



RIS

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Rail Industry Standard for Track to Train RFID Compatibility

Issue record

Issue	Date	Comments
One	September 2015	Original document. This document sets out the Radio Frequency Identification (RFID) structure and communications protocol to be used for data transmission between beacons fitted on the track and RFID on-board readers.

Superseded or replaced documents

This Rail Industry Standard does not supersede or replace any other Railway Group documents.

Supply

The authoritative version of this document is available at www.rgsonline.co.uk. Enquiries on this document can be forwarded to enquirydesk@rssb.co.uk.

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Part 1 Introduction

1.1 Purpose of this document

- 1.1.1 This document is a standard on rail vehicle and track radio frequency identification (RFID) compatibility, for members of RSSB to use if they so choose.
- 1.1.2 This document sets out the technical requirements for the RFID on-board reader and track based beacon interface using the data format structure and communications protocol for Automatic Selective Door Operation (ASDO) functionality, which was originally set out in Appendix 2 of GM/RT2473 issue two.
- 1.1.3 This document also sets out the process for managing data structures for new applications and the change control process for existing applications. Industry governance for these data structures will be through the approval of the application-specific standard in which they are documented, in accordance with the Railway Group Standard Code and Manual.

1.2 Application of this document

- 1.2.1 A member of RSSB may choose to adopt all or part of this document through internal procedures or contract conditions. Where this is the case, the member of RSSB will specify the nature and extent of application.
- 1.2.2 Therefore compliance requirements and dates have not been specified since these will be the subject of internal procedures or contract conditions.

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1.4 The structure of this document

- 1.4.1 This document is set out as a series of requirements, in some cases followed by relevant guidance. The guidance is indicated by prefixing the paragraph number with the letter 'G'.

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1.6 Approval and authorisation of this document

- 1.6.1 The content of this document was approved by Control Command and Signalling (CCS) Standards Committee on 11 June 2015.
- 1.6.2 This document was authorised by RSSB on 12 August 2015.

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Part 2 Requirements for Rail Vehicle and Track RFID Technical Interface Compatibility

2.1 Railway undertaking - architecture interface

- 2.1.1 The RFID protocol shall be transmitted by the on-board reader in the radio frequency (RF) range 865.7 MHz to 867.9 MHz, with an effective radio propagation (ERP) not exceeding 2 W.

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| G 2.1.1.1 | Rationale: The intended emissions lie within the IR 2030/13/3 – UK Interface Requirements 2030 Licence Exempt Short Range Devices frequency band, and at the power levels regulated for the purposes of RFID by Ofcom and the European Radio and Telecommunications Terminal Equipment (R&TTE) Directive, the Radio Equipment Directive (RED) and referenced to EN 302 208. |
| G 2.1.1.2 | The R&TTE 1999/5/EC Directive came into force on 07 April 1999 and will be repealed on 13 June 2016. Products placed on the market prior to 13 June 2016 can continue under R&TTE until 13 June 2017 which will be revised to include guidance that the RED 2014/53/EU came into force on 11 June 2014. The RED applies to products placed on the market on 13 June 2016 or later. |
| G 2.1.1.3 | Independent channel frequency hopping technology can be incorporated to mitigate potential radio interference issues within this frequency band. |
| G 2.1.1.4 | The Great Britain (GB) rail industry has successfully used an ERP of 500 mW for this RFID data transmission. |
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- 2.1.2 The data transfer shall occur when the on-board reader, which includes an integral antenna, and the track based beacon are at a distance of 1 m.

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| G 2.1.2.1 | Rationale: At the required operating frequency and ERP, at distances greater than 1 m between the on-board reader and track based beacon, the data transmission is unreliable. |
| G 2.1.2.2 | Within the 1 m operating distance an optimum data transfer occurs at approximately 500 mm between the on-board reader and track based beacon. |
| G 2.1.2.3 | If space does not permit a reader with an integral antenna to be installed at a suitable location on the underframe, then a separate antenna may be mounted on the underside of the vehicle. |
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- 2.1.3 The RFID system shall not be used at speeds exceeding 75 mph (120 km/h).

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| G 2.1.3.1 | Rationale: The GB rail industry trials have only validated and verified reliable readings for trains travelling at a maximum of 75 mph (120 km/h). |
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2.2 RFID on-board subsystem

- 2.2.1 The RFID on-board readers shall be designed to be mounted on the underside of the vehicle.

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G 2.2.1.1	Rationale: The readers are mounted to enable an unobstructed line of sight for data transmission to occur at distances ≤ 1 m between the on-train reader and the track based beacon.
G 2.2.1.2	Further details on designing and mounting devices are set out in GC/RT5212 issue one 'Requirements for Defining and Maintaining Clearances', GM/RT2149 issue three 'Requirements for Defining and Maintaining the Size of Railway Vehicles' and GE/RT8073 issue two 'Requirements for the Application of Standard Vehicle Gauges'.
2.2.2	The lateral position of the on-board readers mounted on the underside of the vehicle shall be limited to +/- 30 mm of the train / vehicle centreline.
G 2.2.2.1	Rationale: The 30 mm limitation of the lateral position from the centreline enables the data transmission between the track based beacon and the on-board reader to occur within the 1 m range, taking account of cant deficiencies and overthrow of the vehicle.
G 2.2.2.2	If space does not permit a reader with an integral antenna to be installed at a suitable location on the underframe, then a separate antenna may be mounted on the underside of the vehicle.
G 2.2.2.3	In positioning the reader within the train consist, all operational scenarios where the beacon is expected to transfer data should be considered.
G 2.2.2.4	As the train consist can vary in length, due to coupling and uncoupling of vehicles and units, the position of the reader in respect to the whole train formation can also vary. This can affect whether the data transmission between the on-board reader and track based beacon distance of 1 m is achieved for all applications on all routes.
2.2.3	There shall be a clear, unobstructed line of sight between the reader and the beacon when they are within 1 m of each other, to enable data transmission to occur.
G 2.2.3.1	Rationale: Obstructions absorb and reflect varying levels of ultra-high frequencies (UHF), depending on the composition of the material, and may prevent beacon activation or reduce the reliability of the reader receiving the pre-programmed data.
G 2.2.3.2	If space does not permit a reader with an integral antenna to be installed at a suitable location on the underframe, then the antenna may be mounted on the underside of the vehicle.
G 2.2.3.3	The emitted UHF reader signal spreads outwards from the on-board reader, commonly referred to as the 'cone of acceptance'.
G 2.2.3.4	As the UHF band signal emitted from the reader spreads out in a conical shape, part of that signal can, at approximately 1 m from the beacon, start to receive data from the tag. Similarly, having passed over the beacon, the reader continues to receive consistent data until the on-board reader exceeds 1 m from the tag. While passing over the beacon, the optimum read reliability is achieved when the centre of the reader and centre of the beacon become directly aligned.