

► EDITORIAL



Klaus Konrad
GSM-R Project
Manager.

Dear Readers,

We were very impressed by the big interest in our first edition of the GSM-R focus.

This proves that information

about the progress of GSM-R implementation needs to be circulated to show people that GSM-R is making good progress and on a number of railways already in full operation. The figures that were presented at the ERTMS world conference in Bern this year and on the next pages shows that GSM-R is now a proven system, taken into account all over Europe.

The successful interconnection of several GSM-R networks in Europe already enables interoperable traffic across borders. With these interconnections the pre-conditions for a new digital European railway network are established. Any new interconnection enlarges this

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➔ GSM-R STARTS TO TAKE OVER

Dan Mandac,
GSM-R & Telecom Charge de Mission

2007 is an important year for GSM-R: at the beginning of 2007 Europe saw the first railway administration completely migrated to GSM-R – Netherlands (3000 km) 1st of January 2007, the old analogue radio network, TELERAIL, was switched off. And that is not all.

4 more administrations will be migrated by the end of 2007: Norway (3000 km), Sweden (8500 km), and another 2 will have completed first step migration: Germany (24000 km) and Italy (7500 km).

Norway has finished deploying the GSM-R network, at the end of 2007 they will migrate to the new system; Sweden has finalized their Step1 (8500 km) in 2003, having a mixture GSM-R / NMT450; they are now in tender for the remaining low density traffic lines (1500 km); at the end of 2007 they will completely migrate to GSM-R; Germany will have finalized Step 1 in Q4 2007, that means around 24000 km; they are preparing the documents for tendering Step 2, which means 5000 km more; Step 1 for Italy means 7500 km of Conventional Lines and 110 km for HSL; Conventional Lines will be ready before the end of 2007.

Meanwhile, as shown on the map, certain railway administrations are in the full implementation stage, such as: Austria, Belgium,

Greece, Finland, France, Spain, Switzerland and UK.

Czech Republic has awarded the first project following the pilot in June and intends to finalize the construction phase by the end of 2009.

Denmark has awarded the radio planning, it is in progress.

Bulgaria has awarded the 50 km ETMS pilot, with GSM-R component

Hungary is in the tendering process; Croatia, Lithuania, Poland, Romania, Slovenia are preparing for tender.

In Europe, where the total railway network taken into account is 221025 km, GSM-R coverage is planned for 149673 km (as shown in Table1). In other words 67.7 %

On 1st September 2007 the network comprised 60507 km equipped with GSM-R infrastructure, of which 40918 is in operation! *continuing on page 3* ►►



► EDITORIAL

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network. Linking this digital network with the national fixed railway networks allows the creation of a new basis of fixed and mobile railway telecom networks as the future backbone telecom network for railways.
In this edition you will find information on the implementation in Germany and Norway, on the new world record for railways in France and the additional measurements with GSM-R at high speed at more than 500 km/h during this world record run. This was the first time that the mandatory requirement to run with GSM-R up to 500 km/h could be tested under real conditions. Another important issue is the work on defining the way from



GSM-R networks have been performed, the results are under investigation. A first analysis shows that availability and reliability can be achieved. The measurements will soon be

repeated, the test-conditions and the test-plan will be worked out together with RFI. Next year's work will be to standardise together with ETCS the parameters for this new bearer-service and to introduce this in the EIRENE specifications.

There are not only positive aspects relating to GSM-R, we also have to face interference from parts outside the GSM-R world. These are mainly issues arising from public operators when starting to introduce also UMTS in the 900 MHz band and new developments, like Multi Carrier Power Amplifier (MCPA). This means we have to protect GSM-R as far as possible

against this impact from outside. Frequency issues arising already in some countries need our full attention and the request for additional frequencies close to the GSM-R band is essential. You might see that with growing implementation also the problems are growing and that we are still in the middle of the process. Work on GSM-R will be a long-term process and do not forget, we must start thinking about the next generation now. It is interesting to observe that with the positive experiences in Europe are resulting in ever more requests from from outside Europe for help with launching implementations. Not only have the Asian area, also Africa, North and South America and Australia now indicated their willingness to introduce GSM-R as the communication system for railways. I hope that you will find this edition interesting and we intend to continue the work to keep you informed about the progress of GSM-R. ■

Klaus Konrad
GSM-R Project Manager.



CSD towards TC/IP as a bearer service for ETCS and other non-safety-related applications. GPRS seems at the moment the best suitable solution, but the way towards more advanced solutions shall be open. First measurements about the QoS with GPRS in operating

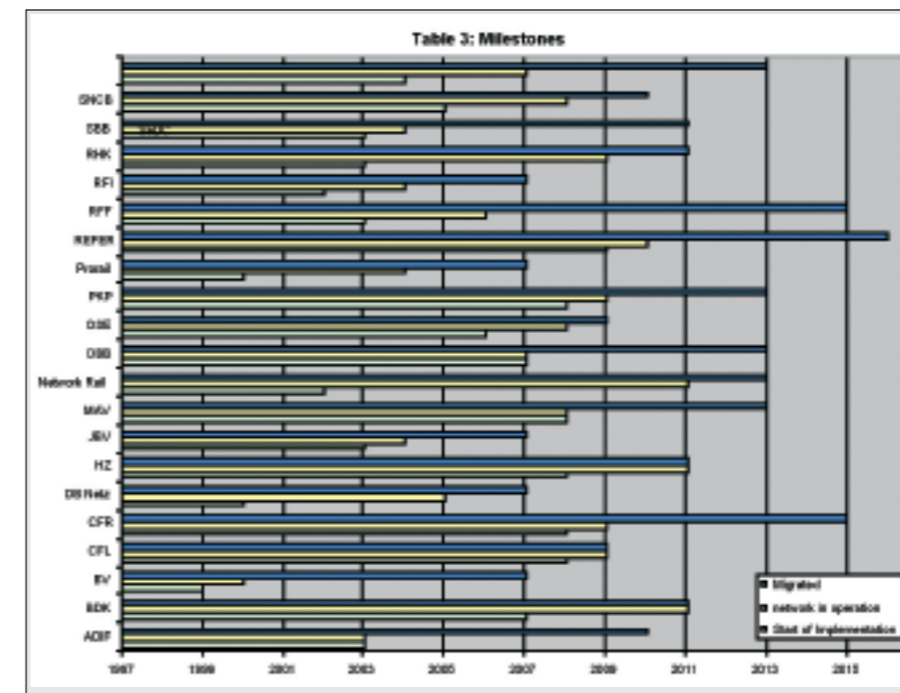
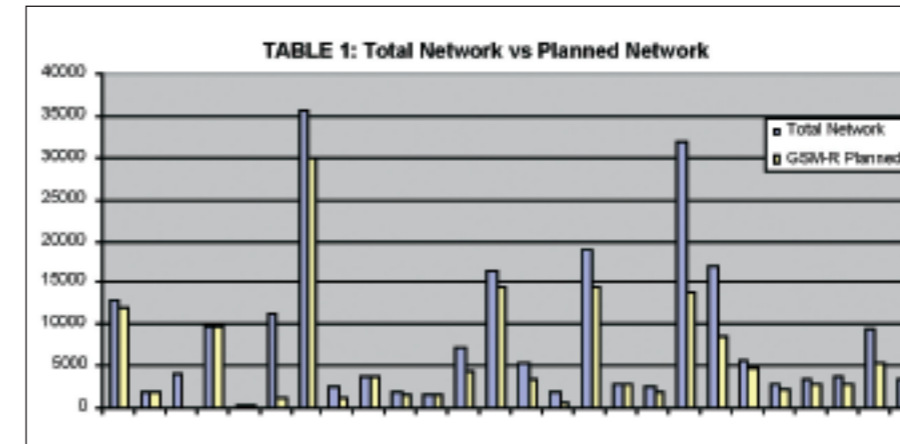
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That means that 27% of the network planned to be covered with GSM-R is in operation.

timetable (based on the national implementation plans),.

At the end of 2007, as mentioned earlier, Europe will have 5 administrations migrated; which means 47700 km.

Table 3 shows the GSM-R implementation



By 2013 most of the administrations will have migrated. An administration is migrated when the only radio system on the network is GSM-R.

The timetable for some administrations are missing from this plan, such as Bulgaria, Estonia, Leetonia, Luxembourg, Slovakia, Serbia, Montenegro, Bosnia-Herzegovina, Albania. We expect 50% of the GSM-R planned network in Europe to be operational by the end of 2011.

As for coverage of the European Corridors, the current situation is shown below, as well as the prognosis for 2010.

For the mobile users part, of the 384.700 users planned so far (for all European projects), 114876 are activated, which means almost 30 %. Of these, 17287 are activated cab Radios.

Network figures at 1st September 2007: We can say now that GSM-R is well on its way.

Work remains to be done on specifications, technological improvement and at operational level, but tests have shown a robust system, which is interoperable, works well, is equipped to meet the requirements of ETCS and at the same time enables seamless communications. ■

GSM-R Relevant Figures for Europe, 01.10.2007

Infrastructure :	
Total Railway Network	221 025 km
Planned with GSM-R	149 673 km
Network Constructed	60 507 km
Network in operation	40 918 km
Mobile Users :	
Planned	384 700 km
Activated	114 876 km
Installed Cab Radios	17 927 km

67,7 % of the Railway Network is planned to be covered with GSM-R
Constructed Network : **40,4 %**
Network in operation : **27 %**
Mobile Users Activated : **30 %**

➔ GSM-R FREQUENCY MANAGEMENT

Packet Switching Mode for ETCS and other data applications

GSM-R is by definition a mobile communication system, therefore its main asset is the frequency spectrum. Frequency spectrum is a limited natural resource, consequently a dedicated bandwidth for railways is vital, due to extremely large needs in all domains, to use radio communications.

In 1995, after long discussions and negotiations, CEPT (Comité Européen de Postes et Télécommunications) recommended the use of a special range of frequencies in the 900 MHz band for railway purposes only. The so-called UIC frequency band was specified as 876-880 MHz and 921-925 MHz.



In 2000, the European Radio Communication Committee (ERC), further to GSM-R Memorandum of Understanding (signed by 32 Railway administrations in 1997), the GSM-R Accord of Implementation (signed by 16 railway administrations in 2000) and the success of EIRENE and MORANE programs, accepted the importance of the **European designation of a frequency spectrum for the UIC railway traffic control system** and agreed to supersede the ERC Recommendation TR25-09 "CEPT/ERC Designation of frequencies in the 900 MHz band for railway purposes" with ECC Decision ECC (02) 05 of 5 July 2002, "The designation and availability of frequency bands for railway purposes in the 876-880 MHz and 921-925 MHz bands".

Since 2002, the reserved bandwidth for GSM-R has been part of the TSI for HSL (2002/731/EC) and since 2004 part of TSI for Conventional Lines (2004/447/EC) - Interoperability Directives which provide the legal basis to be converted into national law by each EU Member State.

Dan Mandoc, IUC - Hans Bier, DB Netz

It has been proved that due to very high requirements for ERTMS, GSM-R should have a dedicated bandwidth, to minimize the possible interferences.

Studies have revealed that after 2012, when ETCS level 2 should be in full swing, in some so-called bottlenecks there will be a lack of capacity, due to very high needs. Such bottlenecks would be big hubs, like Clapham Junction, Frankfurt, Paris Nord, Mannheim.

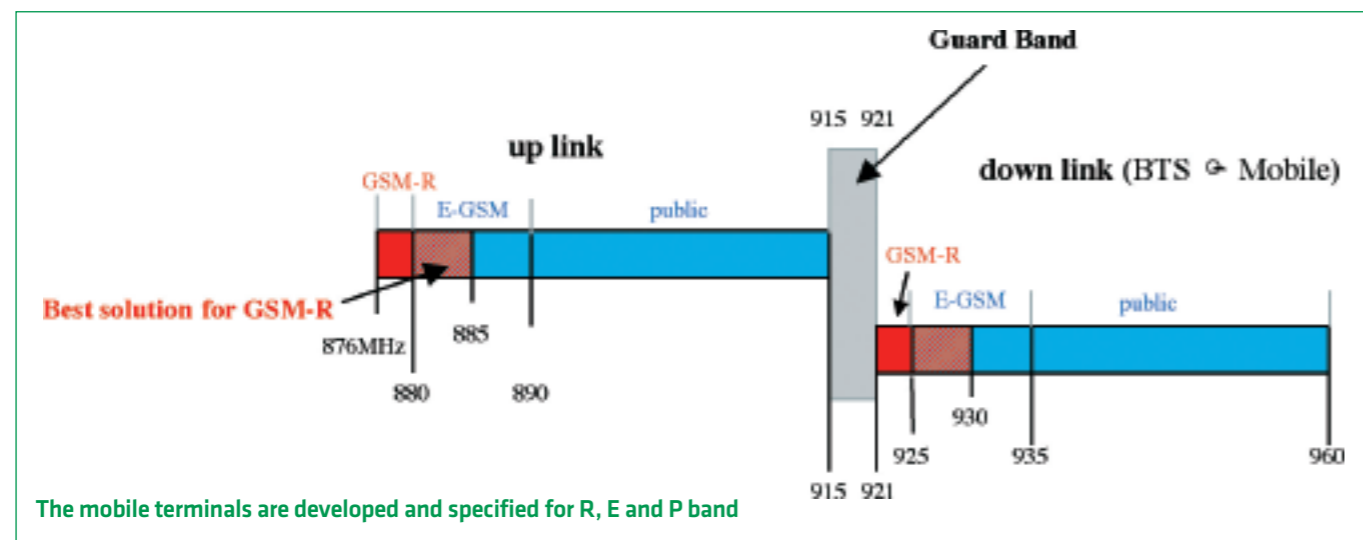
Investigation has started on 2 levels:

1. Obtaining additional frequencies.
2. Searching for technology solutions or changing Operational Rules.

From the frequency point of view, GSM-R has, as mentioned, a 4 MHz full duplex band; which means 19 frequency carriers, each of them having 8 timeslots; of those, two 2 timeslots are reserved for signalling messages.

The most discussed solutions for the predicted lack of capacity are listed below :

- Alternative planning concept
- AMR - Half Rate
- Uplink request
- Direct Mode
- National Roaming
- Extension of license for existing analogue frequencies
- National Roaming
- Other frequency bands
- Packet switching mode



The mobile terminals are developed and specified for R, E and P band



Direct Mode

Direct mode is a "Walkie - Talkie" functionality, where the infrastructure will not be used, except for a timer, which will indicate the time allowance for this feature/terminal; it is in the specification process in ETSI, it will be usable in maintenance activities and shunting; it is foreseen for 2008, predicted improvement in frequency usage: 10%.

National Roaming

Some ASCII features are available, emergency call seems to be critical; at the moment it is possible only in restricted areas.

Other frequency bands

The other potential frequency bands are close to the UIC bandwidth - i.e. in the trunk band which is right below the GSM-R band or E-GSM band (E=Extended) which is directly above. Another possibility discussed is to have a bandwidth allocated in 1800 MHz band.

Alternative planning concept

Planning with other cell sizes and additional network elements can be a key factor for traffic control, items in discussions are umbrella cells, micro cells and use of repeaters; the status is in discussion, availability is foreseen in 2008, predicted improvement in frequency usage: 10 %, general usage.

AMR Halfrate

AMR supports speech and group calls, but it is not specified for data; it is not yet specified at ETSI level for GSM-R; all terminals using this feature have to be modified, it is foreseen for 2009, predicted improvement in frequency usage: 30%; will be used mostly in shunting;

Uplink request

Guarantees that only those group areas where the needed subscriber is available are active; it is foreseen for 2009, predicted improvement in frequency usage: 30%; will be used mostly in shunting;



Trunk band is suitable for GSM-R communications, but mobiles and fixed transceivers do not work in this frequency area, therefore has to undergo a frequency shifting, which seems to be extremely costly, especially in case of a network which is already implemented; therefore the usage of this bandwidth cannot be a first step in interoperable applications, such as train radio, it will mostly be suitable for local applications, such as maintenance or shunting.

Regarding the possible usage of the 1800 MHz band, at the UIC Frequency workshop held in Paris on 25th of July, the IG representatives accepted the task of studying such an alternative, to see the impact on the network.

The best solution would be to obtain a harmonized frequency bandwidth in the E-GSM area, but due to the increase in Public Operators requests, it appears extremely difficult to obtain.

UIC launched a Memorandum of Understanding to all ERIG (European Radio Implementation Group) railways in September 2005, where this request was clearly stated. This MoU has still only been signed by 14 railways. All others appear to be less concerned, either because they do not anticipate a lack of frequencies in the coming years due to their network structure or they intend to use only limited services.



Packet Switching Mode

There are two methods for data transmission mode at GSM level: circuit switching mode (CSD), and packet switching mode.

We are using now the CSD mode for ETCS application, due to the current GSM-R development stage and the applicable TSI specifications.

This method is proven to be robust for ETCS quality of service constraints, but it is extremely wasteful in terms of frequency bandwidth resources.

The solution would be to find a packet switching solution, which will use the network only for the duration of the MA transmitting, plus call set-up time, but has to be robust enough to fulfill ETCS constraints, and also, at least in first stage, have backward compatibility with CSD, so that trains using the 2 modes to be able to operate in both modes.

The most appropriate solution at this moment seems to be GPRS, since in principle GPRS is GSM native; most of the administrations have implemented GPRS, like: Italy, Netherlands, Belgium, Switzerland, Sweden, Norway; it appears to be working well but it is not used yet in operational applications.



After a 2 years' work, UIC has produced the White Paper – GPRS for ERTMS, explaining the benefits of the change and proposing a timetable for the implementation.

This was the source of a change request in the TSI, which is now pending introduction in the 3.0.0 basket or to be introduced in a next variant of 3.0.0. The change request is not specifically about GPRS, but about any packet switching solution which is proven to be robust enough for ETCS constraints.

Recently some administrations had GPRS QoS test campaigns, for example Italy and Sweden.

Italy had a test campaign with both network suppliers, in the condition of large

packets (4 Mbits) and the results were encouraging.

This is why UIC has proposed common tests to RFI to take place in the near future which aim to prove that GPRS can be a solution for ETCS, in the context of capacity problems.

A further issue is interference management.

Due to the increase in the public operator business, and the predicted migration to UMTS in the E-GSM band, there are ever more sources of interference with predictable blocking results.

One of the most important threats was the intention of the PD's to promote UMTS 900, using report 96 at the ECC level.

In a dedicated workshop in Mainz a team made up of railway representatives and UIC managed to introduce railway concerns and point of view, taking the decisions from the European level to national level.

A new threat is now MCPA (Multi Carrier Power Amplifiers), which is a new, extremely high-performance transceiver, but for it to function well the specifications need to be

relaxed. At this moment we are in the monitoring/warning phase on this matter.

Other threats will appear.

In order to prevent this, a major task is work on harmonized blocking conditions, which have to be included in the specifications, and one of the most important events will be the real life test in Nokia lab, performed together with RHK, in which all cab radio manufacturers have been invited to participate. ■



➤ GSM-R ON THE EE HIGH SPEED LINE Rémi Bévot, SNCF Engineering, GSM-R project Director - Pierre Messulam, SNCF, ERTMS Strategy

1. The EE High Speed Line

On the 10th of June 2007, commercial operations of the Eastern European High Speed Line (EE HSL) have been launched. This was the result of many years of efforts targeting the development of high speed railway from Paris towards Germany and eastern Europe.

With a length of 300 kilometers and commercial operations at 320 km/h, the EE HSL, at its current stage brings significant reductions of trip durations between Paris and many cities such as



Reims, Metz, Nancy in France, Luxemburg, Francfort, Ulm, München in Germany.

This project has included many innovations in different areas such as the platform, civil works and GSM-R coverage and test plans have been designed in order to validate operations at a speed of 360 km/h. In addition, a specific sub-project named V150 has been designed, co-managed by RFF, SNCF and Alstom, the objective of which was to set a new railway speed world record, objective which was fulfilled on the third of April 2007, with a train that achieved the incredible speed of 574,8 km/h !

In the context of this event, and beyond the world record itself, the V150 team has accomplished the following achievements in a pretty short period of time:

- More than 700 km performed at a speed higher than 500 km/h,
- More than 2200 km performed at a speed higher than 400 km/h.

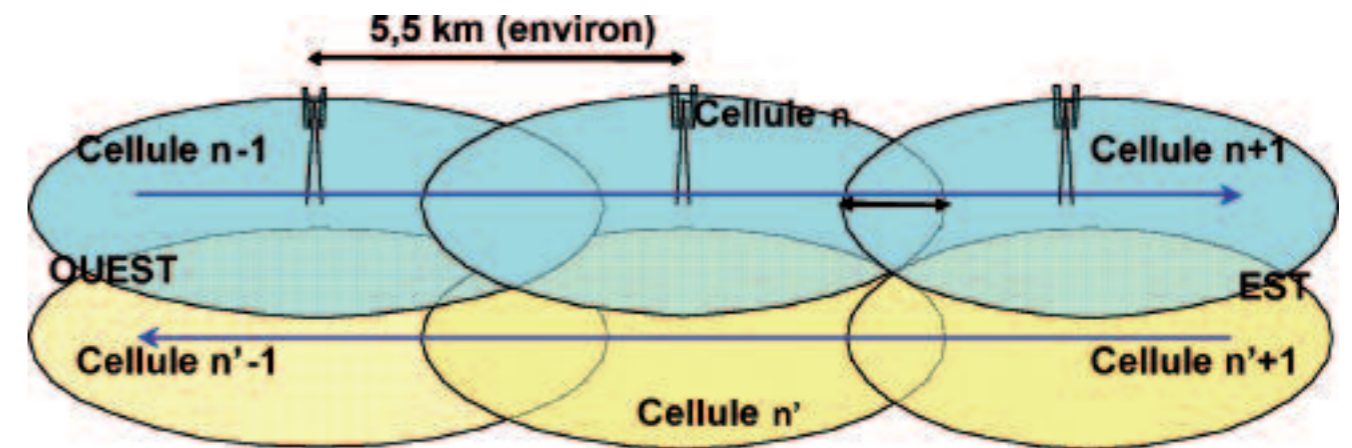
2. GSM-R on the EE HSL

This V150 project was obviously a tremendous opportunity for many technical teams to perform some unique experiments. This has been the case for the engineering team responsible for GSM-R radio design and implementation.

Before delivering some of the results that were gathered through high speed testing, let us describe quickly the GSM-R radio network architecture, which is quite innovative. GSM-R technology was implemented on the EE HSL line in order to provide :

- Ground to Train Radio services for drivers and dispatchers,
- Radio transmission for the ETCS signalling application

To meet the radio service availability requirements specified by ETCS, the project team decided to implement two layers of GSM-R radio coverage, as shown in the diagram below.



All cells belonging to the same layer are linked in a secure manner to one BSC, all cells belonging to the other layer are linked in a secure manner to another BSC.

The different BSC/TCUs are linked in a secure manner to one single MSC which is supposed to be very reliable and have a high level of availability.

Such an architecture is quite efficient, although not easy to validate and tune: the lack of GSM-R frequencies and the proximity of conventional lines also equipped with GSM-R caused some difficulties which had to be overcome.

It must be added that GSM-R radio coverage is extremely good on the EE HSL : some important margins have been defined and agreed very early on in the project, due to the fact that this line was the first in France on which ERTMS would be implemented and tested.

3. GSM-R at very high speed

Key to the V150 project was a train dedicated to very high speeds and including a car in which it was possible to install antennas

and GSM-R CAB Radio surrounded by appropriate test tools.

These experiments were performed with the RFF GSM-R infrastructure of the EE HSL and with the SNCF Cab Radio.

GSM-R calls were possible up to the record speed, which means that the technology was able to cope with the impacts of distortion due to the Doppler effect induced by speed and with the high frequency of handovers.

To sum up the results :

- Voice quality is quite acceptable up to 500 km/h. It must be noted that our experiments were performed with normal GSM-R technology, that is without customised parameters nor dedicated development: old non-AMR GSM vocoders, BTS radio Transmitters not including latest signal processing improvements.
- Data uplink quality at a bit rate of 4800 bps is good up to 350 km/h.
- Data downlink quality at a bit rate of 4800 bps is good up to 450 km/h

4. Conclusion

These results demonstrate that the engineering choices made for the EE HSL project are viable, not only at the speed of 320 km/h for commercial operations but also at speeds significantly higher.

The information gathered when performing data calls leads us to be confident that the GSM-R quality of service observed along the line should meet the requirements of the ETCS project. The system tests that will be performed during the coming months should confirm this assessment.

These results helped us to get a better understanding of the GSM-R system behaviour under extreme conditions, for both infrastructure and mobile sides. In the future, RFF and SNCF will be in a better position to:

- develop efficient engineering rules for upcoming High Speed Lines, and especially for those equipped with ERTMS technology,
- cooperate with suppliers in order to improve the technology towards additional performance. ■



➤ GSM-R AND THE FIXED NETWORK

Klaus Konrad, GSM-R Project Manager

The aim of the project is to maintain and update the existing specifications and standardizations for GSM-R.

The objective is to support new and ongoing implementations, gathering information about gaps and inconsistencies in the specifications while also taking into account upcoming requests for improvement and new requirements.

The project aims also to be the technical expert group for ERA, CER and EIM for handling the functional and technical content of change requests to the system. It is also the interface between the railways and other standardization organizations, such as ETSI, CENELEC and JPC Rail.

The **ERIG** platform group's activity for 2007 was carried out as scheduled, with good results.

The **ERIG** group had 3 meetings, each of them with more than 29 participants, and was an excellent information exchange platform and advisory board and the forum where the related permanent working groups presented their reports.

FG (GSM-R Functional Group) had 3 meetings, where items such as Overlapping Group Call Areas, Shunting FRS, Juridical Recorder, High Priority Call, Border Crossing, Enhanced Railway Emergency Calls, Driver Training, DSD

As for the Timetable for 8/16 the following dates are proposed:

FG final approval, functional benefits assessed	Q 1 2008
OG final approval, operational benefits and costs assessed	Q 1 2008
IG final approval, generic costs assessed	Q 2 2008
ERIG final approval	Q 2 2008
CR submittance to ERA for early Cost Benefit Analysis (CBA) work	
CER and EIM approval and submit CRs into ERA CCM process	Autumn 2008
ERA CG starts CR assessments	Autumn 2008
ERA CG approval	Autumn 2008
ERA CCB approval	Autumn 2008
Article 21 Committee approval	Autumn 2008

Alarm, Explicit Call Transfer, EDOR, etc. were discussed and decided upon.

OG (GSM-R Operators Group) also had 3 scheduled meetings, where items like Cell Reselection, Shunting FRS, Late Entry, Cab radios with 2 MMI's, NCH Repetition period, High priority Calls, eREC, eLDA,

Overlapping Emergency Calls Areas, QoS, IOT, Common OPH & GPH & Cab Radios Test Cases, International Numbering and Addressing, FFFIS for SIM Cards, SMS, Awakening Dispatcher, etc. have been discussed, and decided upon.

The timetable for EIRENE 8/16 was pre-planned; also the content.

The new content in 8/16:

- Improved "All Drivers in the Area" functionality (Late Entry)
- Improved Shunting, which also might include Improved cell reselection mecha-



nism in Group Calls

- Dispatcher Silent Joining in Group Calls
- Alerting Dispatcher involved in Group Call
- Improved Border Crossing functionality
- enhanced Railway Emergency Call eREC
- Subset 093 QoS requirements for ETCS
- O-2475; O-2875

Following the UIC International ERTMS Conference held in Berne, an action was launched to reconsider the options in EIRENE 7/15, i.e. every option will be evaluated, with the aim of reaching a clear decision either to keep it or not, taking into account the impact on the system, the costs, the global need and also the constraints related to interoperability; action which will be coordinated by ERA.

Also another task is to finalize the GSM-R Version Management and to include this proposal into the TSI.

This task is linked to an action to define the pre-conditions for a European test laboratory to facilitate the process of certification of products and software releases. ■



➤ GSM-R WORLD WIDE STATUS & POTENTIAL

Ola Bergman, GSM-R IG Speaker

Upon UIC initiative Railway Companies from 24 countries and Eurotunnel signed up for GSM-R in June 1997 in the EIRENE Memorandum of Understanding. During the ten years since then around 25 further countries have demonstrated their commitment to introduce GSM-R - this adds up to 50! All these together operate more than 200.000 km railway! They operate more than 100.000 locomotives and employ more than 3 million people! These figures show both the growing world wide interest for GSM-R and the potential of GSM-R market. And it's very likely that we will see these figures grow even more in the future. Obviously UIC took a very wise decision to go for GSM-R back in 1997! Around half of the 50 countries committed to GSM-R are in different states of GSM-R implementation. And five of them are using GSM-R in operation! One of these five, namely Netherlands, fully migrated to GSM-R at the beginning of 2007. There GSM-R is THE ONLY RADIO SYSTEM since almost a year. And GSM-R has proved itself during this time! When the old analogue radio system was switched off on 1st January 2007 the digital GSM-R system took over without any interruptions or disturbances. This positive trend has been maintained since then to the satisfaction of the infrastructure owner, the GSM-R Operator and GSM-R users and passengers and freight companies continue to benefit from 1st class train service.



GSM-R Data Netherlands

3100 km in operation (100 % of planned total)

All 2.500 Engines fitted with GSM-R Cab radios

All EIRENE Mandatory Functions...

... plus many Options in operation!

Roaming with Germany, Belgium and France for border crossing trains ETCS L2 on HSL Amsterdam - Belgium and Freight line Rotterdam - Germany GSM-R Operation outsourced to KPN

At the end of 2007 Germany, Italy, Norway and Sweden will have joined Netherlands adding up to five countries in full GSM-R operation. This will continue with three further countries in 2008 followed by two more in 2009. In 2010 it is anticipated that 50% of the planned networks are fully migrated to GSM-R.

GSM-R Functional Evolution

GSM-R is a mature technology. Still there is room for improvement with respect to new functionality. Requirements for new GSM-R functionality are articulated as Change Requests to EIRENE. They are in the absolute majority of cases originated in one

of UIC bodies Functional Group, Operators Group or European Radio Implementers Group. Following discussions and agreement with GSM-R Industry they are channeled through the Community of European Railways represented by Mr. Klaus Konrad into the Change Control Management process of the European Railway Agency ERA for assessment and approval. Some changes may also require improvements of ETSI 3GPP specifications (ETSI:

European Telecommunications Standardisation Institute; 3GPP: 3rd Generation Partnership Project). These are prepared by a special committee TC-RT chaired by Mr. Robert Sarfati for final approval in the concerned 3GPP groups.

EIRENE is subdivided into two specifications, the Functional Requirements Specification FRS and the System Requirements Specifications SRS. UIC issued the first final versions 5/13 in December 2000. Version 6/14 was issued almost 3 years later in October 2003 followed by version 7/15 another 2 _ years later in May 2006. Version 8/16 planned to be issued by UIC in spring 2008.

UIC bodies are currently discussing the following additions to EIRENE 8/16:

1. Improved "All Drivers in the Area" functionality (Late Entry). This new function will improve the mechanism to reach all train drivers in a certain area - also when the train enters the area after the group call was set up
2. Improved shunting includes simpler operation and HMI redesign of the Shunting Radio. Improved cell reselection will reduce the voice interruption when the Shunting Radio is moving from one radio cell to



another (this applies for all group calls)

3. Silent Joining in Group Calls.

4. Dispatchers or Train Controllers may be involved in many simultaneous calls. This function will alert the Dispatcher to actively take part in the group call from which the alert was sent

5. Usage of the packet data service of GSM - GPRS - would increase the possible number of simultaneous ETCS L2 connections, i.e. more trains could be served. GPRS is a well established technology in service in many networks

6. ETCS Data Only Radio EDOR, there is a need to have a distinct specification for an on-board radio unit only used for ETCS data exchange with RBCs.

7. Current Quality of Service specifications - i.e. specifications for call set up times, data transmission quality and similar - are subject to amendments and clarifications

Further improvements in discussion are:

1. Improved Border Crossing will make the Train Border Crossing process smoother and quicker with a minimum of interruption

2. Enhanced Railway Emergency Call eREC. This new function will allow for a much more precise area selection for the broadcast of Railway Emergency Calls - it will e.g. be possible to select between the High Speed Line or the Conventional Line also when they are close together - running in parallel e.g. Today both lines are notified about an emergency taking place on only one of them.



GSM-R Platform Evolution

The platform for GSM-R must be both stable and flexible supporting investments protection but also allowing for new EIRENE functionality, new ETCS requirements and to be able to incorporate useful improvements from the public telecom market following relevant trends in the public sector.

The platform basically supports the following three application areas:

1. Platform for EIRENE Voice Services

2. Transmission Platform for ETCS Levels 2 and 3

3. Platform for miscellaneous optional data services (using circuit or packet switched data - GPRS)

The platform will improve and be available for the next decades with continuously improved price/performance while benefiting from public market developments. Harmonized operational rules would lessen the number of different implementations to support different operational needs and hence lead to reduced costs.

GSM-R Version Management

Work is presently ongoing to control the evolution of GSM-R

by a dedicated process GSM-R Version Management where the entire pan European GSM-R system is taken from one EIRENE level to the next. Long term GSM-R IG planning within of this concept estimates around three years between consecutive EIRENE versions on average. N-1 backwards compatibility is considered as the best option, since functional delta in installed base as small as possible and the number of required interoperability tests is minimum, hence cost saving.

(Explanation: Backwards compatibility means that an old version can technically coexist with a more recent version without any operational and other impacts. Backwards compatibility is required since an entire complex structure like the pan European GSM-R system cannot be upgraded from one version level to the next over night but it will rather take years. So e.g. a GSM-R Cab radio version N-1, must be able to operate in a network on level N. Or vice versa, a CAB radio already upgraded to level N must work correctly in a GSM-R network level N-1) Improved ERTMS/GSM-R Validation

One essential requirement on GSM-R is the validation of EIRENE End-to-End Functionality while preserving Interoperability:

- of interconnected GSM-R Networks
- of Network Elements in one Network
- of Terminals with Networks
- all supplied by different Vendors
- two concurrent EIRENE versions (N and N-1)



Until now a fragmented approach with Global Network IOT's and National (Field) Tests was applied. This approach certainly was so far successful - but it took a lot of time in many cases and it was not optimized.

Within the Scope of GSM-R Version Management there will be a structured validation approach with "full coverage" addressing all important interoperability aspects, network-network, mixed networks, terminal-network while preserving N-1 backwards compatibility.

This will improve quality and reduce costs. A permanent European Test Lab for GSM-R to perform the required validation tests is in discussion.

The GSM-R Industry Group

The GSM-R Industry Group, which was founded in 2000, aims at following and supporting the Railways at the forefront of GSM-R. The GSM-R Industry Group continuously adapts to the maturing GSM-R environment and is amending its MoU from year 2000. There will also be a new version of the home page www.gsm-rail.com available within short.

The new MoU and home page will reflect the current work of the GSM-R Industry Group to support and participate in the Change Control Management CCM process of ERA and to develop and implement GSM-R Version Management. Apart from this work in close cooperation with different UIC bodies continues as has been practiced since 2000.

GSM-R is a mature and widely used system:

- developing into a World standard
 - in successful operation
 - interoperable
 - stable but still open for improvement
 - future proof
- it's GSM-R! ■

➔ GSM-R SHUNTING: LATEST DEVELOPMENTS IN THE SPECIFICATION

Simon Wootton, Detica Ltd



This article focuses on the latest developments that have been made on the specification of GSM-R shunting and provides an overview of the proposed new shunting functionality.

It builds on the information that was provided by Klaus Konrad in the last issue of Focus, in which he explained the status of the GSM-R shunting specifications and talked about some of the challenges that have been faced in developing a system that can support the rules and regulations of different national railways. He also explained how an ad-hoc group of shunting experts had been set up to create a modified document to describe the functional requirements for a new Operational Shunting Radio (OPS).

This work of this ad-hoc group has now been completed and change requests to the EIRENE FRS and SRS have been raised. These change requests are currently under discussion between the working groups and GSM-R Industry.

The main proposed changes to the specification are as follows:

- Addition of a new section for the Operational Shunting Radio (OPS). The principle behind this is that the OPS will be based on the standard Operational Handheld Radio (OPH) with the addition of a number of extra features to support shunting.
- Improved specification for the OPS user interface.
- Removal of the need for members to reg-

ister to functional numbers.

Increased flexibility in the realisation of the link assurance signal functionality and the use of the push-to-talk (PTT) button. A number of parameters relating to these functions will be set according to national preferences by maintenance personnel, thus allowing a single piece of equipment to support diverse operational concepts in different countries

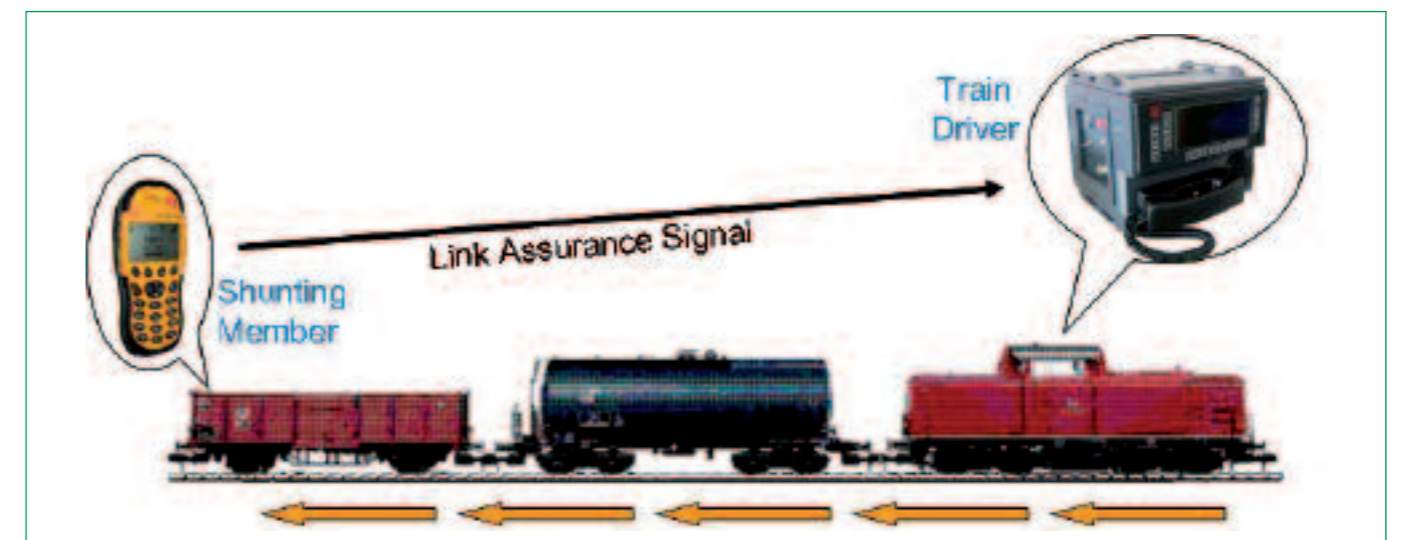
• Addition of point-to-point calls as well as group calls for shunting.

• Updated requirements on climatic conditions.

It is anticipated that these changes will be finalised with GSM-R Industry over the next weeks. The change requests will then be introduced via EIM and CER into the ERA Change Control process and incorporated into future releases of the EIRENE FRS and SRS.

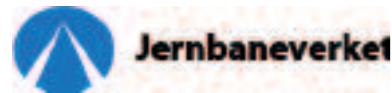
Once this process is complete, it will give rise to an improved shunting solution that can support the diverse rules, regulations and operational concepts that exist with respect to shunting in different national railways. It will also allow additional features to be integrated into the system to allow shunting operation to become more efficient, safer and more reliable (particularly under extreme environmental features).

This should help railways to benefit from economies of scale when purchasing their GSM-R mobile equipment without significantly compromising their preferred method of working. ■



NORWEGIAN NATIONAL RAILROAD ADMINISTRATION

Terje Steinsvik, Leader JBV Nett



Background

The idea of replacing existing radio and telephone systems in Norway with the emerging GSM-R technology goes back to the 90th.s. But it was actually the tragic train accident that happened in 1999 that led to the government decision to implement a GSM-R network in Norway. Commitment, scope and funding were agreed in 2002. The first priority was to field the GSM-R network along all Main Lines where no emergency communication system existed which encompassed approximately 40 percentages of the Main Lines in Norway. The second priority was to replace the old analogue radio communication system which has been in operations along the major part of the Norwegian rail network up to now. By the end of this year JBV (Norwegian National Rail Administration) has met the obligation with the GSM-R network as the sole and approved communication system for train traffic operations on all Main Lines in Norway.

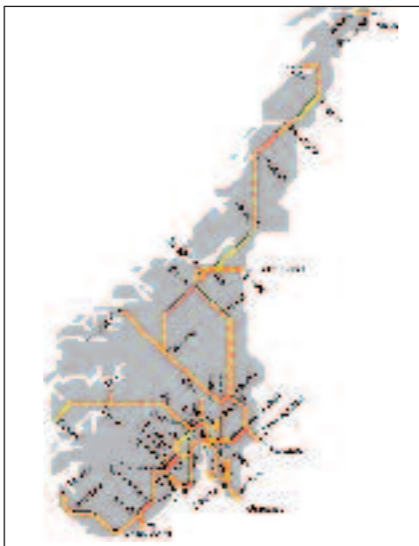
Milestones

2002 Invitation to tender
2004 Contract award
2003 First line in traffic
2006 Radio network completed
2007 Full functionality
(GSM-R applications)

1	MSC
5	BSC
520	BTS
600	Tunnels
3800km	GSM-R lines
1024	Cabradios
2500	Subscribers
25	Dispatchers

The way ahead

In parallel with activities for completion of building and implementation of the GSM-R network with fulfilling of the mandatory requirements, activities in the area of other rail related applications have commenced. The management decision to implement GPRS in our GSM-R network will boost the opportunities to utilize the network to the extent possible.



Lines with GSM-R

Another important decision taken is to implement ERTMS which relates well the implementation of GSM-R in Norway. The future integration between signalling and communication systems will pay the way for the future rail network in Europe, and Norway is definitely joining in by the huge investments in this area.

Number of network elements

Migration process

The NNRA's migration strategy has the security aspect as the main driver. This entails that the train operator and the train should have only one communications system to relate to at any given time. In other words just one communication system in use at any train line at the time. In consequence the GSM-R network had to be field and brought in to operation line by line for all rail lines equipped with the old analogue rail radio system (Scanet). This situation applies for 60 percents of the Norwegian rail lines. The Scanet radio system will cease operation by the end of 2007 (planned) and at that time all communication between rolling stock and train operators will be by usage of the GSM-R network.

In the transition period the train driver has to cope with two train radio systems in the driver cabin where only one can be used at a time. The challenge is increased with the fact that in most driver cabins the space in front of the driver is limited which in turn makes it necessary with a temporary installation of the GSM-R radio for a certain

period of time. The temporary installation is solved with the use of a handheld operational radio in a car kit with hands free, external- power and -antenna. NNRA has been granted time limited dispensation for this solution from the Norwegian Rail Authority. This temporary GSM-R measure will be in operation for a period of 8 months after the old train radio system (Scanet) has been switched off, to leave time for the train companies to get the installation of the mandatory cab radios executed and completed.

Despite the fact that the preferred migration strategy (the only way actually) has created some difficulties for the train companies they are unified in stating that the GSM-R network provides enhanced and added security and 100 percentages radio coverage which is a great improvement. Particularly travelling in the more remote areas of Norway where normal GSM coverage is sketchy or not in existence at all, radio availability is really appreciated.

The migration strategy also imposes a different way of operation for the train operators in a limited period of time. The train operator's consol has to be equipped with another radio terminal supporting the GSM-R network. Then the train operator has to deal with two different sets of proceedings and radio systems, pending the radio solution in use on a particular rail line subject to operation. This working situation will end as soon as the analogue system (Scanet) is deactivated.

Another challenge is that the old system provided position control while the new system only gives position indication. In order to comply with this requirement from the train operators physical signs had been put up along the rail lines for the purpose of identification of position if a signal should fail.

At a very early stage in the GSM-R project different communication forums were established, to assure exchange of views between all parties involved in the GSM-R. Some of the forum evolved into working group and working parties. Activities of this nature have been quite essential for the progress that has been achieved. Further



initiatives in the area of training and adequate information handling are also of significant importance.

We are now entering in to the last phase of the project after reached five critical milestones. In 2008 the Norwegian railway will operate with just one radio system - the GSM-R.

The challenge of a balanced focus

Building and rolling out GSM-R is approached by European rail administrations in different ways. Jernbaneverkets approach was to build and introduce GSM-R services at a high speed. The purpose was to quickly enable emergency communication between the train controllers and train drivers. In particular train lines without the ATC system or a train radio system in operation. In parallel the GSM-R operations centre was established, providing services like:

- Network surveillance
- Network operations and maintenance
- Field operations management
- Customer care
- Terminal management

The build up of Operations Centre Marienborg (OPM) started four months before opening the first (Section of Line) SOL. In the first stage all activities were project oriented, and initial focus was to get technical installations and systems up and running. When the first SOL opened on 15th

of May 2004, facilities and systems were in place, but no actual framework yet for operations.

OPM was established as a completely new organisation in Jernbaneverket. There were given no restrictions in defining an operational framework. Different kinds of best practices were looked into, and two major directions chosen:

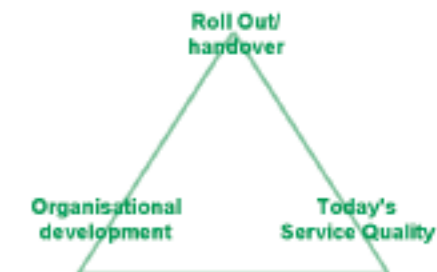
- ISMS - Information Security Management Standard, ISO/IEC 27001.
 - ITIL - IT Infrastructure Library, which has now developed into an international standard for IT Service Management, ISO/IEC 20000.
- The reasoning behind these choices is that operations need a management framework where recurring external revisions measure organisational development and compliance with international standards. In addition best practices frameworks enable benchmarking for cost benefit analyses.

Opening GSM-R services was a milestone for OPM. The challenge now was that the organisation was built on staff and competences, but needed operational structure. The conflict between focusing on fault management for improving the daily GSM-R service quality and putting effort in defining processes and procedures for operations, was present indeed. It is fair to say that this was one of the biggest management challenges so far. Was it as important to solve technical issues today as

to develop the organisation, enabling future economic and secure service provisioning?

The roll out continued consequently with new SOLs brought into service. Later in the roll out phase, Jernbaneverkets Telecom Department, which OPM is a part of, was to take over the ownership as well from the GSM-R Procurement Project. A more than fair share of resources from OPM were needed to fulfil these emerging tasks. Then the balanced focus issue occurred, namely to balance the focus between the three major tasks.

- Roll out/handover,
- Today's service quality, and
- Organisational development.



OPM experienced that the organisational development needed special treatment. This was because it was much easier for the staff to focus on those tasks giving immediate result, like fixing a technical problem. As well we experienced a silent resistance from the staff to enter into process orientation. It was not expressed verbally, rather stated through their performance. OPM overcame this challenge by motivating the staff for ISMS certification. By making ISO/IEC 27001 a common goal, the related work to describe processes and procedures became necessary, and progress here became visible. Through certification preparation, the organisational process maturity, and hence ITIL maturity, reached a higher level. OPM believes it is important to have a balanced focus, since the three major tasks will be present at any time. The task "Roll out/handover" may be replaced by the term "New services". It is most likely to happen that operations in general will increase the amount of services supported, since economies of scale implies such a decision. From its initial objective to operate GSM-R, the objective now is all rail related ICT solutions. New services will on a large scale be moved in to OPM's organisation



We also have entered interconnect agreements with some of the Norwegian public telecom operators. Our users have access to international calls, SMS services, receiving and voice calls outside and within the GSM-R network.

Our focus for the time being is to improve this service to a more professional level. One possible solution is to register Norwegian Rail as a public telecom operator with the Norwegian Telecom Regulatory Authorities.

The reason to do so is simply to get access to the regulated telecom market. It will improve our cost picture, in the sense that we then can demand the national regulated prices and conditions for Interconnection and Roaming.

and operational framework. To be able to succeed in such an environment, a balanced focus is necessary.

Strategic alliances

Very early in the process it was recognised that entering strategic alliances with the public mobile and fixed telecom operators, would be of great importance to manage the quick roll-out. The Norwegian Rail was also in the possession of some very attractive base station location which was of interest to the public mobile operators. During 2004 and 2005 we entered reciprocal site agreements with Telenor ASA, the former Norwegian telecom incumbent, both within the area of mobile, fixed and broadcast and with the second largest mobile operator, Netcom. All together we have in the range of more than 600 base stations; whereas 520 is GSM-R base stations and more than 80 wireless links base stations. In total we have just above 260 base stations rented through these partnerships. In addition is the two mobile operators sharing at more than 60 of the Norwegian Rail build and owned base stations. The agreements handle all aspects of delivery times, project responsibilities, sharing of infrastructure and cost sharing, rental prices, security, access management and all other aspects of responsibilities.

Regarding tunnels, we have more than 600 tunnels covered with GSM-R installations. Tunnels longer than 1000 meters, is fed

with signals from both sides of the tunnel. In addition all tunnel radio infrastructure is equipped and made ready both to handle the major GSM operators radio equipments as well as the new government run emergency Tetra network.

Regulatory affairs

We managed to get a national roaming agreement with Telenor Mobil in place quite early in the roll-out phase, which has given us the advantage to give our users coverage both outside our normal area of coverage and filling in gaps during the roll-out phase. In addition a international roaming agreement was entered with Banverket (Swedish Rail) and the Swedish GSM-R network.



We also benefit from this by taking part of the regulations regarding operating conditions and price regulations within the telecom market. As a very small telecom operator when it comes to generating volumes, we can benefit from this, short term as well as long term.

Cooperation

We work in close cooperation with the train companies, mainly NSB, to create a solution for both improving the public GSM coverage onboard the trains, as well as looking into the possibility to give public internet access onboard the trains by using some of our infrastructure that do not interfere or jeopardize train operation. ■

FS - RETE FERROVIARIA ITALIANA



The GSM-R world has changed in 2007 from implementation towards commercial operation and this will continue also in the next years. Starting from the implementing stage, where the system is under test, there will be a new status, of a working system, with more than 25% of the planned network in operation, with migrated administrations, where GSM-R remains as the only radio system.

Work on GSM-R is not finalized, upgraded features for better functionality and interoperability have to be developed.

In this context, an important event is the below presented workshop, where at the request of the ERTMS Platform, RFI was asked to give more details on the successful commercial opening of their new high-speed-lines with ETCS and GSM-R and the relevant IOT-testing.

“State of the art of the GSM-R use in ERTMS/ETCS application”

Rome, 21st November 2007

The use of radio transmission, based on GSM-R, in the most advanced signaling applications is a relatively young reality. In the last few years the use of this new

transmission means for transmitting safety related information between track and train has been adopted and is growing in the implementation of the European interoperable control command system ERTMS / ETCS.

Significant issues in terms of quality of the service and availability of the transmitted information have been addressed in these first applications.

The full interoperability among the systems in different countries and from different suppliers and the demonstration of the compliance to an end to end safe operation in all the countries based on the European specifications is progressing.

The already existing applications and their solution will allow to speed up the fundamental aspects above indicated.

RFI host a one day workshop, to share experience on GSM-R application results and discuss on next steps.

The conference is mainly addressed to National Safety Authorities, Independent Assessors, Railway infrastructure and undertaking companies.

The European bodies (ERA, EIM, CER, EEIG ERTMS Users Group, UIC, Unisig) will provide the appropriate attendance, in compliance with the given information.

Using GSM-R, RFI in Italy is covering 7500 km of conventional lines including 855 km in tunnels.

The coverage of the rail network will be completed within 2009.

The implemented GSM-R services are:

- Voice and data communications between trackside and on-board staff,
- Voice and data communication for maintenance and shunting staff,
- Data communication as a bearer to the safety related ERTMS/ETCS level 2 application,
- SMS based application, supporting services in the areas of Traffic Control Rooms, information for public and on-board applications,
- GPRS, used to manage public information and other on-board services, through audio and video train systems.

Starting from December 2005 the high speed lines Roma-Napoli (186 km) and, from February 2006, Torino-Novara (85 km) are in commercial service: these lines are equipped with ERTMS/ETCS level 2, exploiting GSM-R as a carrier for the data communication between trackside and on-board equipment. Further high speed lines, also equipped with ETCS level 2, will enter in operation in 2008 and 2009. In the period 2008-2015 more than 2400 Km of conventional lines will use the GSM-R for the radio infill functionality (corridors A, B, D).





Preliminary Agenda

The one day workshop, from 9.30 to 16.30, opens with the Italian case and goes ahead with discussion panels on the hot topics of the moment.

Opening session, and qualification of open issues

RFI will present its own experience and results on GSM-R, and start discussion on open issues at international level.

RFI presentation is mainly focused on QoS and monitoring, and on ETCS parameters and their effects on the radio disconnection management and on the operation safety.

RFI will present its adopted criteria and

related applied solutions, compliant with the standards, referring on the obtained results upon its applications in operational environment.

Discussion Panels

Open hot items on GSM-R will be examined and deeply discussed in a panel, composed by testimonials qualified for experience or specialization. Identified subjects of shared interest for the panels are within the following list:

- Identification of potential obstacles for interoperability and how to remove them
- Completeness of the GSM-R specifications
- What has been put in place to tackle potential problems due to different interpretations of specifications and national

implementations of GSM-R, and how to map the incompatibilities

- Quality of Service common tests put in place and cross acceptance of results
- Specific other open issues, resulting from national implementation, as summarized by a short introduction presented by the European Railway Agency, acting as chairman of the pane).

Such workshops will also in the future be very important as a platform for newly implementing railways and railway undertakings and especially for those railways that are just at the beginning of projects. They are seen as a back-up on practical cases to the dissemination of specifications and guide-lines by the UIC. ■

➔ THE GSM-R TEAM

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