

GSM-R

Incident Resolution Guide for GSM-R Faults and Failures

Version Control

Issue	Date	Comment
1	30 January 2014	Level 2
2	5 February 2014	Table format change, removal of duplicate software table and change to Process flow chart page 21
3	10 February 2014	Table change to include FGW comments
4	19 February 2014	Final sentence added to Section 6
5	21 March 2014	1 st Version endorsed by DAB. Final row of table on page 10 removed as full circumstances not yet consulted.
6	23 rd February 2014	NR3.4.1 software included
7	22 nd June 2015	For the purposes of delay attribution, cab radio software versions NR3.4.1 and NR3.5 are identical. NR 3.5 software included Appendix b format changes 204b TEC cause statement GSM-R NFF change of responsibility
8	20 th June 2016	TEC 101a TEC 101b, TEC 102d, TEC 102g, TEC 102m, TEC 102q, TEC204a, TEC 204c have been removed TEC 102s TEC 102t TEC 102u TEC102v TEC 102w TEC 302e new entries Software updates Flowchart update – An FMS record should be raised for all GSM-R reported faults Revised Incident recording form
9	19 th Feb 2017	TEC 102t TEC 102u, TEC 310a amendments TEC 102w, TEC 102y, TEC 207a, TEC 207b, TEC 310b additions
9.1	1 st June 2017	Updated to reflect change from DAG to DAPR

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1) Introduction

GSM-R relies heavily on interactions between train borne (Cab Radio) and ground based (GSM-R Network) radio systems. Problems may be experienced by Drivers and or Signallers when using GSM-R to communicate. These issues may occur within the GSM-R network or Cab Radio and could be hardware, software or firmware related. There are also certain procedural and behavioural aspects to consider when setting up GSM-R or when dealing with known or arising GSM-R issues.

2) Purpose

The purpose of this guide is to assist Delay resolution staff in gaining an accurate understanding of the cause of reported GSM-R faults and failures leading to delays and cancellations associated with operating GSM-R services. This guide supplements, but is not incorporated into the Delay Attribution Principles and Rules (DAPR).

3) Scope

This document is applicable to the reporting and recording of faults and operational failures of the GSM-R where rail vehicles are fitted with the Siemens GB radio (The guide is predominantly based on Siemens although, there are other manufacturers). The GSM-R radio can be considered as having 3 main areas of concern:

- Journey Registration and De-registration
- Cab radio system
- GSM-R network (coverage, call failure, misrouted calls, public mobile interference)

This guide provides assistance in managing the DAPR with respect to these 3 issues. The IRG provides supplementary guidance to that provided in the DAPR, section G, on Railway Emergency Calls (RECs).

4) Process

This guide is to be used in conjunction with the daily (Monday to Friday) registration / registration reject reports produced by Stoke TEC (Telecoms Engineering Centre) for each train operator and RPMMs which details the causes for registration failure. The production and distribution of these statistics does not sit within the timescales of delay attribution and does not necessarily provide a level of detail needed to properly attribute cause. For example, a 'wrong head code' categorised registration failure could be because the Driver has entered the wrong head code, or it could be that the Signaller has entered the wrong head code into the train describer.

If a more detailed investigation is required from Stoke TEC then the TRUST incident must be created with GSM-R contained within the incident and, where appropriate, a fault entry raised in FMS and issued to Stoke TEC to investigate.

In addition, further input from train operators' fleet and/or operations staff and Network Rail's maintainers and operations staff may be required to conclude the cause of individual incidents raised in

TRUST or CCIL and sent to Stoke TEC to investigate. To support this, Driver reports / TRUST reports will need to be sufficiently detailed to enable Stoke TEC to trace events in their data.

In addition to the registration / registration rejection reports this guide contains various tables to assist in identifying the cause of failures and allocating the correct delay cause code. Notes on Tables 1 to 3:

- 1) The 'Driver/Signaller failure report' (column A) is only a guide; various terms may be used to describe the same fault.
- 2) The 'TEC cause statements' (column B) refers to the cause stated in the 5 x daily registration data issued to train operators and RPMM's. Further details of the causes can be found in those reports.
- 3) Details of which version of software are on which vehicle (Column C) are available from various sources including the train operator's GSM-R project manager, NRT's SIM Database and ATOC Component Tracker.
- 4) Column D and E identifies the most likely cause for the outcome of the TEC investigation. It may identify additional investigations required to identify a No Fault Found (NFF) result.
- 5) Column F of table 1 relates the investigation result in relation to the responsible parties.
- 6) Column G relates to the agreed IRG process outcome.
- 7) Column H is used by Stoke TEC to indicate within the investigation close out details which agreed cause it is within the IRG.
- 8) Operational knowledge may be required to supplement TEC results. In some cases TEC will not be able to determine a precise event (e.g. whether the Driver entered the wrong head code in the cab radio, or the Signaller entered the wrong head code in to the TD) and operational specialists may be required to investigate further.

The IRG attributes cab radio software faults to Network Rail that are known software faults and are captured in this guide in tables 1 to 3.

To clarify, the known cab radio behaviours that might be considered cab radio software faults, these are:

- Blank screen
- Stuck at initialisation
- Unresponsive to button presses

This is subject to eliminating the presence of Public Mobile Network Operator interference as the fundamental reason why the Cab Radio has not functioned as expected.

These are covered in further detail in Appendix B of this guide.

If at any point in the process the data or evidence provided by Stoke TEC is called into question then further explanation, investigation or input from NRT will be required.

5) GSM-R Cab Radio Registration

GSM-R related delays are occurring due to Drivers having difficulty in registering the cab radio. This may be reported by them as 'registration issues' or 'setting up radio issues' for example.

The GSM-R registration process is complex and requires the numbers entered by the Driver to be checked (correlated) with Train Descriptor (TD) information. There are two main categories of registration error: human errors in entering the data and network errors due to system interactions.

Human errors can be either Driver related or Signaller related in interposing the wrong description or late interpose. Network/system interactions are many and varied and cause a number of registration rejection symptoms.

The main failure causes for registration are outlined in Table 1 on the following pages.

For completeness cab radio and network causes for registration failure have been included together with the cause and the agreed IRG and Stoke TEC attribution code. These together with the daily (Monday to Friday) registration / registration reject reports produced by Stoke TEC (Telecoms Engineering Centre) for each train operator and RPMM's will answer a significant number of reported registration failures. Any that are not sufficiently answered by these 2 documents will need to be raised to Route Control to put onto FMS and pass to Stoke TEC.

It's agreed that if the use of IRG and daily registration / registration rejections sheets do not identify the cause then an investigation from Stoke TEC will be raised via FMS. Stoke TEC have an agreed SLA to respond in 5 working days, see flow chart page 25.

6) General Attribution Principles for Use within Section 7

Relating to Registration incidents, where the Driver did not follow the RSSB GSM-R User procedure and has consequentially caused all or the majority of the delay then attribution should be to TG/FC. Similarly where the GSM-R itself remains the cause of all or the majority of the delay then attribution should be to JO.

Relating to Registration incidents, where the Driver or stock are late arriving on their inward working, then cognisance must be taken of the expected departure time in line with the appropriate Planning Rules for turn-around times.

Relating to Registration incidents, cognisance should also be taken where the actions of the Driver and or Signaller to get trains moving and register subsequently has reduced overall delay.

7) Table 1 – Registration Failure Causes

Table 1: Registration Failure Causes							
A.	B.	C.	D.	E.	F.	G.	H.
Driver/Signaller Failure Report	TEC Cause Statement	CR Software versions	Operational Knowledge / Cause	Cause/Action Required	Network Rail or operator cause?	IRG Code	Stoke TEC Code
Registration attempt failed - message REGISTRATION FAILED on DCP	'Engine number already registered' A CT2 registration is already registered to another cab radio on same train (occupying same track circuit berth). No attempt made to deregister other radio within 30 minutes.	N/A	Driver changes ends and required to register other end with different head code within 30 minutes	Driver incorrectly "keeps registration" (human error) when leaving driving cab while requiring to change end and register other cab radio to continue journey. Driver to deregister other end or 30 minute timer times out that end	Operator	TG/FZ	TEC102a
	'Engine number already registered' No attempt made to deregister previous journey for that cab radio, before leaving operational GSM-R area. Registration stuck in radio and network.	NR2.6 and NR2.8	Driver is required to deregister train part way through a journey before leaving GSM-R coverage	Driver fails to deregister cab radio when leaving defined GSM-R area boundary. TEC release head codes in accordance with relevant Work Instruction.	Operator	TG/FZ	TEC102b

Table 1: Registration Failure Causes (Continued)

A.	B.	C.	D.	E.	F.	G.	H.
Driver/Signaller Failure Report	TEC Cause Statement	CR Software versions	Operational Knowledge / Cause	Cause/Action Required	Network Rail or operator cause?	IRG Code	Stoke TEC Code
Registration attempt failed - message REGISTRATION FAILED on DCP	'Engine number already registered' Previous working deregistration attempt partially failed leading to a 'Stuck registration FC01 and/or FC08 in network'. Various e.g. ATI/PLU page clash with deregistration attempt, lost message etc.	All software	n/a	Various network related interactions TEC release head codes in accordance with the relevant Work Instruction.	Network Rail	J0	TEC102c
	'Not interposed'. Head code not interposed in TD when Driver attempts registration	N/A	Signallers manually interpose train description in TD system.	Signaller late to interpose TRN in TD system. Signaller to interpose TRN	Network Rail	OC	TEC102e
		N/A	ACI automatically interposes train description in TD system but is timed to be less than 10 minutes before booked departure.	ACI late to interpose TRN in TD system. Driver to retry registration closer to departure time ACI modification if systematic problem location	Network Rail	OH	TEC102f

Table 1: Registration Failure Causes (Continued)

A.	B.	C.	D.	E.	F.	G.	H.
Driver/Signaller Failure Report	TEC Cause Statement	CR Software versions	Operational Knowledge / Cause	Cause/Action Required	Network Rail or operator cause?	IRG Code	Stoke TEC Code
Registration attempt failed - message REGISTRATION FAILED on DCP	'Wrong Signal' Driver entered wrong signal location code for berth occupied by train	N/A	Registration location not affected by dual-berthing issues (e.g. turn round point/ bi-di platform)	Driver error (human error) in entering signal ID Driver to correct wrong entry	Operator	TG/FZ	TEC102h
		N/A	Signal ID plate located too far from driving cab position and repeater signage not installed as agreed.	Driver unable to read signal identity plate due to distance	Network Rail	J0	TEC102i
Registration attempt failed - message REGISTRATION FAILED on DCP	'Wrong signal' Driver entered the correct signal but the GSM-R system expected a different signal (data-fill error/dual berthing etc.)	N/A	Registration location affected by dual-berthing issues (e.g. turn round point, bi-di platform, shunt on main route etc.)	GSM-R system data-fill has not allowed for trains to register using the particular signal berth	Network Rail	J0	TEC102j
	'Wrong Head code' Driver entered TRN different to that expected by TD	N/A	Location covered by ACI and entered TRN is incorrect	Driver error in entering head code.	Operator	TG/FZ	TEC102k
	'Wrong Head code' Driver entered TRN different to that expected by TD	N/A	Location requires manual Signaller interpose and TRN entered was correct	Signaller error in entering head code. Signaller to correct wrong entry	Network Rail	OC	TEC102l

Table 1: Registration Failure Causes (Continued)

A.	B.	C.	D.	E.	F.	G.	H.
Driver/Signaller Failure Report	TEC Cause Statement	CR Software versions	Operational Knowledge / Cause	Cause/Action Required	Network Rail or operator cause?	IRG Code	Stoke TEC Code
	'Datafill not defined duplicate berth'	N/A	n/a	The data-fill for the cell has not been set to allow for a duplicate berth. Design error. GSM-R data modification required	Network Rail	J0	TEC102n
	'Wrong cell' The cab radio has camped onto a cell not designed to provide coverage at the location of the train.	N/A	n/a	The cab radio is attached to a cell that does not serve the location where the train is, for various reasons related to the network configuration or PMO Interference	Network Rail	J0	TEC102o
	'Duplicated Mobile' or 'Engine number already registered' The network sub-system database contains multiple MSISDNs for the CT3 engine number	N/A	n/a	The records in the network system have not been updated correctly when radios have been swapped in the field. TEC to correct errors.	Network Rail	J0	TEC102p
	'Engine number already registered.' Radio activity confirmed but no de-reg attempts are seen for FC01 or FC08 from the cab radio.	All	The Drivers have been instructed to pull the key and walk away to de-register the journey. The Driver doesn't press another button the radio after removal of the key	Cab radio software. TEC manually release head codes or TEC release head codes after 12hrs.	Network Rail	J0	TEC102r

Table 1: Registration Failure Causes (Continued)

A.	B.	C.	D.	E.	F.	G.	H.
Driver/Signaller Failure Report	TEC Cause Statement	CR Software versions	Operational Knowledge / Cause	Cause/Action Required	Network Rail or operator cause?	IRG Code	Stoke TEC Code
Registration attempt failed – message REGISTRATION FAILED ON DCP	Evidence recorded in the GSM-R System Log files indicates that after experiencing two or more unsuccessful GSM-R Registration attempts the Driver did not attempt to contact the Signaller.	All software	RSSB GSM-R User Procedures (Cab Radio) indicate that should a Driver experience two consecutive unsuccessful GSM-R Registration attempts, the Driver is to contact the Signaller. The GSM-R Log Files indicate that the Driver did not contact the Signaller.	Driver did not contact Signaller after two failed GSM-R Registration attempts. Driver to contact the Signaller should they experience two unsuccessful GSM-R Registration attempts.	Operator	TG/FC	TEC102s

Table 1: Registration Failure Causes (Continued)

A.	B.	C.	D.	E.	F.	G.	H.
Driver/Signaller Failure Report	TEC Cause Statement	CR Software versions	Operational Knowledge / Cause	Cause/Action Required	Network Rail or operator cause?	IRG Code	Stoke TEC Code
Registration attempt failed – message REGISTRATION FAILED ON DCP	Evidence recorded in the GSM-R System Log files indicates that, after experiencing two or more unsuccessful GSM-R Registration attempts, where the first attempt is within 2 minutes prior to departure time, the first attempt by the Driver to contact the Signaller was at a time greater than 2 minutes after the departure time.	All software	<p>If a Driver experiences two consecutive unsuccessful GSM-R Registration attempts, then the Driver should immediately contact the Signaller to resolve the Registration failure.</p> <p>It is accepted that for short turn around times it may not be possible for the Driver to contact the Signaller prior to the Scheduled Departure Time. In these circumstances it has been agreed that an extended duration of up to 2 minutes after the scheduled departure time is deemed sufficient for the Driver to contact the Signaller to resolve the registration issue. The GSM-R Log Files indicate that the Driver</p>	<p>Where the Driver made an initial attempt to register within 2 minutes prior to the scheduled departure time and after experiencing two (or more) unsuccessful GSM-R Registration attempts, the first attempt by the Driver to contact the Signaller was at a time greater than 2 minutes after the scheduled departure time.</p> <p>Driver to contact the Signaller should they experience two consecutive unsuccessful GSM-R Registration attempts within 2 minutes before the scheduled departure time.</p> <p>Cognisance to be taken of crew / stock late due to previous working.</p>	Operator	TG/FC	TEC102t

Table 1: Registration Failure Causes (Continued)

A.	B.	C.	D.	E.	F.	G.	H.
Driver/Signaller Failure Report	TEC Cause Statement	CR Software versions	Operational Knowledge / Cause	Cause/Action Required	Network Rail or operator cause?	IRG Code	Stoke TEC Code
			attempted to register within 2 minutes prior to the departure time but made a first attempt to contact the Signaller at a time greater than 2 minutes after the scheduled departure time.				

Table 1: Registration Failure Causes (Continued)

A.	B.	C.	D.	E.	F.	G.	H.
Driver/Signaller Failure Report	TEC Cause Statement	CR Software versions	Operational Knowledge / Cause	Cause/Action Required	Network Rail or operator cause?	IRG Code	Stoke TEC Code
Registration attempt failed – message REGISTRATION FAILED ON DCP	Evidence recorded in the GSM-R System Log files indicates that the Driver made a first Registration attempt after the scheduled departure time and there is no evidence that the Cab Radio was reset.	All software	If the Cab Radio is functioning correctly, the Driver should attempt registration prior to the scheduled departure time.	<p>The GSM-R log files indicate that the first attempt to register was after the scheduled departure time and there is no evidence that the Cab Radio was reset.</p> <p>Where operations allow, a Driver should attempt full GSM-R registration procedures prior to the scheduled departure time.</p> <p>Cognisance to be taken of crew / stock late due to previous working.</p>	Operator	TG/FC	TEC102u

Table 1: Registration Failure Causes (Continued)

A.	B.	C.	D.	E.	F.	G.	H.
Driver/Signaller Failure Report	TEC Cause Statement	CR Software versions	Operational Knowledge / Cause	Cause/Action Required	Network Rail or operator cause?	IRG Code	Stoke TEC Code
Registration attempt failed - message REGISTRATION FAILED on DCP	Evidence recorded in the GSM-R System Log files indicates that the Driver made a first Registration attempt after the scheduled departure time and there is evidence that the Cab Radio was reset and operational service was restored within a time window no greater than 5 minutes after the scheduled departure time	All Software	<p>If the Driver has had to reset the Cab Radio to restore it to operation use, evidence of a CT3 Interrogation shall be recorded in the GSM-R System log files.</p> <p>On the basis that NRT has received the specific reason why the Cab Radio was reset, NRT has agreed to accept a GSM-R related Train Delay where evidence in the GSM-R system log files indicates that the CT3 interrogation restored operational service to the Cab Radio within a time window no greater than 5 minutes after the scheduled departure time.</p>	<p>The GSM-R log files indicate that the first attempt to register was after the scheduled departure time and there is evidence that the Cab Radio was reset and operational service was restored within a time window no greater than 5 minutes after the scheduled departure time.</p> <p>Where operations allow, a Driver should attempt full GSM-R registration procedures prior to the scheduled departure time.</p> <p>Note: Where the Driver or stock are late arriving on their previous working, then cognisance must be taken of the expected departure time in line with the appropriate Planning Rules for turn-around times.</p>	Network Rail	J0	TEC102v

Table 1: Registration Failure Causes (Continued)

A.	B.	C.	D.	E.	F.	G.	H.
Driver/Signaller Failure Report	TEC Cause Statement	CR Software versions	Operational Knowledge / Cause	Cause/Action Required	Network Rail or operator cause?	IRG Code	Stoke TEC Code
Registration attempt failed - message REGISTRATION FAILED on DCP.	<p>Evidence recorded in the GSM-R System Log files indicates that the Cab Radio was reset and operational service was restored at a time greater than 5 minutes after the scheduled departure time.</p> <p>No evidence can be identified in the GSM-R System Log files to confirm that a Registration attempt was made prior to the Cab Radio restoration timestamp (as indicated in the paragraph above).</p>	All Software	<p>If the Driver has had to reset the Cab Radio to restore it to operation use, evidence is posted in the GSM-R Log files that indicates when the Cab Radio reconnected with the GSM-R Network. Once reconnected to the GSM-R Network, the Driver shall see GSM-R GB on the Cab Radio Screen and shall be able to make a Registration attempt.</p> <p>It is expected that under normal circumstances the Cab Radio should be reconnected with the network at a time no greater than 5 minutes after the scheduled departure time.</p>	<p>The GSM-R log files indicate that the Cab Radio was reset which resulted in the Cab Radio reconnecting with the GSM-R Network at a time greater than 5 minutes after the scheduled departure time then further investigations should be undertaken to ascertain the reason for the additional delay. This could include signal being put back or driver locating a phone.</p> <p>Where operations allow, a Driver should attempt full GSM-R registration procedures prior to the scheduled departure time.</p> <p>Attribution should be to the largest identified cause - either the GSM-R fault itself or the driver failing to adhere to operational processes.</p>	Largest Cause	J0/TG/FC	TEC102w

Table 1: Registration Failure Causes (Continued)

A.	B.	C.	D.	E.	F.	G.	H.
Driver/Signaller Failure Report	TEC Cause Statement	CR Software versions	Operational Knowledge / Cause	Cause/Action Required	Network Rail or operator cause?	IRG Code	Stoke TEC Code
Registration attempt failed - message REGISTRATION FAILED on DCP	Evidence recorded in the GSM-R System Log files indicates that the Driver made 3 or more unsuccessful GSM-R registration attempts before contacting the Signaller.	ALL	If a Driver experiences two consecutive unsuccessful GSM-R Registration attempts, the Driver should immediately contact the Signaller thereby securing the maximum time remaining (prior to the scheduled departure time) to resolve the Registration failure.	<p>The Driver made 3 or more unsuccessful Registration attempts resulting in insufficient time remaining to resolve the Registration failures.</p> <p>The Driver should immediately contact the Signaller should they experience two unsuccessful Registration attempts before the scheduled departure time.</p>	Operator	TG/FC	TEC102x

Table 1: Registration Failure Causes (Continued)

A.	B.	C.	D.	E.	F.	G.	H.
Driver/Signaller Failure Report	TEC Cause Statement	CR Software versions	Operational Knowledge / Cause	Cause/Action Required	Network Rail or operator cause?	IRG Code	Stoke TEC Code
Registration attempt failed - message REGISTRATION FAILED on DCP.	Evidence contained within the GSM-R System Log files indicates that the Signaller had interposed a Head Code in to a berth when, at the same time, there existed and interpose for the same head code in the same TD Area.	All Software	<p>A condition for a successful GSM-R Registration is that there should exist one unique Head Code entry in the TD System per TD Area.</p> <p>The GSM-R System shall reject any registration attempt where it identifies the existence of duplicate Head Codes entered in to the TD System for the same TD Area; the system cannot correlate a train to two different berths.</p>	<p>The TD System contains duplicate Head Code entries in different berths but in the same TD Area. In this scenario, the GSM-R System is unable to correlate the Head Code with the TD Berth and rejects the registration attempt.</p> <p>When required, the Signaller must ensure that one unique Head Code is entered in to a TD Area.</p>	Network Rail	OC	TEC102y
Multiple Drivers experiencing Registration failed - message REGISTRATION FAILED on DCP	FTS/FTN/GSM-R/TD.net, issues on a localised or wider area basis, registration attempts will fail to register due to the dependency of these systems	N/A	n/a	Failure of dependent system leading to loss of registration function in the network	Network Rail	J0	TEC103a

8) Table 2 – Cab Radio Failure Causes

Table 2: Cab Radio Failure Cause							
A.	B.	C.	D.	E.	F.	G.	H.
Driver/Signaller Failure Report	TEC Cause Statement	CM Software versions	Operational Knowledge	Cause/Action Required	Network Rail or operator cause?	IRG Code	Stoke TEC Code
One of various cab 'radio failure' messages displayed on DCP, cab radio cannot be recovered by reboot (see Appendices A and B)	Note: If a genuine cab radio fault TEC cannot diagnose this other than to see that no interactions are logged between the cab radio and the network.	All software	See Appendix B for Siemens fault codes for known software faults.	Cab radio fault Diagnosis by operator's maintainer (may result in NFF)	Operator	M8/M9 (NFF)	TEC201a
	Note Accepted general practise on Failure 01 is to re-boot the radio if this resolves the problem then it is a NR software issue	All software		Cab radio fault F01 Diagnosis by Diver. Drive to re-boot radio to try and clear software issue	Network Rail	J0	TEC201b
Radio cannot find GSM-R network - message SEARCHING FOR NETWORKS on DCP	confirmed Network failure present at train location at time reported	N/A	Will affect multiple trains in the area of loss of coverage	GSM-R infrastructure equipment failure resulting in loss of coverage. Scale of loss depends on nature of equipment / system failure	Network Rail	J0	TEC202a

Table 2: Cab Radio Failure Cause (Continued)

A.	B.	C.	D.	E.	F.	G.	H.
Driver/Signaller Failure Report	TEC Cause Statement	CM Software versions	Operational Knowledge	Cause/Action Required	Network Rail or operator cause?	IRG Code	Stoke TEC Code
Radio cannot find GSM-R network - message SEARCHING FOR NETWORKS on DCP	No network failure detected at train location at time reported TEC may detect cab radio reboot (CT3 interrogation). TEC may have previous reports (Problem ID for location/fleet concerned)	All software	Most often occurs when entering a GSM-R operating area from outside of coverage but is known to occur less frequently when trains are in coverage area. Maybe an area subject to multiple reports over time.	Potential PMO interference causing either signal blocking or forcing cab radio into permanent searching networks mode. Driver reboots cab radio and restores GSM-R network connection. Cab radio maintainer tests show no fault with camping onto GSM-R network. BSS investigation required	Network Rail (see appendix C)	J0	TEC202b
	No network failure detected at train location at time reported	All software	Cab radio maintainer tests show fault with camping onto GSM-R network	Various cab radio faults including faulty antenna	Operator	M8	TEC202c

Table 2: Cab Radio Failure Cause (Continued)

A.	B.	C.	D.	E.	F.	G.	H.
Driver/Signaller Failure Report	TEC Cause Statement	CM Software versions	Operational Knowledge	Cause/Action Required	Network Rail or operator cause?	IRG Code	Stoke TEC Code
Cab radio reboots mid-journey, may fully recover or display various messages on DCP including 'Radio Failure 01' or halt at 'initialising' with 3 blocks	No network failure detected at train location at time reported TEC may detect cab radio reboot (CT3 interrogation). TEC may have previous reports (Problem ID for location/fleet concerned)	All software	May occur with cab radio outside or within GSM-R coverage. Cab radio maintainer tests show no fault with cab radio Cab radio fully recovers if Driver reboots using MCB. Cab radio maintainer tests show no fault with cab radio	Potential PMO interference BSS investigation required	Network Rail	J0	TEC203a
Cab radio display blank and doesn't respond to any button presses	TEC confirm cab radio attached to GSM-R network, NLU/PLU transactions may or may not have occurred.	All software	Cab radio recovers when rebooted	Unknown but cab radio cannot self-recover	Network Rail (software fault)	J0	TEC204b
Cab radio will not power up correctly	Note: If genuine cab radio fault TEC cannot diagnose this other than to see that no interactions are logged between the cab radio and the network	All software	Fault occurred when radio was powering up and will not respond to a reboot. Cab radio maintainer confirms radio locked up. Screen can show many states depending on where radio is in power up cycle	Software fault in cab radio	Network Rail (software fault see Appendix C)	J0	TEC205a
Cab radio equipment vandalised	No requirement for TEC investigation	All software	Operator's maintainer confirms equipment vandalised	vandalism	Operator	VB/FZ	TEC206a

Table 2: Cab Radio Failure Cause (Continued)

A.	B.	C.	D.	E.	F.	G.	H.
Driver/Signaller Failure Report	TEC Cause Statement	CM Software versions	Operational Knowledge	Cause/Action Required	Network Rail or operator cause?	IRG Code	Stoke TEC Code
The Cab Radio Displays one of the following messages, > Failure X > Radio Failure > Cab Radio Flt > EPROM/RAM Flt	While attempting to enter service from a Maintenance Depot, the Cab Radio that is required to be driven from at any time during its planned workings is defective (hardware fault).	All Software	The Location where the train is entering service is a maintenance depot and unless alternative arrangements can be made that would avoid the need to drive from the train unit that contains the defective cab radio hardware then the train cannot enter service. The Cab Radio (hardware) installed in train unit being driven from is defective.	The Cab Radio hardware is defective, there is no opportunity to drive the train from an alternative unit (that is installed with a fully functional radio), and the train is scheduled to enter service from a maintenance depot. The train cannot enter service.	Operator	M0	TEC207a
The Cab Radio Displays one of the following messages, > Failure X > Radio Failure > Cab Radio Flt > EPROM/RAM Flt	While attempting to enter service from a location other than a Maintenance Depot, the Cab Radio that is required to be driven from at any time during its planned workings is defective (hardware fault).	All Software	A train unit being driven from a defective Cab Radio (hardware) may enter service provided one of the following can be achieved: > A transportable/handheld GSM-R terminal can be supplied at the start of the Journey. > If the defect was not previously known, the Operator can provide the Driver a transportable/handheld GSM-	Unknown but cab radio cannot self-recover.	Operator	M0	TEC207b

DAB

Delay Attribution Board

Ref: IRG Level 2
Issue: 9.1
Effective date: 1st June2017

			R terminal within 75 miles of the location where the defect was identified. The Operator was unable to provide a transportable/handheld GSM-R terminal.				
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9) Table 3 – Network Radio Failure Causes

Table 3: Network Radio Failure Cause							
A.	B.	C.	D.	E.	F.	G.	H.
Drive/Signaller Failure Report	TEC Cause Statement	CM Software versions	Operational Knowledge	Cause/Action Required	Network Rail or operator cause?	IRG Code	Stoke TEC Code
Radio cannot find GSM-R network – message <i>SEARCHING NETWORKS</i> on DCP	GSM-R infrastructure failure present at train location at time reported. TEC able to report scale of network loss (BSC, repeater, BSC)	N/A	Will affect multiple trains in area of coverage loss	GSM-R infrastructure equipment failure resulting in loss of coverage. Scale of loss depends on nature of equipment/system failure	Network Rail	J0	TEC301a
Call routed to incorrect Signaller	Cab radio camped onto wrong cell or data-fill error in cell design	N/A	n/a	Cab radio is attached to a cell not covering the track location due to cell design/data issues/errors or PMO interference. BSS investigation required	Network Rail	J0	TEC302a

Table 3: Network Radio Failure Cause (Continued)

A.	B.	C.	D.	E.	F.	G.	H.
Drive/Signaller Failure Report	TEC Cause Statement	CM Software versions	Operational Knowledge	Cause/Action Required	Network Rail or operator cause?	IRG Code	Stoke TEC Code
Call routed to incorrect Signaller	Cab radio camped onto correct cell but unregistered, call routed correctly under LDA rules to Nominated Signaller	N/A	Nominated Signaller for LDA routing is not the controlling Signaller for train location	Driver used 'call Signaller' or 'Standing at Signal' button when unregistered instead of using phonebook or dialling CT7 number from signal CT7 plate	Operator	TG/FZ	TEC302b
				CT7 number plate missing from signal - Driver used 'call Signaller' or 'Standing at Signal' button when unregistered instead of dialling CT7 number from signal CT7 plate	Network Rail	JO	TEC302c
Call routed to incorrect Signaller	Cab radio uncorrelated due to registration error by Driver. Driver used wild card or registered in non-TD linked cell.	N/A	Registration took place in non-TD linked cell) or Driver used wild card to force acceptance of wrong head code	Driver entered wrong head code during registration preventing correlation and hence eLDA call routing	Operator	TG/FZ	TEC302d

Table 3: Network Radio Failure Cause (Continued)

A.	B.	C.	D.	E.	F.	G.	H.
Drive/Signaller Failure Report	TEC Cause Statement	CM Software versions	Operational Knowledge	Cause/Action Required	Network Rail or operator cause?	IRG Code	Stoke TEC Code
Contact Signaller call routed to incorrect Signaller	Evidence recorded in the GSM-R System Log Filed, indicates that while unregistered, the Driver attempted to contact the Signaller using the 'contact Signaller' button Note: If the phonebook was utilised, but incorrectly, then attribution to be made to cause of failure	All software	RSSB GSM-R User Procedures (Cab Radio) indicate that when unregistered, the Driver should use the phonebook to contact the Signaller. The GSM-R Log Files indicate that the Driver attempted to contact the Signaller using the 'contact Signaller' button	Driver attempted to contact the Signaller using the 'contact Signaller' button while unregistered. When unregistered, the Driver should use the phonebook to contact the Signaller. Should the use of the phonebook cause the call to be wrong routed, this action must be reported.	Operator	TG/FC	TEC302e

Table 3: Network Radio Failure Cause (Continued)

A.	B.	C.	D.	E.	F.	G.	H.
Drive/Signaller Failure Report	TEC Cause Statement	CM Software versions	Operational Knowledge	Cause/Action Required	Network Rail or operator cause?	IRG Code	Stoke TEC Code
Registration failed - message <i>REGISTRATION FAILED</i> on DCP	Network sub-system required to support registrations has failed (MSC)	N/A	Will affect multiple trains in the area of coverage	GSM-R infrastructure equipment failure resulting in total loss of coverage both registration and calls	Network Rail	J0	TEC303a
	Network data base system/toolset errors (SIM DB, SOP) Dynamic/static tables etc.	N/A	No effect on normal running Will affect multiple trains in the area of coverage	Will only affect new fitment or radio changes	Network Rail	J0	TEC303b
Various - Unable to make call, loss of network coverage	TEC advised by equipment maintainer that infrastructure equipment has been vandalised	All software	Infrastructure maintainer confirms equipment vandalised	Vandalism	Network Rail	XB	TEC304a
Call or 'Standing at Signal' message failed to connect	No network failure detected at train location at time reported. TEC may have previous reports (Problem ID for location concerned)	All software	Cab radio operating successfully elsewhere	Potential GSM-R coverage issue or PMO interference. BSS investigation required	Network Rail	J0	TEC305a
	No network failure detected at train location at time reported.	All software	Cab radio fails calls elsewhere	Potential GSM-R cab radio issue. Operator's maintainer diagnosis/tests required	N/A	As per the investigation outcome	TEC305b

Table 3: Network Radio Failure Cause (Continued)

A.	B.	C.	D.	E.	F.	G.	H.
Drive/Signaller Failure Report	TEC Cause Statement	CM Software versions	Operational Knowledge	Cause/Action Required	Network Rail or operator cause?	IRG Code	Stoke TEC Code
One way speech for Driver/Signaller call. Signaller/Driver not able to hear the Driver/Signaller.	TEC can confirm radio activity and call sets up are OK. Only the Signaller can be heard on BBRC recording and it is clear that the Driver is unable to hear the Signaller (or vice versa).	All software	Radio recovers when re-booted and calls are now OK.	Software fault in cab radio	Network Rail	J0	TEC306a
		All software	The radio has the same issue after re-boot.	The cab radio hardware fault Maintenance Engineer is required to test the cab radio hardware.	Operator	M8	TEC306b
Railway Emergency Call	Railway Emergency Call	All software	REC call sets up per design for call initiated in a particular Group Call Area.	A REC call initiated.	Reason for REC	As per DAPR Section G	TEC307a
Railway Emergency Call	Railway Emergency Call	All software	REC call set up as per design for a call initiated in a particular Group Call Area.	The train is stopped by a NFA test call where a test TEC notification was sent prior to the test call	Operator	TG/FZ	TEC308a

Table 3: Network Radio Failure Cause (Continued)

A.	B.	C.	D.	E.	F.	G.	H.
Drive/Signaller Failure Report	TEC Cause Statement	CM Software versions	Operational Knowledge	Cause/Action Required	Network Rail or operator cause?	IRG Code	Stoke TEC Code
				The train is stopped by a NFA test call where a test REC notification was not sent prior to the test call.	Network Rail	OC or JO if undertaken by project	TEC308b
Driver to Signaller or Signaller to Driver voice calls	Calls are set up but no communication is established between the Driver and the Signaller (or vice, versa). Voice recorded on the BBRC, but it is clear that the Driver and Signaller can't hear one another.	All software	Multiple units experiencing the same issue when contacting the same Signaller from the same Cell location or vice, versa. It is identified that the Cell coverage is OK. Other unit radio activity is seen for serving Cell location.	Faulty Dicora hardware or connections	Network Rail	JO	TEC309a
GSM-R Network or dependant sub-system failure. Cab Radio displays 'Searching Network' or 'No Network'.	A fault has occurred within the GSM-R Network which has resulted in a Radio coverage gap of less than approximately six miles of route.	All	NRT has communicated the fault details and operational impact to Route Control, clearly indicating that the area of impact is less than approximately six miles of route. Route Control has communicated the operational impact to the affected Drivers.	A Driver(s) has implemented railway operational restrictions which is contrary to the requirements/guidance presented in Operational Requirements for GSM-R Radio (RIS-3780) e.g. driver action, Operator Control directive, union directive. A fault has occurred in the GSM-R Network which has	Operator	T* / F*	TEC310a

Table 3: Network Radio Failure Cause (Continued)

A.	B.	C.	D.	E.	F.	G.	H.
Drive/Signaller Failure Report	TEC Cause Statement	CM Software versions	Operational Knowledge	Cause/Action Required	Network Rail or operator cause?	IRG Code	Stoke TEC Code
			<p>Train operations shall be permitted to continue normally without restriction.</p> <p>Where the affected area contains a Registration location, the affected Driver should implement guidance presented in RSSB GSM-R User Procedures (Cab Radio) document number NS-GSM-R-OPS-0514.</p> <p>A Driver(s) has implemented railway operations restriction.</p>	<p>resulted in a Radio coverage gap of less than approximately six miles of route (generally one base station coverage)</p> <p>The fault and an assessment of Operational Impact has been communicated by NRT to Route Control and Route Control have communicated operational impact to the affected Train Operators.</p> <p>Railway Operations are permitted to continue without restriction. Where registration is affected, Drivers should contact the Signaller through alternate means and implement guidance presented in RSSB GSM-R User Procedures (Cab Radio) document number NS-GSM-R-OPS-0514.</p>			

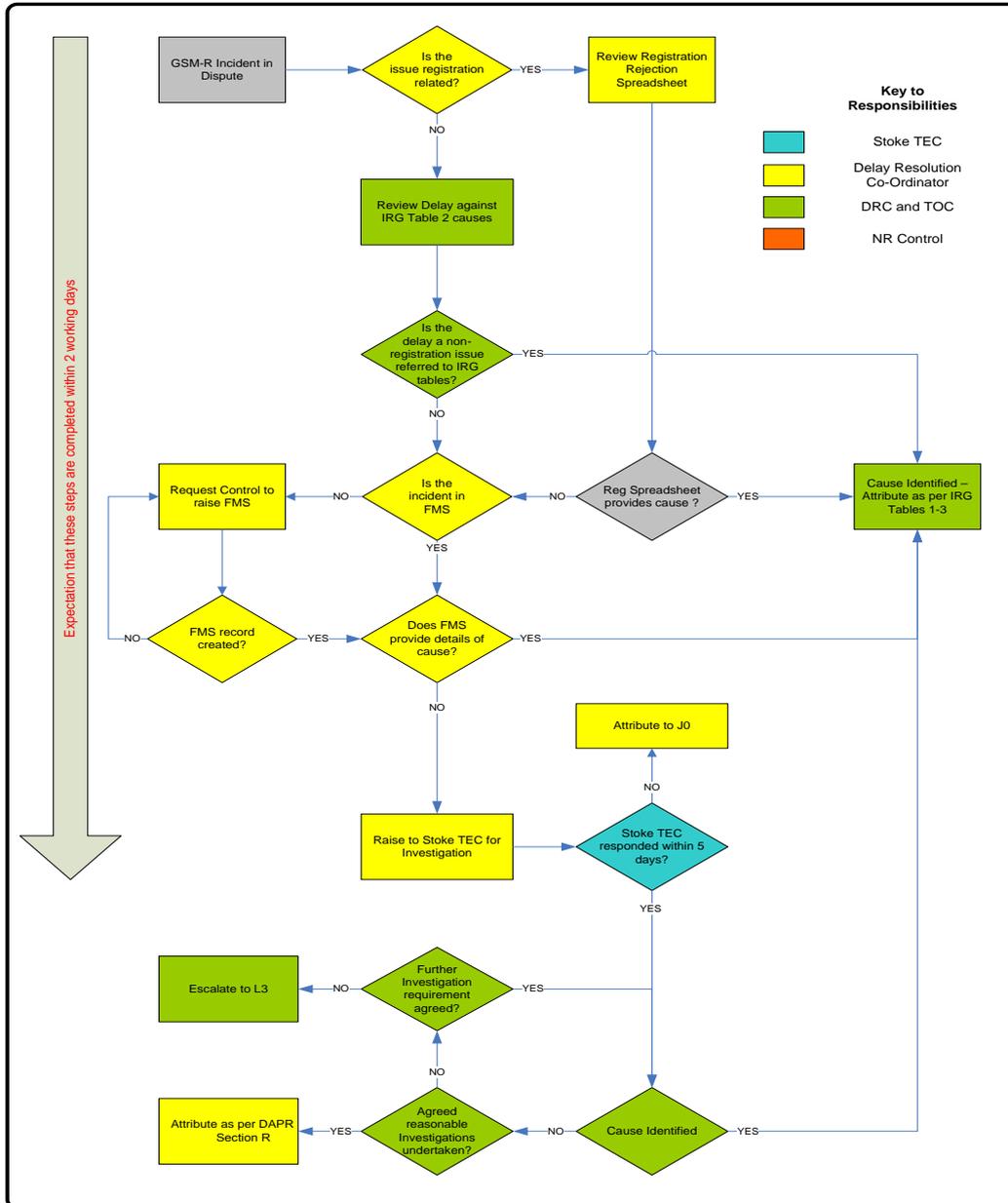
Table 3: Network Radio Failure Cause (Continued)

A.	B.	C.	D.	E.	F.	G.	H.
Drive/Signaller Failure Report	TEC Cause Statement	CM Software versions	Operational Knowledge	Cause/Action Required	Network Rail or operator cause?	IRG Code	Stoke TEC Code
<p>GSM-R Network or dependant sub-system failure.</p> <p>Cab Radio displays 'Searching Network' or 'No Network'.</p>	<p>A fault has occurred within the GSM-R Network which has resulted in a Radio coverage gap of less than approximately six miles of route.</p>	<p>All</p>	<p>NRT has communicated the fault details and operational impact to Route Control, clearly indicating that the area of impact is less than approximately six miles of route.</p> <p>Route Control has communicated the operational impact to the affected Control Areas.</p> <p>Train operations shall be permitted to continue normally without restriction.</p> <p>Where the affected area contains a Registration location, the affected Signaller should implement guidance presented in RSSB GSM-R User Procedures (Cab Radio) document number NS-GSM-R-OPS-0514.</p>	<p>A Signaller has implemented railway operational restrictions which are contrary to the requirements/guidance presented in Operational Requirements for GSM-R Radio (RIS-3780) e.g. Control directive, union directive.</p> <p>A fault has occurred in the GSM-R Network which has resulted in a Radio coverage gap of less than approximately six miles of route (generally one base station coverage)</p> <p>The fault and an assessment of Operational Impact has been communicated by NRT to Route Control and Route Control have communicated operational impact to the affected Train Operators.</p>	<p>Network Rail</p>	<p>OC / OD</p>	<p>TEC310b</p>

Table 3: Network Radio Failure Cause (Continued)

A.	B.	C.	D.	E.	F.	G.	H.
Drive/Signaller Failure Report	TEC Cause Statement	CM Software versions	Operational Knowledge	Cause/Action Required	Network Rail or operator cause?	IRG Code	Stoke TEC Code
			A Signaller has implemented railway operations restriction.	Railway Operations are permitted to continue without restriction. Where registration is affected, Drivers should contact the Signaller through alternate means and implement guidance presented in RSSB GSM-R User Procedures (Cab Radio) document number NS-GSM-R-OPS-0514.			

10) Process Flow chart



Note 1: Where an investigation is incomplete, attribution should be made to the Access Party from which the required information, relevant to the prime cause, was not provided.

Note 2: When both parties agree that an investigation has been concluded, and no cause has been identified, the incidents will be coded to J0 (zero) Network Rail responsibility.

Note 3: Stoke TEC should respond within 5 days of any request being made of them to investigate an incident.

Abbreviations

ACI	Automatic Code Insertion
ATI	Any Time Interrogation
BSC	Base Station Controller
BSS	Base Station Sub-system
BTS	Base Transceiver Station
CR	Cab Radio
CT2	Call Type 2
CT3	Call Type 3
DAPR	Delay Attribution Principles and Rules
DB	Database
DCP	Driver's Control Panel
DOM	Disc On Module
DSDR	Driver's Safety Dive Relay
eLDA	enhanced Location Dependent Addressing
EVC	European Vital Computer
FMS	Fault Management System
FTN	Fixed telecom Network
FTS	Fixed Terminal System
GPS	Global Positioning Satellite
GSM-R	Global System for Mobile communications – Railways
I	Interpose
ID	Identity
LAC	Location Area Code
LDA	Location Dependent Addressing
MCB	Miniature Circuit Breaker
MO	Mobile Originated
MSISDN	Mobile Subscriber Integrated
MT	Mobile Terminated
NFF	No Fault Found
OTDR	On Train Data Recorder
PA	Public Address
PIN	Personal Identity Number
PMO	Public Mobile Operator
PMU	Portable Maintenance Unit
PLAU	Periodic Location Area Updates
REC	Railway Emergency Call
SIM	Subscriber Identity Module
SOP	Service Order Provisioning
TD	Train Describer
TD.net	Train Describer network interface
TEC	Telecoms Engineering Centre
TRN	Train Reporting Number
UPS	Uninterruptible Power Supply
WHC	Wrong Head Code

11) Information Required

When reporting a GSM-R failure to either Route control, Stoke TEC or TOC control the minimum information requirement that needs to be captured and recorded to undertake the investigation is set out in 1 to 8 below.

Failure to capture and record the information in full may cause delay to the delay resolution process.

1. Date of occurrence
2. Time of occurrence
3. Location of occurrence
4. Head code of train involved
5. Train Unit / Loco Number
6. What GSM-R related action was the driver attempting to conduct?
7. What was the outcome of the last GSM-R related attempt?
8. What did the GSM-R Cab Radio display?

Points 1 to 5 should be recorded in the TRUST incident as standard.

Points 6 to 8 will normally be ascertained subsequently from relevant sources.

12) **APPENDIX A – SIEMENS FAULT CODES FOR NR3.1, NR3.3, NR3.4.1/3.5 SOFTWARE**

DCP Message	Cause
Failure 01	Transceiver fault
Failure 02	SIM PIN fault
Failure 03	SIM card missing
Failure 04	SIM card invalid
Failure 05	Software invalid
Failure 06	Database invalid
Cab Radio Flt	DCP lost communication with radio unit
Warning 01 – 07	Warning faults are not service affecting
Battery low	Not service affecting

13) APPENDIX B - GSM-R programme note: delays due to known software faults

The following table aims to highlight the previous and current known faults that occur on a cab radio. Until a version of software that has demonstrated resolution to these issues is available, instances where these symptoms are seen should be attributed to Network Rail, (through code J0).

The following table summarises the known faults with the 5 software versions in use across the network. Note that version NR3.4 was not used beyond an operational trial

Software Fault Description	Version 1		Version 2		
	2.6	2.8	3.1	3.3	3.4.1/3.5
	PA registration trapped if Driver's key off within 5s of 'confirm deregister'/press tick	Yes Bulletin 4	Yes Bulletin 4	resolved	resolved
'Already pre-registered' message requiring radio to be rebooted	Yes	resolved	resolved	resolved	resolved
MT FATAL on power up	Yes	Yes	resolved	resolved	resolved
Cab radio reboots itself	Yes	Yes	Yes	Yes	Yes
'3 bar initialisation'	N/a	N/a	Yes	Yes	Yes
DOM corruption	Yes	Yes	Yes	Yes	resolved
'Searching Networks' issue	N/a	Yes	Yes	Yes	Yes
'blank screen'/'locked-up' radio when Driver's key on/key off within 10s	N/a	N/a	Yes	Yes	resolved
Locked up with GSM-R GB (As distinct from Blank Screen)	Yes	Yes	resolved	resolved	resolved
Intermittent 'Radio Failure 01' (recovered by reboot)	Yes	Yes	Yes	Yes	Yes
GSM-R GB on display but radio locked up	N/a	Yes Funkwerk	Yes Funkwerk	Yes	Yes
Red and Yellow buttons remain illuminated when radio is off	Yes	Yes	Yes	Yes	resolved
Cab radio fails to join REC after receiving call or operational message	Yes	Yes	Yes	Yes	Yes
Radio locked up with blank screen (as distinct from Driver's key issue above)	Yes	Yes	Yes	Yes	Yes