



## Deviation from a Railway Group Standard

(In accordance with the Railway Group Standards Code, Issue Four, part 7)

**Deviation Number: 13/107/DEV**

**1. Start and End Date:**

N/A

**2. Details of applicant:**

, Technical Services Manager, Southeastern, Slade Green Maintenance Depot, Moat Lane, Slade Green, Erith, Kent DA8 2NJ

**3. Your reference number:**

N/A

**4. Status of applicant:**

Railway Undertaking, RSSB Member

**5. Title of certificate:**

Call quality requirements for GSM-R Radio installations using single handset Cab Audio Control Units on Southeastern CI375, 376, 465 and 466 fleets.

**6a. Details of Railway Group Standard (RGS):**

RGS Number:	Issue No:	Issue Date:	Title:
GE/RT8082	One	July 2007	GSM-R Cab Mobile, Great Britain Open Interface Requirements (Rapid Response)

**6b. RGS clause(s):**

3.9.1, 3.9.2, 3.9.3, 3.9.4, 3.9.5 and 3.9.7

**6c. RGS clause requirements:**

**“3.9.1 General**

- 3.9.1.1 This section sets out objective requirements and measurement methods for cab mobile speech quality. Speech quality is assessed at the acoustical interface and includes the performance of both handset and loudspeaker.
- 3.9.1.2 Speech quality is specified in terms of an objective mean opinion score using the TOSQA2001 algorithm. The TOSQA2001 algorithm is currently the validated method used within the telecommunications industry for objective speech quality measurements using acoustical interfaces. It produces values known as TMOS scores which range from 1 to 5, where 1 is 'bad' and 5 is 'excellent'. The TMOS scale is equivalent to the MOS scale described in ITU-P, 800.
- 3.9.1.3 At the time of writing there are no algorithms, for assessing speech quality in a noisy environment, that have been validated at a European standards level. A more general algorithm, based upon ITU P.862 PESQ, is currently being developed within the ITU to address this situation. When the new algorithm becomes available it is the intention that this standard will be modified to use it and to include background noise as part of the tests.

### 3.9.2 Transmitted speech quality requirements

- 3.9.2.1 For speech originated from the handset microphone, the GSM-R cab mobile shall transmit speech that is received with an average TMOS score of no less than 3.8.
- 3.9.2.2 This TMOS requirement shall be achieved for all call types involving speech originated from the cab mobile.
- 3.9.2.3 The measurement method used to verify this requirement shall be in accordance with sub-sections 3.9.4 and 3.9.5.

### 3.9.3 Received speech quality requirements

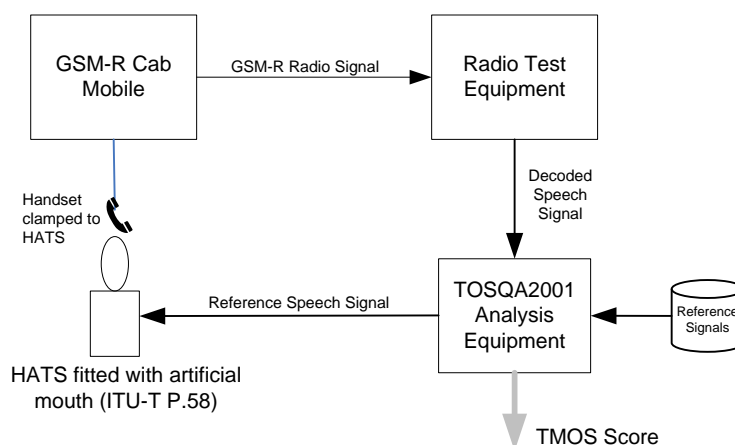
- 3.9.3.1 Two cases shall be assessed for received speech quality at the cab mobile:
- Case 1: Speech output via the loudspeaker only
  - Case 2: Speech output via the handset earpiece only.
- 3.9.3.2 For all call types for which Case 1 is applicable, the GSM-R cab mobile shall provide an average received speech quality TMOS score of no less than 3.8.
- 3.9.3.3 For all call types for which Case 2 is applicable, the GSM-R cab mobile shall provide an average received speech quality TMOS score of no less than 3.8.
- 3.9.3.4 The measurement set-up used to verify these requirements shall be in accordance with sub-sections 3.9.4 and 3.9.6.

### 3.9.4 General requirements for speech quality measurements

- 3.9.4.1 All measurements for speech quality shall be made using the TOSQA2001 algorithm.
- 3.9.4.2 The test set-up shall be calibrated and equalised as prescribed by TOSQA2001.
- 3.9.4.3 A Head And Torso Simulator (HATS) in accordance with ITU-T Recommendation P.58 shall be used to provide the acoustical interface to the cab mobile.
- 3.9.4.4 The HATS shall be equipped with an artificial mouth that conforms to ITU-T Recommendation P.58.
- 3.9.4.5 The HATS shall be equipped with an artificial ear that conforms to ITU-T Recommendation P.57 artificial ear type 3.4.
- 3.9.4.6 All speech samples shall fulfil the requirements of ITU-T, P.800 recommendations.
- 3.9.4.7 All measurements shall be made in an anechoic chamber.

### 3.9.5 Transmitted speech quality measurement method

- 3.9.5.1 The measurement set-up shall be in accordance with Fig.



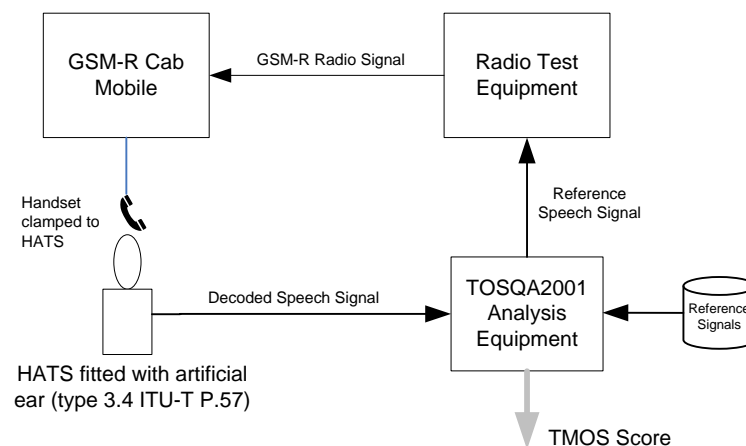
3.4.

**Fig. 3.4 General test set up for transmitted speech**

- 3.9.5.2 The handset shall be attached to the HATS in accordance with ITU-T Recommendation P.64 and at a pressure level of 8N.
- 3.9.5.3 Speech samples shall not be filtered or band limited.
- 3.9.5.4 The average speech level shall be  $-4.7\text{dB}_{\text{Pa}}$  at the HATS mouth reference point.
- 3.9.5.5 The general measurement procedure shall be as follows:
- The GSM-R cab mobile and radio test equipment shall be interconnected via the radio frequency interface
  - A voice call shall be established between the GSM-R cab mobile and the radio test equipment
  - The TOSQA2001 Analysis Equipment shall provide the reference speech signal to the artificial mouth located in the HATS
  - The Cab Mobile shall transmit the speech via the established call to the radio test equipment
  - The radio test equipment shall output the electrical speech signal to the TOSQA2001 analysis equipment from which the TMOS score shall be produced.”

**“3.9.7 Received speech quality measurement method for Case 2:  
Speech output via the handset earpiece**

- 3.9.7.1 The measurement set-up for speech received via the handset earpiece shall be in accordance with Fig. 3.6.



**Fig. 3.6 General test set up for received speech Case 2**

- 3.9.7.2 The handset shall be attached to a HATS in accordance with ITU-T Recommendation P.64 and at a pressure level of 8N.
- 3.9.7.3 The reference speech signals shall be pre-filtered in accordance with ITU-T Recommendation P.48.
- 3.9.7.4 The volume setting at the cab mobile handset earpiece volume shall be set to produce an average received speech level of  $-16\text{dB}_{\text{m}0}$ .
- 3.9.7.5 The general measurement procedure shall be as follows:
- The GSM-R cab mobile and radio test equipment shall be interconnected via the radio frequency interface and the radio test equipment output set to  $-90\text{dBm}$
  - A voice call shall be established between the GSM-R cab mobile and the radio test equipment
  - The TOSQA2001 Analysis Equipment shall provide the reference speech signal to the radio test equipment
  - The radio test equipment shall transmit the speech via the established call to the cab mobile

- e) The cab mobile shall output the speech signal via the handset earpiece to the artificial ear in the HATS
- f) The artificial ear shall output the electrical speech signal to the TOSQA2001 analysis equipment from which the TMOS score shall be produced.”

### 7. Scope of deviation:

A standard GSM-R installation utilises a dedicated GSM-R handset for radio communication function. However, vehicles currently fitted with a single handset will have their Cab Audio Communication Unit (CACU, sometimes known as Drivers Interface Unit - DIU) modified to allow the existing single handset to work in conjunction with the GSM-R radio, thus maintaining the existing arrangement whereby all cab audio functions are managed through a single handset.

This deviation application applies to the use of the existing handset (Whiteley/BTROS TD500 or DAC handset) in place of a dedicated GSM-R handset on the Classes 375 and 376 Electrostar fleets and the Classes 465 and 466 Networker fleets, noting that the existing handset and CACU arrangement will not pass the test requirements in the clauses identified in Section 6 of this application (Details of Railway Group Standard).

It should be noted that the scope of this deviation is similar to that for derogations 09/285/DGN, 10/048/DGN and 12/102/DGN which also relate to the use of a single handset and CACU arrangement which cannot pass the test criteria as set out in section 6 above.

Please note this application is for a project requiring authorisation for placing in service under the Railways (Interoperability) Regulations 2011.

### 8. Duration of the deviation:

For the remaining lifetime of an asset or piece of equipment.

### 9. Method of elimination:

N/A

### 10. Impacts of complying with the current RGS requirement:

- 1) As with derogations 09/285/DGN, 10/048/DGN and 12/102/DGN, there is no known route whereby compliance to the clauses in Section 6 can be achieved.
- 2) The Southeastern Classes 375 and 376 fleets have had a single handset arrangement since they were introduced into service. The existing handset occupies the optimum position in terms of driver ergonomics. Fitment of a dedicated GSM-R handset would require the GSM-R handset to be placed in another location, away from the optimum location.
- 3) The Southeastern Classes 465 and 466 underwent a modification programme to replace separate radio and PA handsets with a single handset arrangement. This new arrangement only allows for one handset to be fitted in the optimum cab location. This means the fitment of a dedicated GSM-R handset would require drivers to change the way they operate the GSM-R radio in comparison to current practice.

### 11. Proposed alternative provisions:

To ensure the best audio handset audio quality is achieved with the existing handset and CACU arrangement, the following actions have been undertaken:

- 1) Handset comparison testing – the audio characteristics of the GSM-R handset (Holmco Funk 75) have been compared with the audio characteristics of the single handset/CACU arrangement - see reports “G44302-B – Handset Comparison” and “G44659 – DAC Handset Evaluation Results”. These reports concluded that the audio quality of the two systems were comparable.
- 2) CACUs that have had GSM-R modifications implemented have been tested on CI376 and 466 (and other) vehicles in conjunction with a GSM-R radio to ensure the handset audio quality is acceptable.

### 12. Impacts of the alternative provisions:

There are no negative impacts of the alternative actions. This is because maintaining the use of a single handset reduces the level of change effected by the introduction of the GSM-R radio to the Classes 375, 376, 465 and 466 cab designs thereby maintaining current driver practice of controlling voice

communications through a single handset.

### 13. What other options have been considered?

- 1) Fitment of a standalone GSM-R radio handset – this has been discounted because the optimum handset position is already occupied by the existing single handset which would have to be retained for other on train communication functions.
- 2) Change the type of single handset used – this has been discounted because:
  - a) there is no handset that is fully compliant with the requirements set out in the clauses in Section 6 of this application, and
  - b) doing so would require a significant redesign of the CACU interface to allow the new handset to be compatible for on train communication functions.

### 14. Consultation with affected parties

The CACU interface modification has been developed by BTROS (formerly Whiteley Electronics), who are the Design Authority for the Passenger Information System that the CACU and single handset form a part of.

### 15. Additional actions/observations:

Upon receipt, the applicant is required to identify affected, interfacing parties and copy this certificate, together with supporting information, to those parties.

The Control Command and Signalling Standards Committee notes this application is against a withdrawn standard. The application is compliant with the relevant replacement standard GK/RT0094 Issue 1, but the deviation is granted on the basis that the applicant is required to comply with GE/RT8082 Issue 1 by project requirements and because GE/RT8082 Issue 1 remains the National Notified Technical Rule (NNTR) as set out by the Department for Transport (DfT).

Attachments:

- DfT's letter dated 11/06/2013 recommending the deviation until the end of the project
- Siemens GSM-R Handset Comparison Results Ref. G44302 Issue B dated 27/07/2009
- 2<sup>nd</sup> GEN CACU Electrostar GSM-R Modification, SAT Specification Ref. G44482 Issue 7 dated 17/01/2011
- 4<sup>th</sup> GEN Class 465/466 DIU GSM-R Modification, SAT Specification Ref. G44500 Issue 1 dated 22/07/2011
- DAC Handset Evaluation Results Ref. G44659 Issue A dated 28/09/2011.

### 16. Signature of applicant:

, Technical Services Manager

### Date of application:

11/07/2013

### 17. Lead Standards Committee details:

#### Name of Committee:

Control Command and Signalling

#### Date of meeting

15/08/2013

#### Minute reference:

13/CCS/08/150

### Authorised by:

Signed by Tom Lee on 04/09/2013

### Date of Authorisation:

04/09/2013

Tom Lee  
Head of New Systems  
Head of Delivery, Control Command & Signalling, and Energy