Global System for Mobile communications - Railways

Eleven members dedicated to supporting GSM-R and next generation networks
**GSM-R Support**

A global railway communication platform

- **Railway specific functionality (EIRENE)**
  - Functional addressing
  - Location dependent addressing
  - Railway emergency calls
  - High priority call confirmations

- **GSM enhancements for railways (by ETSI)**
  - Voice Group Call Service
  - Voice Broadcast Service
  - Enhanced multilevel precedence and pre-emption

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**What is the Railway Operational Communications (ROC) Industry Group?**

It is a single interface to:
- ERTMS MoU Steering Committee
- International Railway Association UIC
- ERTMS users group
- ETCS Industry UNISIG
- European Railway Agency ERA

It gives a single voice to the GSM-R Industry for:
- The global promotion of the technology
- The continued development of the EIRENE standards
- Interoperable systems with seamless integration
- The long-term support of the GSM-R technology

The ROC Industry Group has currently eleven members, dedicated to:
- The active global promotion of the GSM-R technology
- The supply of interoperable end-to-end systems
- The minimization of integration efforts and railway migration costs
- The continued development of the EIRENE standards in line with railway requirements
- Supporting UIC, European Union Agency for Railways and the ERTMS users group
- The smooth evolution and migration to a Future Railway Mobile Communication System (FRMCS)

The ROC Industry Group together with the associated organizations UIC (International Railways Association) and European Union Agency for Railways are committed to long-term support of GSM-R.
Why GSM-R?

With over 35 different European railway communication systems in use, the European Railways decided to work together to achieve inter-operability by using a single communication platform. They identified their shared requirements and various technologies were evaluated.

GSM was chosen as the best technology because:

- It’s widely proven
- It’s highly interoperable
- It is a hugely successful global standard

Railway operators, institutes and industries have established common activities to specify, to test and to approve the systems needed.

The GSM-R standard and its continued development are managed by the European Railways under leadership of UIC (International Railway Association) and European Union Agency for Railways and it benefits from the support of the European Commission and railway bodies.

GSM-R is the wireless communication standard for railway networks. It has been developed under European Union sponsorship to assist railways in achieving their goals of network interoperability, reduced operational costs, improved safety at higher speeds and delivery of new services for the benefit of the railway operating companies and their passengers.

GSM-R is built on GSM technology and benefits from the economies of scale of its GSM technology heritage. It is a cost-efficient digital replacement for existing incompatible in-track cable and analogue railway radio networks.

The standard is the result of over ten years of collaboration between the various European railway companies, with the goal of achieving interoperability using a single communication platform. GSM-R, standardised in EIRENE, is part of the European Rail Traffic Management System (ERTMS) standard and carries the signalling information directly to the train driver, enabling higher train speeds and traffic density with a high level of safety.

GSM-R Success:
Proven interoperability and border crossing (European Corridor)
Its stability and popularity have led to its acceptance outside Europe.

GSM-R as a global system

GSM-R, in commercial operation for over 20 years, is the voice and data radio systems for all European railways and abroad. It’s the off-the-shelf reference solution.
Our members offer fully interoperable EIRENE compliant solutions. Sophisticated network design, using the highest quality and reliability subsystems and components, guarantees voice and data communication at vehicle speeds of up to 500km/h.

Designed for mission-critical networks, Kapsch’s Railway portfolio provides the right mix of scalability, Railway features and high reliability operators need. With more than 80,000 kilometers of access technology and R4 based core networks in 24+ countries, Kapsch solutions are trusted by railway operators from around the world. Through an active role in standardization and the European Shift2Rail program, Kapsch CarrierCom has fully engaged their portfolio into the evolution towards FRMCS. Our products have been designed to ensure a smooth network transition with an evolution enabling virtualized and simplified deployments, all IP/SIP architecture and services harmonization.

- The RDN.base station comprises Digital Modules (DMs) which can be connected to up to six Remote Radio Head (RRH) units replacing up to six last-generation base stations for optimized deployments and simplified maintenance. Kapsch base station is multi RAT ready and can evolve to an eNodeB to pave the way to FRMCS.
- The RDN.core network, englobing MSC, MGW, HLR, SCP and GPRS, delivers field proven solutions providing end to end geo redundancy for highest resiliency. It provides a rich feature set continuously enhanced to align with new standards and railway demands. Our core portfolio will evolve to support multi bearer access and converged service solution to address continuity during technology transition.

Nokia is a vendor with over 30 years’ experience in the railways industry, offering a complete end-to-end railway communications product and service portfolio. As such Nokia’s GSM-R solution is an advanced solution addressing all rail operators’ communication needs by comprising various state-of-the-art products that are utilized in GSM-R as well as deployed and proven in several public networks around the world. These products are flexible, scalable and provide highest reliability and availability, with future evolution capabilities towards FRMCS:

- Geo-redundant ATCA based R4 core architecture paired with state of the art, award winning Flexi BTS supporting various deployment schemes. Newly introduced Flexi Multiradio BTS providing LTE access as well, thus able to pave the way for a smooth migration.
- Complementing IN, HLR and GPRS products with multi radio access support from 2G to 5G, based on modern virtualization and cloud technologies.
- End-to-end network cyber security solution incl. thread defense technologies.
Mobile terminals

Our members offer a complete selection of EIRENE compliant voice/ETCS and GPRS data radio terminals for fixed installation on the trains. Portable and transportable solutions are also available for various applications.

Alstom provides a complete GSM/R portfolio for on-board ERTMS solutions. Almost 6000 trains equipment have been ordered representing more than 6765 ERTMS L2 on-board system on over 130 different train types. Today, 2356 trains are in commercial service on over 70 different types of trains, inside and outside Europe. The fourth–generation EDOR (ARBE-C4) based on improved ETSI professional radio module features is compliant to ERTMS BL3 R2 and includes:

- Support for ETCS over GPRS/EGPRS applications
- Support of Multiplexing for simultaneous ETCS and non-ETCS data transfer using GPRS/EGPRS
- Support for both the ER GSM-R band and the UIC band [873-880 ; 918-925 MHz]
- Integrated Enhanced Duplexer/filter (H-MFA) for:
  - Provision of additional reduction of the interference from public use of GSM/UMTS/LTE
  - Elimination of the possible intermodulation/blocking between the two radio modules

The position of Funkwerk has been steadily strengthened by focusing on the world-wide introduction of mobile terminals for voice and data communication via GSM-R. Funkwerk provides a wide range of handhelds under the name ‘focX’, cab radios under the name ‘MESA’ and EDOR systems under the name ‘RIU-ETCS’ and ‘EDOR 5E’. Funkwerk is one of the leading companies in the GSM-R radio terminal market worldwide. More than 40,000 GSM-R cab radio units were delivered to customers in 25 European and 9 overseas countries. Due to the manufacturing in Funkwerk’s own facilities in Germany, we are able to cover the demanding flexibility and high quality required. All equipment is tested and certified for all GSM-R networks and in many countries.

Products from Funkwerk provide strong robustness against interferences due to the implementation of Funkwerk’s own 2W and 8W new generation module. All transceiver modules are equipped with an additional intelligent filter system to comply with the latest ETSI standard.
Mobile terminals

As true end-to-end producer and supplier of railway communications infrastructure, Kapsch engineered its cab radios to work seamlessly with all communications networks for railways. The RDN.cab radios offer a range of new features that help operators improve the speed and quality of their communications, while reducing operating and support costs. Zero-touch maintenance, real-time tracking and improved diagnostics are just a few of the rich features of the RDN. cab radio. RDN.EDOR cab radio supports reliable data communications for the European Train Control System (ETCS) signaling applications.

Leonardo provides different solutions to meet the requirements for on-board communication equipment. It is possible to select the most appropriate configuration that exactly fits the customer requirements. Leonardo’s GSM-R cab radio systems provide the features of an advanced GSM-R telephone, with all the special railway functions:

- RaCE2500 – Railway Communication System. The rack includes up to two GSM-R radio modules, one for CS voice/data application, the other one (optional radio) for PS or GPRS data transmission, Gateway MVB.
- RaCE 2300 – Cab radio with Compact MMI. This solutions provide voice capability, a dedicated keys for special functions and a comprehensive user friendly menu.
- GSC 2300 – EDOR - ETCS Data Only Radio

Leonardo proposal ranges from on-board to ground based solutions and can be categorized as follows:

- Solutions to improve the safety and efficiency of the rail traffic management, performed mainly by data transmission over a high reliable telecommunication system.
- Solutions that make more efficient the voice communications related to the management of the transport service.
- Solutions to improve security and comfort of the passengers, increasing the competitiveness of the service.

Leonardo’s solutions take into account the evolution towards packet communications integrating the GSM-R with heterogeneous networks.
Mobile terminals

The Nexus Voice is the next generation cab radio from Siemens, adding a number of new features to improve functionality and performance. The addition of a new backplane allows GPS, Wi-Fi and next generation connectivity. This availability of radio modules offers the opportunity of multiple data transfers for an array of applications such as Nexus Connect service Wi-Fi, Nexus Lodestar driver advisory system, Nexus Tracksure remote condition monitoring of the track and Nexus SensorConnect for the remote condition monitoring of the train.

Siemens cab radios operate in a vast range of environmental conditions. With a demonstrated MTBF of over 100,000 hours, minimising down time and total lifetime costs with its high reliability. A unique gland box system allows fast installation and replacement, with a built-in universal voltage power supply, permitting fitment across all rolling stock and suitable for use across the world using 900 MHz or 1,800 MHz frequency bands.

Triorail supplies GSM-R modules, modems and test equipment. The Triorail technology provides exceptionally robust reception characteristics, which ensures the best possible suppression of interfering radio signals, for example of public 2/3/4/5G mobile networks. The product range includes devices in different form factors.

Many projects in the rail industry have been successfully implemented with Triorail modules and modems. The applications are highly diverse and extend to the areas of voice communication and data transmission, including CAB-Radio and ETCS Data-Only-Radio.

Triorail completes the offer with trace devices to assess the air interface of the GSM-R network. Railway operator and infrastructure supplier benefit from various 2-Watt and 8-Watt test equipment to test, monitor and optimize the GSM-R network.
Dispatcher systems

Our members offer EIRENE-compliant dispatcher systems with a wide range of fixed terminals and associated station equipment.

Migration to an IP based system is also now a reality with the definition of UIC IP guidelines and upcoming EIRENE FRS 8.0.0/SRS 16.0.0.

The IP migration will future proof the railway investment while bringing new benefits:

- One multi-service network for different types of applications
- Increase of reliability & availability
- Increase capacity efficiency
- Reduced cost of ownership

Frequentis

The Frequentis FTS 3020 Fixed Terminal System is a converged operational communication solution integrating existing legacy infrastructure with GSM-R and state-of-the-art SIP technology. It is proven with more than 6000 controller positions in operation in GSM-R networks in over 25 countries worldwide. Hot standby and load sharing geo-redundant configurations are part of the FTS 3020 product line. It includes an integrated recording system and different types of DICORA controller terminals featuring enhanced rail features, such as dynamic role management, extended messaging or location based services. The future-proof FTS 3020 System covers all needs for operational communication in Command & Control Centres, as well as at local train stations.

Funkwerk

Funkwerk provides a Fixed Radio Dispatcher with its own 2-watt-module inside for small stations and shunting yards.

It is easy to install – plug in only the antennae and the power supply.
Iskratel SI3000 MPD (Multi-Purpose Dispatcher) system is designed to meet strict requirements and standards to provide a great comfort and increased productivity. It represents a single point of control for all types of operational communications. The complete solution together with a carrier-grade infocommunications platform SI3000 cCS (compact Call Server) assures new features and applications necessary for today’s safe and efficient operations. The system integrates existing legacy telecommunication infrastructure (LB, CB, ISDN), audio announcement systems and SOS pillars with GSM-R and modern IP-based infrastructure. With Iskratel’s platform you are future-oriented, since it is based on the IMS network architecture.

Counting 70 years of experience, Iskratel is the leading European infocommunications vendor and solutions provider with its own R&D and manufacturing centers, 900 employees and local presence in over 30 countries. Iskratel provides telecommunications solutions for communications service providers, and integrated for the digitalization of the transportation, public safety and energy industries.

The RideOnTrack (ROT) dispatcher product family consist of 3 models; DiCa_Rail Modular, DiCa_Rail Compact and DiCa_Rail Mobile. The modular model offers maximum flexibility with a plug-in audio module (left/right) and a stand-alone goose-neck (via USB). The compact model offers integrated high quality audio and an integrated goose-neck. The mobile version allows the dispatcher to roam around in the command center while staying connected with the dispatcher application. Our dispatcher application is fully SIP/IP based and can run on any standard computer.

Dispatching can be done for all operational communication systems in the customer network (GSM-R, DMR, analogue radio, fixed telephony, public address, PBX, PSTN etc.) Beside the mandatory EIRENE features, the ROT dispatcher solution offers functionalities to allow complex call processing scenario’s (roles&profiles, phone books, advanced queue handling etc.). Our system works in Geo-redundant/load sharing mode and can easily be integrated in a legacy network and allows for smooth migration.

The ROT product portfolio for fixed operational communication also offers voice recording, gateways, IpPbx, call center functionalities and several apps to improve the safety of the railway employee.
**Dispatcher Systems**

The Wenzel-MACS-R is a modular IP dispatcher system, outstandingly suited for use in train control centers. Legacy interfaces facilitate the migration of existing systems. The Wenzel-MACS-R ensures high reliability due to its fully redundant architecture and is available even as a geo-redundant two-site solution.

By means of an efficient role management calls are notified to all dispatchers registered for the related role. No role can be left unmanned and no calls get lost. The offered variety of GSM-R dispatcher terminals, in combination with touch screen or monitor, can be easily tailored to operational customer needs and is internationally successfully used.

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**GSM-R support**

**ROC Industry Group members are committed to long-term support for GSM-R technology.**

Our members offer a complete selection of service level agreements that include at least:
- Repair support
- 2nd & 3rd line support
- Training courses

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**Service Level Agreement**

- Maintenance services
- Warranty services
- Training
- Spares and repair services
**GSM-R Support**

**End-to-end services**

Beyond pure GSM-R support, several members of the Industry Group offer end-to-end solutions and have extensive experience as general contractors for entire GSM-R projects.

An end-to-end solution usually includes all implementation tasks from network planning, network infrastructure installation to the complete operation, maintenance and performance monitoring of a GSM-R network. The services of an end-to-end solution are easily adaptable to the customers’ needs.

Furthermore, it includes the entire core and access network infrastructure and necessary know-how for installation, such as the Network Switching Subsystem (NSS) the Base Station Subsystem (BSS), as well as the Operation, Administration and Maintenance (OAM) of entire networks.

The end-to-end solution services offered include radio planning and optimisation of GSM-R networks, such as planning and engineering of network coverage on lines and in tunnels, as well as integration of dispatcher solutions and cab radios within the GSM-R network and legacy systems. Railways opting for this will have one single point of contact with easier overview of the project and its progress.

**Long term support of GSM-R**

Due to the large amount of GSM-R equipment installed and the fact that the railways need to extend the life-cycle of the system, the ROC Industry Group is committed to the maintenance and continuous development of the GSM-R equipment and system platform, in particular to:

- Maintenance of the GSM-R systems hardware/software
- Alignment with the new GSM-R features contained in updated EIRENE and CCS TSI specifications
- Increase of the network capacity implementing packet data functionality GPRS/ E-GPRS and extension of the frequency band with additional 3 MHz (ER-GSM band)
- Mitigation of interferences
- Life-cycle management

The ROC Industry Group is committed to supporting GSM-R until at least 2030 including supporting the controlled migration of the entire system towards IP.

The overriding aim is to guarantee the interoperable operation of GSM-R systems already installed and migration towards future telecom technologies as part of the ERTMS program.
Support for migration to the Next Generation system

An important part of the ERTMS strategy is the evolution of the Railway operational communication system to the Next Generation, to overcome obsolescence, and enable the implementation of future broadband applications and to provide independence of Railway applications from the underlying network technologies. Therefore, the Industry Group is in active cooperation with the Union Internationale des Chemins de Fer (UIC), the European Union Agency for Railways and other Railway Stakeholders across Europe in defining and specifying the Future Railway Mobile Communication System (FRMCS) as next generation Railway operational communications as well as the migration from GSM-R toward this. This will additionally result in an update of the EU legal framework in order to guarantee and maintain technical interoperability across Europe.

As members of the Industry Group and as the key suppliers for the worldwide installed interoperable ERTMS/ GSM-R systems, we gathered invaluable experience over the last 15 years, which will be used to ensure the seamless migration from GSM-R to the Next Generation.
Alstom  www.alstom.com/transport
Frequentis  www.frequentis.com
Funkwerk  www.hfwk.de
Iskratel  https://www.iskratel.com/en/
Kapsch  www.kapschcarrier.com
Leonardo  www.leonardocompany.com
Nokia  www.networks.nokia.com
ROT  http://www.rideontrack.com/
Siemens  www.siemens.co.uk/mobilecomms
Triorail  https://www.triorail.com/home.html
Wenzel  www.wenzel-elektronik.de