Définition des exigences RSC (Radio System Compatibility)	
V1.2	
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Radio System Compatibility (RSC) « GSM-R »	
Checks required to demonstrate technical compatibility for Radio System Compatibility (RSC)	

1 Abbreviations

Abréviation	Description
Cab Radio	GSM-R radio installed in the Cab of a locomotive
EIRENE	« European Integrated Railway radio Enhanced Network »
ETSI	« European Telecommunications Standard Institute »
FRS	« Functional Requirements Specification »
IM	Infrastructure Manager
IM3	Intermodulation product of order 3
LDA	Location Dependent Addressing
REC	Railway Emergency Call
RFL	Réseau Ferré Luxembourgeois (Luxembourg Rail Network)
RFN	Réseau Ferré National (National Rail Network includes the lines of the RFL except for the lines of the tertiary network)
RGE	Règlement Général de l'Exploitation technique (General Regulations for Technical Operation)
SIM	« Subscriber Identity Module-Card » / Telephone card containing the usage data of the GSM-R system
SRS	« System Requirements Specification »
UIC	Union Internationale des Chemins de fer (International union of railways)

2 General

2.1 Purpose

In the Commission Implementing Regulation (EU) 2019/776 of 16 May 2019 amending Commission Regulations (EU) No 321/2013, (EU) No 1299/2014, (EU) No 1301/2014, (EU) No 1302/2014, (EU) No 1303/2014 and (EU) 2016/919 and Commission Implementing Decision 2011/665/EU as regards the alignment with Directive (EU) 2016/797 of the European Parliament and of the Council and the implementation of specific objectives set out in Commission Delegated Decision (EU) 2017/1474, the following is stated:

> 6.1.2.5. Requirements for Radio System Compatibility.

> The Agency shall set up and manage in a technical document the set of checks to demonstrate the technical compatibility of an on-board subsystem with the trackside subsystem. Infrastructure Managers, with the support of the GSM-R suppliers for their network, shall submit to the Agency the definition of the necessary checks (as defined in 4.2.17) on their network by 16 January 2020 at the latest. Infrastructure Managers shall classify their lines according to RSC types for voice and, if applicable, ETCS data in RINF. Infrastructure Managers shall submit to the Agency any changes on the referred checks for their network.

This document is in accordance with the CCS TSI Application Guide (GUI/CCS TSI/2019).

On the national railway network (RFN : Réseau Ferré National), the GSM-R is used for voice communication since 09/12/2018, it is certified in accordance with the European requirements defined in the interoperability specifications based on the decisions 2012/88 / EU of 25.01.2012 modified by decisions 2012/696 / EU and 2015/14 / EU (for ERA Baseline 0 release 4).

The use of GSM-R on the RFN is carried out under the cover of the applicant's safety certificate and the safety approval of the Luxembourg IM.

As a prerequisite for the verification of this document, any GSM-R Cab-Radio intended to be authorized on the RFN must be certified by a notified body (refer to Law of 5 February 2021 relating on rail interoperability, rail safety and the certification of train drivers) at least in accordance with Decision 2012/88 / EU and amended by Decisions 2012/696 /EU and (EU) 2015/14.

2.2 Scope

The current document defines the Radio System Compatibility (RSC) requirements and lists a selection of test cases from the O-3001-1catalogue [1] to demonstrate the technical compatibility of an on-board radio subsystem with the GSM-R CFL trackside subsystem. The RSC tests described in this document do not replace the product conformity testing. The TSI CSS compliancy of the On-Board equipment shall be assessed and notified before conduction the mentioned RSC test cases. These chosen tests are in addition to the tests certified by the NoBo for each part of the subsystem, to ensure the compatibility between hardware, software and configuration of all sub-systems combined (On-board, SIM, Network, FTS)

The verification of requirements relating to the safe integration of radio components on the train is not scope of this document and shall be addressed by the applicant in his safety management system.
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Some checks only require documentation (e.g., for the configuration of the SIM card fitted in the on-board subsystem).

The hardware and software versions of the on-board equipment, as well as the SIM card used to carry out the checks, must be the same as intended for later operation on the Luxembourgish infrastructure.

2.3   **Organization**

The applicant shall inform the Luxemburgish infrastructure manager about the needs to carry out RSC testing in Luxembourg via the contact address in §4 at least 4 months before the the date of the tests. Test cases are divided in dynamic and static tests.

In general, **dynamic tests** are not necessary. If for some unforeseen reasons, they should turn out to be necessary, the paths shall be requested by a railway undertaking (RU) with a valid safety certificate in Luxembourg from the ACF. The infrastructure manager shall be informed via contact address in §4 at least 3 months before the date of the tests.

The coordination of **static tests** (subsystem level) shall be started a least 2 months before the active tests are carried out either in the GI (NOC) laboratory or in a station if approved by the IM.

Equally, the coordination of the **IC level tests** shall start at least 2 months before the date of the tests. Tests are conducted in the GI (NOC) laboratory which offers a test network with hardware and software level identical to the live network.

After conducting the tests, the applicant must provide a report with the results of the tests requested in this document. The report must emphasize any deviation from the expected results. Deviations shall be assessed and classified into minor, major or critical, dependent of the impact for railway traffic regulation, and railway security:

At the beginning of the test coordination, the applicant shall provide:
- The full documentation (in English, French or German language), including:
  o The user manual;
  o A document describing the equipment, with the different configurations;
  o The compliancy agreement against FRS/SRS EIRENE standards;
  o A EC certification.

During the test, the applicant shall provide:
- The on-board equipment to be tested including MMI, power supply, cables;
- A jumper cable to connect to the test laboratory equipment (N-male);
- A SIM card allowed to register on the Luxembourgish GSM-R network;
- An internal trace tool (if necessary).

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2.4 *RST Type*

In accordance with the test process, the network can be divided in 3 categories: No GSM-R, GSM-R for voice calls only, GSM-R for voice and data.

For train operation on the Luxembourgish infrastructure only the GSM-R radio voice part is needed. The configuration is homogeneous to the whole network, for this reason only the type of **RSC-LU-01-V** will be defined for the whole network.

2.5 **References**

[1] : O-3001-1: GSM-R Cab radio testcases catalogue

[2] : ETSI TS 102 933-1 / 2 v1.3.1

[3] : UIC filter GSM R - O-8760 1.0

[4] : COMMISSION IMPLEMENTING REGULATION (EU) No 402/2013 of 30 April 2013 on the common safety method for risk evaluation and assessment and repealing Regulation (EC) No 352/2009

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3 Technical compatibility specifications

3.1 Functional check of the Cab Radio

3.1.1 GSM-R1 requirement

Test Id	Check to apply according to [1]	IC	subsystem Level
1	4.1.1 System boot with error free device 4.1.5 Power-off and back on with different network coverage		X
2	4.4.1 Select manually GSM-R L network while radio coverage is available 4.4.3 Visualisation – network loss		X
3	4.6.1 Registration of train data 4.6.2 Correction of train data 4.6.3 Re-registration after changing networks 4.6.4 Registration of functional address to other driver 4.6.5 Registration / deregistration of stock number 4.6.6 Deregistration of train number 4.6.7 Deregistration of train number – not successful 4.6.8 Forced deregistration		X
4	4.8.2 Incoming PTP call with eMLPP <4> and with train functional identity 4.8.3 Incoming PTP call with eMLPP <4> and with engine/coach functional identity 4.8.6 Outgoing PTP call – MSISDN or number of fixed network user (CoLP) 4.8.7 Outgoing PTP call – functional number 4.8.8 Outgoing PTP call – controller		X
5	4.9.1 Incoming voice group call 4.9.5 Outgoing high priority voice group call – "other drivers in the area" 4.9.6 Visualisation – "Unable to establish VGC"	X	
6	4.12.1 Incoming railway emergency call 4.12.2 Outgoing railway emergency call	X	
Additional check			
7	1777 (Departure Ready) The Cab-Radio is functionally registered (CT2) in the GSM-R system. As soon as a train is ready for departure, the driver signals this to the traffic controller by making a call to the shortnumber 1777. The system checks whether the train number is existing or not and emits a voice message accordingly.		X

3.2 Disturbances generated by PO

3.2.1 Introduction

GSM-R uses the frequency bands 876-880Mhz coupled with 921-925 MHz, adjacent to those of the public mobile networks authorized in the 900 MHz band. Due to this proximity, three events can disturb the reception of GSM-R on the RFN:
- Intermodulation products (IM3)
- Blocking
- Out-of-band

European studies have proven that Cab Radios conform to specifications [2], or the installation of external filters conform to specifications [3], constitute the most effective solutions against the risks of disruption by IM3 and the saturation generated by the presence of public mobile networks.

3.2.2 GSM-R2 requirement

Test Id	Reference	Check	Doc. evidence	Static tests	Dynamic tests
8	Filter	For vehicles with GSM-R Cab Radios that do not conform to specifications [2], or [3], the railway undertaking (RU) shall perform (subsystem level) a risk evaluation and assessment according to [4] of their alternative solution to the interference issue. The risk evaluation and assessment shall describe how the RU has managed the common traffic safety risks and national operational communications requirements. The result of this check will always be "passed"; however, the applicant will have to document the risk management.	X		

3.3 Integration of the GSM-R radio part into the rolling stock

3.3.1 Introduction

As advised in paragraph 3.2.1 of the EIRENE SRS v15.4.0 standard, CFL assumed for the radio planning of the GSM-R network that rolling stock is equipped with an isotropice antenna with a corresponding gain of 0dBi.

3.3.2 GSM-R3 requirement

Test Id	Reference	Check	Doc. evidence	Static tests	Dynamic tests
9	Antenna	An applicant, who cannot provide prove that the GSM-R on-board antenna integration was performed compliant to the assumption of an isotropic 0dBi gain on-board antenna, shall perform a risk evaluation and assessment (subsystem level) in accordance [4] of their alternative solution to describe how the RU has managed the common traffic safety risks and national operational communications requirements. The result of this check will always be "passed"; however, the applicant will have to document the risk management.	X		
10	Integration	An applicant who cannot provide prove that he has installed the GSM-R voice antenna in the free field, on a flat, metallic and horizontal surface with a VSWR measured at the antenna connector of less than 2 in the GSM-R bands shall perform a risk evaluation and assessment (subsystem level) in accordance with [4] to describe how the RU has managed the common traffic safety risks and national operational communications requirements of their chosen alternative solution. The result of this check will always be "passed"; however, the applicant will have to document the risk management.	X		

3.4 **Radio autonomy**

3.4.1 **Introduction**

In the event of a power outage (intended or not), the traffic controller must be able to communicate with the train driver. Thus, the vehicle batteries shall be capable of delivering power to the Cab Radio for two hours in order to guarantee the GSM-R connectivity, including 30 min of communication. Other mandatory consumers such as front lights, rear lights, emergency lighting for passengers, .etc. must be included in the calculation.

3.4.2 **GSM-R4 requirement**

Test Id	Reference	Check	Doc. evidence	Static tests	Dynamic tests
11	autonomy	An applicant who cannot provide prove that the train driver is reachable via GSM-R for two hours after a power outage, including 30 minutes of communication, shall perform a risk evaluation and assessment (subsystem level) in accordance with [4] to describe how the RU has managed the common traffic safety risks and national operational communications requirements of their chosen alternative solution. The result of this check will always be "passed"; however, the applicant will have to document the risk management.	X		

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4   Contact:

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