UK Application of GSM-R

The Operational Concept

Issue: 01
Date: 14 December 2006
Reference: RSSB-GSM-R-OC

Content approved by:
Multi-Functional Standards Committee on 28 November 2006
Intentionally Blank
Executive Summary

This document has been produced by the Rail Safety and Standards Board (RSSB) as part of the rail industry's implementation of GSM-R radio communications to the British railway system. The document describes the conceptual operation of the Global System for Mobile communications – Railways (GSM-R) voice (and some non-European Rail Traffic Management System (ERTMS) data functionality) radio communication system. Use has also been made of a detailed set of operational scenarios to verify against the system design and the Control Command and Signalling Technical Specification for Interoperability (TSI).

The purpose of this document is to:

a) Provide a common vision of GSM-R operation in Great Britain (GB) for all users and stakeholders.

b) Describe the principles underpinning the set of National Notified Technical Rules (NNTRs) which, in tandem with the current TSIs, describe how the essential requirements for a railway system, subsystems and interfaces are to be met in respect of operation on all or part of the United Kingdom's main-line railway network as defined in the Railway and other Guided Transport Systems Regulations (ROGs).

c) Explain the way in which GSM-R will function from the point of view of the user.

d) Allow the stakeholders to understand how GSM-R will affect them.

e) Provide information relevant to (but not limited to) the following:

- Infrastructure Manager
- Railway Undertakings
- RSSB
- Maintenance organisations for traction and rolling stock and infrastructure
- System/equipment suppliers
- Department for Transport (DfT)
- Office of Rail Regulation (ORR)
- Notified Bodies (NoBos)

It is a relevant strategy, as defined in the Railway Group Standards Code, in order that it may be:

- A basis for proposals for Standards change.
- A justification of proposals.
- Used to determine prioritising of those proposals.

The introduction of GSM-R will make possible a significant improvement in the quality of voice communications across much of the network. The GSM-R radio system will
provide secure voice communications between drivers and signallers, relaying calls via radio base stations built alongside the railway or on suitable vantage points.

This document describes the operational concept in terms of application of how GSM-R is envisaged to operate from the point of view of the direct users. This includes roles such as the driver, signaller, route controller, shunter, maintainner, etc.

The document provides a high-level narrative description. It does not generally describe technical details or operational procedures unless these are necessary to understand the concept. It provides the best current view of how the system will operate and will be subject to review and revision, particularly as a result of the Trial.

Although the document’s content is not itself mandatory, as it is a relevant strategy it determines what will be made mandatory in Railway Group Standards which will also be NNTRs.

In describing the functionality of the system, it is assumed that the principles embodied in the current formal railway communication protocols defined in the Rule Book [R2] and GE/RT8046 [R4] will continue to apply. Minor changes to the Rule Book will be required, and have been considered in the proposed rule changes [R12].
The Operational Concept

Contents

Executive Summary ................................................................................................................. 3

Contents .................................................................................................................................... 5

Issue Status .............................................................................................................................. 9

General Information ................................................................................................................. 9

1 Introduction .................................................................................................................. 10

1.1 Background ............................................................................................................... 10

1.2 Content of this Document ......................................................................................... 11

1.3 Purpose of this Document ........................................................................................ 12

1.4 Scope of this Document ........................................................................................... 13

1.5 Excluded From the Scope of this Document ............................................................ 13

1.6 Definitions ................................................................................................................. 14

1.7 References ............................................................................................................... 20

2 GSM-R Overview .......................................................................................................... 21

2.1 System Architecture ................................................................................................. 21

2.2 System Overview ...................................................................................................... 24

3 GSM-R User Types ...................................................................................................... 26

3.1 Signaller .................................................................................................................... 26

3.2 Driver ........................................................................................................................ 26

3.3 Conductor/Guard ...................................................................................................... 26

3.4 Other on-train personnel ........................................................................................... 26

3.5 Shunter ..................................................................................................................... 27

3.6 Route Controller ....................................................................................................... 27

3.7 Electrification Control Operator (ECO) ..................................................................... 27

3.8 Service Delivery Centre (SDC) Personnel ............................................................... 27

3.9 Track Worker ............................................................................................................ 27

3.10 Maintainer ................................................................................................................ 28

3.11 Telecom Engineering Control (TEC) ....................................................................... 28

4 Call Descriptions ......................................................................................................... 29

4.1 Call Types ................................................................................................................. 29

4.2 Call Functions ........................................................................................................... 34

4.3 Calling Methods ........................................................................................................ 36

4.4 Call Connection Performance ................................................................................... 39

4.5 Call Priorities ............................................................................................................. 41

5 Human Machine Interface (HMI) Information ............................................................ 42

5.1 Driver ........................................................................................................................ 42

5.2 Signaller .................................................................................................................... 43

5.3 Route Controller ....................................................................................................... 44

5.4 Electrical Control Operator (ECO) .......................................................................... 45
5.5 Operational Handportable Radio (OPH) ................................................................. 45

6 Normal Working ........................................................................................................... 47
6.1 Cab Mobile Start Up ................................................................................................. 47
6.2 Standing at Signal Message (Scenario 3) ................................................................. 48
6.3 Driver Calls Signaller (Scenario 24) ........................................................................ 49
6.4 Signaller Calls Driver (Scenario 20) ........................................................................ 49
6.5 Shunting Group Call (Scenario 8) ........................................................................... 50
6.6 Switch off Cab Mobile Human Machine Interface (HMI) (Scenario 18)................. 51
6.7 Signal Box Closed (Scenario 10) .......................................................................... 51

7 Abnormal Working ....................................................................................................... 52
7.1 Train Power Failure ................................................................................................. 52
7.2 Unplanned Movement (Scenario 2 Variant 7) ......................................................... 52
7.3 Assisting Failed Trains (Scenario 15 – multi party voice calls) – propelling movement ........................................................................................................................... 52
7.4 Passing Signals at Danger ..................................................................................... 52
7.5 Wrong Direction and Unsignalled Movements ...................................................... 52
7.6 Other Circumstances ............................................................................................. 53
7.7 Driver’s Safety Device (DSD) Activation ............................................................... 53
7.8 Signaller Communication Over Public Address (Scenario 22).............................. 54

8 Degraded Working ....................................................................................................... 55
8.1 Cab Mobile Failure ................................................................................................. 55
8.2 GSM-R Infrastructure Failure ................................................................................... 55
8.3 Registration Failure (Scenario 2 Variant 5) .............................................................. 55
8.4 Duplicate TRNs (Scenario 2 Variant 5) .................................................................... 56
8.5 Enhanced Location Dependent Addressing (eLDA) – correlation failure ............. 56
8.6 Call Failure from Cab Mobile ................................................................................ 56

9 Emergencies and High Priority Calls ......................................................................... 57
9.1 Driver Initiated Railway Emergency Group Call – stop all trains ......................... 57
9.2 Railway Emergency Group Call initiated by other than registered Cab Mobile ...... 58
9.3 Signaller Initiated Railway Emergency Group Call – stop all trains ....................... 58
9.4 Recovery from Railway Emergency Group Calls .................................................. 59
9.5 Route Controller Initiated Railway Emergency Group Call .................................. 59
9.6 Operational Handportable Radio (OPH) Initiated Railway Emergency Group Call.. 59
9.7 Driver initiated Urgent Point-to-Point Call ............................................................ 59
9.8 Signaller Initiated Urgent Point-to-Point Call ......................................................... 59
9.9 Shunting Emergency Group Call ........................................................................... 59

10 Shunting Mode .......................................................................................................... 61
10.1 Arrangements for the use of Radio ........................................................................ 61
10.2 Shunting Group Call ............................................................................................ 61
10.3 Common Shunting Group Call ............................................................................. 61
10.4 Dedicated Shunting Group Call .......................................................................... 62
11 Data Recording ............................................................................................................. 63
  11.1 Recording of Call Traffic .................................................................................. 63
  11.2 Voice Recording .............................................................................................. 63
  11.3 Trainborne Recording ...................................................................................... 63

12 Migration ....................................................................................................................... 66
  12.1 Objectives .......................................................................................................... 66
  12.2 Safety ................................................................................................................ 66
  12.3 Efficiency .......................................................................................................... 66
  12.4 Cost ..................................................................................................................... 66
  12.5 Timescales ......................................................................................................... 66
  12.6 Contingency ....................................................................................................... 67
  12.7 Migration Rules .................................................................................................. 67
  12.8 Technical Requirements .................................................................................... 67

13 Configuration Management ....................................................................................... 69
  13.1 General ................................................................................................................ 69
  13.2 Equipment Access Control ............................................................................... 69
  13.3 Subscriber Management .................................................................................... 69

14 Call Facilities and Accessibility ................................................................................ 70
  14.1 Connectivity Matrix .......................................................................................... 70

15 System Maintenance ................................................................................................... 71
  15.1 Infrastructure Maintenance ............................................................................... 71

APPENDIX 1 - Operational Scenarios .......................................................................... 72
  1 Power Cab Mobile Up - Scenario SCN/NOC/001....................................................... 72
  2 Cab Mobile Registration - Scenario SCN/NOC/002 .................................................. 73
  3 Standing at Signal Message - Scenario SCN/NOC/003 ............................................ 74
  4 Transition between radio systems - Scenario SCN/NOC/005 ................................. 75
  5 Shunting Group call - Scenario SCN/NOC/008 ....................................................... 76
  6 Additional use of text messages - Scenario SCN/NOC/011 .................................... 77
  7 Multi party voice calls - Scenario SCN/NOC/015 .................................................. 78
  8 Switch off cab mobile HMI - Scenario SCN/NOC/018............................................. 79
  9 Echo test facility - Scenario SCN/NOC/019............................................................ 80
 10 Signaller calls driver - Scenario SCN/AOC/020 ..................................................... 81
 11 DSD Activation - Scenario SCN/AOC/021............................................................ 82
 12 Signaller communicates over PA - Scenario SCN/AOC/022 ............................... 83
 13 General Broadcast Call - Scenario SCN/AOC/023 ................................................. 84
 14 Driver calls signaller in TD area - Scenario SCN/AOC/024 ................................. 85
 15 Driver initiates emergency group call - Scenario SCN/EOC/031 ......................... 86
The Operational Concept

16 Operational radio initiated emergency call - Scenario SCN/EOC/032 .................. 87
17 Driver initiates urgent point-to-point call - Scenario SCN/EOC/033 ...................... 88
18 Signaller emergency call ‘stop one train’ - Scenario SCN/EOC/034 .................... 89

APPENDIX 2 – Connectivity Matrix .................................................................................. 90
APPENDIX 3 – Open Points ................................................................................................ 92
The Operational Concept

Issue Status

<table>
<thead>
<tr>
<th>Version</th>
<th>Status</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>During its development and progress through the industry standards process this Operational Concept was referenced as NS-GSM-R-OPS-0503. This document is Issue 7 of NS-GSM-R-OPS-0503 which was submitted to the RSSB Board as RSSB-GSM-R-OC, Issue 1. The RSSB Board endorsed this document for publication as a relevant strategy under the Railway Group Standards Code on 14 December 2006.</td>
<td>14 December 2006</td>
</tr>
</tbody>
</table>

General Information

Each infrastructure manager or railway undertaking is reminded of the need to consider its own responsibilities to ensure health and safety at work and its own duties under health and safety legislation. RSSB does not warrant that compliance with all or any documents published by RSSB is sufficient in itself to ensure safe systems of work or operation or to satisfy such responsibilities or duties.

RSSB members wishing to use the information contained in this document as the basis for further work are strongly advised to contact RSSB for current information on status, further guidance and the possibility of additional support.

Uncontrolled copies of this document may be obtained from the Head of New Systems, Rail Safety and Standards Board, Evergreen House, 160 Euston Road, London NW1 2DX.
1 Introduction

This document has been produced by RSSB on behalf of the GB railway undertakings and infrastructure managers as part of the rail industry’s implementation of GSM-R radio communications to the GB main line railway system. The document describes the conceptual operation of the GSM-R voice (including certain non ERTMS data functionality) radio communication system. Use has also been made of a detailed set of operational scenarios to verify against the system design and the Command Control and Signalling and Operations TSIs.

1.1 Background

1.1.1 The main purpose of voice radio systems between driver and signaller is to provide an effective means of communication to support the safe and efficient movement of trains and general operation of the railway.

1.1.2 The use of radio has long been recognised as providing safety and performance benefits: the primary safety role being as a bearer of communication for passing of safety messages and instructions. This reduces both the need for people to be trackside and the time taken to get a message to its intended recipient which is especially critical in emergency situations. It should be noted that the use of radio in respect of train operations normally takes place during either abnormal, emergency or degraded mode situations.

1.1.3 The use of radio within the driving cab in Britain dates back to the 1980s with its introduction resulting from the following:

   a) The requirement from the outset for Driver Only Operation Passenger (DOO(P)) trains to have discrete communication between the driver and signaller;

   b) A recommendation following the Polmont derailment in 1984 that there be radio communication to alert drivers in an emergency of an unsafe situation. This initially applied where trains ran at 100 mph or above; and

   c) A recommendation in the Hidden Report in 1989 that all trains should have installed a system of radio communication between driver and signaller.

1.1.4 The technology on which the existing British railway voice radio systems are based is reaching life expiry and will become progressively more expensive to maintain.

1.1.5 Under European Interoperability Directives 96/48EC [R10] and 2001/16/EC [R11], all railway routes in Europe being built, upgraded or renewed are to be subject to the requirements of the TSIs. The TSIs specify GSM-R voice and data radio.

1.1.6 Modernisation of the train communications systems is intended to deliver benefits in the quality, cost and efficiency of train operation.
1.1.7 The introduction of GSM-R will deliver safety enhancements that will address many of the communication related recommendations of various accident inquiries, such as direct communication between the driver and the signaller.

1.1.8 GSM-R will make possible a significant improvement in the quality of voice communications across much of the network and all applications will be catered for within the one system. The new radio system will provide secure voice communications between trains and signallers, relaying calls via radio base stations built alongside the railway or on suitable vantage points.

1.1.9 The scope of this document is to define the operating concept of the national GSM-R radio system in order that it shall fulfil its intended purpose.

1.1.10 The purpose of the GSM-R system is to provide the optimum means of communication to support the safe and efficient movement of trains and general operation of the railway system as a whole, taking account of legislation and available funds. Its operations concept and associated specifications must respect the requirements of the Safety Directive to “generally maintain and, where reasonably practicable, continuously improve the overall level of safety, taking into consideration the development of Community legislation and technical and scientific progress and giving priority to the prevention of serious accidents.”

1.1.11 The system will replace Cab Secure Radio (CSR) and National Radio Network (NRN). This includes:
   a) Replacement of the existing CSR/Strathclyde Manning Agreement (SMA) cab mobile equipment.
   b) National replacement of the existing NRN cab mobile equipment.
   c) National introduction of GSM-R cab mobiles.
   d) National introduction of signaller / route controller fixed terminals.
   e) National replacement of CSR and NRN trackside infrastructure equipment.
   f) National replacement of NRN (‘Brunel’) handsets - The trackside users of ‘back to back’ radios may transfer to GSM-R operational handportable radios (OPHs) as GSM-R functionality supports this type of communication.

1.2 Content of this Document

1.2.1 This document describes the operational concept in terms of how the system is envisaged as operating from the point of view of the users of GSM-R. This includes roles such as the driver, signaller, route controller, shunter, maintainer, etc.
1.2.2 The document provides a high-level narrative description. It does not generally describe technical details unless these are necessary to understand the concept. It provides the best current view of how the system must operate and will be subject to review and revision, particularly as a result of the Trial. The document is not itself mandatory, but as it is a relevant strategy it determines what will be made mandatory in Railway Group Standards which will also be NNTRs.

1.2.3 Chapter 2 provides an overview of the GSM-R system. Chapter 3 describes the user types and their interaction with GSM-R. Chapters 4 and 5 describe the equipment function according to the Control Command and Signalling TSI. Chapters 6 to 15 describe how train operation will be affected by the additional functionality and constraints introduced by the system.

1.2.4 In describing the functionality of the system, it is assumed that the principles embodied in the current formal railway communication protocols defined in the Rule Book [R2] and GE/RT8046 [R4] will continue to apply. Minor changes to the Rule Book will be required, and have been considered in the draft rule changes [R12].

1.2.5 Human machine interface (HMI) design is an open point in the TSI and therefore will require a series of NNTRs to mandate any required features. HMI designs can be specific to GB requirements, for example, DOO(P) operation. (A CENELEC specification exists for the European Train Control System (ETCS) driver HMI which includes GSM-R, but there is no standard for an independent radio HMI).

1.3 Purpose of this Document

1.3.1 The purpose of this document is to:

1.3.2 Provide a common vision of GSM-R operation in GB for all users and stakeholders.

1.3.3 Describe the principles underpinning the set of NNTRs which, in tandem with the current TSIs, describe how the essential requirements for a railway system, subsystems and interfaces are to be met in respect of operation on all or part of the UK’s main-line railway network as defined in the ROGs.

1.3.4 Explain the way in which GSM-R will function from the point of view of the user.

1.3.5 Allow the stakeholders to understand how GSM-R will affect them.

1.3.6 Provide information relevant to (but not limited to) the following:

- Infrastructure Manager
- Railway Undertakings
- RSSB
- Maintenance organisations for traction and rolling stock and infrastructure
- System/equipment suppliers
- DfT
• ORR
• NoBos

1.3.7 It is a relevant strategy, as defined in the Railway Group Standards Code, in order that it may be:

• A basis for proposals for Standards change.
• A justification of proposals.
• Used to determine prioritising of those proposals.

1.4 Scope of this Document

1.4.1 GSM-R is defined in the Command Control and Signalling TSI. (The TSI currently refers to the EIRENE Functional Requirement Specification (FRS) [R8] and System Requirement Specification (SRS) [R9]). This document recognises the optional requirements of these documents.

1.4.2 Interoperability requirements as defined in the European Interoperability Directives (96/48EC [R10] and 2001/16/EC [R11]).

1.4.3 Requirements for specific GB functionality, additional to that described in the Control Command and Signalling TSI which is necessary to meet the essential requirements.

1.4.4 Normal, abnormal, degraded and emergency situations (as defined in 1.6.3).

1.5 Excluded From the Scope of this Document

1.5.1 Use of general purpose handportable radios (GPH). Excluded because GPHs do not feature in driver to signaller communications, but their use and indeed that of OPH are at the discretion of individual stakeholder organisations.

1.5.2 The Operational Concept has been developed assuming no provision of OPHs however where the functionality is known it has been included for information purposes only. (Operational Shunting Handportables (OPS) for shunting are however included.)

1.5.3 Use of direct mode operation. [Note that it has been determined that direct mode is not necessary provided that network coverage will be available in all locations to provide this functionality as a point-to-point call using OPHs and cab mobiles if required.]

1.5.4 The detailed design of the user HMIs.

1.5.5 Technical details unless these are necessary to understanding the concept.

1.5.6 Discussion of alternatives or provision of the rationale behind the decisions – this is provided as [R14].

1.5.7 This document provides a common vision of GSM-R operation in GB for all users and stakeholders in relation to voice but not ETCS data.
1.6 Definitions

1.6.1 Abbreviations

- ATOC: Association of Train Operating Companies
- BSC: Base Station Controller
- BSS: Base Station Sub-system
- BTS: Base Transceiver Station
- COSS: Controller of Site Safety
- CSR: Cab Secure Radio
- DOO(P): Driver Only Operation (Passenger)
- DRACAS: Defect Recording and Corrective Action System
- DSD: Driver’s Safety Device
- ECO: Electrical Control Operator
- EIR: Equipment Identity Register
- EIRENE: European Integrated Railway Radio Enhanced Network
- eLDA: enhanced Location Dependent Addressing
- eMLPP: enhanced Multi-Level Precedence and Pre-emption
- ERTMS: European Rail Traffic Management System
- ETCS: European Train Control System
- ETD: Extended Trunk Dialling
- FTN: Fixed Telecommunications Network
- FTS: Fixed Terminal Sub-system
- FRS: Functional Requirement Specification; [R8]
- GB: Great Britain
- GCR: Group Call Register
- GPH: General Purpose Handportable
- GPS: Global Positioning System
- GSM-P: Global System for Mobile communications – Public
- GSM-R: Global System for Mobile communications – Railways
- HLR: Home Location Register
- HMI: Human Machine Interface
- HMRI: Her Majesty’s Railway Inspectorate
- IVRS: Interim Voice Radio System
- LDA: Location Dependent Addressing
- LRU: Line Replaceable Units
- MSC: Mobile Services Switching Centre
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSISDN</td>
<td>Mobile Station International ISDN number</td>
</tr>
<tr>
<td>NNTRs</td>
<td>Notified National Technical Rules</td>
</tr>
<tr>
<td>NoBo</td>
<td>Notified Body</td>
</tr>
<tr>
<td>NRN</td>
<td>National Radio Network</td>
</tr>
<tr>
<td>NSS</td>
<td>Network Switching Sub-system</td>
</tr>
<tr>
<td>OTMR</td>
<td>On Train Monitoring and Recording Systems</td>
</tr>
<tr>
<td>OPH</td>
<td>Operational Handportable Radio</td>
</tr>
<tr>
<td>OPS</td>
<td>Operational Shunting Handportable</td>
</tr>
<tr>
<td>ORG</td>
<td>Operations Review Group</td>
</tr>
<tr>
<td>ORR</td>
<td>Office of Rail Regulation</td>
</tr>
<tr>
<td>PA</td>
<td>Public Address</td>
</tr>
<tr>
<td>PICOP</td>
<td>Person In Charge Of Possession</td>
</tr>
<tr>
<td>PMU</td>
<td>Portable Maintenance Unit</td>
</tr>
<tr>
<td>PSTN</td>
<td>Public Service Telephone Network</td>
</tr>
<tr>
<td>PTT</td>
<td>Push To Talk</td>
</tr>
<tr>
<td>ROGs</td>
<td>Railway and other Guided Transport Systems Regulations</td>
</tr>
<tr>
<td>RSPG</td>
<td>Railway Safety Principles and Guidance</td>
</tr>
<tr>
<td>RSSB</td>
<td>Rail Safety and Standards Board</td>
</tr>
<tr>
<td>SDC</td>
<td>Service Delivery Centre</td>
</tr>
<tr>
<td>SIM</td>
<td>Subscriber Identity Module</td>
</tr>
<tr>
<td>SMA</td>
<td>Strathclyde Manning Agreement</td>
</tr>
<tr>
<td>SMS</td>
<td>Short Message Service</td>
</tr>
<tr>
<td>SPT</td>
<td>Signal Post Telephones</td>
</tr>
<tr>
<td>SRP</td>
<td>Safety Review Panel</td>
</tr>
<tr>
<td>SRS</td>
<td>System Requirement Specification; [R9]</td>
</tr>
<tr>
<td>ST</td>
<td>Stop Acknowledge</td>
</tr>
<tr>
<td>TEC</td>
<td>Telecom Engineering Control</td>
</tr>
<tr>
<td>TD</td>
<td>Train Descriptor</td>
</tr>
<tr>
<td>TIU</td>
<td>Train Interface Unit</td>
</tr>
<tr>
<td>TRN</td>
<td>Train Reporting Number</td>
</tr>
<tr>
<td>TSI</td>
<td>Technical Specification for Interoperability</td>
</tr>
<tr>
<td>UIC</td>
<td>Union Internationale des Chemins de Fer</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>UPS</td>
<td>Uninterruptible Power Supply</td>
</tr>
<tr>
<td>UUS1</td>
<td>User - User Signalling Type 1</td>
</tr>
<tr>
<td>VLR</td>
<td>Visitor Location Register</td>
</tr>
</tbody>
</table>
1.6.2 Terminology

General

Direct Mode
A method of operation for GSM-R radios (of all types) that does not require the provision of trackside infrastructure such as base stations. This equates to the familiar ‘back to back’ operation of radios, and is only effective over short distances.

Driver Only Operation (DOO)
The operation of a train without a person on board for the purpose of protecting the train when the driver is incapacitated and the train is stopped by failure, accident, obstruction of the line or other exceptional incident.

Driver Only Operation (Passenger) (DOO(P))
DOO as applied to trains carrying passengers.

Location Dependant Addressing (LDA) / enhanced Location Dependant Addressing (eLDA)
A means of addressing calls to registered recipients based on the location of the caller, for example, to allow a cab mobile to call the controlling signaller.

However, an external source may be used to derive more accurate/reliable location information. For example the trackside train detection system combined with the train reporting number (TRN) as entered into the cab mobile and as managed by the train describer (TD). This is known as eLDA.

GSM-R
A digital radio system based on the GSM mobile communication standard adapted for use on European railways. The GSM-R system, is defined by the Control Command and Signalling TSI and updates approved as part of the change control process.

GSM-R Operations Review Group (ORG)
The meeting group of GSM-R stakeholder representatives, including railway undertakings and the infrastructure manager, chaired by RSSB. The ORG work has included the Operational Concept and Rule Book issues.

Mobile
A GSM-R cab mobile or operational radio.

Priority and Pre-emption
The Control Command and Signalling TSI determines the ‘enhanced multi-level precedence and pre-emption’ levels for specific call types. The priority and pre-emption requirements specify a hierarchy of call types to ensure that operational and emergency calls are not blocked by lower level priority calls.

Secure Radio System
A radio system that identifies the location or the TRN when used by a driver calling a signaller or vice versa. A radio system that allows operational movement instructions to be passed between the signaller and driver without other signallers or drivers overhearing the communication.
### Subscriber Identity Module (SIM)

SIM provides identity and functionality for the radio.

### The Trial

The Trial in Strathclyde will be undertaken to demonstrate GSM-R as a secure driver/signaller voice radio application for GB and the compliance of GSM-R to the identified requirements.

### Train Reporting Number (TRN)

The TRN (sometimes referred to as the train’s headcode) is the conventional four character (digit, alpha, digit, digit) ‘number’ used as the train identification for railway systems, publications and communication. References to the TRN in this document refer exclusively to the four character format. A given TRN may be in use for more than one train on the GB network at any given time.

This TRN can be expanded to a six character format, as used by Operations Planning, to give a unique identifier of the form ‘digit, alpha, digit, digit, alpha, alpha’.

### Will

A ‘will’ statement is used when a function of GSM-R is specified as part of the Control Command and Signalling TSI.

### Must

A ‘must’ statement is used when a measure is required, in conjunction with the TSI, to meet the essential requirements.

### Equipment Types

<table>
<thead>
<tr>
<th>Equipment Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cab Mobile</td>
<td>For the purpose of this document, a cab mobile is a GSM-R radio that, as a minimum, meets all the mandatory requirements as specified within the Control Command and Signalling TSI, including NNTRs, and which is being used as a train radio (either fixed or transportable) in the sense set out in GE/RT8080 [R5].</td>
</tr>
<tr>
<td>General Purpose Radio</td>
<td>A standard handportable radio closely based on commercially available units for general use.</td>
</tr>
<tr>
<td>Operational Handportable Radio (OPH)</td>
<td>A hand-held robust portable GSM-R radio with the capability to make and receive railway emergency calls that, as a minimum, meets all the mandatory requirements for an ‘operational radio’ as specified within the Control Command and Signalling TSI, including NNTRs. Referred to as OPH for radios without shunting mode and OPS for those with.</td>
</tr>
<tr>
<td>Fixed Terminal</td>
<td>The fixed equipment provided to interface GSM-R with a static user such as a signaller. The functionality required by the route controller terminals is essentially the same as for the signaller terminal, but the control area will differ and the call set-up subsystem may be integrated into their own function management system. [R8]</td>
</tr>
</tbody>
</table>

### Staff Role Types

This clarifies the relationship with the GB use of the term...
and that used in the Control Command and Signalling TSI. (Shown in italics)

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signaller</td>
<td>The signaller. <strong>EIRENE FRS/SRS: Primary Controller</strong> The location and direction of movement of any particular train permits the identification of a unique train controller who has primary responsibility for that train (for example the controller who is the first point of contact in an emergency).</td>
</tr>
<tr>
<td>Controlling Signaller</td>
<td>The signaller controlling the area within which the mobile (cab mobile or operational radio) is currently located. <strong>EIRENE FRS/SRS: Primary Controller</strong> The location and direction of movement of any particular train permits the identification of a unique train controller who has primary responsibility for that train (for example the controller who is the first point of contact in an emergency). This controller is termed the primary controller.</td>
</tr>
<tr>
<td>Route Controller</td>
<td>The infrastructure manager route operations control office operator. <strong>EIRENE FRS/SRS: Secondary Controller</strong> Any train controller who is not a primary controller. A given train and its location and direction will uniquely define a secondary controller.</td>
</tr>
<tr>
<td>Electrical Control Operator (ECO)</td>
<td>The ECO controlling the area within which the mobile (cab mobile or operational radio) is currently located. <strong>EIRENE FRS/SRS: Power Supply Controller</strong> A controller responsible for the management of the traction power supply.</td>
</tr>
<tr>
<td>Driver</td>
<td>The person undertaking driving duties.</td>
</tr>
<tr>
<td>Maintainer</td>
<td>Infrastructure manager or railway undertaking responsible for maintenance of GSM-R trackside or trainborne equipment.</td>
</tr>
<tr>
<td>Shunting Group Leader</td>
<td>Person in charge of a dedicated GSM-R shunting group.</td>
</tr>
<tr>
<td>Shunter</td>
<td>Person undertaking control of shunting activities.</td>
</tr>
<tr>
<td>Service Delivery Centre (SDC) Operator</td>
<td>A railway undertaking’s controller responsible for the planning of train services, especially in regards to contingency plans.</td>
</tr>
<tr>
<td>Train Preparer</td>
<td>Person preparing a train for service (who may also be the driver) who will check that GSM-R cab mobiles are operating correctly to enable the train to go into service.</td>
</tr>
</tbody>
</table>
### 1.6.3 Types of Operation

The following are based on the Health and Safety Executive (HSE) / Her Majesty's Railway Inspectorate (HMRI) Railway Safety Principles and Guidance (RSPG) but have been adapted to distinguish situations where railway operations are degraded but GSM-R is functioning normally. The RSPG definition is provided in italics for reference.

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>“The conditions which a part of the railway is designed to accommodate. This would include the peaks, for example rush hours, and troughs in demand experienced during the day.” Normal is to be considered as situations expected to be encountered entering, exiting and making train movements in the GSM-R area and any set up or close down arrangements as part of start of service or end of service duties. Normal also includes any routine maintenance activities that do not affect the ability of the system to provide a fully functional operational railway.</td>
</tr>
<tr>
<td>Abnormal</td>
<td>“Extreme loading on a part of the railway system. For example, this may be the result of extended delays on one part of the service impinging on another.” An unforeseen or unplanned event, which does not have life threatening or extreme loss implication, including faults and failures external to GSM-R equipment. Examples would include the failure of a train due to traction problems, or the reduction of infrastructure availability due to a bridge strike or broken rail. Under these conditions it is expected that GSM-R will operate as designed but be subject to abnormal system loading. Abnormal would also include any planned maintenance activity not affecting the functionality of GSM-R on the lines remaining open to traffic.</td>
</tr>
<tr>
<td>Degraded</td>
<td>“The state of the part of the railway system when it continues to operate in a restricted manner due to the failure of one or more components.” A planned or unplanned reduction in the ability of GSM-R to operate in its normal manner. This could include ‘graceful’ or partial degradation where it remains acceptable to continue to operate the GSM-R equipment. It would also include any planned outages to amend or upgrade GSM-R equipment where this will result in a reduction of service during the change over.</td>
</tr>
<tr>
<td>Emergency</td>
<td>“A current unforeseen or unplanned event which has life threatening or extreme loss implication and requires immediate attention, for example a fire”. Complies with the RSPG definition and includes any failures of the GSM-R system that may cause immediate risk of extreme loss.</td>
</tr>
</tbody>
</table>
1.7 References

[R1] GSM-R Voice Radio, Operations Concept, Tim Ware & Chris Exley, RSSB. Draft for Issue 1 as at 31/03/04.


[R12] UK Application of GSM-R, Amendments to GE/RT8000, NS-GSM-R-OPS-0505, RSSB.

[R13] Comments on Concept of Operations at 1b, NS–GSM-R–OPS–0504, RSSB

[R14] Operational Justification NS-GSM-R–OPS–0508, RSSB

[R15] GSM-R Migration Strategy, NS-GSM-R-IMP-5502, RSSB.


[R17] GSM-R Voice Protocols developed by Tony Walton, Network Rail
2 GSM-R Overview

2.1 System Architecture

The GSM-R equipment, when deployed to fulfil the Control Command and Signalling TSI [R9], including NNTRs, will comprise:

2.1.1 Trackside Equipment

2.1.1.1 The base station sub-system (BSS) provides radio coverage with the provision of radio ‘cells’. These are radio reception areas which comprehensively cover the railway infrastructure and includes measure of overlap to allow a smooth transition from one to the next. A larger overlap, or even duplication, is possible for critical locations where loss of a cell would have unacceptable performance or safety implications. Generally, one base transceiver station (BTS) will drive each cell, but other arrangements may be necessary to cover ‘difficult’ radio topography such as deep cuttings or tunnels. Groups of BTSs are controlled by a Base Station Controller (BSC) which is linked by a Fixed Telecom Network (FTN) (in other words a land-line or similar connection appropriate to the locality) to the network switching sub-system (NSS).

2.1.1.2 The core of the NSS is the mobile services switching centre (MSC). The MSC is supported by a number of data stores or ‘registers’ to record current configuration details: A visitor location register (VLR) contains temporary details of subscribers active within the MSC area; a group call register (GCR) contains attributes of voice group and broadcast call configurations for the MSC area, and home location registers (HLRs) hold subscriber details on a permanent basis. The NSS is duplicated to facilitate ‘disaster’ recovery. The trackside data and voice recorder will be associated with the MSC.

2.1.1.3 The MSC is connected to the FTN which has connections to the other networks, including the UK public service telephone network (PSTN) and UK railway internal telephone network. A fixed terminal sub-system (FTS) connects the MSC to a further FTN to provide links to the user interfaces (fixed terminals) of the signaller and route controller.
2.1.1.4 The railway undertaking’s control offices or SDCs are connected via the internal railway network (or PSTN if appropriate). An SDC terminal allowing the user to select trains by their TRN is feasible and will be examined for further publications of this document. The SDC controllers are able to contact cab mobiles via the controlling signaller.

2.1.1.5 The FTS also connects the MSC to the TD.

2.1.1.6 It is expected that the infrastructure managers will implement a largely new FTN to support GSM-R.

2.1.1.7 The signaller and route controller fixed terminals have a handset, a loudspeaker and a display and input device. The handset is used for normal two-way voice communications and is provided with a push to talk (PTT) button. It is possible for the terminals to receive incoming voice calls and issue data text messages simultaneously.

An example of a signaller’s fixed terminal.

2.1.2 Handportable Equipment

2.1.2.1 OPHs are intended for railway staff engaged in duties affecting the operational railway. In particular, OPHs have the ability to send and receive Railway Emergency Group Calls, and (optionally) to send the continuous ‘link assurance’ information required for shunting

2.1.2.2 System information provided by the infrastructure manager is stored on the ‘SIM’ card of the handportable.

2.1.2.3 Dependent on the policy of individual railway undertakings and confirmation of adequate network coverage, drivers may be issued with a handportable for use. The normal use of these would be controlled in a similar manner to standard mobile telephones. However, the driver would be able to associate the OPH with the cab mobile for operational use, for example when leaving the driving cab in accordance with their duties to conduct failure investigation. The requirements for these handportables are set out in Railway Group Standard GE/RT8081 [R6].

1 Referred to as operational handportable radio (OPH) for radios without the link assurance function and operational shunting handportable (OPS) for those with.
2.1.3 Trainborne Equipment

2.1.3.1 An antenna is located on the vehicle roof, connected to the main radio equipment. Also directly connected are the power supply and up to two cab mobile HMIs. Other connections to trainborne systems are via the train interface unit (TIU), allowing interface with a range of mandatory and optional systems.

2.1.3.2 The HMI includes a control/display unit, together with a loudspeaker and handset. These will be positioned within the cab in a suitable manner for the safe and efficient operation of the radio. The handset is used for normal two-way voice communications and is provided with a PTT button. The loudspeaker allows incoming calls to be relayed whilst the handset is in its cradle. This is essential for incoming broadcast and emergency calls.

2.1.3.3 Trainborne systems that normally must be connected to the TIU include:

a) The driver’s safety device (DSD), allowing activations to be reported automatically to the controlling signaller.

b) The train public address (PA) system, allowing authorised users (for example the controlling signaller) to make announcements should the driver be unavailable or incapacitated.

c) Trainborne data recorder, allowing radio system status and operation to be recorded.

The retrospective application of GSM-R will interface the DSD/PA on train monitoring and recording system (OTMR) to the GSM-R mobile.

*This may be supplied as part of the cab mobile.

2 Note that these interfaces may not be practicable for certain types of traction.
2.1.3.4 To support incident management trains must be able to maintain communications capability for a minimum of two hours, allowing at least 30 minutes talk time. To support this some vehicles may need an optional uninterruptible power supply (UPS).

2.2 System Overview

2.2.1 GSM-R provides connection and communication options relevant to the rail industry, including:

   a) eLDA to allow the cab mobile to be connected to the controlling signaller. This uses information from, for example, the TD, to associate the mobile with a particular geographic location, and hence with that location’s calling options. This allows the driver to be connected directly with the controlling signaller when required.

   b) Functional addressing (to allow a user to be selected/indicated by their identity rather than normal phone number). For example, when calling a train by its TRN, the TRN is used as a functional number (representing the journey the train radio is carrying out at the time). This functional number is converted into the actual phone number of the radio by the network before the radio is called.

   c) Priority and pre-emption, ensuring that higher priority calls are not delayed by lower ones.

   d) High priority call between signaller and driver and also between driver and signaller.

   e) Telephone book dialling, where the intended recipient is selected from a directory stored on the radio, rather than entering their telephone number directly.

   f) Normal dialled calls to internal railway network, PSTN, other GSM-R radios.

   g) Short code dialling, where the user dials a shortened form of the number and the network translates this into the full number.

   h) Mobile radios automatically connect to the network and can have a functional identity allocated to them. The mobile remains connected as it moves across radio boundaries automatically changing channels as required.

   i) Connections to train systems such as DSD, PA equipment and on train data recorder.

   j) Railway Emergency Group Calls

   k) Group Calls and Broadcast Calls

   l) Text messaging

   m) Fax

   n) Bearer for miscellaneous data services.

2.2.2 In order to use a mobile, it is first connected with the network. This is an automatic process. Registering the mobile associates the functional identity of the mobile with its number to permit functional addressing.
2.2.3 Trackside BTS and associated equipment must be deployed to give radio coverage to provide a radio service (including coverage to tunnels and cuttings) and at least equivalent to that of CSR.

2.2.4 A specific transportable version of the cab mobile must be provided with all the functionality described in this Operational Concept as it applies to cab mobiles. This is particular relevant to the migration strategy and implementation of GSM-R.
3 GSM-R User Types

This section outlines the GSM-R operational users and their expected interaction with GSM-R.

3.1 Signaller

3.1.1 The signaller (and controlling signaller) must be provided with a signaller’s fixed terminal which permits them to make and receive the full range of voice and text call types described in this document.

3.1.2 Signallers will also be able to set up Multi-party Conference Calls in defined circumstances and connect users otherwise barred from connecting together directly. The signaller’s fixed terminal must contain a dynamic list of all registered mobiles within GSM-R cells aligned to the signaller’s area of control. The signaller will be the main user of GSM-R for calls to and from drivers.

3.1.3 For any track section, a lead signaller must be identified by the infrastructure manager to respond to incoming GSM-R calls from drivers.

3.2 Driver

3.2.1 The driver will use the cab mobile that is positioned in the driving cab as the primary means of communication. Prior to registration the driver will be able to use the cab mobile. Once the cab mobile is registered, the additional functionality defined in Railway Group Standards must be available, including the ability to receive secure communication from the signaller.

3.2.2 Drivers will be allowed to take part in shunting activities by selecting shunting mode on the cab mobile. Drivers will be able to initiate calls by either pressing the quick dial buttons, or by inputting the appropriate telephone number using the HMI’s associated keypad. However, it is likely that the calls that can be made from a cab mobile to other cab mobiles will be constrained to those deemed necessary, by the railway undertaking, using the call barring facility.

3.3 Conductor/Guard

The conductor/guard will have access to cab mobiles that are normally not in use by the driver for use in emergencies (for example rear/intermediate cab). Conductors/guards may also use the non-driving cab mobiles for authorised commercial requirements authorised by the railway undertaking. Conductor/guards may also be issued with OPHs depending on the policy of the railway undertaking.

3.4 Other on-train personnel

Other on-train personnel, such as buffet car crew, will be able to make emergency calls from cab mobiles that are not normally in use by the driver. Such staff may be issued with OPHs depending on the policy of the railway undertaking.
3.5 Shunter

Shunters (including shunting group leaders) may use OPHs for shunting (OPS) to conduct shunting activities where a cab mobile is required to be brought into the shunting group. GSM-R OPS mobiles may also be issued to shunters in place of existing back-to-back shunting radios according to the policy of the railway undertaking.

3.6 Route Controller

Route control operators must be provided with a route controller’s fixed terminal. Route controllers will receive Railway Emergency Group Calls initiated in any cells assigned to their area of control. Primary responsibility for responding to such calls will be the controlling signaller. Route controllers must not be able to send or receive pre-defined text messages, as they are not responsible for controlling train movements. Route controllers must not normally contact drivers as this will remain the primary responsibility of the controlling signaller or railway undertaking staff as authorised by the railway undertaking.

3.7 Electrification Control Operator (ECO)

As a user of fixed telephony connected to the FTN, the ECO must be able to receive communications from the signaller or route control in the same manner as exists today currently defined in Railway Group Standards. Users of cab mobiles or OPHs must be able to contact the ECO by all of the three following mechanisms:

a) Via the signaller or route controller (who can forward the call through if required); or

b) By directly dialling the ECO fixed telephone number; or

c) By dialling a short code.

3.8 Service Delivery Centre (SDC) Personnel

As previously noted in section 2.1.1.4 the issue of whether an SDC is provided with a fixed terminal for operational efficiency purposes is to be examined. As a user of fixed telephony connected to the internal railway network, the SDC operators and maintainers will be able to communicate with GSM-R users either by dialling the mobile station international ISDN number (MSISDN) (subject to call barring) or by being forwarded through by the controlling signaller or route controller.

3.9 Track Worker

Track workers such as the controller of site safety (COSS), person in charge of possession (PICOP) etc. may be provided with OPHs. The OPH may be used as a conventional GSM-R telephone or may be used in operational activities such as the control of engineering possessions and work sites. OPHs used for operational activities can be registered with the controlling signaller or as a work group in similar fashion to a shunting group.
3.10 Maintainer

Maintainers are the railway undertakings or infrastructure managers (or their agents) that will be required to maintain the cab mobile and the GSM-R infrastructure. This document only includes those maintenance activities that affect the operational capability of the railway.

3.11 Telecom Engineering Control (TEC)

The day-to-day monitoring and administration of the network must be undertaken by a TEC managed by the infrastructure manager. The TEC must also manage event logging and voice recording.
4 Call Descriptions

4.1 Call Types

4.1.1 Point to Point Voice Call

4.1.1.1 Standard Point to Point Call

This allows simultaneous communication between two parties in the manner of a standard telephone call. The parties may be on the same network (for example GSM-R) or different (for example Global System for Mobile communications – public (GSM-P) or PSTN). There must be some limitations on the ability for GSM-R and non GSM-R users to contact the cab mobile. The address book provided in the cab mobile must be configured by the railway undertaking. The driver must not be able to amend or customise the address book.

Users must be able to make calls to the PSTN network and internal railway network numbers subject to call barring arrangements. Drivers will be able to call signallers by the fixed terminal’s GSM-R number. The call will still be active even if the driver leaves the signaller’s area of control.

4.1.1.2 Urgent Point-to-Point Call – Driver to Signaller

This allows an Urgent Point-to-Point Call to be made from a driver to the signaller or from the signaller to a specific driver that uses priority level 2 and therefore goes to the top of the queue on the signaller’s fixed terminal ahead of standard point-to-point calls as well as other operational calls. For the driver this must be initiated by the use of the “yellow button”. The call will still be active even if the driver leaves the signaller’s area of control.

4.1.1.3 Urgent Point-to-Point Call – Signaller to Driver

An Urgent Point-to-Point Call from the signaller to a driver must be presented to the driver as an ‘Urgent Call’ using priority level 2 (4.1.7). The call must still be active even if the driver leaves the signaller’s area of control.

4.1.1.4 PA announcements

Signallers in DOO(P) areas are able to establish a point-to-point call to a train to make an announcement over the train’s PA system. This function is mandatory for trains operating in DOO(P) mode and must be provided on all trains with this functionality currently connected to CSR and SMA radios. The call will still be active even if the driver leaves the signaller’s area of control.

4.1.2 Echo Call Test

4.1.2.1 A specific form of point-to-point call is an Echo Call Test which must enable the user to make a call and leave a voice message on a recording facility which will then be replayed to the user thus proving that the cab mobile or operational radio is able to make and receive voice calls.

4.1.2.2 This facility is primarily for the use of the cab mobile maintainer and is not normally to be used by the driver or train preparer.
4.1.3 Broadcast Voice Calls

4.1.3.1 General Broadcast Voice Calls are from either the controlling signaller or route controller and are a one-way announcement from the initiating fixed terminal to all registered and unregistered mobiles (note it goes to OPHs as well) in a pre-defined area.

These calls are pre-recorded (and played back to check content) for automatic broadcast at defined intervals. Cab mobiles receiving a General Broadcast Voice Call will automatically present the speech over their loudspeaker. The driver may optionally use the handset. The broadcast message will be prefixed and suffixed with a pre-programmed indication that a GeneralBroadcast Voice Call is being made and that it is complete in order that the driver may differentiate between a broadcast and group call and that late entrants are aware that they have missed part of the message.

4.1.3.2 Berth Triggered Broadcast Voice Calls are automatically triggered on activation of the train detection equipment and are a one-way announcement from the initiating fixed terminal to the train. This is only to be available in areas where eLDA is supported within the network.

4.1.3.3 The types of messages that can be made have been determined [R17]. Proposals will be developed by RSSB on behalf of industry and presented to Traffic Operation and Management Standards Committee.

4.1.4 Group Voice Call

4.1.4.1 Group Voice Calls provide voice communication between numbers of users in a pre-defined area, all of whom are members of the same call group. The area over which Group Voice Calls are implemented can be modified within the network. Similarly, the composition of call groups can be modified within the network. Only a signaller or route controller is able to set up a Group Voice Call involving drivers. A lead shunter may do this for Shunting Group Calls. Drivers are not able to set up Group Voice Calls other than making a Railway Emergency Group Call.

4.1.4.2 A given user can be a member of more than one call group. A mobile can set up a group call to any group number for which it has a valid ‘subscription’.

4.1.4.3 The Group Voice Call is constrained by the system such that:

   a) Only one mobile user involved in the Group Voice Call is able to talk at any time. This is managed using the PTT button on the mobile, which, when activated, both enables the microphone and requests the uplink from the network.

   b) Fixed terminal users who are involved in the call may speak at any time during the call.

4.1.4.4 Group Voice Calls are generally to all users within the pre-defined area, which may include more than one fixed terminal user. At least one signaller fixed terminal and one route controller fixed terminal may be defined as being within each group call area.

---

3 In other words, the group number is stored on the SIM card.
4.1.4.5 The area relevant to an initiating Group Voice Call is configured within the network and can be made up of one or more cells.

4.1.4.6 For cab mobiles, the Group Voice Call may be either a Railway Emergency Group Call or used for shunting purposes using a custom call group. For OPHs, it is likely that various engineering call groups will also be required; however the arrangements for this have not been developed in this issue of the Operational Concept.

4.1.4.7 Group Voice Calls may vary in priority, see 4.5, in particular, a special type of high priority group voice call is defined as a Railway Emergency Group Call (4.1.7).

4.1.5 Multi-party Voice Calls

A Multi-party Voice Call is a type of voice call enabling a specific group of participants to all converse within a single call. Essentially the same as a conventional conference call, a Multi-party Voice Call is essentially a combination of point-to-point calls whereby participants are selected to join the call by the initiator.

4.1.6 Public Emergency Voice Call

In the UK, this is achieved by dialling 112 or 999, although these numbers would not normally be used if the user had available a means to call the controlling signaller, route controller or ECO as appropriate. These numbers can be dialled from all GSM-R mobiles and terminals. All such calls must be directed to the rail emergency operator.

4.1.7 Railway Emergency Group Call

4.1.7.1 General

Railway Emergency Group Calls are the highest priority call and may be initiated by a cab mobile, an OPH, or a fixed terminal (for example the signaller’s or route controller’s). On the cab mobile (and the OPH) the Railway Emergency Group Call will be initiated by activating a red button which will also be known as the “All Trains Stop Button”.

The recipient of Railway Emergency Group Calls will vary with the situation, as described in chapter 9, and includes other cab mobiles, fixed terminals and OPHs associated with the GSM-R group call area where the Railway Emergency Group Call originated from.

The infrastructure manager and railway undertakings will agree the configuration of the Railway Emergency Group Call areas in relation to cell topology, possible traffic movements, and the association of signallers and route controllers to particular track sections.

4.1.7.2 Handling of calls by fixed terminals

For all incoming Railway Emergency Group Calls, the signaller(s) and route controller(s) will be provided with an audible and visual indication that a Railway Emergency Group Call has been received together with details of the incoming caller’s identity and location:

a) For unregistered cab mobiles (including Railway Emergency Group Calls made in rear/intermediate cabs), the signaller(s) and route
controller(s) assigned to the group call area will be presented with
the vehicle number, together with the cell identity. The controlling
signaller will be required to identify that the caller is within their area
of control by reference to the cell identity, vehicle number and/or by
establishing communication with the call initiator. In these
circumstances, other signallers and the route controller(s) in receipt
of the Railway Emergency Group Call must monitor the response
from the controlling signaller and take appropriate steps if no
response, or an inappropriate response, is forthcoming. Should a
signaller other than the controlling signaller respond to the Railway
Emergency Group Call, then that signaller must relinquish the lead
responsibility to the controlling signaller as soon as possible.

b) For unregistered OPHs, the signaller(s) and route controller(s) will
be provided with the MSISDN and cell identity. The controlling
signaller must be required to identify that the call is within their area
of control by reference to the cell identity and by establishing
communication with the call initiator. In these circumstances, other
signallers and the route controller(s) in receipt of the Railway
Emergency Group Call must monitor the response from the
controlling signaller and take appropriate steps if no response, or an
inappropriate response, is forthcoming. Should a signaller other
than the controlling signaller respond to the Railway Emergency
Group Call, then that signaller will relinquish the lead responsibility
to the controlling signaller.

c) For registered OPHs, the signaller(s) and route controller(s) will be
provided with the functional identity (for example PICOP) and cell
identity. However, if the registered OPH is associated with a cab
mobile then the functional identity will be the TRN and location
information (see (d) below).

d) For registered cab mobiles, the signaller(s) and route controller(s)
will be provided with the functional identity (for example, TRN) and
location information:

i) In LDA areas the controlling signaller must identify that the train
is in their area of responsibility by reference to the functional
identity (for example TRN), cell identity and any incoming
message from the call initiator. In these circumstances, other
signallers and the route controller(s) in receipt of the Railway
Emergency Group Call must monitor the response from the
controlling signaller and take appropriate action, if there is no
response, or an inappropriate response, is forthcoming. Should
a signaller other than the controlling signaller respond to the
Railway Emergency Group Call, then that signaller must
relinquish the lead responsibility to the controlling signaller as
soon as possible.

ii) In eLDA areas the signal number must be provided by the
network instead of the cell identity, and the controlling signaller
will be notified that the incoming Railway Emergency Group
Call is in their area of control.
4.1.7.3 Handling of incoming calls by trains

The cab mobile will announce the receipt of an incoming Railway Emergency Group Call from another train, a fixed terminal or OPH with an audible and visual indication, for example an alarm accompanied by the flashing text ‘STOP’. This will be overheard by all users receiving the Railway Emergency Group Call, for example, over the driving cab loudspeaker.

Trains entering the area of an ongoing Railway Emergency Group Call will receive the emergency audible and visual indications and receive any ongoing voice message, etc. as soon as they enter the area covered by the call. This involves automatic pre-emption of another lower priority call should the driver be engaged in a call already. However, once the original Railway Emergency Group Call has been terminated then trains entering the area will not necessarily be aware of the emergency via the GSM-R radio.

Once the driver becomes aware of the incoming Railway Emergency Group Call, the driver must bring the train to a stand immediately.

Trains in receipt of the Railway Emergency Group Call must remain at a stand until authorised to proceed by the controlling signaller responsible for the area. The controlling signaller must contact each train individually to authorise them to proceed.

Failure of a mobile initiated Railway Emergency Group Call to be connected will result in the mobile equipment automatically retrying for a period of 30 seconds. After this time, if the call is not connected, then an indication will be provided to the user.

Failure to send a Railway Emergency Group Call from the fixed terminal will result in a call fail indication to the user. The user must then re-initiate the call.

4.1.7.4 Shunting Emergency Calls

Shunting Emergency Calls can be initiated by any user in the shunting group, and are communicated to all other users in the shunting group only. The controlling signaller must be invited to join the shunting group should shunting activities take place on the running line in order that any emergencies affecting the running line or the shunting movement can be communicated appropriately.

4.1.8 Text Messages

4.1.8.1 Pre-defined text messages will be sent on a point-to-point basis.

4.1.8.2 Pre-defined text messages can be used to replace verbal messages and hence reduce staff workload. These comprise:

a) ‘Standing at Signal’ (SG) (driver to controlling signaller)

b) ‘Wait’ (controlling signaller to driver)

c) ‘Contact Signaller’ (controlling signaller to driver)

4.1.8.3 Pre-defined text messages will also be used to report train status information, comprising DSD activated (train to signaller).
4.1.8.4 The TRN or traction unit number will accompany a pre-defined text messages from cab mobiles.

4.1.8.5 On receipt of the ‘Contact Signaller’ text message, the driver will be able to respond directly to the calling number.

4.1.8.6 The network is capable of handling SMS text messages however no specific operational use has been identified.

4.1.9 Pre-defined Text Messages (UUSI)

The following pre-defined text messages (UUIS) have different behaviours depending on whether they are in eLDA or LDA areas.

<table>
<thead>
<tr>
<th>Call Type</th>
<th>TD Areas</th>
<th>Non TD Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Normal Operation (eLDA)</td>
<td>Loss of Correlation / Un-Registered</td>
</tr>
<tr>
<td>DSD</td>
<td>Controlling Signaller</td>
<td>Nominated Signaller</td>
</tr>
<tr>
<td>Standing at Signal</td>
<td>Controlling Signaller</td>
<td>Nominated Signaller</td>
</tr>
</tbody>
</table>

4.2 Call Functions

4.2.1 General Telephony Functions

4.2.1.1 Caller engaged is indicated for voice calls.

4.2.1.2 If a call to a cab mobile (Call B) is of a higher priority than the existing one already taking place (Call A) then the new call (Call B) will pre-empt the existing call (Call A).

4.2.1.3 ‘Call Hold’ allows the user to temporarily exit from an existing call. The user can re-join the call which is on hold at any time.

4.2.1.4 ‘Call Waiting’ informs a user, who is involved in an existing call, of attempts by other users to contact them.

4.2.2 Call Barring

4.2.2.1 This can be applied to limit the range of numbers accessible from a given radio, and also the range of other callers able to access that user. It is achieved by the network management or maintenance facilities acting under the instruction of the railway undertaking.

\(^4\) ‘Un-plated signal’ is a location where the network is able to route all calls/text messages to the controlling signaller, however, some text messages may be rejected.

\(^5\) Plated signal’ is a signal where the controlling signaller’s phone number is provided, because the network is unable to route all calls/text messages to the controlling signaller. However the network can be configured to route all calls/text messages to a nominated signaller.
4.2.2.2 Individual users may be prevented from making calls to:
   a) Another network (fixed or mobile) (for example, can only call on the GSM-R network).
   b) Certain types of numbers within or external to the network (for example, cannot call tele-shopping numbers).
   c) Certain pre-defined telephone numbers (for example, cannot call drivers and on-train users).
4.2.2.3 Individual users may be prevented from receiving calls from:
   a) All other networks (fixed or mobile).
   b) Certain other networks (fixed or mobile).
   c) Certain types of numbers within or external to the network.
   d) Certain pre-defined telephone numbers.
4.2.2.4 Call accessibility and connectivity matrices are detailed in section 14.

4.2.3 Call Divert

Calls (with the exception of group and general broadcast calls) and pre-defined text messages can be diverted from one GSM-R terminal (fixed or mobile) to another GSM-R terminal (fixed or mobile), or an external number.

4.2.4 Call Forwarding

4.2.4.1 In the case of voice calls to a fixed terminal, it is possible for the user who is attempting to forward a call to converse with the intended recipient prior to forwarding.

4.2.4.2 The call must be forwarded with the same eLMPP priority as the originating call.

4.2.4.3 In addition, a call that is likely to involve the passing of operational instructions must only be forwarded if the communication remains secure as defined in 1.6.2 'Secure Radio System'.

4.2.5 Area Call Functions

4.2.5.1 Area Calls include General Broadcast Calls, Group Voice Calls and Railway Emergency Group Calls. The area is based on the radio reception area and the association of cells in the cell plan design, rather than any specific and fixed geographic area. This difference compared to CSR has major implications for the operation of GSM-R. The network must be configured to constrain the calls to lines of route as far as is practical. Under failure conditions, the mobile will either lose GSM-R coverage altogether or automatically seek out the strongest signal to use, which may not be the one intended for that track section.

4.2.5.2 Mobiles that move out of the call area during the call will be automatically dropped from the call, however, no indication of this is provided to the fixed terminal or other mobiles.
4.2.5.3 Mobiles which move into the call area after the call has been established will automatically join the call (subject to the priority considerations of section 4.5).

4.3 Calling Methods

4.3.1 Telephone Number

4.3.1.1 PSTN calls are set up in the conventional way by entry of the intended recipient’s PSTN number. Calls to internal railway network extensions must be made using their direct dial in number.

4.3.1.2 The number of each signaller’s fixed terminal must be published in operating notices as today to enable users to dial the signaller.

4.3.1.3 In certain locations lineside signs (Figure 1) must be provided with the signaller’s fixed terminal telephone number to ease communication.

Figure 1

4.3.2 Short Code Dialling

4.3.2.1 This is where the number dialled is a special shortened form of the normal number. The short codes from the mobile must be:

   a) 1200 for the signaller
   b) 1300 for the route controller
   c) 1400 for the ECO
   d) 299 for a Railway Emergency Group Call
   e) 1299 for an Urgent Point-to-Point Call
   f) 599 for a Shunting Emergency Call

4.3.2.2 For more information on calls in non eLDA areas refer to the table in 4.3.6.6.

4.3.3 Telephone Book Dialling

4.3.3.1 The cab mobile will have two telephone directories they will be capable of storing sufficient numbers to contain all the necessary numbers for each of the railway undertakings operating in the UK.

4.3.3.2 The directories will store different sets of data: one will store the most frequently used numbers and be configurable by the railway undertaking, the other will contain all signal box and control office numbers on the network.

4.3.3.3 Access to the directories will be via a single button press or the menu.
4.3.3.4 Railway undertakings will be able to configure the single button option at installation, to access either of the two directories.

4.3.3.5 The numbers contained within the directories will include any necessary prefix required to enable calls to be established.

4.3.3.6 It is the responsibility of the infrastructure manager to make arrangements (where necessary with the railway undertaking) to keep the directories of signal boxes and control office numbers up to date in a controlled manner to a level of integrity consistent with the fact that the ability of the driver to contact the signaller is an essential safety function.

4.3.4 Special Dialling Buttons

HMIs must have customised\(^6\) buttons to initiate standard calls, such as calling a particular number, or sending a pre-defined text message. The design must be optimised to balance dedicated function buttons for frequently used/critical functions against multi-function buttons or menu access for lesser applications.

An example of a driver's cab mobile.

4.3.5 Functional Identity

4.3.5.1 By registering the mobile, users will be identified by their functional role rather than by numbers associated with the mobile, for example, MSISDN or vehicle number. This allows users to be identified by their role and be associated with their TRN.

4.3.5.2 The mobile upon receipt of an incoming call will search the telephone directories for a corresponding entry. Where a corresponding entry is found the functional identity of the caller will be displayed, for example, signaller, Yoker.

4.3.5.3 A cab mobile will be able to be called by the following numbers:

a) Its MSISDN ‘phone number, as determined by the SIM card installed in the radio.

b) Its vehicle number identity (this is stored on the SIM and can be accessed using the portable maintenance unit (PMU)). This number is stored 'semi-permanently' in an infrastructure database when the radio is installed. Any calls to the vehicle number are routed by the network to the associated MSISDN ‘phone number.

\(^6\) Such customisation will be on a design basis, not applied by the user.
c) Its TRN. This number is recognised by the system when the cab mobile is registered with the network. The registration process sets up a call routing arrangement in the network so that any call to the TRN is routed to the associated MSISDN ‘phone number.

4.3.5.4 An OPH will be able to be called by the following numbers:
   a) Its MSISDN ‘phone number, as determined by the SIM card installed in the radio.
   b) Its functional identity if registered.

4.3.5.5 When a registered cab mobile is involved in a call with a signaller or route controller, it will be identified by its functional number. If no functional identity number is available the vehicle number will be displayed.

4.3.5.6 Functional identities will be used to identify users of OPHs and OPS, for example, shunting group leaders and shunting team members.

4.3.6 Call Routing of Point-to-Point Calls

4.3.6.1 GSM-R allows calls to be routed for a given function to a destination number that is dependent upon the user’s location. The basic location information is the cell identity. This information alone may not provide sufficient granularity to route a call to the correct recipient.

4.3.6.2 The basic location data can be enhanced to facilitate the routing of calls from registered mobiles to the appropriate recipient, for example, the controlling signaller for the mobile’s location.

4.3.6.3 GSM-R supports eLDA, and draws the required information from compatible systems, for example BR1810 TDs. This facility is not available for OPHs.

4.3.6.4 The application of Global Positioning System (GPS) is not considered in this document.

4.3.6.5 If the TD data is deemed unusable by the system then it will use the fall-back option of LDA routing based on the cell identity.
4.3.6.6 Point-to-Point Voice Calls

<table>
<thead>
<tr>
<th></th>
<th>TD Areas</th>
<th>Non TD Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Call Type</strong></td>
<td>Normal Operation</td>
<td>Loss of Correlation</td>
</tr>
<tr>
<td></td>
<td>(eLDA)</td>
<td>/ Un-Registered</td>
</tr>
<tr>
<td><strong>Call Signaller</strong></td>
<td>Controlling Signaller</td>
<td>Nominated Signaller</td>
</tr>
<tr>
<td><strong>Call Route Controller</strong></td>
<td>Controlling Route Controller(^9)</td>
<td>Nominated Route Controller(^9)</td>
</tr>
<tr>
<td><strong>Call ECO</strong></td>
<td>Controlling ECO(^9)</td>
<td>Nominated ECO(^9)</td>
</tr>
<tr>
<td><strong>Yellow Button</strong></td>
<td>Controlling Signaller</td>
<td>Nominated Controlling Signaller</td>
</tr>
</tbody>
</table>

4.4 Call Connection Performance

4.4.1 The time taken for a call to be established will be no longer than those required in the Control Command and Signalling TSI.

4.4.2 The table below details the system performance targets for the different types of calls [R16]:

---

\(^7\) ‘Un-plated signal’ is a location where the network is able to route all calls/text messages to the controlling signaller, however, some text messages may be rejected.

\(^8\) ‘Plated signal’ is a signal where the controlling signaller’s phone number is provided, because the network is unable to route all calls/text messages to the controlling signaller. However the network can be configured to route all calls/text messages to a nominated signaller.

\(^9\) eLDA calls are resolved down to specific signallers’ areas. These areas are then associated with one particular route controller (for 1300 calls) or ECO (for 1400 calls). Therefore, in some areas, 1300 and 1400 calls may be routed to a route controller or an ECO other than the one with responsibility for the area the call originated in. This will occur in areas where the signaller’s control area spans an ECO boundary or route controller’s boundary.
### KPI Definition

<table>
<thead>
<tr>
<th>KPI Definition</th>
<th>Minimum Performance Level</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurements are made under mobile conditions to be representative of operational conditions.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Call success rates</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Railway Emergency Group Calls successfully connected and completed (for fixed-to-mobile and mobile-to-fixed calls)</td>
<td>99%</td>
<td>Call ‘successfully connected’ is defined as a call which is successfully established between the user terminals in question (in other words, the call reaches the called terminal). Call ‘completed’ is defined as the established call being held continuously for a period of 2 minutes and then terminated as a normal release.</td>
</tr>
<tr>
<td>Signaller originated point-to-point ‘stop’ calls and driver originated Urgent Calls (‘yellow button’) successfully connected and completed.</td>
<td>99%</td>
<td></td>
</tr>
<tr>
<td>All other calls, not covered by the above, successfully connected and completed.</td>
<td>98%</td>
<td></td>
</tr>
<tr>
<td><strong>Speech quality for all voice call types</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speech Quality expressed as Mean Opinion Score (MOS) for successfully established calls.</td>
<td>MOS &gt;=3 for 99% of speech samples</td>
<td>Mean Opinion Score value of 3 represents threshold for acceptable speech quality</td>
</tr>
<tr>
<td><strong>Headcode registration</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time to complete mobile to network transaction for UK headcode registration</td>
<td>95% within 30s</td>
<td>Includes unsuccessful call attempts</td>
</tr>
<tr>
<td><strong>Coverage Levels (signal strength)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coverage Level (Voice)</td>
<td>95% &gt;-98 dBm</td>
<td>Targets from EIRENE SRS</td>
</tr>
<tr>
<td><strong>Call set-up times</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Railway Emergency Group Calls</td>
<td>&lt;2s</td>
<td>Targets from EIRENE FRS</td>
</tr>
<tr>
<td>Group calls between drivers in the same area</td>
<td>&lt;5s</td>
<td>Measurements based on set up time from the moment the caller operates the call request to the point when the call set up indication is received by the calling terminal with a confidence of 95%.</td>
</tr>
<tr>
<td>All operational mobile-to-fixed calls not covered by the above (including Urgent Point-to-Point Calls)</td>
<td>&lt;5s</td>
<td>EIRENE FRS</td>
</tr>
<tr>
<td>All operational fixed-to-mobile calls not covered by the above</td>
<td>&lt;7s</td>
<td>EIRENE FRS</td>
</tr>
</tbody>
</table>
4.4.3 The infrastructure manager must develop a system for monitoring the achievement of these performance targets.

4.5 Call Priorities

Priorities 0,1,2,3 and 4 are available on cab mobiles and fixed terminals; 0, 3 and 4 on OPHs. These are automatically assigned when selecting the type of call to be made. The following table illustrates their usage and their relationship with the Control Command and Signalling TSI priorities:

<table>
<thead>
<tr>
<th>Type of Call</th>
<th>eMLPP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Railway Emergency Group Call</td>
<td>0</td>
</tr>
<tr>
<td>Railway operator emergency (999/112)</td>
<td>2</td>
</tr>
<tr>
<td>Urgent Point-to-Point Calls</td>
<td>2</td>
</tr>
<tr>
<td>Operational Driver to Signaller call</td>
<td>3</td>
</tr>
<tr>
<td>Operational Signaller call</td>
<td>3</td>
</tr>
<tr>
<td>Low priority call</td>
<td>4</td>
</tr>
<tr>
<td>Predefined text message</td>
<td>System configurable according to the type of text message</td>
</tr>
<tr>
<td>ERTMS (For information)</td>
<td>1</td>
</tr>
</tbody>
</table>

The user must determine by using knowledge, experience and the Rule Book the correct call type applicable to the circumstance.
5 Human Machine Interface (HMI) Information

5.1 Driver

5.1.1 The cab mobile HMI will display the following information:
   a) A visual and audible alert for new events.
   b) Calling party (number or, where appropriate, functional identity) of caller.
   c) Radio status (for example shunting mode, self test passed).
   d) Network identity and status (in other words is there trackside coverage available).
   e) TRN
   f) Error messages, for example, registration failure.
   g) Another ‘Call Waiting’ / ‘call on hold’.

5.1.2 The cab mobile HMI must display the following information:
   a) Text messages (including ‘Wait’, ‘Contact Signaller’).
   b) DSD activation message sent to signaller.
   c) ‘STOP’ indication.

5.1.3 The cab mobile HMI will accept the following control actions:
   a) Power radio on - all radios must be available for use by authorised staff and access must be strictly controlled by the railway undertaking. This may be a reaction to the operation of other on train controls such as the battery switch.
   b) Power radio off - a driver must be able to power down the cab temporarily and not lose journey registration.
   c) Switch HMI on – (this will invoke self-test of the HMI display).
   d) Test the radio.
   e) Set up the radio (including registering the TRN, and de-registering).
   f) Initiate a single button call to signaller.
   g) Initiate a short-code call.
   h) Initiate an “all trains stop” Railway Emergency Group Call.
   i) Enter and amend a telephone number to be called.
   j) Select a stored number (telephone directory).
   k) Send a pre-defined text message (‘Standing at Signal’)
   l) Answer an incoming call.
   m) Put a call on hold.
   n) Divert a call to another number.
   o) Terminate a call.
   p) Menu access to other functions.
5.1.4 The cab mobile HMI must accept the control action to initiate an Urgent Point-to-Point Call (Yellow Button).

5.1.5 During group calls, the PTT button initiates the process of making the driver the person able to talk at that time. During a Railway Emergency Group Call the driver, having operated the PTT button, will have to wait for the system to react. This waiting time will be under one second.

5.1.6 The cab mobile will automatically direct certain incoming calls to the cab loudspeaker. This includes urgent, broadcast, emergency and priority 3 point-to-point calls.

5.2 Signaller

5.2.1 Signallers will be provided with a GSM-R fixed terminal to supplement their existing communication systems with drivers, route control, other signallers and public services, etc. The GSM-R fixed terminal may exist either as a separate terminal or be integrated into other systems.

5.2.2 The GSM-R fixed terminal HMI will display the following information:

- A visual and audible alert for incoming calls and messages.
- Calling party (number or, where appropriate, functional number or identity) of incoming caller.
- Text messages (‘Standing at Signal’, DSD Alarm)
- Fixed terminal status
- Call status
- Queued calls, listed firstly by priority and secondly in time of receipt order.
- Registered cab mobiles and OPHs within the signaller’s control area.\(^{10}\)
- Error messages and information feedback.
- Pre-defined areas of group calls and Railway Emergency Group Calls.

5.2.3 The HMI will accept the following control actions:

- Initiate a dialled call.
- Call a pre-defined functional number by functional identity and call by traction unit number (for example TRN).
- Initiate an “all trains stop” Railway Emergency Group Call.
- The ability to enter and amend a dialled telephone number.
- Select a stored number.
- Answer an incoming call.
- Put a call on hold.
- Transfer a call

\(^{10}\) Cab mobiles and OPHs that are not registered will not appear on any fixed terminal mobile lists.
i) Set up a Multi-party Call.
j) Terminate a call.
k) Management of the order in which calls are answered.
l) Accept/relinquish area of GSM-R communication.

5.2.4 The HMI must accept the following control actions:
   a) Initiate a high priority point-to-point call.
   b) Record, playback and transmit a broadcast call.
   c) Send a pre-defined text message (‘Wait’, ‘Contact Signaller’).

5.2.5 The PTT button activates the microphone in the handset.

5.2.6 The fixed terminal will automatically direct certain incoming calls to the loudspeaker, for example, the Railway Emergency Group Call.

5.2.7 The network has an internal directory of preset and fixed numbers available on the infrastructure manager’s rail infrastructure system. The user of the fixed terminal cannot change this store of numbers except as provided for in the locally defined area of the fixed terminal.

5.3 Route Controller

5.3.1 Route controllers must be provided with a GSM-R fixed terminal to supplement their existing communication systems with other control offices, ECO, signallers and public services, etc. This is especially for during the migration phase where it will be necessary to initiate railway emergency group calls upon receipt of an incoming NRN emergency call.

5.3.2 The fixed terminal HMI will display the following information:
   a) A visual and audible alert for incoming calls and messages.
   b) Calling party (number or, where appropriate, functional number or identity) of incoming caller.
   c) Fixed terminal status
   d) Queued calls, listed firstly by priority and secondly in receipt time order.
   e) Error messages and information feedback.
   f) Pre-defined areas of group calls and Railway Emergency Group Calls.

5.3.3 The HMI will accept the following control actions:
   a) Initiate a dialled call.
   b) Initiate an “all trains stop” Railway Emergency Group Call.
   c) Record, playback and transmit a broadcast call.
   d) Enter and amend a telephone number to be called.
   e) Select a stored number.
   f) Answer an incoming call.
   g) Put a call on hold.
h) Transfer a call.
i) Terminate a call.
j) Management of the order in which calls are answered.
k) Re-configure area of GSM-R control.

5.3.4 The PTT button activates the microphone in the handset.

5.3.5 The fixed terminal will automatically direct certain incoming calls to the loudspeaker, for example, the Railway Emergency Group Call.

5.3.6 The network has an internal directory of preset and fixed numbers available on the infrastructure manager’s rail infrastructure system. The user of the fixed terminal cannot change this store of numbers except as provided for in the locally defined area of the fixed terminal.

5.4 Electrical Control Operator (ECO)

5.4.1 The ECO is already connected to the FTN and has emergency call connection to relevant route control, signallers and lineside telephony, which will continue to be used.

5.4.2 If it is necessary for a driver to contact an ECO then this can either be achieved by contacting the signaller who can either deal with the situation or patch the call through to the ECO or by direct dial in. ECO direct dial telephone numbers and short codes are also available for the driver and published in operating notices.

5.5 Operational Handportable Radio (OPH)

5.5.1 The OPH HMI will display the following information:

a) A visual and audible alert for new events.
b) Calling party (number or, where appropriate, identity) of incoming caller.
c) Text messages (SMS messages and UUSI ‘Contact Signaller’).
d) Radio status
e) Network status (in other words is there trackside coverage available?).
f) Functional role or MSISDN number.
g) Mode (normal or shunting if an OPS).
h) Error messages

5.5.2 The OPH HMI will accept the following control actions:

a) Power radio on or off.
b) Test the radio.
c) Set up the radio (for example for shunting group calls).
d) Initiate a dialled call.
e) Call a pre-defined functional number (for example TRN).
f) Initiate an “all trains stop” Railway Emergency Group Call (if authorised).

g) Amend a telephone number to be called.

h) Select a stored number.

i) Answer a call.

j) Receive a broadcast and Railway Emergency Group Call.

k) Put a call on hold.

l) Transfer a call to another number.

m) Terminate a call.

n) Create and send a variable content text message.

o) Use link assurance functionality (OPS only).
6 Normal Working

Flow charts are provided for this subject area in APPENDIX 1- Operational Scenarios.

6.1 Cab Mobile Start Up

6.1.1 Power Up Cab Mobile (Scenario 1)

6.1.1.1 When the battery switch or auxiliary set switch supplying the vehicle is closed, power is available at the trainborne radio equipment. The trainborne radio will automatically undertake a self-test and the results of the self-test are indicated on the HMI when activated for a period of time.

6.1.1.2 During the preparation of a cab, the train preparer must switch on the HMI by inserting the driver’s key, which will initiate a test of the HMI which the train preparer must observe.

6.1.1.3 Once the self-test has successfully completed, the cab mobile is ready for service.

6.1.1.4 The cab mobile will have the option of a more detailed interactive self-test.

6.1.1.5 Following the self-test and HMI test, the radio will automatically connect to the GSM-R network and display the network identity. It will then be capable of making and receiving calls.

6.1.2 Cab Mobile Registration (Scenario 2)

6.1.2.1 An unregistered cab mobile will be capable of making and receiving all types of calls (including Railway Emergency Group Calls) but will not benefit from functional addressing and functional identity. Also, eLDA will not function on an unregistered cab mobile.

6.1.2.2 When a train is ready to enter service it must be ‘registered’ with the network so that its identity is shown as the TRN. The GSM-R system requires the use of a unique eight-digit identity number. GB operation uses a four-digit alpha-numeric TRN. To resolve this conflict, the system will operate with the eight-figure number as an internal system number but use the four-character TRN as the identity displayed on both the fixed terminal and cab mobile HMIs. If a train is on infrastructure where GSM-R has not been implemented then this process will be stored within the cab mobile and enacted by the driver once the train enters a GSM-R area. This process is known as pre-registration.

Note that the registration of GSM-R cab mobiles will only be required where a train has a defined TRN. Any moves that do not require a TRN will not require GSM-R registration.
6.1.2.3 The infrastructure manager must develop the process for converting TRN to unique identity for GSM-R and agree it with the railway undertakings. The railway undertakings must publish the TRN and unique GSM-R identity details to drivers, for example on the driver’s slip, so that they have the number in their possession when preparing/taking over a train. The driver will be provided with a 5 digit number which relates to the TRN. As TRNs are not themselves unique across the country (and possibly within a signaller’s area) these five digits must be supplemented with the last three digits of the signal number associated with the signal that the train is standing at, thus creating the 8 digit registration number.

6.1.2.4 When the driver attempts to register an 8 digit registration number that is already in use, it will be rejected. The driver must contact the controlling signaller to obtain an alternative 5 digit number. The signaller must be able to generate this number from the fixed terminal.

6.1.2.5 Alias plates (Figure 2) must be provided at locations where trains are required to register where a signal is not available. There are three scenarios where alias plates may be required these are:

a) When registering at a location where a signal is either not provided or its number does not correspond to the signal berth.

b) When registering within a cell that has signals where the last three digits are the same (for example, WC101 and C101).

c) When registering at a signal that has only alpha characters.

Figure 2

6.1.2.6 In eLDA areas, the network must automatically correlate the registration number with the TD information to derive the exact location of the train.

6.1.2.7 It is important that subsequent changes to the TRN are entered into the system in a timely manner. The process of re-registering the radio with a new TRN must require the driver to de-register the previous functional identity.

6.1.2.8 The cab mobile HMI will be provided with a simple mechanism to start the registration process.

6.1.2.9 Registration failures are dealt with in 8.3.

6.2 Standing at Signal Message (Scenario 3)

6.2.1 When a train is detained at a signal the driver must contact the controlling signaller within a pre-defined time. This contact is possible, in certain areas by, the use of a pre-defined text message, ‘Standing at Signal’ offering advantages in:

a) Speed of operation.
b) Reducing driver and in particular signaller workload.

In areas where a lineside sign is provided, the driver must dial the signaller as outlined in 6.3.

6.2.2 The signaller will receive the ‘Standing at Signal’ pre-defined text message in the fixed terminal’s incoming message queue together with an audible tone.

6.2.3 Receipt of the text message by the signaller’s HMI will be indicated on the cab mobile HMI. If the text message is not received the driver will be advised that the text message has failed, the driver must then contact the signaller by voice.

6.2.4 The signaller must either respond with a predefined text message, indicating that the driver should ‘Wait’ for the signal, or by voice contact with the driver. The ‘Wait’ message is displayed on the cab mobile HMI until cancelled by the driver.

6.3 Driver Calls Signaller (Scenario 24)

6.3.1 The driver has a choice of 3 call priorities in ascending order:
   a) Dialled call or short code call or single button operational call (all priority 3)
   b) Urgent Point-to-Point Call (yellow button) or public emergency call (priority 2)
   c) Railway Emergency Group Call (‘all train stop button’ (red button), priority 0)

6.3.2 The driver, after ensuring that it is safe to do so, can request voice contact with the controlling signaller by making a normal point-to-point call.

6.3.3 Except where a lineside sign (Figure 1) is provided, a single button press or short code dialling on the HMI will automatically route the call to the controlling signaller for the train’s current location, determined from its TRN. The signaller will be alerted to the incoming call, which will be entered into the incoming call queue on the fixed terminal, and must answer it when appropriate. The incoming call will be accompanied by the train’s identity and location.

6.3.4 Where a lineside sign (Figure 1) is provided, the driver must contact the signaller by dialling the full fixed terminal number indicated on that lineside sign. Signal box fixed terminal telephone numbers must published in operating notices and will be contained in the mobile telephone directory and plated on certain signals. The signaller will be alerted to the incoming call, which will be entered into the incoming call queue on the fixed terminal, and can answer it when appropriate. The incoming call will be accompanied by the train’s identity (if registered) and cell identity.

6.4 Signaller Calls Driver (Scenario 20)

6.4.1 The signaller can request voice contact with a driver or OPH user by making a normal point-to-point call.

6.4.2 The signaller has a choice of 4 call priorities in ascending order:
   a) Dialled call to external number (priority 4)
b) Dialled call to any other number (priority 3)
c) Call by functional identity (registered radios only), Group Voice Call, PA or Broadcast (priority 3)
d) Urgent Point-to-Point Call (priority 2)
e) Railway Emergency Group Call (priority 0)

6.4.3 The signaller will be provided with a ‘mobile list’ on the fixed terminal which will detail all registered mobiles currently in their area of control or in non eLDA areas all registered mobiles in the relevant cells.

6.4.4 The mobile list will display all registered cab mobiles contact details as the TRN. Normally, the signaller will select the train they wish to contact by using the TRN.

6.4.5 The mobile list will show OPHs, if registered, as their functionality identity.

6.4.6 If the train is unregistered then the signaller can make the call using the traction unit number, (if known). The signaller can call only TRNs on the mobile list, although any train can be called via the traction unit number or MSISDN.

6.4.7 If there is a duplicate of the TRN on the controlling signaller’s mobile list, this will be highlighted.

6.4.8 The cab mobile may respond to the incoming call by alerting the driver with a visual indication on the cab mobile’s HMI and an audible tone over the cab loudspeaker. The identity of the incoming caller will also be displayed on the HMI. The driver may respond to the call if it is safe to do so.

6.4.9 To minimise the likelihood of distracting the driver from the driving task, the signaller must be able to send a pre-defined text message ‘Contact Signaller’ to which the driver may respond, by initiating a call, when it is safe and convenient to do so.

6.5 Shunting Group Call (Scenario 8)

6.5.1 Movements controlled by a shunter may be controlled by conventional handsignals or voice radio as at present. GSM-R may be used to replace back-to-back radios with a link assurance facility, in which case the shunter can use an OPS during the movement, and the driver can switch the cab mobile to shunting mode, or continued voice contact must be used to assure the maintenance of contact if using an alternative GSM-R solution. This process is described in greater detail in chapter 10.

6.5.2 The control of shunting movements by a shunter on a running line is expected to be very rare. For example, it may be used to reverse a train over a crossover during single line working. If GSM-R were to be used in these circumstances then the shunter would be expected to use a shunt mode to control the move. This method of working ensures that the signaller is alerted to any shunting emergencies and able to subsequently initiate a railway emergency group call.

12 If a Shunting Group call was to be permitted, then the controlling signaller must be a member of the Shunting Group.
6.6 Switch off Cab Mobile Human Machine Interface (HMI) (Scenario 18)

6.6.1 When a cab is no longer required for driving, the radio must be de-registered and the HMI switched off. A de-registration facility will be available for the driver to remove the train radio identity from the GSM-R system, independently of switching the HMI off. However, removal of the driver’s key must automatically de-register the cab mobile from the GSM-R network after a predefined period of time.

6.6.2 Shutting down the cab, for example to change ends, change traincrew or attend to a fault, will lead to the cab mobile automatically de-registering after a time period (30 minutes) unless the driver, in response to the cab mobile, inputs a command for the cab mobile to remain registered for a period of time. This will enable the driver to remove their key for legitimate reasons without losing the cab mobile registration. Cab mobiles left registered will increase the likelihood of a later registration being rejected due to a duplicate identity in the system.

6.7 Signal Box Closed (Scenario 10)

(This is not included in Appendix 1 as a flowchart for this scenario was not developed)

Where a signal box (or signaller’s fixed terminal) closes, but the line remains open, the role will either be transferred to the controlling signaller or the driver will be responsible for dialing the controlling signaler using route knowledge and published data.
7 Abnormal Working

7.1 Train Power Failure

An option to provide a continuous supply for the GSM-R radio must be available to ensure that, in the event of a train power failure, communication can be made or continued to aid recovery for a minimum of two hours. The nature of the vehicles to be fitted and the railway undertaking’s requirements will determine the method of provision. The process for determining the capacity of the continued supply shall be based on the following factors:

a) Existing train battery arrangements.

b) Likely length of time of an incident.

c) The railway undertaking’s policy.

7.2 Unplanned Movement (Scenario 2 Variant 7)

7.2.1 A train movement not in the Working Time Table requires a TRN to be generated conventionally. This TRN then must be integrated into the GSM-R registration process (6.1.2). If the driver has not already been provided with the 5 digit registration number then a registration number is required from the controlling signaller who must provide the number.

7.2.2 For trains planned using Short Term or Very Short Term planning processes the 5 digit registration number must be generated by the railway undertaking along with their train path bid and confirmed by the infrastructure manager when accepting the bid.

7.3 Assisting Failed Trains (Scenario 15 – multi party voice calls) – propelling movement

7.3.1 The use of the multi party voice calls may be used when a train is assisting another train or locomotives are working in tandem. The cab to cab communications will be facilitated by the signaller.

7.4 Passing Signals at Danger

The controlling signaller may instruct the driver using the GSM-R radio to pass a signal at danger provided a point-to-point call is established with the driver (rather than a group call, Railway Group Standard GE/RT8081 [R6]).

7.5 Wrong Direction and Unsignalled Movements

The controlling signaller may instruct the driver in wrong direction and unsignalled movements provided a point-to-point call is established with the driver (rather than a group call, Railway Group Standard GE/RT8081 [R6]). In an area that normally supports eLDA the driver must be made aware that when, for any reason, the TD fails to step into the next berth, correlation with the GSM-R radio will be lost until train and TD berth are re-united. The signaller and driver in these circumstances must come to a clear understanding as to how future communication will be handled.
7.6 Other Circumstances

7.6.1 The General Broadcast Voice Call facility may be used to broadcast information to a number of trains in the signaller's control area or to each train as it approaches a pre-defined location (in areas supporting eLDA only), for example, train delays. This method is not suitable for safety-critical communication because drivers do not confirm receipt of these messages.

7.6.2 To reduce the signaller's workload, broadcast calls are pre-recorded by the signaller. The GSM-R system will then automatically repeat the General Broadcast Voice Calls at intervals defined by the signaller to all trains in the area defined by the signaller.

7.6.3 The signaller is included in the General Broadcast Voice Call and is therefore aware that the call has been broadcast. If for some reason the General Broadcast Voice Call has failed then the signaller must either contact each driver as appropriate or set up the General Broadcast Voice Call at another suitable location.

7.6.4 Berth Triggered Voice Calls are sent to each train that triggers a specific signal berth (for registered trains in areas supporting eLDA only). If the call fails the signaller will be notified and is required to make alternative arrangements.

7.7 Driver's Safety Device (DSD) Activation

7.7.1 If the DSD is activated because the driver is incapacitated or releases the DSD for any other reason when it should remain depressed, then the cab mobile will detect this and enter a delay period of 7 seconds (configurable in 1 second increments between 1 to 30 seconds) during which time the driver may reset the DSD without triggering the alarm. At the end of the delay period, if the DSD has not been reset then the GSM-R cab mobile will trigger a DSD released audible warning and visual indication for a period of 8 seconds (configurable in 1 second increments between 1 to 30 seconds).

7.7.2 If the DSD is not reset by the driver within the warning time, a Priority 2 DSD alarm pre-defined text message is sent to the signaller and is identified on the fixed terminal's incoming call message queue with the TRN with a suitable audible tone. This appraises the signaller of the event and allows mitigating action to be taken.

7.7.3 When the DSD alarm is sent to the signaller this is indicated on the cab mobile HMI as an acknowledgement that the message is received.

7.7.4 If the train is registered and in an eLDA area then the DSD alarm message will be displayed with the TRN and signal location on the controlling signaller's fixed terminal.

7.7.5 If the train is registered but not in an eLDA area and there is more than one signaller mapped to the cell then the DSD alarm message will be sent to a signaller nominated by the infrastructure manager and will be displayed with the TRN together with the cell identity.
7.7.6 If the train is not registered, then the DSD Alarm will be sent to all signallers’ fixed terminals mapped to the call originating cell, and will display traction unit number and cell identity. The controlling signaller will be required to identify that the call is within their area of control by reference to the vehicle number and cell identity. In these circumstances, other signallers in receipt of the DSD alarm will monitor the response from the controlling signaller and take appropriate steps if no response, or an inappropriate response, is forthcoming. However, if the wrong signaller were to respond in error, then it will be possible for that signaller to contact the controlling signaller and make the necessary arrangements for the management of the incident to be handed over.

7.8 Signaller Communication Over Public Address (Scenario 22)

7.8.1 If circumstances require it, the controlling signaller must be able to make announcements over the train PA system, for example if the driver is incapacitated.

7.8.2 In the event of a train stopping out of course and the DSD alarm being received by the signaller, the signaller would normally make an Urgent Point-to-Point Call to the driver of the train concerned. However, if the signaller were to receive no response, the signaller could then make an announcement over the train’s PA system to request other traincrew to contact the driver.

7.8.3 The signaller must select the train from the fixed terminal mobile list or dial headcode and initiate a PA call.

7.8.4 The PA function consists of a priority 3 call.

7.8.5 Upon receipt of an incoming PA call, the cab mobile will automatically answer the call and connect it to the train’s PA system through the cab mobile’s interface.

7.8.6 The incoming PA call will be displayed on the cab mobile’s HMI display.

7.8.7 Once the signaller’s call to the PA system has been established, it will be indicated to the signaller on the fixed terminal’s display and the signaller is able to make an announcement over the connected train’s PA system.

7.8.8 The signaller’s announcement will also be heard over the cab mobile’s associated loudspeaker.

7.8.9 Once the signaller has completed the announcement over the train PA system, the signaller must terminate the call which will result in the cab mobile’s HMI display returning to its normal steady state. The cab mobile will also be able to terminate a call.
8 Degraded Working

8.1 Cab Mobile Failure

If a cab mobile fails its self-test and is identified as a service affecting failure, then it must be treated as a failure. The appropriate response should be in accordance with Railway Group Standard GO/RT3437 [R7] and the individual railway undertaking’s contingency plans.

8.2 GSM-R Infrastructure Failure

8.2.1 In the event of a failure of the trackside radio infrastructure or systems, the appropriate planned response by the infrastructure manager will be implemented by the infrastructure manager and railway undertakings.

8.2.2 The appropriate planned response will be developed over the next few months and will be based upon the process for developing the Interim Voice Radio System (IVRS) degraded mode instructions.

8.2.3 The degraded mode instruction will cover:
   - MSC failure
   - Multi BTS failure
   - Single BTS failure
   - Fixed terminal failure

8.2.4 A fixed terminal failure will result in the fixed terminal being replaced. The replacement may be managed by the signaller although technical support will be required to upload the terminal configuration. In the interim the role can be recovered by another fixed terminal, providing provision has been made for this during the configuration of the other fixed terminal.

8.3 Registration Failure (Scenario 2 Variant 5)

8.3.1 If the cab mobile fails to register with the system, the HMI will indicate a ‘registration failed’ error message. If the radio has tested OK and network coverage is indicated as being available, then the entered number may be a duplicate. The train preparer must attempt a second time, and if the registration still fails, the train preparer must check the number with the controlling signaller.

8.3.2 In the event that the GSM-R system does not accept the 8 digit registration number, the driver must request an alternative 5 digit registration code from the controlling signaller (by dialling the signaller using the unregistered GSM-R cab mobile) and retrying using one of two alternative 5 digit registration codes. This must, if necessary be repeated for the second alternative number.

8.3.3 If it is still not possible to register the radio then the appropriate response should be in accordance with Railway Group Standard GO/RT3437 [R7] and the individual railway undertaking’s contingency plans.

8.3.4 If the wrong TRN is registered this must be identified by the driver and contact made with the signaller.
8.4 Duplicate TRNs (Scenario 2 Variant 5)

8.4.1 Ideally, TRNs should be unique within each signaller’s GSM-R area. If duplication occurred then there would be ambiguity concerning which train was communicating, which could lead to miscommunication errors.

8.4.2 Where a duplicate TRN exists within a signaller’s GSM-R area, then this will be highlighted to the signaller when attempting to call one of the trains by its TRN, or if a call is received by the signaller from one of the trains. The traction unit number will be displayed for each train.

8.5 Enhanced Location Dependent Addressing (eLDA) – correlation failure

The system uses the TD to correlate trains and their location as shown in the signalling system. If this information is incorrect for any reason, the system will revert back to LDA routing.

8.6 Call Failure from Cab Mobile

If a call fails or the communication link is broken during a call then the person with lead responsibility will be responsible for re-establishing the call (assuming that the reason for the call is still valid). If the call cannot be re-established, then an alternative means of communication must be used, for example, signal post telephone.
9 Emergencies and High Priority Calls

The driver or signaller, using experience supported by appropriate training and guidance, must determine how best to react in specific circumstances. This may be by use of the Railway Emergency Group Call (red button – all train stop) or the Urgent Point-to-Point Call (yellow button).

9.1 Driver Initiated Railway Emergency Group Call – stop all trains

9.1.1 A driver must initiate a Railway Emergency Group Call by pressing the red button (all trains stop) on the cab mobile HMI. The call will be automatically connected to all signaller and route controller fixed terminals mapped to the group call area\(^{13}\) and other mobiles within the pre-defined emergency area (at a minimum the same radio cell and generally the adjacent cells as well).

9.1.2 The fixed terminals will announce the incoming Railway Emergency Group Call and automatically answer, playing the audible output over the loudspeaker.

9.1.3 The fixed terminal will display the TRN (if registered) or vehicle number of the initiator and group service area from where the call originated.

9.1.4 Any subsequent railway emergency group calls will be displayed in the incoming call queue and because of their priority, automatically displayed at the top of the call queue in time order.

9.1.5 The signaller will then answer each of the subsequent railway emergency group calls in time order, having dealt with each of the previously received calls.

9.1.6 Other cab mobiles will announce the receipt of an incoming Railway Emergency Group Call with an audible and visual indication, for example, an audible alarm accompanied by the flashing text ‘STOP’. The speech is relayed automatically via the cab loudspeaker. On receipt of this indication, the driver must bring the train to a stand. This includes automatic pre-emption of another lower priority call should the driver be engaged in a call already. However, once the original Railway Emergency Group Call has been terminated then trains entering the area will not be made aware of the emergency via the cab mobile. Trains leaving the emergency call area will drop out of the Railway Emergency Group Call.

9.1.7 Drivers are expected to stop their trains if initiating, or upon receipt of, the Railway Emergency Group Call, in accordance with the Rule Book [R2].

9.1.8 Trains entering the area of an ongoing Railway Emergency Group Call will join the Railway Emergency Group Call automatically and the train’s cab mobile will emit the emergency audible and visual indications, including the flashing text ‘STOP’.

9.1.9 The driver will be required to press the stop acknowledge (ST) button to acknowledge receipt of the stop message and to stop it from flashing.

\(^{13}\) There is a system constraint that limits the maximum number of fixed terminals associated with a Railway Emergency Group Call; that is five. This constraint needs to be given careful consideration during the development of the cell plan/configuration.
9.1.10 Failure of a Railway Emergency Group Call to be connected within 30 seconds will result in the attempt being abandoned and the fact that the call was not established being indicated to the call initiator. The system will initiate a retry strategy during the 30 second period if initially unsuccessful.

9.1.11 Once the Railway Emergency Group Call has been received, the controlling signaller shall assume lead responsibility for the call. Once the nature of the emergency is understood, appropriate procedures must then be followed, which may include one or more of the following:

a) Instructing drivers/signallers on their required actions using the current call. Whilst this option may be quicker than those listed below, it should not replace them.

b) Returning signals to danger.

c) Instructing other trains in the emergency area not using GSM-R to stop.

d) Making an Urgent Point-to-Point Call to a particular train instructing them to stop.

e) Making point-to-point calls to stop particular trains.

9.2 Railway Emergency Group Call initiated by other than registered Cab Mobile

In the event of the driver being incapacitated, other on-board staff may use the cab mobile if they have the appropriate competence. The railway undertaking must ensure that access to the cab and radio is provided to those on board staff with this competence.

9.3 Signaller Initiated Railway Emergency Group Call – stop all trains

9.3.1 In an emergency, a signaller must initiate a Railway Emergency Group Call to stop all trains in an area by selecting a pre-defined area and sending the all trains stop Railway Emergency Group Call. The call will be automatically connected to all mobiles within the area and all terminals associated with the area. It will also be connected to any trains subsequently entering that area whilst the call is in progress. Trains leaving the area whilst the call is in progress will be automatically disconnected.

9.3.2 Cab mobiles receiving the Railway Emergency Group Call will announce this to the driver as the same message as described in 9.1 and relay the speech over the loudspeaker. Drivers receiving the Railway Emergency Group Call stop message must bring their train to a stand, in accordance with the Rule Book [R2]. They must then wait for the signaller to contact them.

14 The more specific the area, the smaller the number of trains unnecessarily involved in the emergency, but the longer the signaller may take to select the area.
9.3.3 The controlling signaller must verify that the drivers of all the trains in the Railway Emergency Group Call area have brought their trains to a stand. (This involves looking at the signal box panel to check all the trains have stopped).

9.4 Recovery from Railway Emergency Group Calls
Any driver that has stopped their train following receipt of a Railway Emergency Group Call must remain at a stand until contacted by the controlling signaller and provided with suitable instructions.

9.5 Route Controller Initiated Railway Emergency Group Call
The route controller must be able to make a Railway Emergency Group Call to all trains in pre-defined areas. A signaller affected by the call must monitor it and take appropriate action. The system will respond in the same manner as described for Railway Emergency Group Calls initiated by the signaller.

9.6 Operational Handportable Radio (OPH) Initiated Railway Emergency Group Call
Railway Emergency Group Calls will be initiated by pressing the emergency button.

9.7 Driver initiated Urgent Point-to-Point Call
9.7.1 This functionality may be used by the driver when an urgent call is required to be made to the signaller which does not affect the safety of other trains. For example, this functionality may be used when summoning the emergency services for a passenger on board the train.
9.7.2 Drivers will be able to use this functionality with a minimum of driver action being required, for example as a single key stroke (yellow button).

9.8 Signaller Initiated Urgent Point-to-Point Call
If a signaller needs to contact a train urgently the signaller may initiate an Urgent Point-to-Point Call. The cab mobile will indicate that it is receiving an urgent call.

9.9 Shunting Emergency Group Call
9.9.1 This is initiated by a member of a Shunting Group Call activating the emergency function on their radio. The emergency indication will be communicated to the other radios in the shunting group, and any other radios in shunting mode in the area, only. It will not be otherwise identified on a signaller’s HMI or cab mobile unless they have been registered into the shunting group.
9.9.2 Upon receipt of a Shunting Emergency Group Call a cab mobile and fixed terminal will behave as described in section 9.1.
9.9.3 Drivers are expected to stop their trains if initiating, or upon receipt of, the Shunting Emergency Group Call, as described in 9.1.7
9.9.4 The shunting group leader must take charge of the situation. Options open to them (but not the other shunting group members) include the ability to leave the group call temporarily in order to make other calls (for example, a Railway Emergency Group Call), after which they rejoin the group call. In the meantime the other shunting group members remain active within the Shunting Group Call.
10 Shunting Mode

10.1 Arrangements for the use of Radio

10.1.1 Where existing back-to-back radios are in use, and provide a reliable and safe method of work, they may be the preferred method at that location and can continue to be used or they may be replaced by GSM-R.

10.1.2 GSM-R may be used to communicate the shunter’s movement control instructions to the driver’s cab mobile in shunting mode, supported by the link assurance information. Link assurance is a continuous transmission, generated whilst the shunter holds a button depressed on the OPS. The driver interprets loss of this transmission as a command to stop the train. In the absence of the link assurance function (for example, defective radio), the Rule Book allows continuous voice communication by the repetition of verbal instructions as an alternative.

10.1.3 If a normal point-to-point call was used then the link assurance function would not be available but users would be able to receive Railway Emergency Group Calls.

10.1.4 A cab mobile will not be able to receive Railway Emergency Group Calls when in shunting mode.

10.2 Shunting Group Call

10.2.1 This is a specific form of group call intended for shunting purposes. Shunting Group Calls allow voice communication within the shunting group so that all group members are aware of the situation. Communication is restricted to the group and controlled by the PTT button.

10.2.2 ‘Common’ Shunting Group Calls are identified by an identity unique to that area. Therefore, calls using the common group of a given area are common to all users in that area. If a member of the group moves outside that area they are automatically disconnected.

10.2.3 ‘Dedicated’ Shunting Group Calls may be established independently of the common shunting group for that area. These are more controlled in that they have one person as the ‘group leader’, who is responsible for admitting other persons to the group.

10.2.4 These are described in greater detail below.

10.3 Common Shunting Group Call

Each person wishing to join the call places their mobile (OPS or cab mobile) into shunting mode and enters the identities of the Shunting Group Call area and the common shunting group. A person may leave the Shunting Group Call at any time but the call will remain active, unless they are the last person to leave the call. When they wish to leave they may terminate the call. On exiting shunting mode the cab mobile will return to normal mode. The cab mobile will also return to normal mode if it is powered down having been left in shunting mode.
10.4 Dedicated Shunting Group Call

10.4.1 The shunting group leader places an OPS into shunting mode, and registers with a new shunting group as the 'lead shunter'. This involves indicating the required identity to be used, and the number of people to be included in the call. When the network has created the group call, the shunting group leader communicates the identity to the members and instructs them to enter the call.

10.4.2 The member places their mobile (OPS or cab mobile) into shunting mode and enters the identity of the dedicated Shunting Group Call and joins as a 'dedicated shunting team member'.
11 **Data Recording**

11.1 **Recording of Call Traffic**

The trackside equipment will log details of calls and text messages made using the GSM-R network. This information will be available to enable monitoring of system integrity and user discipline.

11.2 **Voice Recording**

11.2.1 Network voice communication to or from OPHs, cab mobiles, signallers’ fixed terminals and route controllers’ fixed terminals will be recorded by the trackside GSM-R system. These records will be retained for a defined period, for example 14 days (see [R3] and [R5]). This information may be accessed, by relevant authorised persons, on request within a short timeframe.

11.2.2 Voice recording is undertaken for two major reasons. Firstly, for competence assessment purposes and, secondly, for incident investigation. This is currently achieved by downloading of voice recorders located within each signal box.

11.2.3 The GSM-R central voice recorder offers more flexibility to support competency management systems than the present system. It is possible to extract voice recording by signaller position (not the most straightforward approach), by cab mobile, calling party number and called party number.

11.2.4 The central voice recorder exports files in wav format which is generally readable on PCs and will be distributed by the TEC.

11.2.5 Recordings of all communications, in particular post-incident, must be made available and used for incident analysis by railway undertakings and infrastructure managers.

11.2.6 The recording of data and voice will also be carried out to ensure system integrity and user discipline.

11.3 **Trainborne Recording**

11.3.1 The GSM-R radio must be provided with an interface to enable connections with modern OTMR.

11.3.2 The GSM-R radio must be connected to the OTMR, if provided, on trains.

11.3.3 As a minimum the emergency calls listed in section 11.3.4 and DSD alarms must be recorded on the OTMR.

11.3.4 The principles for the cab mobile interface to the OTMR are as follows:

a) Data sent to the OTMR shall have consistent timing between data items to permit event reconstruction.

b) The OTMR shall appear at the OTMR port or ports with the same delay and sequence irrespective of its source within the cab mobile.

c) The output presented to the OTMR shall exceed the minimum recording resolution of existing OTMRs.
d) There is no requirement for the information sent to the recorder to comply with Home Office guidelines for evidential data.

e) The cab mobile shall supply all mandatory and optional data as specified in the Control Command and Signalling TSI and additional events as listed in the table below. Two types of data interface shall be available from the cab mobile, serial or digital status. The table below provides an indication of the information needed on each type of interface.

<table>
<thead>
<tr>
<th>Event</th>
<th>Serial Interface</th>
<th>Digital Interface</th>
</tr>
</thead>
<tbody>
<tr>
<td>Railway Emergency Group Call activation by driver*</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Railway Emergency Group Call received by cab mobile*</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Railway Emergency Group Call terminated by network</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Railway Emergency Group Call terminated by cab mobile</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Railway Emergency Group Call failed including call direction and reason for failure</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Railway Emergency Group Call confirmation*</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Railway Emergency Group Call confirmation including call confirmation string</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Power up failure including reason for failure</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Self test results</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>DSD message transmitted*</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Network Status</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Urgent Point to Point Call received by cab mobile</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Urgent Point to Point Call activation by driver</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
### Table: OTMR Control Command and Signalling TSI Requirements

<table>
<thead>
<tr>
<th>Event Description</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urgent Point to Point Call terminated by network</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Urgent Point to Point Call terminated by cab mobile</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Start of on train PA announcement</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Termination of on train PA announcement</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Public emergency call activation by driver</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

* indicates a Control Command and Signalling TSI mandatory requirement.

- **f)** The data items sent to the OTMR for recording shall be user configurable for each type of interface (parallel data and serial) and for the train type.
- **g)** The method of configuration shall be by the Train Configuration File.
- **h)** No data is received from the OTMR other than for handshaking purposes, where needed.
- **i)** The OTMR units shall provide the time tagging of received data.
- **j)** The cab mobile shall not send audio or voice conversations to the OTMR.
12 Migration
Set out below are the key elements of the migration strategy [R15] for the implementation of the GSM-R radio system within GB.

12.1 Objectives
The main objectives of the migration strategy are as follows:
   a) Allow for the safe and efficient migration to GSM-R.
   b) Maximise the benefit of GSM-R as early as possible.

The following are seen as the key influences on delivering the Migration Strategy objectives, which will require mitigation measures.

12.2 Safety
In addition to safety risk for workers exposed to the infrastructure and train fitment activities (for which suitable control procedures exist), significant influences (both positive and negative) on safety are:
   a) A reduced migration timescale increases safety benefit captured.
   b) Migration on NRN routes before CSR routes where safety benefit is considered to be higher.
   c) Confusion by driver and/or signaller, over which radio to use when dual radios are being operated.

12.3 Efficiency
An efficient roll-out of GSM-R is one where the minimisation of cost and minimisation of timescales allow early use of the system.

12.4 Cost
Significant influences on the cost are:
   a) Dual cab mobile fitment as this requires each vehicle to be modified twice (once to fit GSM-R and once to remove NRN and/or CSR). This requires additional vehicle downtime and may entail two separate designs to be undertaken.
   b) Driver and signaller training (too early or lack of use will require refresher training).
   c) Dual signal box (and control office) fitment similarly will require equipment fitment and then later recovery of the CSR and NRN equipment.

12.5 Timescales
Fitment of the infrastructure first followed by the trains increases the roll-out duration.
Dual cab mobile fitment reduces roll-out duration (Scenario 5).
12.6 Contingency

Significant influences on contingency planning are:

a) A ‘big bang’ switch over approach allows no progressive application and build up of experience and reliability.

b) Dual cab and signal box (control room) fitment allows fall back position.

c) The availability of transportable radio (NRN or CSR) or signal post telephones (SPT) may offer suitable contingency.

Fitting CSR last limits potential disruption on intense DOO(P) services should early in-service performance prove to be unreliable, which might be expected on the introduction of any major new system.

12.7 Migration Rules

These rules are stated as follows:

a) GSM-R need not be present on an entire railway undertaking’s journey/route before that route can be used, for example it should be used when a sensible proportion of a route is covered to elicit early benefit.

b) On any one journey, the driver must not be required to switch between different radio systems more than twice (to be confirmed), or more than once every two hours.

c) Switching cab mobiles shall only be undertaken when the train is stationary to avoid distraction during radio set up, except when entering a GSM-R area and the cab mobile has been pre-registered.

d) Where c) is not possible (for example, it has not been possible to pre-register the cab mobile) then the train shall operate throughout on the legacy system.

e) Bringing GSM-R into use should as far as practicable be based on a railway undertaking’s operating area/route basis to maximise use of GSM-R at the earliest time.

f) GSM-R must be the primary means of communication in a designated GSM-R area, but trains may enter/continue in service if a working legacy radio is available and operative in the designated GSM-R area.

12.8 Technical Requirements

The ‘technical requirements’ necessary to support migration are as follows:

a) Radio change boards must be provided at locations where radio change is required to mitigate driver’s forgetting to select the correct radio. These locations must also be published in local instructions.

---

15 Switching between GSM-R and SMA on the move and vice-versa will be explored as part of the Strathclyde trial.
b) It is preferable to test GSM-R where trains start on another system. However, trains failing GSM-R registration, either at the start or when switching over, may continue onwards using the legacy system.
13 Configuration Management

13.1 General

The process for the control of updates of both hardware and software applications applicable to GSM-R will be agreed by both the infrastructure manager and the railway undertakings through the rail industry’s standards process. This will enable a planned approach to such upgrades and re-configuration, as necessary, to the GSM-R system.

13.2 Equipment Access Control

In order to provide maximum security within a mobile network, it is important that unacceptable mobiles are excluded before actually using the network. The equipment identity register (EIR) provides the facility to prevent unwanted mobiles using the network. Experience with existing mobile networks has shown the importance of mobile management. Mobiles using the services of a mobile network should be of an approved type, should not be declared stolen or lost and should not induce problems within the network. From a service point of view, having an EIR in a mobile network generally decreases the number of thefts of handsets since it becomes pointless to steal a handset that can no longer be used, even when its SIM-card is replaced.

13.3 Subscriber Management

13.3.1 Access to the network will be limited to and determined by the user profile programmed on SIMs and the Connectivity Matrix in the network. GSM-R contains a provisioning system to manage network use. The system manages SIM record creation, amendment and deletion together with services available to individual subscribers and classes of subscribers. Specific services for GSM-R include the creation and modification of membership for groups.

13.3.2 Further development of the principles for the management and control of the SIM card is an open point and will be resolved in subsequent issues of this document.
14 Call Facilities and Accessibility

14.1 Connectivity Matrix

14.1.1 The Connectivity Matrix is detailed in APPENDIX 2 – Connectivity Matrix.

14.1.2 The main features of the Connectivity Matrix are:

   a) Drivers cannot call the drivers of other trains direct.
   b) Drivers can only be called by a fixed terminal.
   c) Drivers access to a limited number of PSTN numbers, contained within the railway undertaking’s configurable telephone directory.
   d) There is no single button call access to route controllers or ECOs for drivers.
   e) Route controllers, as well as signallers, are able to make Railway Emergency Group Calls.
15 System Maintenance

15.1 Infrastructure Maintenance

15.1.1 The maintenance strategy for the GSM-R radio infrastructure is described below.

15.1.2 The TEC must monitor the network centrally on a 24 hour, seven days a week, 365 days a year basis and report faults to Infrastructure Fault Control as they arise. An asset database, fault trouble ticket system and real time element management systems must be provided for this purpose.

15.1.3 The TEC must manage faults in the network in accordance with the Fault Management Procedure. This covers the interface to the Maintenance Directorate for the infrastructure, the Infrastructure Fault Controls and the parties responsible for maintenance. The TEC manages escalation between maintenance levels on a given trouble ticket. The elements of the Fault Management Procedure which relate to the operation of an interface to trains must be agreed with the railway undertakings using the normal standards process.

15.1.4 A Defect Recording and Corrective Action System (DRACAS) must be provided and managed by the infrastructure manager. The elements of this that relate to interfaces with mobile equipment, train operation or overall system availability or reliability must be agreed with the railway undertakings through normal industry processes (Standards or Network Change). For the infrastructure, the TEC will either receive details of faults from Infrastructure Fault Control or will be the instigator of fault reports to the Infrastructure Fault Control when detected through the network monitoring systems. The use of a DRACAS system enables the monitoring of reliability, maintainability and operational performance in service and ultimately minimise the incidence of failures and cost of support. Details of each identified fault is recorded, along with solutions and associated timescales to rectify the fault. This enables analysis of fault causes and rectification procedures and the identification of actions to minimise future occurrences and impact.

15.1.5 The TEC retains and manages records of all assets, including all identification details on installation, commissioning and then track assets through all maintenance and logistics activities.
APPENDIX 1- Operational Scenarios

1 Power Cab Mobile Up - Scenario SCN/NOC/001

Start condition
Train or traction unit cut out and the cab radio powered down.

AIS/BIS
User switches AIS/BIS, powering up cab mobile

Cab Mobile
Radio connects to GSM-R network

Cab Radio (MMI)
User switches MMI 'On'

MMI display
successful completion of automatic diagnostic testing will be indicated to the user

Test successful

End condition
Cab radio powered up, connected GSM-R network, cab mobile MMI switched on, radio status displayed (for example, network name and traction unit number) and able to send and receive calls.

Notes:
[R1] FRS 5.2.3.17(M) - registration with other on train systems, such as ERTMS/ETCS
[R1] FRS 5.2.3.1(M) - connection of the Cab Radio to an authorised mobile network
[R2] SRS 10.5(M) - connection of Cab Radio to an authorised mobile network shall cause the following:
- the name of network to be displayed on MMI
- an audible indication of successful connection

Variant
V1. Invoke Self Test

Variant
V2. Cab mobile connects to incorrect network

Note1: [R1] FRS 5.2.3.4(M), [R2] SRS 5.4(M) - powering up the radio will initiate the following:
- automatic self testing
- automatic selection of default language
- automatic selection of the pre-set loudspeaker volume
- registration with other on train systems, such as ERTMS/ETCS
- connection of the Cab Radio to an authorised mobile network

Note2: [R1] FRS 5.2.3.44 - 5.2.3.46(M) - it shall be possible to initiate tests of the radio to provide the driver with a reasonable level of certainty that the radio and MMI are working. (M) - such tests shall not prevent calls. (M) - the result of the tests shall be displayed in a similar format to the self-test when MMI is powered on. (M)

Note3: [R1] FRS 5.2.3.6(M), [R2] SRS 5.2.3.17(M) - switching on the MMI shall cause the following:
- self test of MMI (eg transitory lighting of the display and of all the controls and indicator lights of the MMI)
- determination of the status of the Cab Radio providing a display of radio status on the MMI

Note4: [R1] FRS 5.2.3.1(M) - connection of Cab Radio to an authorised mobile network shall cause the following:
- the name of network to be displayed on MMI
- an audible indication of successful connection

Note5: [R10] Operations Concept 6.1.1.5 - enhanced cab mobile will display the rolling stock number of the vehicle (configured by the maintainer at installation), once connected to an authorised network

Variant
V3. Cab mobile connects to incorrect network

Variant
V4. Cab mobile connects to incorrect network
2 Cab Mobile Registration - Scenario SCN/NOC/002

Start condition
Cab mobile powered up, connected to authorised network and MMI displaying traction unit number.

Cab Radio (MMI)
Driver selects 'Registration' & enters eight digit registration code.

MMI display
Driver checks registration number displayed is correct

Cab Radio (MMI)
Driver confirms registration number by pressing enter

Fixed Terminal Sub-System
Correlates information

Registration successful

MMI display
Successful completion of registration is indicated to the user

End condition
Registration complete, cab mobile and signallers MMI displaying TRN and cab mobile available for service (associated signal number will be displayed in TD areas)

Notes:
- GSM-R Registration Number (GRN) consists of eight digit code comprising of a 5 digit encrypted head code followed by a 3 digits numeric signal code, based on the last 3 digits of the signal that the train is facing.
- The driver is required to enter the running number information, the information entered shall be shown on the display and require confirmation by the driver before further actions are possible.
- Successful completion of the registration process will be indicated in the following way: FTS will send an SMS message to the cab mobile containing TRN and associated signal number (TD areas). (note, in non-TD areas just the TRN will be sent)
3 Standing at Signal Message - Scenario SCN/NOC/003

Start condition

Then standing on the approach side of a signal displaying a danger aspect, Cab Radio powered up, connected to authorised network, registered with GSM-R system, displaying correct TRN.

Note1: [R11] 6.1.1 Standing at signal

The 'standing at signal' message facility is not supported by other than UK GSM-R enhanced cab mobiles.

Variant V2

Variant V4

Variant V3

Variant V5

Variant V6

Variant V7

Note2: [R11] 6.1.1 Standing at signal

- if the GSM-R system cannot route the message to the correct controller (for example, the train is not in a TD area), the enhanced cab mobile indicates that 'standing at signal' message can not be sent.

Note3: [R11] 6.1.1 Standing at signal

- enhanced cab mobile indicates that 'standing at signal' message has been received by controller.

Note4: [R11] 6.1.1 Standing at signal

- if the driver attempts to send a 'standing at signal' message whilst involved in a call, an enhanced cab mobile will transmit the message once the driver has left the call. Cab mobile then indicates that the message has been successfully transmitted.

Note5: [R11] 6.1.1 Standing at signal

- Fixed terminal displays receipt of 'standing at signal' message (including the head code and the signal number the train is facing) in the incoming call queue.

Controller (signaller) responds by:

- sending 'wait' message
- calling driver
- accepting from queue and taking no further action (for example, clearing signal)

Note6: [R11] 6.1.1 Standing at signal

- The 'wait' message can only be sent in direct response to the receipt of a 'standing at signal' or 'stop acknowledgement' message.

Note7: [R11] 6.1.1 Standing at signal

- If 'wait' is sent whilst the driver is involved in a call, the message will not deliver once the driver has left the call. The fixed terminal will indicate that the system is attempting to deliver the message.
4 Transition between radio systems - Scenario SCN/NOC/005

**System boundary**
- Driver identifies that train will be leaving GSM-R area

**Start condition**
- GSM-R cab mobile powered up, connected with GSM-R network, registered with NSS, displaying correct TRN, available for service and train operating normally.

**Change over process**
- Driver operates change over switch in order to select appropriate radio system.

**Alternative radio system**
- Driver commissions alternative radio system.

**End condition**
- GSM-R cab mobile powered up, connected with GSM-R network, registered with NSS, displaying correct TRN, available for service and train operating normally.

**Notes:**
- [Iss007] Where possible the provision of any lineside signage needs to coincide with the signalers area of control rather than the limits of the GSM-R system boundary.
- [R3] 5.2 Equipment requirements - multiple radio systems in the cab, so that only one cab mobile shall be operational at one time, to prevent confusion amongst users of cab mobiles.
- [Gn9.] The driver of a train needing to make the transition from GSM-R to NRN will only need to operate the 'change over' switch, as the NRN radio will already be powered up. However, the driver will be required to check the correct radio zone identification code is displayed on the NRN MMI.
- [Gn10.] The driver of a train needing to make the transition from GSM-R to CSR will need to operate the 'change over' switch and register the CSR radio in the normal manner.
- [Gn13.] If the train will not re-enter a GSM-R area before completing its journey, then the driver will be required to deregister the cab mobile (for example, pressing the 'deregistration' button on the cab mobile MMI). If deregistration is not undertaken and successfully completed, it will prevent the reallocation of the TRN at a later date.

**Notes:**
- Driver will be able to easily identify which radio system is in operation, by checking the position of the 'change over' switch (where provided) and the provision of appropriate labelling.
- Once the train leaves the GSM-R cell boundary the cab mobile will indicate to the driver that there is no network coverage (for example, the name of the authorised network no longer be displayed on the cab mobile MMI). This indication will not be accompanied by an audible warning, as the audible output of the GSM-R cab mobile will have been suppressed when the 'change over' switch was operated.

**Notes:**
- The driver will be able to easily identify which radio system is in operation, by checking the position of the 'change over' switch (where provided) and the provision of appropriate labelling.
- If a previously registered GSM-R cab mobile subsequently enters another area, where GSM-R network coverage is provided, the cab mobile will be available for use by the driver, providing the driver operates the change over switch.
5 Shunting Group call - Scenario SCN/NOC/008

Driver (Cab Mobile)

- **Start condition**: Cab mobile powered up, connected to GSM-R network and able to send and receive calls.
  - Cab mobile MMI
  - Displays options and prompts driver to enter location ID.
- **Operation**: Driver enters five-digit location ID and selects shunting mode.
- **Operation**: Cab mobile MMI confirms that cab mobile is attempting to join common shunting group call.
- **Operation**: Cab mobile MMI displays options and prompts driver to input location ID.
- **Operation**: Cab mobile MMI confirms that access has been granted to the common shunting group and indicates that PTT facility is in use.
- **Operation**: Cab mobile MMI enters into service in the call by pressing PTT.
- **Operation**: Cab mobile MMI displays options and selects dedicated shunting group.
- **Operation**: Cab mobile MMI enters location ID and selects dedicated shunting group.
- **Operation**: Cab mobile MMI confirms access granted to dedicated shunting group and indicates that PTT facility is in use.

Shunter (Operational Portable Handset)

- **Start condition**: Shunter is able to participate in the call by pressing PTT.
- **Operation**: Shunter selects menu options and enters dedicated shunting group.
- **Operation**: Access granted to dedicated shunting group call.

Common shunting group

- **Start condition**: Cab mobile powered up, connected to GSM-R network and able to send and receive calls.
- **Operation**: Cab mobile MMI displays options and prompts driver to enter location ID.
- **Operation**: Cab mobile MMI confirms that access has been granted to the common shunting group.
- **Operation**: Cab mobile MMI enters into service in the call by pressing PTT.
- **Operation**: Cab mobile MMI displays options and selects dedicated shunting group.
- **Operation**: Cab mobile MMI enters location ID and selects dedicated shunting group.
- **Operation**: Cab mobile MMI confirms access granted to dedicated shunting group.

GSM-R Network

- **Start condition**: Cab mobile powered up, connected to GSM-R network and connected to the common shunting group call.
- **Operation**: Cab mobile MMI displays options and selects dedicated shunting group.
- **Operation**: Access granted to dedicated shunting group call.

Uncontrolled When Printed
Document withdrawn as of 07/03/2015
6 Additional use of text messages - Scenario SCN/NOC/011

Driver
Cab Mobile

Start condition:
Cab Radio powered up, connected to authorised network, registered with NSS, displaying correct TRN.

Cab Radio (MMI)
Driver selects text messaging function

Cab Radio (MMI)
Driver composes text message and presses enter button

Cab Radio MMI display
Driver is prompted to enter recipient

Cab Radio (MMI)
Driver enters ISDN and presses enter button

Cab Radio MMI display
Visual indication, confirming to the driver that the cab mobile is attempting to send the message.

Cab Radio (MMI)
Out going SMS

End condition:
Cab Radio powered up, connected to authorised network, registered with NSS, displaying correct TRN and confirmation that the variable text message has been received.

Signaller
Fixed Terminal

Start condition:
Audible and visual indication, alerting the signaller of incoming text message

Signaller's terminal
Signaller selects train from call queue and reads text message

Signaller's Terminal
Signaller deletes SMS text message and takes no further action.

Yes

Respond to message

Signaller receives SMS text message

NSS

Out going SMS

Incoming SMS

NSS

Radio infrastructure

Radio infrastructure

Radio infrastructure

Fixed Terminal

Radio infrastructure

Acknowledgement

No

Variant V1

Text message failed

Variant V2

Text message not delivered

Variant V3

Signaller sends variable text message

Driver
Cab Mobile

Cab Radio (MMI)
Driver selects text messaging function

Cab Radio (MMI)
Driver composes text message and presses enter button

Cab Radio MMI display
Visual indication, confirming to the driver that the cab mobile is attempting to send the message.

Cab Radio (MMI)
Out going SMS

End condition:
Cab Radio powered up, connected to authorised network, registered with NSS, displaying correct TRN and confirmation that the variable text message has been received.
7 Multi party voice calls - Scenario SCN/NOC/015
8 Switch off cab mobile HMI - Scenario SCN/NOC/018

**Start condition**
Cab mobile powered up, connected to authorised network, registered with NSS, displaying correct TRN.

**Deregistration**

**MMI display**
Confirmation message received confirming deregistration is complete

**Cab Radio (MMI)**
Driver presses ‘deregistration’ button

**Driver**

**NSS**
Network Sub-System

**Variant**
V1. Driver fails to deregister cab mobile
V2. Driver requires a change of TRN

**Note1:** [R11] 8.1.3
Pressing the ‘deregistration’ button will cause the Network Sub System (NSS) to delete the Functional Number (FN), thereby deleting the correlation with the FTS.

**Note2:** [R2] EIRENE SRS 11.3.11
States that an identified set of users shall be allowed to deregister a functional number for management or supervisory purposes (for example, to deregister a functional number which is no longer valid but which has not been deregistered by the driver).

**Variant**
V3. Driver unable to deregister

**End condition**
Cab mobile powered down, deregistered, driving cab decommissioned and driver no longer in cab.

**Note3:** [R11] 8.1.3
The Fixed Terminal Sub-System (FTS) recognises the absence of the FN and deletes the associated correlation from the location processor, updating the mobile list by deleting the TRN and berth ID or cell ID from the list and updating the berth list to show the corresponding TRN is not registered.

**Note4:** [R2] EIRENE SRS 11.3.12
The result of the deregistration procedure shall be sent back to the mobile. In the event of a failure, an indication of the cause shall be provided. Information on the outcome shall be provided to the mobile according to [TS GSM 04.80] and [TS GSM 04.82].

**Note5:** [R11] 8.1.3
Once deregistration has been successfully completed the FTS will send a confirmation message to the cab mobile to advise the driver that full deregistration has been successfully completed (for example, the TRN no longer being displayed on the cab mobile’s MMI).
9  Echo test facility - Scenario SCN/NOC/019

Start condition:
- MMI powered up, connected to authorized network, able to send and receive calls.

Echo test required

End condition:
- MMI powered up, connected to an authorized network, able to send and receive calls and available for registration.

Variants:
- Call busy
- Call fails to establish
- Test successful
- Echo Call Test facility failure

Note1: see issue list I1.

Note2: [R2] SRS 5.5.4(M) it shall be possible to initiate outgoing voice calls in one of four ways, depending on the intended recipient(s) of the call:
- emergency access, capable of rapid activation in an emergency with a minimum of actions being required by the driver (single red button)
- priority access, requiring the minimum of driver actions to initiate a call (eg a single key stroke)
- stored number, facility for the driver to store or select telephone or functional numbers manually (eg menu type access)
- dial access, facility for the driver to enter or select telephone or functional numbers manually.

Note3: see assumption As5

Note4: [R2] SRS 5.5.1(M) the sequence of actions required for a mobile originated call to another user shall be as follows:
- Initiating a call, system is provided with the necessary information to set up the call (eg number, bearer type, ... in the call can communicate
- Call termination, where one of the parties involved in the call terminates the call.

Note5: [R13] 3. Test mode - Echo Test
- user undertakes the following:
  - lifts handset
  - presses PTT
  - records message
  - releases PTT

Echo call test facility
- system records message and plays back to user

Cab Radio
- User listens to recording and terminates call at end of message, by replacing handset at end of message.
10 Signaller calls driver - Scenario SCN/AOC/020

Driver

Cab Mobile

Start condition:
- Cab radio powered up, connected to authorised network, registered with GSM-R system and displaying correct TRN.
- Train in service running under normal operating conditions.

Variant V8.
- Call not answered

Cab Radio (MMI)

Driver answers call, by lifting handset or pressing the 'call accept' button on the cab mobile MMI.

MMI display

Audible and visual indication, alerting the driver to an incoming call, including the functional ID of the caller.

The functional ID of the caller will be displayed on the cab mobile.

Safe to answer
No

Note 3:
- The presence of an incoming point-to-point call will be indicated to the driver on the cab mobile MMI. The indication will consist of a visual message displayed on the cab mobile MMI, which will be accompanied by an audible tone, designed to alert the driver without causing distraction.

Note 4:
- Rule Book, TW1
- Allows the driver to use fixed radio equipment whilst the train is moving, providing the driver can do so safely and will not become distracted.

GSM-R

Network

Call connected

V1. Task not registered

Variant V1.
- Train not registered

Variant V3.
- Signaller initiates an urgent point-to-point call

Auto answer

Call initiated

GSM-R

Radio infrastructure receives call

Radio infrastructure establishes call

Cab mobile answers call

GSM-R

Network

Call connected

Call answered

Fixed Terminal

Signaller

Fixed Terminal

Signaller identifies the train to be communicated with from train list.

Variant V2.
- Signaller initiates a point-to-point call to an unregistered train

Variant V5.
- Train moves out of signaller's area of control.

Variant V6.
- Call busy

Variant V4.
- Call pre-emption: signallers initiated calls (incoming).

Variant V10.
- Signaller sends 'contact signaller' request predefined text message.

Variant V1.
- Train not registered

Variant V3.
- Signaller initiates an urgent point-to-point call

Variant V9.
- Call rejected

Variant V10.
- Signaller sends 'contact signaller' request predefined text message.

Variant V1.
- Train not registered

Variant V3.
- Signaller initiates an urgent point-to-point call
### 11 DSD Activation - Scenario SCN/AOC/021

**Start condition**: Driver requests DSD

- Driver releases DSD

**DSD reset**

- Signaller's terminal
  - Audible and visual indication on signaller's fixed terminal.
  - Signaller initiates point-to-point call and awaits response from driver.

**DSD text message transmitted**

- Signaller's terminal
  - Audible and visual indication on signaller's fixed terminal.

**DSD text message received**

- Cab mobile
  - Displays confirmation message to the driver that DSD message has been sent.

**End conditions**

- Driver answers
- Signaller

### Notes:

1. **[Gn4]** DSD activation
   - Once the DSD has been activated, the train must come to a complete stand before the driver can attempt to reset it and release the brakes. This can also incur a two-minute penalty after the train has come to a stand, depending on the traction unit.

2. **[Gn6]** MMI indications
   - The cab mobile indication will be easily recognisable and different from that of normal cab mobile functions other than those associated with emergency situations.

3. **[Gn7]** MMI indications
   - Up on receipt of the DSD text message, the fixed terminal(s) will display the DSD activation message, the TRN and location information (for example, 1L62 SG023 DSD ACTIVATED).

4. **[Gn9]** Cancelling audible and visual indication
   - Once a DSD text message has been transmitted to the controlling signaller, an indication will be displayed on the cab mobile and the event recorded on the train C7/8 via a standardised interface.

5. **[Gn10]** MMI indications
   - The transmission of the DSD text message will only take place after a predefined period of time (for example, thirty seconds).

6. **[Gn13]** Urgent point-to-point call
   - Once the controlling signaller has selected the DSD activation message from the fixed terminal's mobile list, the signaller will be presented with a number of options (for example, initiating a point-to-point call to the originating cab mobile).

7. **[R11]** Clearing DSD activation message
   - 6.1.4 DSD activated, states that the signaller in control of the area and responsible for managing the incident, upon receipt of the DSD activation message, will be able to select the train transmitting the DSD data message from the terminal's mobile list and delete the 'DSD activation' message.

---

**Start condition**: Cab mobile powered up, connected to GSM-R network, registered with NSS, displaying correct TRN. Train in service running under normal operating conditions, when the driver becomes incapacitated.

- Cab mobile
  - Displays confirmation message to the driver that DSD message has been sent.

**Driver action**

- Driver releases DSD

**Start condition**: Cab radio powered up, connected to GSM-R network, registered with NSS, displaying correct TRN. Train in service running under normal operating conditions, when the driver becomes incapacitated.

- Cab mobile
  - Audible and visual indication displayed on cab mobile's MMI after a predefined period of time.

**Variant**

1. **V2**
   - Driver resets DSD

2. **V3**
   - DSD message transmitted in non-TD area

3. **V4**
   - DSD message not sent

4. **V5**
   - DSD message received in non-TD area

---

**Start condition**: Cab mobile powered up, connected to GSM-R network, registered with NSS, displaying correct TRN. Train in service running under normal operating conditions, when the driver becomes incapacitated.

- Cab mobile
  - Displays confirmation message to the driver that DSD message has been sent.

**Driver action**

- Driver releases DSD

**Start condition**: Cab radio powered up, connected to GSM-R network, registered with NSS, displaying correct TRN. Train in service running under normal operating conditions, when the driver becomes incapacitated.

- Cab mobile
  - Audible and visual indication displayed on cab mobile's MMI after a predefined period of time.

**Variant**

1. **V1**
   - Train not registered.
12 Signaller communicates over PA - Scenario SCN/AOC/022

**Start condition**
- Cab radio powered up, connected to the GSM-R network displaying correct TRN with NSS, displaying correct TRN. Train in service running under abnormal operating conditions.
- Visual indication displayed on cab mobile's MMI informing the driver that a PA call has been established.

**Signaller's terminal**
- Signaller selects train and initiates PA call.

**End condition**
- Train stopped with the signaller communicating with railway personnel or passengers through the public address system.
- Signaller makes announcement.

**Scenario**
- **SNC/AOC/020** Signaller calls driver.
- **SNC/AOC/021** DSD activation.

**Variant 8, Call not answered**
- Signaller decides to use PA call.
- Fixed terminal MMI confirms that PA call has been initiated.
- Radio infrastructure requests call.
- Cab mobile answers call.
- Radio infrastructure establishes call.
- GSM-R network.
- Call connected.
- Auto answer.
- Fixed terminal MMI indicates PA call is connected.
- Signaller's announcement will be played over the trains PA system and cab mobiles loudspeaker.

**Variant 7, train moves out of signaller's area of control**
- Signaller terminates call.
- Fixed terminal MMI returns to steady state once the signaller has terminated the PA call.

**Variant 9, Signaller not heard over PA**
- Fixed terminal MMI confirms PA call has been established.
- Call established.
- Signaller's announcement will be played over the trains PA system and cab mobiles loudspeaker.

**Variant 10, Signaller terminating call**
- Fixed terminal MMI returns to steady state once the signaller has terminated the PA call.

**Note 1:** The signaller will select the train from the mobile list displayed on the fixed terminal, using the TRN, MSISDN or traction unit number and initiate a PA call (if a train is not registered, then the PA call facility will still be available, but the signaller will have to enter the MSISDN to initiate the call).

**Note 2:** The fixed terminal will indicate that the system is attempting to establish the call (for example, 'connecting' could be displayed).

**Note 5:** Once the signaller's call to the PA system has been established, it will be indicated to the signaller on the fixed terminal. The signaller will now be able to make an announcement over the connected trains PA system (see SCN/AOC/020).

**Note 6:** Upon receipt of an incoming PA call, the cab mobile will automatically answer the call and connect it to the train PA system through the cab mobile's interface.

**Note 7:** The signaller's announcement will also be heard over the cab mobile's associated loudspeaker.

**Note 8:** The signaller terminating the call, will result in the cab mobile's MMI display returning to its normal steady state (for example, displaying TRN and location information).

**Note 10:** The signaller terminating the call, will result in the cab mobile's MMI display returning to its normal steady state (for example, displaying TRN and location information).
13 General Broadcast Call - Scenario SCN/AOC/023

Start condition
The signaller receives a report of exceptional railhead conditions, informs Operations Control of the circumstance, uses the GSM-R broadcast facility to inform drivers of the prevailing railhead conditions.

Cab mobile MMI
Visual indication displayed on cab mobile's MMI informing the driver that a broadcast call has been initiated.

Fixed terminal
Request call
Radio infrastructure
Receive call
Cab mobile
Answer call
Radio infrastructure
Establish call

Variant
V5. Call rejected

Variant
V3. Call arbitration

Variant
V6. Call not established

Variant
V4. Handset not in cradle

Variant
V7. Train moves out of signaller's area of control.

Cab mobile loudspeaker
Signallers announcement will be played over cab mobiles loudspeaker.

Signaller's Terminal
Signaller's pre-recorded message transmitted.

Call connected
Auto answer

Signaller's Terminal
Indicate broadcast call is connected.

Call established

Signaller's announcement

Cab mobile MMI
MMI returns to steady state once the broadcast call has been terminated.

Uncontrolled When Printed
Document withdrawn as of 07/03/2015
UK Application of GSM-R
RSSB-GSM-R-OC
Issue 01
Date 14 December 2006

14 Driver calls signaller in TD area - Scenario SCN/AOC/024

Driver

Cab Mobile

Start condition
Cab mobile powered up, connected to authorised network, registered with NSS and displaying correct TRN. Train in service running under normal operating conditions.

Variant
V1. Train not registered

Variant
V2. TD failure

Variant
V3. Driver initiates call in non-TD area

Call mobile

Driver initiates point-to-point call by using the quick dial function 'CS' button on the cab mobile MMI.

Variant
V4. Call pre-emption: drivers initiated call

Variant
V5. Train moves out of signaller's area of control

Variant
V6. Call not established

MMI display

Cab mobile indicates that the call has been initiated and that the GSM-R system is attempting to connect the call.

Note 2:
The cab mobile will indicate that the point-to-point call has been initiated, by displaying a visual indication on the cab associated MMI.

Note 1:
Rule Book, TW1

Signaller

Fixed Terminal

Call connected

Signaller answers call

Fixed terminal MMI

Fixed terminal indicates an incoming call and displays the caller's identity and location.

Variant
V1. Train not registered

Variant
V2. TD failure

Variant
V3. Driver initiates call in non-TD area

Variant
V4. Call pre-emption: drivers initiated call

Variant
V5. Train moves out of signaller's area of control

Variant
V6. Call not established

GSM-R

Network

Network infrastructure

Able to connect the cab mobile MMI or the fixed terminal, depending upon the call service required.

Call initiated

Signaller answers call

Fixed terminal MMI

Fixed terminal indicates an incoming call and displays the caller's identity and location.

Note 2:
Gn7

Note 3:
Gn8

Once the driver has initiated the point-to-point call, the GSM-R system automatically identifies the controlling signaller, using the cell and TD information available and routes the call to the correct signaller.

Note 4:
Gn9

The presence of the incoming point-to-point call will be indicated to the signaller on the fixed terminal. The indication will consist of the TRN and signal ID and be displayed in the fixed terminal's call queue list.

Note 5:
Gn11

In order for the signaller and driver to be heard by each other, the push-to-talk (PTT) button must be depressed. This activates the microphones in their respective handsets. Further benefits include the reduction of background noise and the improvement of radio discipline.

MMI display

Signaller depresses PTT and communicates with driver.

End condition
Cab mobile powered up, connected to authorised network, registered with NSS and displaying correct TRN. Train in service running under normal operating conditions and driver and signaller communicating.

Note 2:
Gn10

The presence of the incoming point-to-point call will be indicated to the signaller by the fixed terminal. The indication will consist of the TRN and signal ID and be displayed in the fixed terminal's call queue list.

Variant
V7. DR signaller

Variant
V8. Call not answered

Variant
V9. Fixed terminal MMI

Variant
V10. Signaller answers call

Variant
V11. Call not answered

Variant
V12. Fixed terminal MMI

Variant
V13. Signaller answers call

Variant
V14. Call not answered

Variant
V15. Fixed terminal MMI

Variant
V16. Signaller answers call

Variant
V17. Call not answered

Variant
V18. Fixed terminal MMI

Variant
V19. Signaller answers call

Variant
V20. Call not answered

Variant
V21. Fixed terminal MMI

Variant
V22. Signaller answers call

Variant
V23. Call not answered

Variant
V24. Fixed terminal MMI

Variant
V25. Signaller answers call

Variant
V26. Call not answered

Variant
V27. Fixed terminal MMI

Variant
V28. Signaller answers call

Variant
V29. Call not answered

Variant
V30. Fixed terminal MMI

Variant
V31. Signaller answers call

Variant
V32. Call not answered

Variant
V33. Fixed terminal MMI

Variant
V34. Signaller answers call

Variant
V35. Call not answered

Variant
V36. Fixed terminal MMI

Variant
V37. Signaller answers call

Variant
V38. Call not answered

Variant
V39. Fixed terminal MMI

Variant
V40. Signaller answers call

Variant
V41. Call not answered

Variant
V42. Fixed terminal MMI

Variant
V43. Signaller answers call

Variant
V44. Call not answered

Variant
V45. Fixed terminal MMI

Variant
V46. Signaller answers call

Variant
V47. Call not answered

Variant
V48. Fixed terminal MMI

Variant
V49. Signaller answers call

Variant
V50. Call not answered

Variant
V51. Fixed terminal MMI

Variant
V52. Signaller answers call

Variant
V53. Call not answered

Variant
V54. Fixed terminal MMI

Variant
V55. Signaller answers call

Variant
V56. Call not answered

Variant
V57. Fixed terminal MMI

Variant
V58. Signaller answers call

Variant
V59. Call not answered

Variant
V60. Fixed terminal MMI

Variant
V61. Signaller answers call

Variant
V62. Call not answered

Variant
V63. Fixed terminal MMI

Variant
V64. Signaller answers call

Variant
V65. Call not answered

Variant
V66. Fixed terminal MMI

Variant
V67. Signaller answers call

Variant
V68. Call not answered

Variant
V69. Fixed terminal MMI

Variant
V70. Signaller answers call

Variant
V71. Call not answered

Variant
V72. Fixed terminal MMI

Variant
V73. Signaller answers call

Variant
V74. Call not answered

Variant
V75. Fixed terminal MMI

Variant
V76. Signaller answers call

Variant
V77. Call not answered

Variant
V78. Fixed terminal MMI

Variant
V79. Signaller answers call

Variant
V80. Call not answered

Variant
V81. Fixed terminal MMI

Variant
V82. Signaller answers call

Variant
V83. Call not answered

Variant
V84. Fixed terminal MMI

Variant
V85. Signaller answers call

Variant
V86. Call not answered

Variant
V87. Fixed terminal MMI

Variant
V88. Signaller answers call

Variant
V89. Call not answered

Variant
V90. Fixed terminal MMI

Variant
V91. Signaller answers call

Variant
V92. Call not answered

Variant
V93. Fixed terminal MMI

Variant
V94. Signaller answers call

Variant
V95. Call not answered

Variant
V96. Fixed terminal MMI

Variant
V97. Signaller answers call

Variant
V98. Call not answered
15 Driver initiates emergency group call - Scenario SCN/EOC/031

Driver of train travelling normally observes an obstruction on the adjacent line which has the potential to affect the safe running of trains and uses the emergency group call facility to notify the controlling signaller and other drivers associated with the emergency group call area.

- Driver initiates emergency group call - Scenario SCN/EOC/031
  - Signaller 'A'
  - Signaller 'B'
  - Operation Controller
  - Cab Mobile
  - Fixed Terminal

Railway Emergency call established:
- Driver sends predefined text message to signaller, confirming that the train is at a stand.
- Signaller monitors the call and the controlling signaller takes lead responsibility.

Parallel activity:
- Radio infrastructure identifies functional role of initiator and correlates with emergency call list attached to cell where call was initiated.
- Cab mobile continues to press the PTT button, but stops speaking and allows the signaller to speak.
- Signaller presses PTT button in order to communicate with the initiating driver.
- Driver requests emergency call.
- Operation controller confirms that the Railway Emergency call has been established.
- Cab mobile confirms that the Railway Emergency call has been established.

Actions:
- Driver initiates a Railway Emergency call, by depressing the PTT and then pressing the red 'EM' button.
- The driver upon receipt of the emergency stop message, immediately applies the brakes and brings the train to a stand in a suitable location.
The Operational Concept

16 Operational radio initiated emergency call - Scenario SCN/EOC/032

Railway Emergency call established

Start condition
A track worker working on or near the line, observes a train pass with a door open, fearing that someone has or could fall from the train onto the emergency group call facility on the operational hand portable to notify the controlling signaller.

Actions

End condition
All trains within the emergency group call area stopped, the drivers of those trains listening to the initiator's message to the controlling signaller. Other fixed terminal users associated to the emergency group call are monitoring the call and the controlling signaller taking lead responsibility.

Diagram:
A flow chart of an emergency group call. The flowchart illustrates the sequence of events from the time the initiator presses the PTT button in order to communicate with the emergency group call, to the controlling signaller's confirmation of the call's receipt.
17 Driver initiates urgent point-to-point call - Scenario SCN/EOC/033

**Start condition**
- Cab mobile powered up, connected to authorised network, registered with NSS and displaying correct TRN. Train is in service running under normal operating conditions.

**Variant**
- V4. Train moves out of signaller's area of control.
- V3. Call pre-emption: drivers initiated call
- V2. Non-TD area or TD failure
- V1. Train not registered

**Variant**
- V6.
- V5. Call not established.

**MMI display**
- Cab mobile indicates that the call has been initiated and that the GSM-R system is attempting to connect the call.

**Call initiated**
- Cab mobile initiates an urgent point-to-point call using the quick dial function yellow button on the cab mobile's MMI.

**GSM-R Network**
- Network identifies the location of the caller and where possible uses LDA or Non-TD areas LDA to route the call.

**End condition**
- GSM-R cab mobile powered up, connected with GSM-R network, registered with NSS, displaying correct TRN, driver and signaller communicating and train operating normally.

**Fixed terminal MMI**
- fixed terminal indicates that call has been established.

**Variant**
- V8. Call not answered
- V9. Call not pre-empted: drivers initiated call

**Variant**
- V7. Train moves out of signaller's area of control.

**Options**
- Call not answered
- Fixed terminal MMI
- Fixed terminal MMI
- Fixed terminal MMI

**Signaller answers call**
- Signaller depresses PTT and communicates with driver.

**Variant**
- V6. Train moves out of signaller's area of control.
18 Signaller emergency call ‘stop one train’ - Scenario SCN/EOC/034

Start condition
- Cab mobile powered up, connected to network, registered with NSS and displaying correct TRN. Train in service running under normal operating conditions.

GSM-R
- Cab mobile (MMI)
  - Driver lifts handset and transfers incoming call from loudspeaker to handset.
- Signaller (Fixed Terminal)
  - Fixed terminal will display all trains within the signaller’s area of control. Trains will be identifiable by their associated TRN.

Scenario
- Signaller initiates an stop all trains emergency group call (variant V1).

Signaller's outgoing call rejected (variant V5).

Uncontrolled When Printed
Document withdrawn as of 07/03/2015
### APPENDIX 2 – Connectivity Matrix

<table>
<thead>
<tr>
<th>Initiator</th>
<th>Fixed terminals</th>
<th>Cab mobiles</th>
<th>Fixed extensions</th>
<th>Recipient</th>
<th>Fixed terminals</th>
<th>Cab mobiles</th>
<th>Fixed extensions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed terminals</td>
<td>Cab mobiles</td>
<td>Fixed extensions</td>
<td>Fixed terminals</td>
<td>Cab mobiles</td>
<td>Fixed extensions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signaller supervisor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Route controller</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Railway Undertaking SDC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Driver</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Train staff</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public address</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPH User</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FTN extension</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ETD extension</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSTN extension</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rail emergency call handling centre</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Signaller or signaller supervisor</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Route controller</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Railway Undertaking SDC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Driver</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Train staff</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public address</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OPH User</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FTN extension</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ETD extension</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSTN extension</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rail emergency call handling centre</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Notes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1.1/3 FT calls CM (PTP CT2)</td>
<td>3</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Includes calling by headcode. Only CT2 numbers in train list can be called. Signaller is only terminal with a train list</td>
</tr>
<tr>
<td>2.1.4 FT calls CM (PTP CT3)</td>
<td>3</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Includes calling by headcode. Only CT2 numbers in train list can be called. Signaller is only terminal with a train list</td>
</tr>
<tr>
<td>2.1.4 FT calls CM (PTP CT8)</td>
<td>3</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Includes calling by headcode. Only CT2 numbers in train list can be called. Signaller is only terminal with a train list</td>
</tr>
<tr>
<td>2.1.5 FT calls CM [PA] (PTP CT2)</td>
<td>3</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Includes calling by headcode. Only CT2 numbers in train list can be called. Signaller is only terminal with a train list</td>
</tr>
<tr>
<td>2.1.8 FT calls OPH (PTP CT2)</td>
<td>3</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Includes calling by headcode. Only CT2 numbers in train list can be called. Signaller is only terminal with a train list</td>
</tr>
<tr>
<td>2.1.8 FT calls OPH (PTP CT6)</td>
<td>3</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1.8 FT calls OPH (PTP CT8)</td>
<td>3</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1.9 FT calls Extn (PTP CT9&amp;0)</td>
<td>4</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Priority only applies to GSM-R network portion of call</td>
</tr>
<tr>
<td>2.1.9 FT calls Extn [999/112] (PTP CT9)</td>
<td>2</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1.10 FT calls FT (PTP CT7)</td>
<td>3</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Includes calling by headcode. Only CT2 numbers in train list can be called. Signaller is only terminal with a train list</td>
</tr>
<tr>
<td>2.1.10 FT calls FT (PTP CT8)</td>
<td>3</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Includes calling by headcode. Only CT2 numbers in train list can be called. Signaller is only terminal with a train list</td>
</tr>
<tr>
<td>2.2.1 FT calls CM [Urgent] (PTP CT2)</td>
<td>2</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.2.1 FT calls CM [Urgent] (PTP CT3)</td>
<td>2</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3.1 CM calls FT [Single button] (PTP CT1)</td>
<td>3</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3.1 CM calls Route control/ECO [menu] (PTP CT1)</td>
<td>3</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3.2 CM calls FT [phonebook] (PTP CT7)</td>
<td>4</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>CM configured to assign priority 3 to CT7 calls from phone book</td>
</tr>
<tr>
<td>2.3.2 CM calls FT [dialled] (PTP CT7)</td>
<td>4</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>2.3.3 CM calls FT (PTP CT7)</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3.3 CM calls FT (PTP CT8)</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3.4 CM calls Extn [999/112] (PTP CT9)</td>
<td>2</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3.5 CM calls CM (PTP CT2)</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3.5 CM calls CM (PTP CT3)</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3.5 CM calls CM (PTP CT8)</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3.5 CM calls CM (PA) (PTP CT2)</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3.5 CM calls CM (PA) (PTP CT3)</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3.5 CM calls CM (PA) (PTP CT8)</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3.5 CM calls CM (Yellow button) (PTP CT1)</td>
<td>2</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3.5 CM calls FT [Single button] (PTP CT1)</td>
<td>2</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3.5 CM calls FT (PTP CT7)</td>
<td>2</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3.5 CM calls FT (PTP CT8)</td>
<td>2</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3.5 CM calls FT (Yellow button) (PTP CT1)</td>
<td>2</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5.3</td>
<td>OPH calls CM (PTP CT3)</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5.3</td>
<td>OPH calls CM (PTP CT8)</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5.3</td>
<td>OPH calls CM [PA] (PTP CT2)</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5.3</td>
<td>OPH calls CM [PA] (PTP CT3)</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5.4</td>
<td>OPH calls OPH (PTP CT2)</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5.4</td>
<td>OPH calls OPH (PTP CT6)</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5.4</td>
<td>OPH calls OPH (PTP CT8)</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5.5</td>
<td>OPH calls Ext (PTP CT9&amp;0)</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5.5</td>
<td>OPH calls Ext [999/112] (PTP CT9)</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.7.1</td>
<td>Ext calls FT (PTP CT8)</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.7.2</td>
<td>Ext calls CM (PTP CT8)</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.7.3</td>
<td>Ext calls OPH (PTP CT8)</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 4.1.1 | FT makes group call (VGCS CT5) | 3 | Y | Y | Y | Controller recipients configured in group call register
| 4.2.1 | FT makes REC (VGCS CT5) | 0 | Y | Y | Y | Controller recipients configured in group call register
| 4.3.1 | CM makes group call [Trains] (VGCS CT5) | Y | Y | Y | Y |
| 4.4.1 | CM makes REC (VGCS CT5) | 0 | Y | Y | Y | Controller recipients configured in group call register
| 4.5.1 | OPH makes group call (VGCS CT5) | Y | Y | Y |
| 4.6.1 | OPH makes REC (VGCS CT5) | Y | Y | Y |
| 4.7.1 | OPH makes shunting group call (VGCS CT5) | Y | Y | Y |
| 4.7.2 | OPH makes shunting emergency (VGCS CT5) | Y | Y | Y |
| 5.1.1 | FT makes broadcast (VBS CT5) | 3 | Y | Y | Y | Not TSI compliant - need to pursue with UIC FD/OG
| 6.1.1 | CM sends 'Standing at Signal' | 3 | Y | Y | Y | Barred through no subscription to SMS MO
| 6.1.2 | FT sends 'Wait' | 3 | Y | Y | Y | Barred through no subscription to SMS MO
| 6.1.3 | CM sends 'Stop acknowledge' | 3 | Y | Y | Y | Barred through no subscription to SMS MO
| 6.1.4 | CM sends 'DSD activated' | 2 | Y | Y | Y | Barred through no subscription to SMS MO
| 6.2.1 | FT sends SMS to FT | Y | Y | Y | Y | Barred through no subscription to SMS MO
| 6.2.2 | FT sends SMS to CM | Y | Y | Y | Y | Barred through no subscription to SMS MO
| 6.2.3 | FT sends SMS to OPH | Y | Y | Y | Y | Barred through no subscription to SMS MO
| 6.3.1 | CM sends SMS to FT | Y | Y | Y | Y | Barred through no subscription to SMS MO
| 6.3.2 | CM sends SMS to CM | Y | Y | Y | Y | Barred through no subscription to SMS MO
| 6.3.3 | CM sends SMS to OPH | Y | Y | Y | Y | Barred through no subscription to SMS MO
| 6.4.1 | OPH sends SMS to FT | Y | Y | Y | Y | Barred through no subscription to SMS MO
| 6.4.2 | OPH sends SMS to CM | Y | Y | Y | Y | Barred through no subscription to SMS MO
| 6.4.3 | OPH sends SMS to OPH | Y | Y | Y | Y | Barred through no subscription to SMS MO
| 7.1 | Calls to other GSM-R Network | Y | Y | Y | Y | Barred through no subscription to SMS MO
| 7.2 | Calls to ETCS | Y | Y | Y | Y | Barred through no subscription to SMS MO

**KEY**

| Y | Call permitted |
| blank | call not permitted |
| | Out of scope and so undefined |
### APPENDIX 3 – Open Points

<table>
<thead>
<tr>
<th>No.</th>
<th>Open Point</th>
<th>Action required</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Section 1.6.2 – SIM definition – SIM provides identity and functionality for the radio.</td>
<td>To be developed.</td>
</tr>
<tr>
<td>2</td>
<td>Section 8.2.2 - The appropriate planned response will be developed over the next few months and will be based upon the process for developing the Interim Voice Radio System (IVRS) degraded mode instructions.</td>
<td>To be developed.</td>
</tr>
<tr>
<td>3</td>
<td>Section 13.3.2 - Further development of the principles for the management and control of the SIM card is an open point and will be resolved in subsequent issues of this document.</td>
<td>To be developed.</td>
</tr>
</tbody>
</table>