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RADIO SPECTRUM COMMITTEE

Working Document

Subject: Updated version of the working document on GSM-R interferences and coexistence with public mobile networks, taking into consideration observations made by RSC delegations

This is a Committee working document which does not necessarily reflect the official position of the Commission. No inferences should be drawn from this document as to the precise form or content of future measures to be submitted by the Commission. The Commission accepts no responsibility or liability whatsoever with regard to any information or data referred to in this document

The purpose of the document is to present different aspects of the coexistence between the railway communication system based on GSM-R and public mobile networks, especially from a regulatory standpoint, and to propose a way forward.

The previous version of this document was presented at RSC #54 of 9 December 2015. Thereafter RSC delegates were invited to transmit their observations to the RSC secretariat.

The updated revision 2 version, consolidated by the European Union Agency for Railways (ERA) under the monitoring of DG MOVE and DG Connect, takes into consideration the received observations (see Evolution sheet).

A short meeting between RSC and RISC was planned on the basis of this document in the occasion of RSC#56 (6-7 July).

During that meeting, both Committees endorsed the revision 2, although it was agreed that two specific comments raised during the meeting would be solved bilaterally by the MS involved.

This revision 3 includes the agreed text and the result of the bilateral discussions on those two specific comments, as reflected in the Evolution sheet).

The appendix of this document is to be sent to the Member States' transport and telecom attachés and published on the website of the European Union Agency for Railways, on the page dedicated to the interference issues.



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Railway Interoperability and Safety Committee

Radio Spectrum Committee

Working document

The purpose of the document is to present different aspects of the coexistence between the railway communication system based on GSM-R and public mobile services, especially from a regulatory standpoint, and to propose a way forward.

This version (05) was endorsed by the Radio Spectrum Committee and the Railway Safety and Interoperability Committee in their joint meeting on July 2016 during their joint meeting organised on 6 July 2016.

Since the first report to the RISC #66 on the interference situation, many actions and studies have been conducted, leading to a better understanding of causes and potential mitigation techniques to ensure coexistence between public mobile network with GSM-R railway communication.

DG MOVE, DG CONNECT and the European Union Agency for Railways (ERA) have been working for three years with stakeholders (including UIC, ETSI, CEPT and GSMA) within the "GSM-R Follow Up Group" (GFUG) to address the challenges of interference.

The goal of this document is to present an overview of different aspects of the coexistence between GSM-R and mobile public services, especially from a regulatory point of view, and to propose a way forward for managing the interference issue. This document is not part of any legislative procedure.

GFUG members were consulted on a draft version of this document.

This document was presented at RISC #74 on 7 October 2015 and at RSC #54 on 9 December 2015. Further comments were received on version EN03.

RSC delegates have transmitted observations to the RSC secretariat on the version of this document endorsed by the RISC on 7 October 2015. Further comment were received on version EN03.

The updated version EN04, consolidated by the European Railway Agency under the monitoring of DG MOVE and DG Connect, takes into consideration the received observations.

The steps taken after the circulation of the version EN04 were:

- It was discussed during the joint RISC-RSC meeting organised on 6 July 2016; a report on the next steps identified in the conclusions of this document was also presented;
- Both Committees endorsed the version EN04, although it was agreed that two specific comments raised during the meeting would be solved bilaterally by the MS involved.

Version EN05 includes the agreed text and the result of the bilateral discussions on those two specific comments.

The appendix of this document is to be sent to the Member States' transport and telecom attachés and published on the website of the European Union Agency for Railways, on the page dedicated to the interference issues.

APPENDIX



EUROPEAN COMMISSION

Communications Networks Content & Technology Directorate-General
Mobility and Transport Directorate-General

Railway Interoperability and Safety Committee

Radio Spectrum Committee

Working document

The purpose of the document is to present different aspects of the coexistence between the railway communication system based on GSM-R and public mobile services, especially from a regulatory standpoint, and to propose a way forward.

This document was presented and discussed at both Radio Spectrum Committee and Railway Safety and Interoperability Committee meetings during 2015 and 2016. Improvements from both committees were taken into consideration and this document was endorsed by the Radio Spectrum Committee and the Railway Safety and Interoperability Committee in their joint meeting organised on 6 July 2016.

This document is not part of any legislative procedure and does not necessarily reflect the official position of the Commission. No inferences should be drawn from this document as to the precise form or content of future measures to be submitted by the Commission. The Commission accepts no responsibility or liability whatsoever with regard to any information or data referred to in this document.

Evolution sheet

RISC document number & date	RSC document number & date	Modification / Description / Distribution
DV81EN00 22 Sept 2015		First issue. Distributed to GFUG for comments. Uploaded in CIRCA for information to RISC #74.
DV81EN01 25 Sept 2015		Revision prior to RISC#74, with modifications from European Union Agency for Railways, DG MOVE and DG CONNECT; uploaded in CIRCA for RISC#74. Presented in RISC meeting on 7-8 Oct 2015.
DV81EN02 15 Oct 2015		Including comments from MS in RISC (DE, IT, BE), CER and GSM Association.
	RSCOM15-60 30 Nov 2015	Including editorial modifications by DG CONNECT on DV81EN02; uploaded in CIRCA for RSC#54. Presented in RSC meeting on 9 Dec 2015.
DV81EN03 7 Apr 2016	RSCOM15-60 rev1 7 Apr 2016	Including comments from MS in RSC (UK, FR, PT, ES, and SE). Distributed to RSC and RISC for action together with a questionnaire, and to GFUG, TCAM and ECC FM54 for information.
DV81EN04 13 Jun 2016	RSCOM15-60 rev2 13 Jun 2016	Including comments from MS in RSC (FR) and RISC (IE). Editorial comments in chapters 2 and 3 from DG MOVE and CONNECT. Distributed to RSC and RISC for discussion in the joint meeting on 6 Jul 2016.
DV81EN05 13 July 2016	RSCOM15-60 rev3 13 July 2016	Including comments from MS in RSC (NL, DE, FR) and RISC (IE), received in writing and during the joint RSC/RISC meeting on 6 July 2016. RSC/RISC agreed to endorse the previous version during the meeting, and to receive the final document after the inclusion of the comments.

1. PROBLEM DEFINITION

1.1. Situation of the frequency bands used

The frequency bands 876-880 MHz and 921-925 MHz (R-GSM band) are harmonised for railway communication in Europe. Adjacent to the R-GSM bands are the frequency bands 880-915 MHz and 925-960 MHz (E-GSM band) used by public mobile operators which are EU harmonised for the usage of GSM and UMTS/LTE technologies. In addition, the bands 873-876 MHz and 918-921 MHz, although not harmonised for use for GSM-R in the EU and in the CEPT, may be used on a national basis subject to national decision¹.

1.2. Coexistence issues and mitigation solutions

Several cases of interference on GSM-R have been reported in various Member States, causing operational and even safety issues (see below).

Those interference cases result from the coexistence of radio communications in the R-GSM band with mobile networks communications operating in the adjacent band (above 925 MHz) including in E-GSM Band and are affecting today mainly the GSM-R voice service. With the successive rollout of the ETCS service, this will also become an issue for the operation of trains using ETCS, as interference can affect all kinds of GSM-R applications in a given frequency up to a complete loss of connection. The trend in re-farming the 900 MHz band for mobile broadband communications by introducing in that frequency band other mobile systems (UMTS, LTE) than GSM could be a limiting factor to solve the issues. This trend is ongoing in several EU Member States. In some Member States, mobile broadband networks with national coverage are already in place.

Three main categories of coexistence issues and relevant mitigation solutions have been identified:

1. **Intermodulation products** are self-generated by the GSM-R receiver itself in its reception band in presence of two or more mobile networks signals in the adjacent band.
→ These intermodulation phenomena can be mitigated by means of hardware modifications, e.g. insertion of a filter or use of an improved radio receiver.
2. **Blocking** is a coexistence phenomenon that can be caused by either insufficient selectivity of the GSM-R receiver (filter discrimination), saturation of the front-end (LNA and/or mixer) or reciprocal mixing (with local oscillator phase noise).

¹ See [ECC/DEC/\(04\)06](#) on “The availability of frequency bands for the introduction of Wide Band Digital Land Mobile PMR/PAMR in the 400 MHz and 800/900 MHz bands”, considering “e) that this ECC Decision also provides a possibility for a GSM-R extension into the bands 873-876 MHz and 918-921 MHz on a national basis”.

According to the information available in the [European Communications Office Frequency Information System](#) (EFIS) in July 2016, 4 EU Member States have a provision for this possible use in their national frequency plans (Croatia, Czech Republic, Germany, Hungary); 2 other EU Member States have indicated this provision but information does not appear in EFIS (Austria, Latvia); 2 additional countries have also this provision in EFIS (Liechtenstein, Switzerland).

→ These intermodulation phenomena can be mitigated by means of hardware modifications, e.g. use of an improved radio receiver.

3. **Out of Band emissions** from radio services in the adjacent frequency band falling into the native receive band of the GSM-R receiver can also cause a degradation of the communication service.

→ This kind of radio interference can be solved only by technical measures on the source side (in the emitting sites of the public networks and the GSM-R networks) and by a proper coordination/cooperation between public mobile operators and GSM-R operators, where radio site densification may also be an effective mitigation measure.

2. BETTER COEXISTENCE BETWEEN GSM-R AND MOBILE NETWORKS

The Electronic Communications Committee (ECC), a committee of the CEPT² is an organisation where expert policy makers, regulators and industry stakeholders from 48 countries across Europe collaborate to harmonise the efficient use of the radio spectrum.

Besides producing CEPT reports in response to the European Commission mandate under the Radio Spectrum Decision³, CEPT/ECC develops and adopts various deliverables supporting a voluntary approach on harmonisation: Decisions (regulatory texts providing measures on significant harmonisation matters) and Recommendations (harmonisation measures). Contrary to EU legislation, which is compulsory, CEPT/ECC regulation is adopted by the various countries on a voluntary basis.

Moreover, CEPT develops guidance to support a more efficient usage of spectrum. All the ECC deliverables are subject to public consultation. In particular, ECC published in May 2015 the final version of ECC Report 229⁴, providing views from all interested parties⁵ and guidance to enable a better coexistence between GSM-R and mobile networks. The main conclusions of this report are:

- *Railway interoperability must be ensured.*
- *Both GSM-R and mobile networks licensees use their assigned radio spectrum in compliance with the relevant technical standards and European and national regulations.*
- *Measurement campaigns concluded that current GSM-R receivers are affected by intermodulation products that can be mitigated by the use of improved radio receivers or external filters⁶.*

² Conference of European Post and Telecommunications administrations

³ [Decision 676/2002/EC of the European Parliament and of the Council of 7 March 2002 on a regulatory framework for radio spectrum policy in the European Community \(Radio Spectrum Decision\)](#) OJ L 108, 24.4.2002, p.1.

⁴ [ECC Report 229: "Guidance for improving coexistence between GSM-R and MFCN in the 900 MHz band"](#).

⁵ Representatives from UIC, Infrastructure Managers, Railway Undertakings, GSMA, and National Regulatory Administrations jointly contributed to the drafting of ECC Report 229.

⁶ GSM-R receivers compliant with [ETSI TS 102 933-1 v1.3.1](#) are robust against self-generated interference.

- *As the implementation of such radios in all trains within Europe will require some time and resources, a systematic approach based on coordination/cooperation is recommended during a transition period, and even after in case of interference due to out of band emissions where improved radio receivers or filters are ineffective.*
- *Before and during the transition period, the coordination/cooperation process is intended to avoid/mitigate issues related to intermodulation or blocking.*
- *Changes at the GSM-R radio equipment such as incorporation of a filter in trains (in cab radios or EDORs⁷) or change of radio modules, as well as changes on the MFCN network side, are expensive and time consuming.*
- *Visibility and exchange of information between the stakeholders shall continue after the transition period to prevent any further issues.*
- *A generic process for coordination/cooperation to resolve interference cases on existing, new and modified radio sites is described and can, on a voluntary basis, be adapted to meet national needs.*
- *The coordination/cooperation effort should be kept as low as possible to avoid jeopardising rollout of both GSM-R and public mobile networks, and an evaluation of the likelihood of interference and of its possible degree of impact on railway operation is recommended (pre-filtering).*

ECC Report 229 is therefore a useful toolbox for national regulatory administrations to set up an appropriate, efficient and fruitful coordination between mobile network operators and railway operators. ECC Report 229 (section 7) gives guidance on a generic coordination/cooperation process that can meet each national situation and acknowledges that in some countries a national process may already exist and therefore there should not be two parallel coordination/cooperation processes at national level. It remains a national decision, noting that there are existing processes in use in some CEPT countries.

The assessment of the usefulness of the toolbox as described in this report in the different CEPT countries, including Member States, will be done during the first half of 2016. Any follow up action will be decided based on feedback from CEPT countries during the second half of 2016.

3. EU TELECOM REGULATORY FRAMEWORK

The Radio Spectrum Decision⁸ establishes a policy and legal framework to ensure harmonised conditions with regard to the availability and efficient use of the radio spectrum; nevertheless spectrum management remains a national competence in the area of coordination between various radio systems at national level.

The European Framework provides policy objectives in particular:

⁷ ERTMS Data Only Radio.

⁸ [Decision 676/2002/EC of the European Parliament and of the Council of 7 March 2002 on a regulatory framework for radio spectrum policy in the European Community \(Radio Spectrum Decision\) OJ L 108, 24.4.2002, p.1](#)

- R&TTE/RED Directive⁹
- Radio Spectrum Decision
- Framework Directive¹⁰
- Radio Spectrum Policy Programme¹¹
- Council Directive on the frequency bands to be reserved for the coordinated introduction of public pan-European cellular digital land-based mobile communications in the Community¹²

The definition of harmful interference can be found in the Framework Directive as well as in the Directive on the authorisation of electronic communications networks and services¹³, where harmful interference means *interference that seriously degrades, obstructs or repeatedly interrupts a radio communications service operating in accordance with the applicable Community or national regulations.*

Spectrum management in cooperation with spectrum users is taking care of efficient use of spectrum at national level to ensure the coexistence between various users. In order to ensure that radio equipment uses the radio spectrum effectively and supports the efficient use of radio spectrum, radio equipment should be designed so that in the case of a receiver, it has a level of performance that allows it to operate as intended and protects it against the risk of harmful interference, in particular from shared or adjacent channels, and, in so doing, supports improvements in the efficient use of shared or adjacent channels (see RE-D).

The current EC Decision to harmonize the use of 900 MHz and 1800 MHz frequency bands for electronic communication services¹⁴ has been developed on the basis of CEPT report in response to EC mandates and adopted further to consultation of Member States; Member States should ensure that introduction of UMTS/LTE systems gives appropriate protection to legacy systems in adjacent bands. It is also mentioned in this framework

⁹ [Directive 2014/53/EU of the European Parliament and of the Council of 16 April 2014 on the harmonisation of the laws of the Member States relating to the making available on the market of radio equipment and repealing Directive 1999/5/EC](#). OJ L 91, 7.4.1999, p.10. It is known as the "Radio Equipment Directive", in short: "RED". This Directive will be applicable from the 13 June 2016 onwards, at which date the RED will replace the R&TTE.

¹⁰ [Directive 2002/21/EC on a common regulatory framework for electronic communications networks and services](#). OJ L 108, 24.4.2002, p.33.

¹¹ [Decision 243/2012/EU establishing a multiannual radio spectrum policy programme](#). OJ L81, 21.3.2012, p.7.

¹² [Directive 2009/114/EC amending Council Directive 87/372/EEC on the frequency bands to be reserved for the coordinated introduction of public pan-European cellular digital land-based mobile communications in the Community](#). OJ L274, 20.10.2009, p.25.

¹³ [Directive 2002/20/EC of the European Parliament and of the Council of 7 March 2002 on the authorisation of electronic communications networks and services \(Authorisation Directive\)](#). OJ L108, 24.4.2002, p.21.

¹⁴ [Commission Implementing Decision 2011/251/EU of 18 April 2011 amending Decision 2009/766/EC on the harmonisation of the 900 MHz and 1 800 MHz frequency bands for terrestrial systems capable of providing pan-European electronic communications services in the Community](#). OJ L 106, 27.4.2011, p. 9.

that Member States should take whatever measures are necessary to protect the continued operation of GSM systems from harmful interference. Moreover any other system deployed in the 900 MHz bands needs to ensure technical compatibility both with adjacent networks operated by other rightholders in these bands and with the use of frequency bands adjacent to the 900 bands. In addition, Member States are taking into account national policy objectives to support the development of wireless broadband and GSM-R.

Furthermore, Article 20 of the Framework Directive covers the steps to be taken in case of a dispute between undertakings: the national regulatory authority shall issue a binding decision in case there is no agreement between the disputing parts.

While coordination/cooperation requirements apply to all parties, EU Member States should ensure coexistence between various spectrum users at national level.

Therefore, EU Member States should develop coexistence solutions between GSM-R systems and public mobile systems to ensure an efficient usage of the spectrum

4. RAILWAY INTEROPERABILITY

4.1. How to achieve interoperability within the European Union rail system?

The conditions to be met to achieve interoperability within the EU rail system are established in the Railway Interoperability Directive¹⁵ and in technical specifications for interoperability (TSIs) where all the conditions with which an interoperability constituent must conform, and the procedure to be followed in assessing conformity are described. The European railway system is internationally interconnected and needs interoperability.

From a radio communication standpoint, railway interoperability implies that GSM-R, as per the definition of the legal technical specification, the CCS TSI¹⁶, shall fulfil essential requirements to enable the safe and interoperable movement of trains in Europe:

- Availability of the GSM-R frequencies (recital 12).
- Requirements for voice and operational communication applications, and data communication applications for ETCS as defined in indexes 32, 33, 64 and 65 of the Table A 2 of the Annex A.

It is reminded that, in any case, the specificities of vehicles and infrastructures should be traced, according to Articles 33, 34 and 35 of the Railway Interoperability Directive in national vehicle registers, the European register of authorised types of vehicles and the register of infrastructure.

¹⁵ [Directive 2008/57/EC of the European Parliament and of the Council of 17 June 2008 on the interoperability of the rail system within the Community \(Recast\)](#). OJ L 191, 18.7.2008, p. 1–45., recasted in [Directive \(EU\) 2016/797 on the interoperability of the rail system within the European Union](#), OJ L 138, 26.5.2016, p. 44–101.

¹⁶ [Commission Regulation \(EU\) 2016/919 of 27 May 2016 on the technical specification for interoperability relating to the control-command and signalling subsystems of the rail system in the European Union](#). OJ L 158, 15.6.2016, p. 1–79.

4.2. Developments of the CCS TSI regarding evolution of the radio environment

Upon a request from a Member State to correct "a critical error" in the CCS TSI related to interference, the European Railway Agency reviewed the parameters of the CCS TSI and concluded that there was no critical error and that no amendment was necessary¹⁷.

The CCS TSI does not offer the possibility to define harmonised levels of interference.

To cope with the expected evolution of the radio environment, as described in UIC document O-8736¹⁸, the next version of the CCS TSI will refer to the requirements set in the ETSI specification TS 102 933 on improved radio receivers. This will only apply to new, updated or upgraded on board subsystems, as every change of requirement in a new version of a TSI shall ensure compatibility with subsystems already placed in service in accordance with former TSI versions. This principle helps promoting the competitiveness of rail transport and preventing unnecessary additional costs.

4.3. National Rules

In the railway regulatory framework, there is room for national rules only for parameters of the railway system that need to be harmonised but are not yet covered, or not intended to be covered, by EU legislation.

National rules therefore only exist in the following cases:

- Open Points in TSIs and other EU railway legislation;
- Compatibility with existing railway networks (Legacy systems);
- For maintenance and cross acceptance of railway vehicles / networks authorised before the TSIs came into force ("Non TSI-Conform subsystems");
- For networks / vehicles not intended to be harmonised by European rules (e.g. metric gauge, on-track plant);
- Cases where a TSI gives different possibilities for the same parameter;
- Derogations.

Against this background, it is not possible for a Member State to adopt a national rule imposing to Railway Undertakings a specific solution for improved radio receivers.

When an issue is identified that was not foreseen when the TSI was developed the preferred approach is to address the change in the TSI rather than allow the creation of multiple National Rules that may create new barriers to the free circulation of trains.

¹⁷ [Agency Opinion regarding request from Sweden of a critical error in the CCS TSI related to the protection against GSM-R interferences.](#)

¹⁸ [UIC O-8736 Assessment report on GSM-R current and future radio environment.](#)

In order to eliminate the obstacles to interoperability, article 8 of the Railway Safety Directive is intended to reduce the number of national safety rules and to avoid adopting new national safety rules.

4.4. Authorisation for placing in service of a railway subsystem

Principles

The authorisation for placing in service of a railway subsystem is the recognition by the Member State that the applicant for this subsystem has demonstrated that it meets, in its design operating state, all the essential requirements of the Railway Interoperability Directive when integrated into the rail system. The applicant for an authorisation for placing in service of a subsystem shall establish an "EC" declaration of verification as described in the Interoperability Directive. These elements include in particular the reference to the TSIs and national rules applicable in order to meet the essential requirements set out in the same Directive. In addition to this declaration, the applicant also submits to the (railway) National Safety Authority the certificates of verification issued by a Notified conformity assessment Body and a technical file accompanying the EC declaration of verification. The National Safety Authority assesses these documents, in particular the aspects regarding technical compatibility and safe integration of subsystems within the vehicle, on the basis of the relevant TSIs and national rules and, where applicable, common safety methods on risk assessment.

In the case of improved radio receivers

Today (before the entry into force of the forthcoming CCS TSI), as it is not required by the TSI or by a national rule, the installation of improved radio receivers is not part of the authorisation procedure.

Nevertheless, Railway Undertakings may equip their vehicles with protective measures complying with the improved requirements as defined in the ETSI specifications TS 102 933 in order to manage the risk of interference, and describe them in their Safety Management System (see point 6.2 of the document). In order to reduce the time and costs for the implementation of protective measures on board, Railway Undertakings could arrange a detailed planning to minimize the operational disruptions. When a modification in a vehicle is already planned, the protection against interference could be implemented at the same time, without additional cost due to the unavailability of the vehicle.

5. OPERATIONAL IMPACT OF GSM-R DISRUPTION

GSM-R is mandatory to exchange data between train and trackside, when running in ETCS Level 2, and for the voice communications between driver and traffic control centre.

Procedures for the interoperable operation of the railway services are provided in the OPE TSI¹⁹.

Appendix A of the OPE TSI provides the specific procedures for train operation with ETCS and for "degraded situations". Within them, there are multiple cases where the driver needs to contact the control centre; this is done by establishing a call via GSM-R. If the interference prevent the radio to establish the call, this will cause an additional delay, and the specified fall back solution (if available) needs to be used.

The basic voice and operational applications include the establishment of Emergency Calls, Voice Group and Broadcast Calls, Point-to-Point Calls, and the capability of addressing to a speaker by its functional role or depending on its location area. Moreover, GSM-R allows fulfilling the obligations of information from the staff authorising train movements to the driver in real time, and it provides an interoperable mean for the transmission of modifications to the information contained within the Route Book. The unavailability of GSM-R has therefore an impact on them.

For trains running with the European train control system using data transmitted by GSM-R (ETCS Level 2), its unavailability causes a system reaction (reduction of the train speed or train stopping) that has also an operational impact.

6. RAILWAY SAFETY

6.1. Is GSM-R a safety supporting system?

As explained above, GSM-R is mandatory to exchange data between train and trackside, when running in ETCS Level 2, and for the voice communications between driver and traffic control centre. The basic voice and operational applications provide valuable tools to allow traffic operation even in ETCS "degraded mode" or during incidents.

In the CCS TSI, the essential requirement for rail safety is directly pointing to the availability/reliability of the subsystems. A lower than required availability and/or reliability of any subsystem can cause a degraded mode of operation which in consequence could decrease the overall safety of the rail system.

It has to be taken into account that, together with the safety of the system itself, when dealing with degraded situations, also the safety of passengers or freight carried on board of a train has to be considered.

GSM-R also assists the Railway Undertakings in handling the incident management or a major rolling stock malfunction in degraded situations and in emergencies. Emergencies cover a broad range of situations: collisions, fires on trains, evacuation of trains, accidents in tunnels, incidents involving dangerous goods, derailments... In such cases, the Railway Undertaking has to provide the Infrastructure Manager with specific information related to these circumstances, especially for the recovery or re-railing of trains. In case of non-critical situations, the Railway Undertaking also has to avoid or decrease the delays caused by the failures encountered.

¹⁹ [Commission Regulation \(EU\) 2015/995 of 8 June 2015 amending Decision 2012/757/EU concerning the technical specification for interoperability relating to the 'operation and traffic management' subsystem of the rail system in the European Union. OJ L 165, 30.6.2015, p. 1–69](#)

GSM-R is not a safety system as defined in EN 50126/128/129, nevertheless it is supporting safety features with respect to the Emergency Call functionality. The Emergency Call is a call set up in some dangerous situations to warn all trains / shunting movements equipped with GSM-R in a defined area. As defined in the Appendix A of the OPE TSI, when the driver receives the audible and/or visual indication associated with the emergency call, the driver shall:

- immediately reduce the speed of the train to the appropriate speed for running on sight and run on sight unless otherwise instructed by the controller;
- obey instructions given by the controller.

Therefore, in case of an accident (collision, fire on train, derailment...), GSM-R helps by supporting the emergency response mitigate the consequences of the accident. Disruption of GSM-R service might as well have an impact on passengers' health, causing people to fall or be hurt (emergency breaking).

For example, the report of the investigation after the incident in Hever, Belgium, in 2013²⁰, considers the possible effects of a disruption in the GSM-R voice communication. The National Investigation Body concluded that, with the aim of drawing lessons from this accident and improving railway operational safety, a recommendation should be sent to the national authorities to ensure that the GSM-R signal is available with the correct characteristics to be received by the on board equipment.

6.2. The Railway Safety Directive: actors and Safety Management System

The Railway Safety Directive²¹ clearly provides in Article 4 that:

- Member States shall ensure that railway safety is generally maintained and, where reasonably practicable, continuously improved, taking into consideration the development of Community legislation and technical and scientific progress and giving priority to the prevention of serious accidents. Member States shall ensure that safety rules are laid down, applied and enforced in an open and non-discriminatory manner, fostering the development of a single European Rail Transport System.
- Member States shall ensure that the responsibility for the safe operation of the railway system and the control of risks associated with it is laid upon the Infrastructure Managers and Railway Undertakings, obliging them to implement necessary risk control measures, where appropriate in cooperation with each other, to apply national safety rules and standards, and to establish safety management systems in accordance with this Directive.

Safety Management System (SMS), common safety methods, roles and responsibilities

The railway Safety Management System is the sum of processes that contributes to the design, planning, delivery and control of operations, as part of a company business. It

²⁰ [http://erail.era.europa.eu/occurrence/BE-2063-8-1/Train-derailment,-19-02-2013,-Hever-\(Belgium\)](http://erail.era.europa.eu/occurrence/BE-2063-8-1/Train-derailment,-19-02-2013,-Hever-(Belgium))

²¹ [Directive 2004/49/EC on safety on the Community's railways, recasted in Directive \(EU\) 2016/798 of 11 May 2016 on railway safety. OJ L 138, 26.5.2016, p. 102–149.](#)

means that the SMS covers only the above mentioned core railway activities outlined in the Railway Safety Directive. Implementing a structured approach enables the identification of hazards and the continuous management of risks related to an organisation's own activities, with the aim of preventing accidents. Implementing all relevant elements of a Safety Management System in an adequate way can provide railway organisations with the necessary confidence about all the risks associated with its activities. When appropriate, it should take into account the interfaces with other Railway Undertakings and Infrastructure Managers in the railway system.

The National Safety Authorities are responsible to assess the Safety Management System implemented by the Railway Undertakings/Infrastructure Manager in accordance with the common safety method for obtaining safety certificates, as referred in the Railway Safety Directive²² and the common safety method for assessing the conformity with the requirements for obtaining safety authorisations given in the Railway Safety Directive²³. These Common Safety Methods are important building blocks in the harmonisation of decision-making principles for National Safety Authorities. It sets out the harmonised way in which all National Safety Authorities should approach assessments prior to the award of safety certificates and safety authorisations, and establishes the principles they need to apply for their supervision, after the awarding of a safety certificate or authorisation.

Analysing the risks related to interference and setting up the relevant framework

Prior to any cooperation between telecom/spectrum authorities and railway safety/regulatory, as part of its safety management system, the Railway Undertaking and Infrastructure Manager are in charge of identifying and analysing the (safety) risks due to radio coexistence issues with adjacent systems, as long as it remains economically viable and compatible with their operational needs.

The relevant National Safety Authority should then check during its assessment that the Railway Undertaking or Infrastructure Manager has established a risk management process that will provide the assurance that any safety risks are adequately identified and controlled. After the granting of the safety certificate or safety authorisation, the relevant national safety authority has also the duty to continuously supervise the safety performance of the Railway Undertaking or Infrastructure Manager through their respective safety management systems.

The supervisory activities undertaken by the relevant national safety authority could be targeted to the specific (safety) risks due to radio coexistence issues with adjacent systems. And it might result in specific checks of the effectiveness of the risk assessment process (to identify and report this type of risks to the relevant authorities) and of risk control measures (e.g. coordination or technical measures) put in place by the Railway Undertaking or Infrastructure Manager to reduce the risk to an acceptable level.

In any case, cooperation between the telecom sector and the railway sector has to be fostered at the member state level.

²² Such common safety method is defined in the [Regulation \(EU\) No 1158/2010/EU](#).

²³ Such common safety method is defined in the [Regulation \(EU\) No 1169/2010/EU](#).

6.3. Safety Risk related to an external cause

Interference to GSM-R is a particular case where the responsibility of the safe operation of the railway system and the control of risk necessitate cooperation with external third parties outside the Railway System. Yet, considering interference to GSM-R, there is no new hazard for the railway system, but a potential external cause of aggravating factor in the event of an accident or an incident.

External causes of aggravating railway risk should be addressed with the telecom sector. The risk may vary depending of spectrum environment (e.g. new technology in use, new antenna, spectrum density, coordination in place...). The Member State, supported by telecom, spectrum and railway authorities, shall establish adequate and fair provision to allow a proper mitigation by railway undertakings, infrastructure managers and mobile network operators.

7. SINGLE EUROPEAN RAILWAY AREA DIRECTIVE

The Directive establishing a Single European Railway Area ²⁴ lays down the rules applicable to the management of the railway infrastructure and to rail transport activities of the Railway Undertakings, the criteria applicable to the licenses for Railway Undertakings, and the principles and procedures applicable to the setting and collecting of railway infrastructure charges and to the allocation of infrastructure capacity.

The Directive contains relevant provisions to deal with disruptions to the railway services, and it provides that the Infrastructure Managers should publish a network statement²⁵ setting out the nature of the infrastructure which may include the radio network, which is available to Railway Undertakings, and containing information on the conditions for access to the relevant railway infrastructure. This information shall be made consistent or shall refer to the rail register of infrastructure (RINF) that must be published and up-to-date.

The Directive also provides for the functions of the national railway regulatory body, and for the right to appeal when an applicant believes that it has been unfairly treated, discriminated against or is in any other way aggrieved.

The national railway regulatory body shall cooperate closely with the national safety authority. Member States shall ensure that these authorities jointly develop a framework for information sharing and cooperation aimed at preventing adverse effects on competition or safety in the railway market. This framework shall include a mechanism for the regulatory body to provide the national safety authority with recommendations on issues that may affect competition in the railway market and for the national safety authority to provide the railway regulatory body with recommendations on issues that may affect safety. Without prejudice to the independence of each authority within the field of their respective competences, the relevant authority shall examine any such

²⁴ [Directive 2012/34/EU of the European Parliament and of the Council of 21 November 2012 establishing a single European railway area. OJ L 343, 14.12.2012, p. 32–77.](#)

²⁵ “network statement” means the statement which sets out in detail the general rules, deadlines, procedures and criteria for charging and capacity-allocation schemes, including such other information as is required to enable applications for infrastructure capacity

recommendation before adopting its decisions. If the relevant authority decides to deviate from these recommendations, it shall justify its decisions.

8. COMPENSATION AND STATE AID RULES

Improved GSM-R radio receivers or filters form a reliable and sustainable solution to cope with interference. Nevertheless time is needed to allow for the natural renewal/upgrade/update of the existing fleet. The Railway sector has indeed expressed its concerns²⁶ about the cost of accelerating such upgrades and the need for a proportionate and non-discriminatory share of this burden.

In that context, The Netherlands developed a GSM-R Interference Control Subsidy Scheme²⁷ worth considering. The scheme has to be carefully designed to make sure that it respects state aid rules. It should be noted that there are guidelines on state aid for railways in a communication from the Commission²⁸, see in particular paragraphs 106-107-108. Moreover, the Commission provides information on its website²⁹. Sweden has recently notified a similar scheme³⁰.

The schemes should take into account the possible existing solutions (installation of improved receivers, installation of fixed filters, installation of switchable filters) in order to match the technical needs (for example, when the vehicles should be able to roam to public networks).

Mobile operators have expressed their concerns regarding the impact of the coordination during the transition period (churn, revenue loss due to coverage degradation, installation of new radio sites, changes of radio site parameters). Moreover, it could be noted that a significant part of mobile UE (user equipment) supports GSM 900 MHz and 1800 MHz only. In case of lost/degraded coverage due to coexistence issues, the mobile users may be unable to connect to mobile networks in trains and along the railway zones, which may include urban areas.

When considering accelerating the deployment of on-board GSM-R solutions Member States shall therefore ensure that the potential burden to achieve better coexistence between GSM-R and public mobile networks is non-discriminatory, transparent and proportionate between, and among, the railways and telecom stakeholders.

9. CONCLUSIONS AND WAY FORWARD

Radiocommunication in support of ERTMS is a multi-level trans-disciplinary subject: its regulation is of relevance for both railways and telecoms. Acknowledging and solving the coexistence between GSM-R and public mobile networks is not only important to ensure a safe railway communication system today, but also to take into account the

²⁶ <http://www.cer.be/publications/position-papers/position-papers-details/cer-uic-position-paper-on-gsm-r-interferences/>

²⁷ <http://english.rvo.nl/subsidies-programmes/how-apply-gsm-r-interference-control-subsidy-scheme>

²⁸ [Communication 2008/C 184/07 on Community guidelines on State aid for railway undertakings](#)

²⁹ http://ec.europa.eu/competition/state_aid/overview/index_en.html

³⁰ [Ordinance on compensation for safety equipment and the installation thereof in the railway's communication systems](#)

challenges of the growing need for public mobile radiocommunications, including the need for wireless broadband coverage along the railways tracks to respond to policy objectives to deliver wireless connectivity to train's passengers, and the trends towards spectrum sharing³¹. However, within the context of Article 4 of the Railway Safety Directive, the way forward should be based on the cooperative approach, taking into account the objectives to ensure coexistence between both systems while ensuring proper operation of GSM-R systems according to railways framework and responding to national policy objectives of wireless broadband coverage imposed to mobile operators in their authorisations³².

Indeed, taking into account the complexity and multiplicity of factors, a single solution, be it technical (e.g. installing filtering function on board trains) or regulatory, cannot be the unique remedy to the operational and safety impacts caused by interference to the GSM-R radio service.

Where appropriate, Member States shall therefore foster the cooperation between the Telecom sector and the Railway sector in order to prevent and to resolve coexistence issues between GSM-R and public mobile networks operating in adjacent bands (see section 7 of ECC Report 229).

Member States are invited to:

- Set up the framework for information-sharing and cooperation between the national railway regulatory authority and the national safety authority to ensure that the railway safety and effectiveness is generally maintained taking into account the competitiveness of the sectors.
- Perform an analysis of the national situation, assessing the potential risks to safe operations of trains in cooperation with the Railway stakeholders, and share the result of this analysis with ERA.
- Ensure that Railway safety and regulatory authorities inform and dialogue with rail stakeholders, and in particular Railway Undertakings to ensure transparency and non-discrimination.
- Promote that national telecom/spectrum regulatory authorities and railway safety/regulatory authorities inform each other and cooperate and:
 - ensure a fruitful cooperation between GSM-R and public mobile networks licensees, taking into account the guidelines and the toolbox provided by ECC Reports 162 and 229 and any other additional forthcoming possible improvements of these toolboxes based on lessons learnt,;
 - analyse the impact on GSM-R stakeholders of the transition period towards more robust GSM-R radio receivers and the need for GSM-R radio site densification where appropriate and accelerate the deployment of sustainable protective measures for trains;

³¹ [Communication from the Commission promoting the shared use of radio spectrum resources in the internal market](#)

³² At least one EU Member State requested the improvement of wireless broadband coverage along the railways tracks

- analyse the impact on public mobile operator of the transition period towards more robust GSM-R radio receivers (i.e. technical and economic impact such as of loss and/or degradation coverage for public mobile networks and end users connectivity, addition of new sites, etc...);
 - ensure that the potential burden to achieve better coexistence is non-discriminatory, transparent and proportionate between the railways and telecom stakeholders.
- Assess the possibility to set a plan for the replacement of radio receivers to make them compliant with ETSI TS 102 933-1 v1.3.1 and any further harmonised standards in the benefit of both stakeholder categories.
 - Put in place a coordination process with the aim to reduce its scope to remaining coexistence issues, in particular for out of band emissions, when the replacement of radio receivers will be achieved.
 - Establish, if relevant and as appropriate and further to the national analysis, a compensation scheme for the accelerated migration to improved GSM-R radio receivers. Evaluate as appropriate according to national context, during the transition period, a compensation scheme to other stakeholders relating to costs incurred for coexistence solutions in the coordination process (for example: mobile operators or GSM-R network operators involved in the development of coexistence solutions during the transition period).
 - Contribute to further work in CEPT in order to assess the need to improve the available toolbox (ECC report) to ensure better coexistence between GSM-R and public mobile networks.

In order to sustainably mitigate interferences due to blocking and intermodulation effects, the ETSI standard for GSM-R radios has been improved with respect to the receiver characteristics and published in June 2014 as ETSI TS 102 933-1 v1.3.1. GSM-R radios compliant with this new specification are robust against public mobile networks emissions in the E-GSM bands.

In consequence, it is recommended that Member States

- Encourage a renewal/upgrade/update of the existing fleet of radio receivers and reduce the time needed for such improvement.
- Aim at minimising the duration of the transition period which is foreseen for the GSM-R radio receivers' replacement with more robust radio receivers.
- Share the relevant information with ERA and the Commission.

The Commission and ERA will analyse the implementation of the measures reported by the Members States, promote exchange of best practices amongst them and propose a way forward.

The European Commission with support of ERA should ensure sharing of information between RISC and RSC on regular basis on the topics mentioned in this document and in particular on any regulatory initiative from the railway sector. As appropriate, ETSI and CEPT could contribute to any update of information from their side during the RSC meetings.

This document could be subject to future review during RISC and RSC meetings in order to assess the need of improvement and follow up actions.