclear, with the risk of reopening some of the previous EECT agreements on the functional scope. As agreed in the first stakeholder Alignment Meeting, UIC and UNITEL are identifying these points, being not part of MORANE2 test programme.
    - In short, whilst the proposal compresses the timeline, it introduces further risks
        - that any changes required from the EECT process need additional time for specification development and further testing and validation.
        - It is not clear yet if additional parallel tests to MORANE2 have to be organised. The need for additional T&V activities for final V3 authorisation remains to be assessed
    - SUMMARY: Very high risk; mitigations proposed address some elements, but residual risk remains high.
- Availability of FRMCS Test Specification
    - UIC V3 Plan is not indicating how/when the delivery of index 97 of CCS TSI Table A2 "FRMCS test specifications" is going to be ensured (e.g. from the specification workstream or from MORANE-2). This document is key to ensure a robust and homogenous deployment strategy for FRMCS and fundamental to ensure an efficient authorisation process. It is to be noted that the delivery of testing specifications may come after the EECT process.
    - It is also not clear, if the overall specifications, including the proposals for testing and certification ensure that FRMCS technical compatibility will be ensured by the certification of each subsystem, without any need of additional RSC checks. If additional checks are triggered it will have a major negative impact on FRMCS deployment.
- Quality and maturity of outputs of V3
    - A sufficient quality and maturity of output for V3 is essential; an efficient EECT process is only possible with high quality inputs from the FRMCS Specification programme.
    - The maturity of specifications deliveries will depend on several factors (e.g. UIC technical resources, including support from railway organisation; active participation of suppliers).
    - Industry should commit to an active participation in development of V2.2, V3p and V3 specifications by proposing technical solutions.
    - A Maturity Check Point should be done by ERA for each EECT delivery.

    - EECT planning for V2.2 (functional), V3p and V3 specifications to be scheduled accordingly to MCP (Maturity Check Point).
    - Although UIC estimates the V3 would introduce minimal changes based on feedback from FP2-MORANE-2, ERA believes that the consolidation phase will require substantial effort.
    - In addition, the treatment of inputs from other T&V than FP2-MORANE2 as an input to EECT V3 cannot yet be planned.
    - SUMMARY: Very high risk; mitigations proposed address some elements, but residual risk remains high.

- Chipset availability
    - Industry reported in the ERA Coordination Radio WG the possible difficulty to have RMR900 MHz chipset complying fully with the ECC/EC spectrum regulation. Technical solutions would either require a change to the spectrum regulation, or more expensive products fitting to the regulation. The exclusive discussions between some Industry actors and chipset suppliers should also be enlarged to other vendors (on-board, trackside). The overall question of chipset dependency for having FRMCS products available in a given timeframe after publication of CCS TSI remains to be clarified.
    - More transparency on RMR chipsets delivery is required. Periodic reporting on its status is essential. The RMR chipset status report should at least cover the following topics:
        - Chipset frequency band availability: RMR900, RMR1900, MNO bands 800, 900, 2600 and 3.5 GHz.
        - Status of delivery of chipsets on sample runs and production runs.
        - Information on the status of delivery of the RMR radio module.
        - Which MNO and RMR bands will be supported.

- Studies on the innocuity of Public Mobile Network Operator bands
    - As per ERA TO recommendation #4, to enable the scenario where On-board FRMCS supports Public Mobile Network Operators frequency bands to have access to other radio resources than RMR, studies should be performed on the innocuity of PMNO bands before confirmation of their mandatory support for On-board FRMCS and to refine the requirements for RMR to PMNO bands isolation in the V3 set of FRMCS specifications.
    - These studies are not currently programmed by the UIC FRMCS programme. If not secured there is the risk of no study results and then MNO spectrum support on-board being removed from V3.
    - A study should be carried out covering at least:
        - The RMR chipset capability;
        - The RMR radio module capability;

- The antenna constellation on trains (GSM-R, RMR, MNO);
- Field tests on radio propagation performance and bearer (IP transmission) quality performance (e.g. message transfer latency, throughput and message error rate);
- Reports by specific railways or external parties on findings on the innocuity of MNO- and RMR-bands.

7. NEXT STEPS

As set out in Section 1, the EU-RAIL System Pillar, through the System Pillar Steering Group, provides a forum for the EC, ERA, EU-RAIL, and railway sector and suppliers to discuss, align and agree on issues relevant to the development of the European railway system.

Additional aspects flagged by stakeholders in relation to the overall FRMCS program coordination can be expressed in a future update of this report or in a standalone report of the system pillar or the deployment group. Such a report would consider what is/are the suitable group/s to perform such an overarching coordination.

The proposed next steps in relation to specification delivery are:

Next step	By when	Responsible
The confirmation with the agreement on this report • the SP-STG members agree the scope of the V3 FRMCS specifications based on a reduced set of functionalities focussed on a stable minimum viable product for implementation (section 3), noting that UNIFE currently do not agree that the defined scope can be delivered in the timeline proposed by UIC (section 3) • the SP-STG members note the proposed timing (section 4) • the SP-STG members note the significant risks to delivery (section 6), and where relevant the mitigations and will address risks and mitigation measures in the stakeholder alignment meetings. • the SP-STG members agree the proposed governance arrangements (section 5), and will through their members work to facilitate these in order to support timely delivery of the specifications at the correct level of quality • the SP-STG members agree the next steps to be implemented (section 7).	October 2025	System Pillar STG members
The establishment of a project manager at the UIC	June 2025	UIC
Setup the Stakeholder Alignment Meetings with ERIG participation and participants nominated by SP STG (see governance chapter) .	September 2025	ERIG/UIC, SP STG
The delivery by the project manager of a project plan for the next two years (with intermediate milestones and monthly reporting , including the definition of the delta between V2.2 and V3p).	September 2025	Project manager[9]

[9] we mean here a project manager to be established for the UIC FRMCS specifications programme

Participants of the Stakeholder Alignment Meetings ensure adequate participation to ERIG and to the appropriate FRMCS working groups and communication about FRMCS within their respective organisations.	From September 2025 onwards	SAM participants
Delivery of functional requirements of V2.2	September-October 2025	UIC FRMCS programme
Monthly reporting related to FRMCS specification development to the Stakeholder Alignment Meetings .	From September 2025 onwards	Project Manager/UIC
Regular reporting to ERIG and EU-RAIL deployment group every 6 months on chipset availability covering RMR frequencies and complying with ECC regulation.	From September 2025 onwards	UNITEL
Providing a quality benchmark by ERA EECT for UIC to do an initial quality assessment of V3p specifications. The same quality assessment should also be used for V2.2 specifications.	December 2025	ERA EECT
Tagging of specification changes with the related Morane2 test results.	continuous as of first Morane2 results	Project manager/UIC
Delivery of a study on MNO frequencies innocuity	At least in June 2027	To be defined
Further next steps follow the timeline presented in section 4		

ANNEX 1: REVISED SCOPE OF FRMCS SPECIFICATIONS (AGREED SCOPE AT EECT LEVEL IN JANUARY 2025)

This annex is providing a view on which features are expected to be part of v3 set of UIC 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 based on the review by EECT end of January 2025 and captured in FRS v2.1.0.

A colour code is used to discriminate between functionalities completely defined in FRS (green colour) and those not yet fully defined (orange colour).

FRS Chapter	Title	Target V3/Vx
5	Application concept	Vx
6	FRMCS functional addressing	V3
8.2.2	Assured voice communication common function	V3
8.2.3	Multi user talker control common function	V3
8.2.4	Role management and presence common function	V3 Presence targeted for Vx
8.2.5	Location services common function	V3
8.2.6	Authorisation of communication common function	V3
8.2.7	Authorisation of application common function	V3
8.2.8	QoS and priority common function	V3
8.2.9	Assured data communication common function	Vx
8.2.10	Inviting-a-user common function	V3
8.2.11	Arbitration common function	V3
8.2.12	Distribution of synchronised time common function	V3
8.2.13	Billing information common function	Vx
8.2.14	Recording common function	V3
9.3	Generic HMI aspects	V3
10.1	Voice communication functions for FRMCS applications	V3
10.2	Generic voice communication	V3
10.3	On-train outgoing voice communication from the train driver towards the controller(s) of a train	V3
10.4	On-train incoming voice communication from the controller towards a train driver	V3

10.5	Multi-train voice communication for drivers	V3
10.6	Banking voice communication	V3
10.7	Trackside Maintenance voice communication	Vx
10.8	Shunting voice communication	V3
10.9	Public emergency call	Vx
10.10	Ground to ground voice communication	V3
10.11	Railway Emergency Communication	V3 REC-Alert with REC-Voice targeted for V3; REC-Data and REC-Alert alone targeted for Vx
10.13	Public train emergency voice communication	Vx
10.14	Working alone	Vx
10.15	On-train outgoing voice communication from train staff towards a ground user	V3
10.16	On-train incoming voice communication from a ground user towards train staff	V3
10.17	Railway staff emergency communication	Vx
10.18	Urgent On-train outgoing voice communication from the train driver towards the controller(s) of the train	V3 Optional for trackside
10.19	Urgent Multi-Train voice communication for drivers	V3 Optional for trackside
10.20	Multi-Train voice communication for drivers excluding ground user(s)	Vx
10.21	On-train voice communication	V3 optional
10.22	Lineside telephony	Vx
10.23	On-train voice communication towards passengers (Public Address)	V3 optional
10.24	Station Public Address	Vx

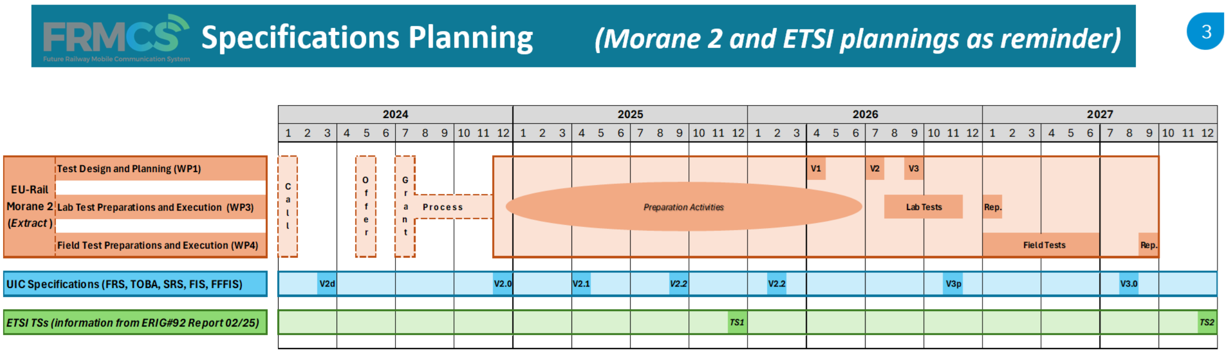
10.25	Communication at stations and depots	Vx
11.1	Data communication functions for FRMCS applications	V3
11.1i	Data communication functions for applications external to FRMCS	V3
11.2	Generic data communication	V3 optional
11.3	Role management and presence application	V3 Presence targeted for Vx
11.4	Automatic Train Protection communication	V3
11.5	Automatic Train Operation communication	V3
11.6	Data communication for Possession Management	Vx
11.7	Trackside Maintenance Warning System communication	Vx
11.8	Remote control of engines communication	Vx
11.9	Monitoring and control of critical infrastructure	V3 optional
11.10	Access to recording of communications	Vx
11.11	Data recording and access	Vx
11.12	Shunting data communication	Vx
11.13	Train integrity monitoring data communication	Vx
11.14	Public emergency warning	Vx
11.15	Critical Advisory Messaging services - safety related data communication	V3
11.16	Virtual coupling data communication	Vx
11.17	Train Parking Protection	Vx
11.18	Key Management System data communication	V3
11.19	On-train Telemetry communications	V3 optional
11.20	Infrastructure Telemetry communications	Vx
11.21	On-train remote equipment control	Vx
11.22	Monitoring and Control of Non-Critical Infrastructure	Vx
11.23	Wireless on-train data communication for train staff	Vx
11.24	Wireless data communication for railway staff on platforms	Vx
11.25	Train driver advisory -train performance data communication	Vx
11.26	Train Departure data communications	Vx
11.27	Messaging Services	V3 Optional for trackside
11.28	Transfer of data	V3 optional
11.29	Record and broadcast of information	Vx
11.30	Transfer of CCTV archives	Vx
11.31	Augmented reality data communication	Vx
11.32	Real time translation of speech data communication	Vx

11.33	Passenger information data communication	V3 optional
11.34	On-train safety device to ground communication	V3
12.1	Basic video communication functions	Vx
12.2	Generic video communication	Vx
12.3	Critical real time video	Vx
12.4	Non-critical real time video	Vx
12.5	Non-critical real time video communication	Vx
13	Handheld terminal requirement	V3
13.1	Use case: Deported control of applications	Vx
14	System management and configuration aspects	V3
15	Digital resilience	V3
16.2	Inter domain change generic	V3
16.3	Interconnection	V3
16.5	Interworking	V3
16.6	Intra domain changes and service continuity	V3

ANNEX 2: UIC SPECIFICATIONS PLANNING PROPOSAL

This annex is the UIC proposal for V3 specifications planning:

- V2.2 functional release: FRS and TOBA FRS versions integrating the closing of functional Open Points
- V2.2 system release: SRS, FIS and FFFIS versions integrating the closing of system Open Points
- V3p: pre-test version of all FRMCS specifications
- V3.0: post-test version of all FRMCS specifications



	Nature	Context	Objectives
V1	Test Plans in Morane 2	Preliminary version	Alignment in Morane 2
V2	Test Plans in Morane 2	Version for lab tests	Execution of lab tests in Morane 2 (3 labs)
V3	Test Plans in Morane 2	Final version	Execution of field tests in Morane 2 (5 lines)
V2d	UIC FRMCS Specifications	**Draft V2 , issued for ERA EECT process**	
V2.0	UIC FRMCS Specifications	**Version after EECT Technical Opinion**	
V2.1	UIC FRMCS Specifications	Version EECT Technical Opinion Addendum	Sector agreement on Categorisation (Mandatory / Option / Information) and List of Open Points
V2.2	UIC FRMCS Specifications	Interim version FRS / TOBA, proposed for EECT	Integrating the closing of functional Open Points
V2.2	UIC FRMCS Specifications	Interim versions SRS / FIS / FFFIS	Integrating the closing of system Open Points
V3p	UIC FRMCS Specifications	Provisional / Pre-test version, proposed for EECT	Stable and cleaned-up version - Considered as semi-definitive
V3.0	UIC FRMCS Specifications	Final / Post-test version, for ERA recommendation	FRMCS 1st Edition, amended from V3p when needed from Morane 2 results
TS1	*ETSI Technical Specifications*	*Phase 1, post-review from NSOs*	*Based on UIC FRMCS V2.1*
TS2	*ETSI Technical Specifications*	*Phase 2, post-review from NSOs*	*Update for final versions*