

Future Railway Mobile Communication System

EIM expectations and key challenges

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GSM-R is the current technology used by the railway industry for its radio mobile communications. **End of life of GSM-R is expected around 2030** based on a GSM-R Industry Group announcement. Furthermore, some IMs are running older version of GSM-R which will need a major replacement by as early as **2023**. It is therefore essential that the successor to GSM-R is **available within a short time frame**.

Work has already started to develop the GSM-R successor under **UIC** leadership, and has more specifically focused on the user requirements specification, system architecture, spectrum needs and the interface between track equipment and onboards.

The purpose of this document is to confirm **EIM expectations for the future system** as well as to identify the **key challenges** for its successful realisation. Finally, it addresses the **next steps** which are needed for its further progress.

1. EIM expectations of the Future Railway Mobile Communication System (FRMCS)

EIM has identified the following expectations of the future system (FRMCS):

- a) Be **cost effective**
- b) Ensure **vendor independence**
- c) Be **future proof**, and provide a long term evolutionary solution for railways
- d) Offer **flexibility in network usage and modelling** (i.e. offer possibility to use private mobile networks, public mobile networks, Wi-Fi-networks, other technology networks with mobility, or hybrid solutions between those systems)
- e) Allow **flexibility at the application level** for the applications which are not critical for interoperability (i.e. IMs/RUs need to have the freedom to implement applications which do not affect interoperability)
- f) Ensure **high availability of service** at least equivalent to GSM-R
- g) Offer **high robustness** (also under mobility conditions) including robustness against interference

- h) Be **interoperable** (i.e. allow trains to function on mobile networks between countries, and allow co-existence between GSM-R and future technologies)
- i) Allow a **seamless migration of voice and ETCS services** to the new communication technology

In order to realise the expectations here above listed, FRMCS will require the following **characteristics**:

- a) Use “**Commercial off the shelf**” solutions as a basis for FRMCS to **limit system costs**, re-enforce **vendor independence** and ensure the **use of up-to-date technology** across time. Following such an approach implies that all Railway specific functionalities¹ will have to be **handled at the application layer** and work with any other underlying transport service
- b) Be **bearer independent** which implies a clear separation between the communication layer and the application layer allowing simultaneous use of 4G/5G private/public and Wi-Fi or other technology with mobility, without service interruption. Following such an approach will greatly **simplify the implementation of FRMCS in ETCS equipped trains** as this will be considered as a minor change and not require the full authorisation of the train². Furthermore, this will allow reconciling **the different life span between ETCS and communication technologies** which are likely to change more frequently and need therefore to be implemented smoothly on ETCS trains.
- c) Allow **efficient, effective and flexible usage of spectrum** so that FRMCS can be used on private networks (which implies to have dedicated spectrum for railways), public mobile networks or other networks with mobility or a mix of networks³. In addition, allowing to **reuse current GSM-R frequencies** (UIC and Extended Band (at least partially) facilitates the **reutilisation of the current GSM-R infrastructure** and limits FRMCS implementation costs⁴
- d) Be **compatible with multiple harmonised type of technologies** to allow a same train to run on different type of networks
- e) Allow for **evolution and adaptability** to grasp new radio access technology(/ies) with limited impact on other control-command and signalling components
- f) Be **IP Based** (Internet technology) to allow an easy and standardised interfacing with applications

¹ Railway specific functionalities include group call, emergency call and role management

² Note that if such an approach is followed, Train operators will have the possibility to install access bearers which are compatible with FRMCS before FRMCS is rolled out, limiting their costs and easing migration from GSM-R towards FRMCS

³ Having spectrum flexibility will enable to use additional spectrum for migration purposes when IMs operate two technologies in parallel

⁴ Re-using UIC spectrum will ensure that GSM-R generated know-how is preserved when using the future system (FRMCS)

2. Key challenges for FRMCS

EIM has identified the following main challenges for a successful roll-out of FRMCS:

- a) Define a **migration strategy** from GSM-R to FRMCS, and handle successfully the co-existence of both systems during migration (e.g. clarify if there is a need for a guard band between both systems during migration)
- b) Define a **spectrum strategy** for FRMCS and ensure that the appropriate bandwidth is reserved for the future system
- c) Ensure that FRMCS is able to **cope with interferences**
- d) Clarify the **financing** of FRMCS development and testing

3. Current status and next steps

a) Technical development:

- Current status
 - UIC has delivered the user requirements specification, after consulting its stakeholders (including EIM representatives)
 - There is now an ongoing evaluation to assess FRMCS compatibility with 3GPP releases.
- Next steps:
 - Finalise the technical specifications and architecture of FRMCS
 - Address how the “railway specific applications” will be developed and tested (Note that there are several options for developing railway specific applications, depending of the number of application providers and whether or not applications of different providers have to be able to operate between each other)
 - Develop and test FRMCS (especially the link between off the shelf solutions and the railway specific applications).

b) Migration – Next steps:

- Specify how to handle backward compatibility to GSM-R and ensure business continuity
- Define the onboard solution which is a prerequisite / important parameter for a successful migration
- Define rules of the game for an IM to be able to close down its GSM-R network in favour of FRMCS

c) Spectrum

- Current status
 - ETSI is currently building a spectrum requirements document, to be presented to frequency management organisations in 2017. This step is essential to get appropriate spectrum for the future system
- Next steps

- Continue the process to ensure that IMs have access to the required spectrum to ensure a smooth migration and reuse of their existing infrastructure

d) Finance and legal – Next steps

- Specify how FRMCS prototyping and development will be financed
- Develop a business case at the European level to support the migration from GSM-R to FRMCS
- Specify the legal framework of the new telecom environment (including which part of FRMCS should be part of TSI CCS)

4. Conclusion

FRMCS will be a **game changer for the railway industry** as it will offer new ways to operate trains and the network (intelligent trains in an intelligent network). Furthermore, it will offer considerable **cost savings** to the railway industry by using “Commercial off the shelf” solutions.

It is therefore urgent to put in place all the conditions which will ensure a **successful launch of FRMCS by 2023**. Consequently, EIM members insist on the need of defining a **detailed plan** for FRMCS completion, but also on having absolute clarity in terms of **project governance** and **responsibilities**.

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