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Level 2

Signalling and Telecommunications Telecoms Clearance for Fixed Transmitters

Endorsement and Authorisation

Endorsed by:

Richard Feasby, Working Group Chair

Authorised by:

Steve Hailes, Steering Group Chair

Accepted for issue by:

Mick McManus, National Standards Manager

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Issue record

Issue	Date	Comments
1	February 2004	First issue
2	October 2004	References to Safety Review Group deleted References to Zones and Titles changed to meet the current organisation.
3	December 2005	Updated for Standards Framework. Renumbered from RT/E/P/30066
4	April 2006	Updated to reflect the transfer of maintenance delivery from Engineering to Maintenance
5	June 2007	Revised electric field limits, methods for summing carriers and calculating clearances to prevent intermodulation effects. Process modified significantly.
6	August 2008	Updated to reflect Phase 2A reorganisation
7	March 2010	Updated to reflect Engineering reorganisation

Reference documentation

NR/L3/TEL/31103, *Energisation of commercial and operational radio antenna systems*

Compliance

This Network Rail standard is mandatory and shall be complied with by Network Rail and its contractors if applicable from 06 March 2010.

When this standard is implemented, it is permissible for all projects that have formally completed GRIP Stage 4 to continue to comply with the Issue of any relevant Network Rail Standards current when GRIP Stage 4 was reached and not to comply with requirements contained herein, unless the designated Standard Owner has stipulated otherwise in the accompanying Briefing Note.

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1 Purpose

Radio transmitters can potentially interfere with Network Rail operational systems, including Signalling & Telecommunications (S&T) systems. The purpose of this procedure is to detail the telecoms clearance process to reduce the risk of interference from fixed transmitters to as low as reasonably practicable (ALARP).

The principal fixed transmitters that may cause interference with Network Rail systems are:

- Network Rail's GSM-R network, which will include over 2000 new trackside radio towers
- Radio transmitters on co-existent or adjoining rail networks
- Third Party radio transmitters on Network Rail property and Network Rail property leased to TOCs and FOCs
- Third Party radio transmitters off Network Rail property, but within 100 m of Network Rail track

The operational systems most likely to suffer interference from fixed transmitters are:

- Network Rail's existing and proposed radio systems, including GSM-R, IVRS, CSR, NRN and RETB
- Trackside systems, including S&T systems. For the equivalent field strength, low frequency transmitters (particularly those lower than 200 MHz) are more likely to cause interference to trackside systems than high frequency transmitters
- Train-borne radio systems

2 Scope

This procedure details the Telecoms Clearance process that shall be applied for new or upgraded fixed transmitters on Network Rail land or property, whether or not they are mounted on towers, buildings or other structures.

Where possible the procedure will also be used to mitigate the risk of new and upgraded fixed radio transmitters off Network Rail property, but within 100 m of Network Rail track.

This procedure describes the process for telecoms clearance on a site-by-site basis. It does not address approval of the fixed transmitter design.

The procedure also provides a process for controlling the risk posed by low power transmitters, such as wireless LANs.

This procedure is written so the maximum field strength which enables interference-free operation of trackside systems is not exceeded anywhere on the network, so no restrictions are made on the positioning of Signalling or Telecommunications equipment in any future renewals schemes.

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This standard does not cover any maintenance requirements related to the radio equipment or tower structures.

This standard does not cover mobile transmitters which are subject to their own approvals through the product acceptance route, nor to train-borne transmitters, which will be subject to its own safety review.

3 Definitions

ALARP

As Low As Reasonably Practicable

CSR

Cab Secure Radio

EMC

Electromagnetic Compatibility

E&P

Electrification and Plant

EIRP

Effective Radiated Power relative to an isotropic antenna

ERP

Effective Radiated Power relative to a dipole

FOC

Freight Operating Company

Frequency Band

A frequency band allocated to a type of radio transmission (e.g. GSM900, GSM1800, UMTS, etc.). Where it is not possible to define the extent of the frequency band, e.g. for analogue systems, the frequency band shall be considered to cover the frequency range $f_0 \pm f_0/20$, where f_0 is the centre frequency of the transmitter under consideration.

GSM-R

Global System for Mobile Communications - Railway

HQ

Headquarters

LAN

Local Area Network

NRN

National Radio Network

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ORN

Overlay Radio Network

REB

Relocatable Equipment Building

RETB

Radio Electronic Token Block

RF

Radio Frequency

S&T

Signalling and Telecommunications

Third Party Operator

For the purposes of this standard, third party operator shall be taken to mean the third party operator or an agent it uses to facilitate the clearance process.

TOC

Train Operating Company

UHF

Ultra High Frequency

4 Compliance Criteria

The following criteria shall be complied with for all new or upgraded fixed transmitters. Energisation testing shall be carried out in accordance with NR/L3/TEL/31103.

At the discretion of the Professional Head (S&T), or authorised representative, consideration may be given to applications that do not comply with these conditions where it can be demonstrated that the proposed fixed transmitter will not cause a reduction in the performance of Network Rail radio, signalling or telecommunications systems.

4.1 Electromagnetic Field Limits

Table 1 defines the maximum permitted electromagnetic field strengths on NR land used for operational purposes, at a height of 1 m above rail. Where S&T equipment is located higher than this (e.g. on the bank of a cutting), then the limit also applies at the height of the middle of the S&T equipment enclosure, etc. and for 5 m either side.

For trackside fixed transmitters, the field strength limits shall be complied with at 1 m above rail over all NR operational land.

The field strength shall be measured using a peak detector with a receiver bandwidth covering the full range of transmit frequencies of the system under test. These limits

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have been based on EMC tests using multiple carriers (ERA Reports 2005-0350 Issue 3 and 2005-0353 Issue 2).

Frequency /MHz	Field Strength Limit /Vm ⁻¹
80 - 380	1
380 - 862	7
Over 862	10

Table 1 Field Strength Limits

4.1.1 Multiple Carriers within the Frequency Band

The field strength from multiple carriers, from the same transmitter or other co-located transmitters within the frequency band (see 4) shall be summed linearly for the largest 3 carriers then according to a power sum thereafter. The total field strength at any location on NR land shall not exceed the limit in Table 1.

$$E_R = \sqrt{(E_1 + E_2 + E_3)^2 + E_4^2 + E_5^2 + \dots + E_n^2}$$

Eqn 1

Where:

E_R is the effective field strength of the proposed transmitter related to its ability to interfere with electronic systems;

E_1 to E_n are the field strengths, measured with a peak detector, of individual carriers from one or more transmitters within one frequency band.

4.1.2 Carriers outside the Frequency Band

The field strength at the measurement location from more than one transmitter operating in different frequency bands, but within ± 150 MHz of the centre of the frequency band, shall be calculated as in 6.1.1 and combined according to a power sum (Eqn 2). The total field strength shall not exceed the limit in Table 1.

$$E_T = \sqrt{E_{R1}^2 + E_{R2}^2 + \dots + E_{Rn}^2}$$

Eqn 2

Where:

E_T is the effective combined field strength;

E_{R1} to E_{Rn} are the total field strengths calculated according to 5.1.1 for different frequency bands (1 to n).

4.1.3 Ambients

Any ambient signals within ± 150 MHz of any of the proposed carriers shall be treated as another field strength contribution, E_{Rn} , in Eqn 2. Ambient less than $\frac{1}{4}$ of the field limit may be ignored.