



References

Mobile Radio Systems

Projects worldwide

Success through Innovation

Funkwerk Know-how on Europe's Tracks

Since 1982 **Funkwerk AG** develops and produces train radio systems for the German and international markets.

GSM-R: Due to the overall market globalization that affects also the railway and other transportation networks the European railway operators are focusing on a homologated digital radio communication platform for seamless international train operations.

Against the background of a merging Europe and increasing globalisation, the European rail network management bodies undertook to introduce the digital communication network GSM-R to ensure European interoperability.

Funkwerk AG is proud to be the **European market leader** in the segment.

GSM-R (Global System for Mobile Communication for Railways) is the standard for information transfer in European rail traffic. In the course of the rapidly advancing European harmonization and the demand for the interoperability of rail traffic connected with it, 32 European railroad companies have decided to introduce this trend-setting technology.

An important technological innovation "Made by Funkwerk" has been the generation of mobile radio terminals for railway companies. For rail traffic, the Single and Dual Mode terminals and the resulting possibility of radio-based operation means a quantum leap with regard to security and efficiency.

For this revolutionary change in technology, Funkwerk takes advantage of its position as a leading supplier of mobile radio terminals in the rail traffic sector. During recent years, this position has been steadily strengthened by focussing on the Europe-wide introduction of voice and data communication via GSM-R (GSM-R voice and ETCS - European Train Control System).

As a europe-wide digital radio communication standard for trains, GSM-R terminals are the technology platform for any communication services of the railways integrated and across borders. For this, Funkwerk has developed terminals for use in power units and locomotives and has already been chosen to be the sole supplier of Deutsche Bahn AG, French SNCF, Belgian SNCB, Swiss SBB and Norwegian NSB.

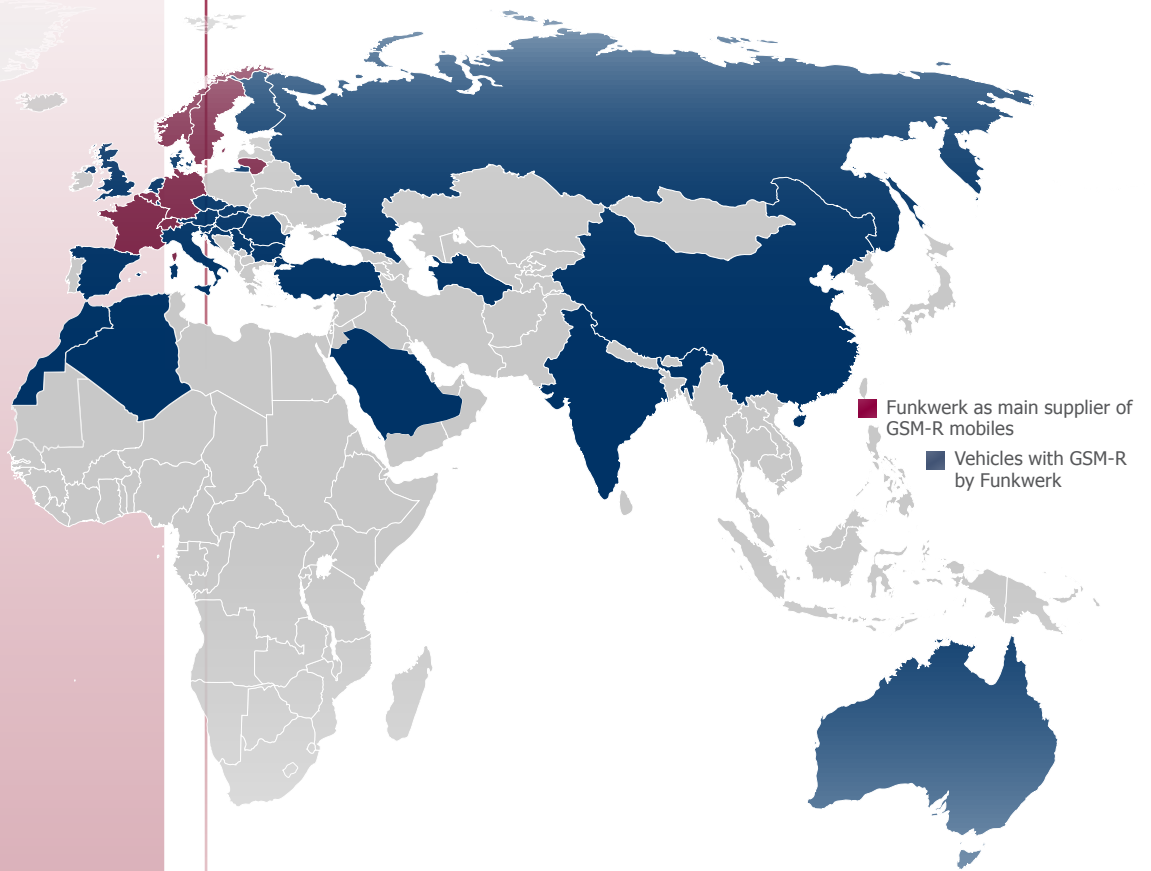


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Worldwide on the track



Market and Projects

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Train Radio System - MESA 26

Austria - ÖBB

Supply of Dual Mode Cab Radios MESA 26 for ÖBB trains. The GSM-R application is compliant to the EIRENE/MORANE specifications.

	Siemens AG Germany
	ÖBB (Austrian Railways)
	100 Cab Radios
	2013 - 2016

Sweden

Supply of Single Mode Cab Radios MESA 26 for retrofitting of serie X2000. The GSM-R application is compliant to the EIRENE/MORANE specifications.

	SJ (Statens Järnvägar)
	85 Cab Radios
	2014 - 2015

Switzerland - SBB (Retrofitting)

Supply of Dual Mode Cab Radios for retrofitting of design.

	SBB (Swiss Railways)
	8 Cab Radios
	2014

Customer	
End-user	
Volume	
Realisation	

Customer and End-user	
Volume	
Realisation	

Customer and End-user	
Volume	
Realisation	



Train Radio System - MESA 26-1800

Australia

Supply of GSM-R Cab Radios, based on the MESA 26 series. Through integration of the latest developments and adaptation of the system to Australian railway technology, it satisfies the requirements of the UGL for a technically sophisticated, innovative and reliable train radio device.

Partner
End-user
Volume
Option
Realisation

UGL Infrastructure Pty Ltd.
TfNSW (Transport for New South Wales)
685 Cab Radios
230 Cab Radios
2010 - 2015



Additionally, by order extra features and a customised user interface (for HMIC) for the GSM-R mode was implemented. Using a web-based RMT system (remote management tool) the diagnosis and software updates can be done via remote maintenance.

Train Radio System - MESA 25

Norway - NSB

Supply of GSM-R Cab Radios based on the already successfully integrated and reliable type series MESA. Through integration of the latest developments and adaptation of the system to railway technology, it satisfies the requirements of the NSB for a technically sophisticated, innovative and reliable train radio device.

The GSM-R application is compliant to the EIRENE/MORANE specifications.

	NSB AS (Norwegian Railways)
	450 Cab Radios
	2005 - 2014



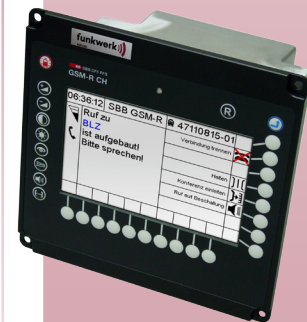
Customer and End-user	
Volume	
Realisation	

Switzerland- SBB | BLS

By order of the Swiss Railways (SBB) a generation of Cab Radios (GSM-R Cab-Radio MESA 25-01) was developed, based on the already successfully integrated and reliable type series MESA.

The GSM-R application is compliant to the EIRENE/MORANE specifications.

	SBB (Swiss Railways)
	1.500 Cab Radios, 2.000 MMIS
	2004 - 2010



Customer and End-user	
Volume	
Realisation	

Train Radio System - Bi-Mode

France - SNCF

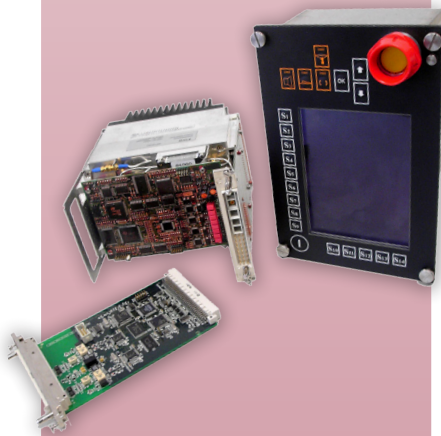
Supply of a analogue train radio module. The analogue train radio module implements all French and Belgian analogue features.

Supply of a Dual Mode MMI, analogue and GSM-R train radio application.

Supply of test equipment.

	Partner
	End-user
	Volume
	Realisation

	Alstom Transportation
	SNCF (French Railway)
	9.000 Cab Radios, 15.000 MMIS
	1999 - 2004



Project mile stones:

- Addition to existing application software about: Italian standard (RFI): end of 2010 and Implementation TETRA Mode: to February 2013
- Roll-out: 2004 to 2015

Train Radio System - MESA 24

Belgium - SNCB

Supply of a complete Dual Mode train radio system (GSM-R and analogue train radio). The analogue train radio module implements all French and Belgian analogue features. The GSM-R application is compliant to the EIRENE/MORANE specifications.

	Siemens Belgien
	SNCB
	2.100 Cab Radios, 3.500 MMIS
	2003 - 2009



Customer	
End-user	
Volume	
Realisation	



Luxembourg - CFL

Since 2004 the Luxembourgian Railways CFL have renewed almost its complete rolling stock and in doing so, have partly replaced the mobile train radio devices. Rail vehicles, going to France and Belgium, are equipped with a Dual Mode Cab Radio from Funkwerk which is compatible to each train radio network needed for CFL's operation.

Customer and End-user	
Volume	
Realisation	

CFL (Luxembourgian Railways)	
67 Cab Radios MESA24B-R2 and MMIS	
2008 - 2010	

The project contains delivery and installation of the cab radio and its accessories. On-site service is handed over to a local partner.

Train Radio System - MESA 23

Germany - DB AG

Supply of Dual Mode train radio solution including analogue and digital radio modes. The analogue train radio module implements analogue modes, e.g. for Austria, Belgium, Czech Republic, France, Luxembourg, Netherlands and Switzerland.

	Nortel Networks Germany GmbH
	DB AG (German Railways)
	9.000 Cab Radios, 15.000 MMIS
	1999 - 2004

Customer	
End-user	
Volume	
Realisation	

Product Overview: GSM-R Boxes / Racks

Different mechanical configurations have been designed to fulfil different technical demands.

The different configurations are determined by:

- environmental conditions of installation temperature; protection grade etc.
- interfaces to the train MVB, RS422, UIC etc.
- applications: analogue voice radio; GSM-R voice radio; data services etc.



Turkey - TCDD

Supply of GSM-R Cab Radios. The MTRS 1+1 RSS is a special terminal variant designed for operation in the GSM-R network for train and shunting radio and data applications.

Partner
End-user
Volume
Realisation

Savronik
TCDD (Turkish Rail)
96 Cab Radios, MMIS
2014

Partner
End-user
Volume
Realisation

Huawei / Alstom
TCDD (Turkish Rail)
30 Cab Radios, MMIS
2014



Lithuania - LG

Funkwerk AG supplies devices from the MESA 23- family and supports with suitable service concerning engineering, installation and training.

A specific feature of this project is an especially developed strategy of the OTA*-software update. Funkwerks contribution for it is an adapted hardware and software to be able to guarantee the accordingly necessary backup ability. The management software and platform for the Remote update on the network side was developed by Funkwerk, too.

The GSM-R application is compliant to the EIRENE/MORANE specifications.

	Belam Riga
	LG (Lithuanian State Railways)
	650 MTRS1 BC and 700 MMIS
	2009 - 2010

*OTA

stands for Over-The-Air and indicated the transmission of parameters over the air interface (GSM-R) and is used at the moment for the actualisation of the SIM entries. In Lithuania the application software should be updated on this way.

Customer	
End-user	
Volume	
Realisation	



Spain - CAF

Supply of GSM-R Cab Radios. This is based on the type serie MESA 23.

	Construcciones y Auxiliar de Ferrocarriles (CAF), S.A.
	RENFE
	164 Cab Radios for 107 trains
	from 2008

Customer	
End-user	
Volume	
Realisation	

Netherlands - KPN

Supply of GSM-R Cab Radios.

Customer	
End-user	
Volume	
Realisation	

KPN	
Railion (Netherland)	
120 Cab Radios (single- and dual-mode)	
2005 - 2006	

Netherlands - Nedtrain

- 120 Cab Radios MESA 23 for type series „G2000“
- 60 Cab Radios MESA 23 for type series „Class 66“
- 60 Cab Radios MESA 23 for track laying machinery

Netherlands - Syntus

- 46 Cab Radios MESA 23 for type series „LINT“

Austria - ÖBB

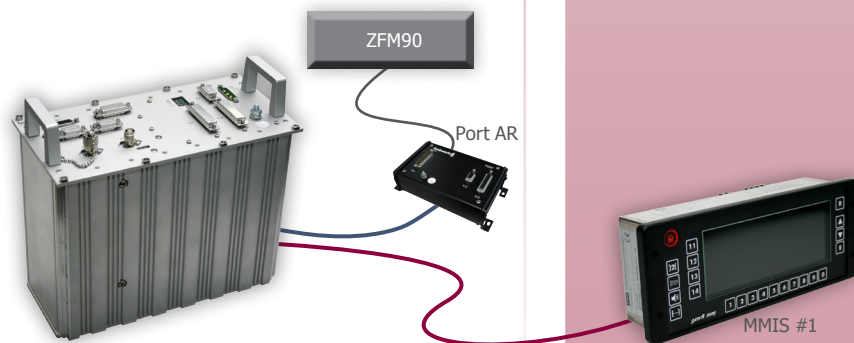
Supply of Dual Mode Cab Radios MESA 23 for retrofitting of several ÖBB train type series. According to the different type-specific train installation locations varied types of Funkwerk Cab Radios were installed. The GSM-R application is compliant to the EIRENE/MORANE specifications.

	ÖBB (Austrian Railways)
	222 Cab Radios, 424 MMIS
	2004 - 2006

That includes delivery of Dual Mode Cab Radios MESA 23, a specially developed solution to connect ZFM90 devices to the MESA 23 and appropriate services.

Additionally, by order of the ÖBB extra features and a customised user interface (on the MMIS) for the GSM-R mode was implemented.

	Supply for 595 vehicles
	2009 - 2012



Schematic: Connect the ZFM90 to the MESA 23 (MTRS1 BC)



Customer and End-user

Volume

Realisation

Volume

Realisation





Sweden

The Swedish solution implements GSM-R voice train radio according to MORANE specifications.

Customer	
Volume	
Realisation	

Alstom and Bombardier	
235 Cab Radios	
2004 - 2006	



Sweden - Green Cargo | SJ | SL

Green Cargo as the biggest freight operator in Scandinavia has decided to order Funkwerk's technology, too. It contains delivery and installation of the **GSM-R Cab Radio MESA 23 GTM+ including appropriate services.**

The GSM-R application is compliant to the EIRENE/MORANE specifications.

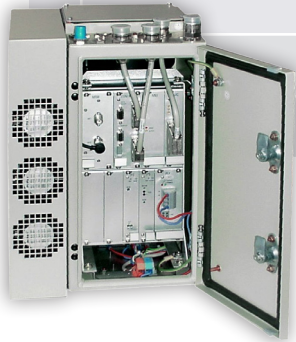
Customer	
Volume	
Realisation	

Green Cargo AB	
536 units GTM+, 231 MMIS	
2006 - 2007	



Norway - CargoNet

Supply of GSM-R Cab Radios.



CargoNet

143 Cab Radios

2005 - 2007

Morocco - ONCF

Supply of GSM-R Cab Radios basing on the already successfully integrated and reliable Cab Radios of Funkwerk.

ONCF (Office National des Chemins de Fer)

78 Cab Radios

2008 - 2010

In additionally, two complete sets of measurement equipment were assembled into ONCF special test-train for service and maintenance of the radio network.





Customer
End-user
Volume
Realisation

Saudi Arabia - Space Top Co. Ltd

Funkwerk AG and Space Top Co. Ltd equipping almost the total vehicle fleet of the SRO with GSM-R Cab radios and all essential accessories. The project contains, in addition, all services like engineering, training, installation and service.

Space Top Co. Ltd
SRO (Saudi Railway Organization)
71 MESA 23 BC and MMIS
2010

Algeria

Supply of GSM-R Cab Radios basing on the already successfully integrated and reliable type series MESA 23. The GSM-R application is compliant to the EIRENE/MORANE specifications.

Customer
End-user
Volume
Realisation

Kapsch Carrier Com
Anesrif
70 Cab Radios
2009 - 2010



Handheld

Austria - ÖBB



ÖBB (Austrian Railways)

2.000 devices (railfocX®) inclusive accessories

2011 - 2016

Germany - Local railway's

DB

99 devices (25 railfocX®; 47 shuntfocX®; 27 dualfocX®S)

2012 - 2014

Austria - Local railway's

Austrian local railway and service provider

approx. 200 devices (railfocX®; dualfocX®S)

2012 - 2014

Germany - Cranes (special solution)

DB Netz emergency technology

4 devices (dualfocX®)

2014



Source: Kranunion

Customer and End-user	
Volume	
Realisation	
Customer and End-user	
Volume	
Realisation	
Customer and End-user	
Volume	
Realisation	
Customer and End-user	
Volume	
Realisation	

Norway

Flytoget AS Norway

40 devices (railfocX®)

2014



Denmark

Eitel Networks Denmark

101 devices (68 railfocX®; 33 shuntfocX®)

2013-2014

DSB Denmark

248 devices (129 railfocX®; 119 shuntfocX®)

2014

England - Network Rail

Hima-Sella Ltd. UK (Network Rail)

555 devices (railfocX®)

Jan. 2013 - Dez. 2014

Vietnam

Aricent Group Vietnam

26 devices (railfocX®)

2012

Customer and End-user

Volume

Realisation

Customer and End-user

Volume

Realisation

Customer and End-user

Volume

Realisation

Customer and End-user

Volume

Realisation

Customer and End-user

Volume

Realisation

Portugal

	Refer Telekom Portugal	
	10 devices (railfocX®)	
		2012 - 2013

Czech Republic

	Kapsch Carrier Com Prague	
	72 devices (70 railfocX®; 2 shuntfocX®)	
		2012 - 2013

Finland

	Corenet Ltd. Finland	
	28 devices (24 railfocX®; 2 dualfocX®S)	
		2011 - 2013

Morocco

	ONCF	
	30 devices (dualfocX®S)	
		2012



Customer and End-user	
Volume	
Realisation	

Customer and End-user	
Volume	
Realisation	

Customer and End-user	
Volume	
Realisation	

Customer and End-user	
Volume	
Realisation	

Data Radio Device

China

Supply of Data Radio Device for CTCS use.

Customer
End-user
Volume
Realisation

Beijing Great Harvest Technology Co., Ltd (BGHT)
China Railway
> 2000 devices
since 2010



Train Manufacturer

Bombardier:

- Type Series „TALENT“
- Motor Coaches for CFL
- Type Series M6 for SNCB
- RIU-ETCS and GSM-R Voice Cab Radios for RENFE
- TRAXX-Plattform

Siemens:

- Type Series 2016 for ÖBB
- Type Series 642 for ÖBB
- Type Series U4 for ÖBB
- Type Series Railjet for ÖBB
- Type Series RABe 514 for SBB
- ZFM04 for ÖBB
- GSM-R modules for NS Reiziger

Stadler:

- Regional Transport Mittelland (CH)
- Type Series „FLIRT“
- Type Series „TILO“
- GTW for Arriva
- GTW for Veolia
- JK OY (Finland)

Voith Turbo:

- Project „Maxima“
- Project „Gravita 10 BB“

Vossloh Spanien:

- Type Series „EURO4000“



Further Operators

Alstom:

- X60, X61 for Sweden
- LINT DIESEL-NETZ OST-WEST for DB AG
- Coradia Lint for LNVG
- Coradia Lint for Netinera

Further Operators

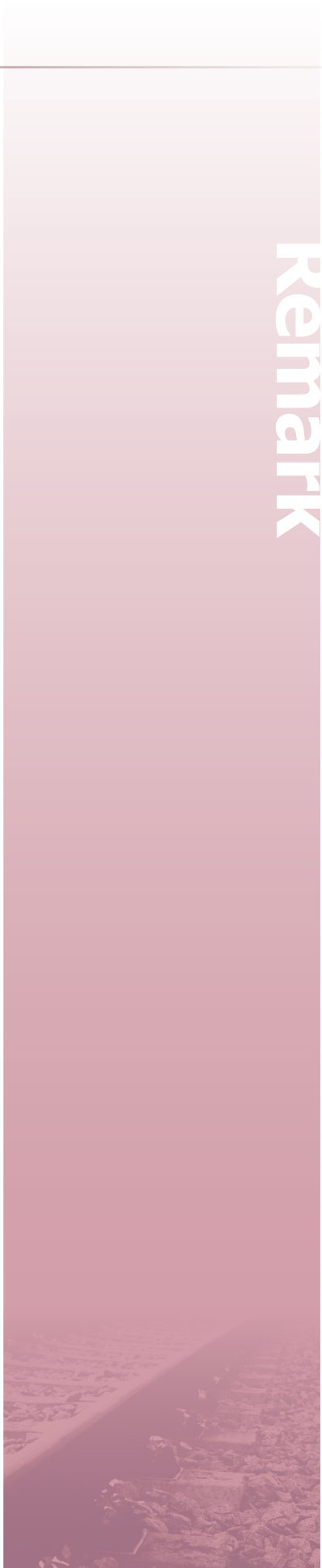
- Arriva (Type Series "FLIRT")
- Bayerische Oberlandbahn BOB
- BLS AG: Private railway "Lötschberger" in Switzerland
- Butzbach-Licher Eisenbahn AG (Hessischen Landesbahn GmbH - HLB)
- Connexion (Type Series "PROTOS")
- Karelian Trains (Finland)
- SBB: Löschrettungszug Windhoff LRZ08
- Serbia: Serbian Railways "Železnice Srbije"
- TCDD: Türkiye Cumhuriyeti Devlet Demiryolları
- ZSSK Cargo (Slovakia) (Type Series 240 of Skoda)

Notice



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Remark



Funkwerk is oriented to the rapid development of communications, information, and security needs of transport companies, industrial companies and institutions.

Funkwerk has been a specialist in the communications systems field of business for many years and is market leader in the segment of GSM-R train radio terminals (Cab Radios).

By integrating pioneering technologies taking into account state of the art standards, Funkwerk creates integrated systems which even satisfy future expectations through their modularity.



System Solutions for Communications Technology

Success based on innovation

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