

Ref:	NR/L1/SIG/30040
Issue:	1
Date:	26 August 2008
Compliance date:	1 December 2008

Level 1

EMC Strategy for Network Rail

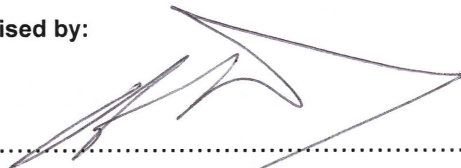
Endorsement and Authorisation

Endorsed by:



.....
S Hailes, Head of Signal Engineering

Authorised by:



.....
A McNaughton, Chief Engineer

Accepted for issue by:



.....
M McManus, National Standards Manager

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Issue record

Issue	Date	Comments
1	26 August 2008	New Issue

Compliance

This Network Rail standard is mandatory and shall be complied with by Network Rail and its contractors if applicable from 1 December 2008.

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.

Reference documentation

References in the text are made to latest editions unless specific editions are cited. Where references are made to other corporate engineering documents which are not yet published, existing documents shall be followed until new documents have been authorised for use.

Legislative

Directive 2004/108/EC of the European Parliament and the Council on the Approximation of the Laws of Member States relating to Electromagnetic Compatibility, 15 December 2004, OJEU L/390, 24-37.

SI 2006 No. 3418 Electromagnetic Compatibility: The Electromagnetic Compatibility Regulations 2006

Other

Network Rail Health & Safety Management System (H&SMS)

The Yellow Book, Engineering Safety Management, Issue 3, RSSB

NR/CS/ACC/029, *Product and Plant Acceptance*

NR/SP/SIG/11201: *Signalling Design Production*

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Supply

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1 Purpose

This document defines the strategy and responsibilities for the management of Electromagnetic Compatibility (EMC) related issues for Network Rail.

Adherence to this document will enable Network Rail to demonstrate compliance to the 'essential protection' requirements of the European Union Directive on EMC 2004/108/EC ("the New EMC Directive"). This Directive has been incorporated into UK legislation by Statutory Instrument 2006 No. 3418 The Electromagnetic Compatibility Regulations (2006), hereafter referred to as the EMC Regulations (2006). The management responsibilities identified in this standard address Network Rail's legal obligations arising in relation to the EMC Directive 2004/108/EC, as transposed into UK legislation by SI 2006 No.3418.

2 Scope

This document constitutes Network Rail's policy with respect to Electromagnetic Compatibility and is applicable to all Network Rail's projects implementing changes to the infrastructure (enhancements and renewals) that affect the electromagnetic properties of the infrastructure.

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3 Roles and Responsibilities

EMC Responsible Person

The person within a company or organisation who has been identified as the Responsible Person as defined in Interpretation 3(h) of the EMC Regs (2006).

NOTE Within Network Rail, this is the Chief Engineer. The management of these responsibilities are then delegated to the appropriate appointments as specified in this standard. In service responsibility is discharged via the Maintenance Support Group (MSG). Any requests from enforcement authorities shall be referred by the Chief Engineer as deemed appropriate.

Designated Project Engineer

For the purposes of this standard, the Designated Project Engineer acts as the EMC Responsible Person under delegated authority from the Chief Engineer during time of alterations to the infrastructure unless an alternative appointment is made and recorded.

Maintenance Engineer

For the purposes of this standard and for compliance with the EMC Regs (2006), the Maintenance Engineer, or his delegated representative is responsible for maintaining the equipment and/or installation as identified in the relevant Operations & Maintenance Manual (O&MM).

Within Network Rail, the Maintenance Engineer is the individual with the formally delegated responsibility for the management of an asset in a geographical area or at a specific location.

Notified Body

NoBo

A Notified Body is a body appointed by an EEC member government to review Declarations of Conformity submissions, etc. The involvement of a Notified Body is *not* a requirement of the new EMC Directive but is an option for manufacturers and suppliers who wish to seek third party endorsements of their DoCs.

NOTE There are different NoBos dealing with different Directives.

Project Manager

The Project Manager is responsible and accountable for the completed Project, and will check that the completed Project is acceptable to the Sponsor and Maintenance Engineer responsible for managing the asset.

Within Network rail, the Project Manager is the person appointed by Network Rail with overall responsibility for the management of a Project to deliver the Remit.

The EMC National Specialist Team

EMC NST

The EMC NST is the centre of technical expertise within Network Rail. It exists to advise on matters concerning EMC and to assist Projects and Area Delivery Units, to meet Network Rail's legal obligations under the EMC Regs (2006) and to help minimise operational difficulties caused by potential EMC phenomena and to close out EMC mitigation issues.

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4 Definitions

The following definitions and are considered helpful to the understanding of this document:

As low as is reasonably practicable (ALARP)

ALARP is a principle method for demonstrating risk mitigation. Determining that risks have been reduced ALARP involves an assessment of the risk to be avoided, against the sacrifice (in money, time and trouble) involved in taking measures to avoid that risk.

Note: See definition of “so far as is reasonably practicable” (“SFAIRP”) below for a Health & Safety Executive comparison of the terms “ALARP” and “SFAIRP” and Network Rail’s policy on the application of this concept in Section 3.5 of Network Rail’s Health & Safety Management System (H & SMS).

Apparatus

Any finished appliance or combination of appliances made commercially available as a single functional unit and liable to generate electromagnetic disturbance, or whose performance is liable to be affected by such disturbance. Apparatus may include mobile installations, and other devices intended to be moved and operated in a range of locations.

Component

Any item which is intended for incorporation into an apparatus that is liable to generate electromagnetic disturbance, or whose performance is liable to be affected by such disturbance.

Electromagnetic Compatibility

The ability of a device, unit of apparatus, or system to provide immunity and function satisfactorily in its electromagnet environment without introducing intolerable electromagnetic disturbances into that environment.

Fixed Installation

A particular combination of different types of apparatus that are assembled, and installed at a specific location.

Note: Once permanently installed, all the railway infrastructure would be considered to be a fixed installation.

Immunity

The ability of equipment to perform as intended without degradation in the presence of an electromagnetic disturbance.

Mobile Installation

A combination of apparatus and, where applicable, other devices, intended to be moved and operated in a range of locations.

Note: Within Network Rail this applies to trains and rail-road vehicles. Mobile installations are treated as apparatus in the context of the EMC Regs 2006.

Notified Body

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A person resident, incorporated or carrying on business in the UK who is designated by the Secretary of State to perform the verification function provided for in the EMC Directive.

Responsible Person

- In relation to apparatus means the manufacturer established in the Community or the authorised representative of; otherwise the person who places the apparatus on the market or puts it into service.

- In relation to fixed installation, the person who, by virtue of their control of the fixed installation is able to determine that the configuration of the installation is such that when used it complies with the essential requirements.

Safety critical system

Safety critical system is a system whose failure on its own (in any mode) during normal operation of the railway will give rise to a potential or actual unsafe condition.

Safety related system

Safety related system is a system whose failure (in any mode) will not cause a potential or actual unsafe condition to occur, but will increase the level of risk for a hazardous situation or event.

So far as is reasonably practicable (SFAIRP)

Railway duty holders are required to go through a process of risk assessment which results in them making a decision about whether they consider that their safety measures are adequate to reduce risks SFAIRP. To demonstrate that an employer has complied with Health & Safety Law by ensuring “so far as is reasonably practicable” that the duties to provide the health, safety and welfare at work of their employers and those affected by their undertakings are met.

Note: “SFAIRP and “ALARP” in terms of what they require of duty holders, is that the Health & Safety Executive considers that duties to provide health and safety so far as is reasonably practicable (SFAIRP) and duties to reduce risks as low as is reasonably practicable (ALARP) call for the same set of tests to be applied. However, SFAIRP and ALARP are not always interchangeable because legal proceedings will have to employ the particular term cited in the relevant legislation. Network Rail’s policy in this regard is detailed in Section 3.5 of the H&SMS.

System

A combination of apparatus, appliances and components designed and combined by a single body, which is intended to be installed and operated as a single functional unit to perform a specific task.

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5 Abbreviations

Abbreviations considered helpful to the understanding of this standard are provided in Table 1.

ALARP	As low as reasonably practicable
CE	Symbol denoting compliance with all relevant EU Directives
DC	Direct current
DoC	Declaration of Conformity
EMC	Electromagnetic Compatibility
EMI	Electromagnetic Interference
EN	European Norm
EU	European Union
ESM	Engineering Safety Management
GRIP	Guide to Railway Investment Projects
GS	Group Standard
HAZID	Hazard Identification
HMRI	Her Majesty's Railway Inspectorate
H&SMS	Health & Safety Management System
HQ	Network Rail Headquarters
MSG	Maintenance Support Group
NST	National Specialists Team
O&MM	Operations and Maintenance Manual
PRG	Project Review Group
ROGS	The Railway and Other Guided Transport Systems (Safety) Regulations 2006
SFAIRP	So far as is reasonably practicable

Table 1 – Abbreviations

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6 Introduction to the EMC Directive

The New EMC Directive came into force across the EU from 20th July 2007. The previous Directive remains in force until 2009, and so the Directives overlap by two years. The EMC Directive is not retrospective upon existing installations.

The essential protection requirements of the new EMC Directive remain unchanged:

- The electromagnetic disturbance generated by an apparatus does not prevent radio and telecommunications equipment, and other apparatus, to operate as intended;
- The apparatus has an adequate level of intrinsic immunity to electromagnetic disturbance to allow it to operate as intended.

The UK Statutory Instrument SI 2006 No. 3418: The EMC Regulations 2006, implementing Directive 2004/108 has been published and subsequently amended by Correction Slip in November 2007. Directive 2004/108 divides equipment into two categories: 'Apparatus' and 'Fixed Installations'.

The EMC Regulations 2006 cover both apparatus and fixed installations. 'Inherently benign equipment' is excluded from the scope, whether it is an apparatus, system or fixed installation. According to Statutory Instrument 2006 No. 3418 inherently benign equipment cannot contain semiconductors (such as rectifiers and transistors).

The important change concerning the railways is that fixed installations (which cover most railway assets) have been brought within the scope of the New Directive. A fixed installation is required to be installed with regard to the information on the intended use of its constituent parts and by applying good engineering practices, with a view to meeting the essential protection requirements of the EMC Directive. Engineering practices have to be documented, and the documentation held by the person responsible for the installation for as long as it is in operation. Apparatus intended specifically for a pre-defined installation is not required to undergo conformity assessment unless it is also commercially available on the market.

The New Directive aims to reduce the regulatory burden placed on manufacturers by the previous EMC Directive and makes the involvement of a Notified Body voluntary. Consequently greater care may be required by Network Rail when assessing relevant documentation submitted by manufacturers.

The implementation of the EMC Regulations does not alter the application of UK legislation regulating the safety of equipment or the safety of railway transportation systems. Therefore, Network Rail's compliance with the EMC Regs 2006 is addressed under our existing Health and Safety Management System (H & SMS).

7 Statement of Compliance

The following statements govern Network Rail's compliance status of its infrastructure assets:

Existing legacy installations are not subject to the new regulations.

Providing that existing processes for safety assurance and product and vehicle acceptance have been complied with and that the evidence required by the new regulation is readily available, then Network Rail presumes compliance with the essential requirements of the EMC Directive.

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For alterations to existing installations, the requirements of the EMC Regulations 2006 are met by demonstrating compliance with existing assurance procedures under Network Rail's Health and Safety Management System.

The Company's standards have been consistently updated to the 'state of the art' status as required by the new EMC Regulations by following best practice in the field as defined in harmonised European (EN) standards.

8 Responsibilities for managing EMC

The new EMC Regulations require the identification of a 'responsible person' for our installations. This person has a legal duty to provide evidence that a new installation is compliant with the requirements of the Regulations throughout the operational life of the installation. The 'responsible person' must either be competent in EMC engineering for both systems and installations, or have access to such skills.

For Network Rail, the Chief Engineer is designated as the EMC responsible person (the 'responsible person in relation to fixed installations' as defined in the EMC Regulations 2006) for our installations as required by the EMC Regulations 2006, as illustrated by the flow chart in Figure 1. During time of alterations to the infrastructure the designated responsible person on the project acts as the EMC responsible person until the handover of the changed installation to Maintenance is completed. For new and novel installations, the handover involves a safety case which is endorsed by the nominated representatives with delegated authority who have responsibility for assets that form part of the installation. Any maintenance for EMC forms part of the established Operational and Maintenance Manual.

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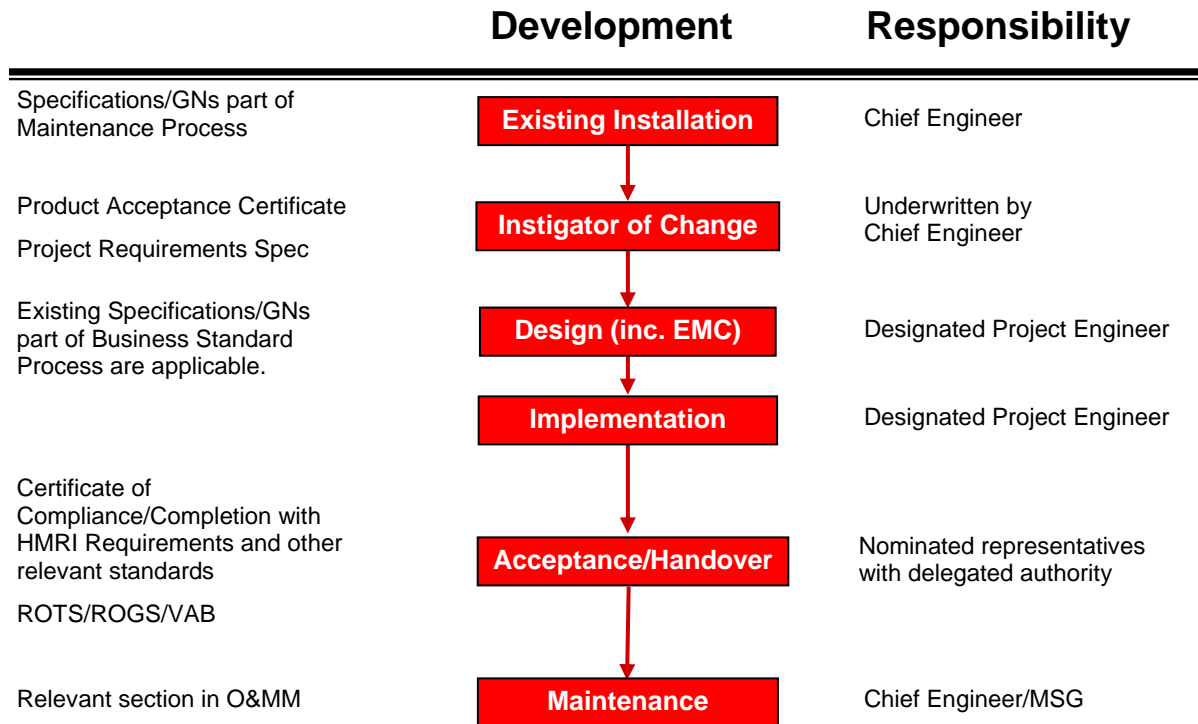


Figure 1 – Responsibility for EMC Management

The chart is operated through various stages of GRIP and is in line with Network Rail's H&SMS. For as long as the fixed installation or apparatus is in operation the responsible person shall be able, on request, to present to the enforcement authority (Department of Trade and Industry or OfCom for radio spectrum matters) evidence that it complies with the essential requirements of the EMC Directive 2004/108/EC. The evidence shall be structured in accordance with NR/L2/SIG/30041 and shall be archived in the records related to the installation in question in accordance with NR/SP/SIG/11201: *Signalling Design Production* for relevant installations. The evidence shall be appropriately referenced in the Health and Safety File for the project in relation to the installation.

9 Methodology for Demonstration of compatibility

Electromagnetic compatibility is normally demonstrated through testing. This involves measuring the emissions generated by equipment and demonstrating the immunity of equipment to externally generated disturbances relevant to the intended application environment.

Testing is normally performed on individual items of equipment or at a system level where that is practical. However, testing of installations to specifications is not practical and alternative methods have to be derived to meet the essential requirements of the EMC Directive. This is generally achieved through emission testing of representative parts of the installation, by adopting good installation practice and from knowledge of the results of immunity tests carried out on individual parts of the installation.

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Some tests cannot be applied because of the nature and use of the equipment. In such cases it may be necessary to impose stringent limits, and/or to undertake additional tests depending on the operating environment and the criticality of the installed equipment.

9.1 Railway Standards for EMC

The EM environment of a railway system is complex and it is important for the safe operation of such a system that the integrity of its command and control (C&C) systems is not compromised by interference. A systematic approach to EMC requires that all railway and near neighbour interfaces are defined, and personnel safety is addressed.

The relevant product EMC standard applicable to the railway environment is BS EN50121. The Code of Practice GM/RC/1500 as part of Railway Group Standards, is applicable to EMC at the interface between the railway and its environment, including public spaces, which is adequately addressed by demonstrating compliance with BS EN 50121-2.

The scope of BS EN50121 covers the frequency range from DC to 400 GHz. However, immunity requirements are only defined for specific phenomena below 150 kHz while emission requirements are only specified above 9 kHz and as such it doesn't cover the complete frequency range in its scope. This leaves a risk to EMC for our infrastructure which shall be addressed in accordance with NR/L2/SIG/30041.

With respect to degraded modes, the achievement of EMC in the context of safety shall preferably be approached in accordance with the principles of the Engineering Safety Management laid down in the Yellow Book. The demonstration of compatibility shall be a pass/fail criterion under all normal modes of operation.

The EMC Assurance Guide (NR/L2/SIG/30041) provides guidance on the EMC standards framework that can be applied for all equipment deployed on Network Rail's operational infrastructure before placing it in service.

9.2 Infrastructure susceptibility

Data on the EM susceptibility of rail infrastructure and the methodology for demonstration of compatibility with rolling stock within 3m of the centre of the nearest railway line are given in Network Rail's standards (Table 2).

These documents are updated regularly and information on their status and other related documents can be obtained from the EMC NST in the Engineering Directorate. Satisfying these requirements does not however guarantee that EMC will always be achieved. In some cases additional integration testing may be necessary.

For radiated emissions, Network Rail operates a telecoms clearance process which reduces the risk of interference from fixed radio transmitters to our most sensitive lineside systems to ALARP as detailed in NR/SP/TEL/30066: *Signalling and Telecommunications Telecoms Clearance for Fixed Transmitters*.

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The Infrastructure can also be affected through EMI generated externally such as lightning, 3rd party transmitters and EMI from cabling sourced or routed through a non-railway third party or neighbouring railways. Their effect on analogue or digital signal integrity should be defined by individual risk assessments in accordance with NR/L2/SIG/30041: *EMC Assurance Process for Network Rail*.

Standard Reference	Title
NR/SP/SIG/50002	Methodology for the demonstration of compatibility with single rail Reed Track Circuits on the AC railway
NR/SP/SIG/50003	Methodology for the demonstration of compatibility with Reed Track Circuits on the DC railway
NR/SP/SIG/50004	Methodology for the demonstration of electrical compatibility with DC (AC-immune) Track Circuits
NR/GN/SIG/50005	Methodology for the demonstration of compatibility with 50 Hz Single Rail Track Circuits
NR/SP/SIG/50006	Methodology for the demonstration of compatibility with 50 Hz Double Rail Track Circuits
NR/GN/SIG/50007	Methodology for the demonstration of compatibility with HVI Track Circuits
NR/GN/SIG/50008	Methodology for the demonstration of compatibility with TI21 Track Circuits
NR/GN/SIG/50009	Methodology for the demonstration of compatibility with FS2600 Track Circuits
NR/L2/SIG/50010	Methodology for the demonstration of compatibility with train detection systems in use on non-electrified lines
NR/SP/SIG/50011	Methodology for the demonstration of compatibility with Axle Counters
NR/SP/SIG/50012	Methodology for the demonstration of compatibility with TPWS trackside equipment
NR/GN/SIG/50013	Methodology for the demonstration of compatibility with Interlockings
NR/GN/SIG/50014	Methodology for the demonstration of compatibility with Lineside Equipment on AC and DC Railways
NR/SP/SIG/50015	Methodology for the demonstration of compatibility with Reed FDM Systems

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Standard Reference	Title
NR/SP/TEL/50016	Methodology for the demonstration of compatibility with Telecomms Systems
NR/GN/SIG/50018	Methodology for the determination of interaction with Neighbouring Railways

Table 2 – Network Rail Infrastructure Susceptibility

9.3 Installation rules

Failure to obtain EMC between individual railway systems can generate a risk to performance and/or safety.

Compliance with British and European harmonised standards for EMC does not cover all legal obligations.

The installation requirements specified by manufacturers with respect to EMC shall be reviewed prior to placing the equipment into service. It is also necessary to demonstrate that the equipment is to be installed in accordance with Network Rail's best practice for earthing and bonding in the intended environment. Any specific installation conditions, or variations from the manufacturer's installation requirements shall be defined on the Certificate of Acceptance for the relevant apparatus or system.

10 EMC National Specialist Team

The EMC NST is the centre of technical expertise within Network Rail. The purpose of the EMC NST is to advise on matters concerning EMC and to assist Projects and Area Delivery Units, to meet Network Rail's legal obligations under the EMC Regs (2006) and to help minimise operational difficulties caused by potential EMC phenomena by advising on EMI mitigation measures.

The EMC NST performs the assurance activities on behalf of the Engineering function by advising on EMC deliverables further detailed by NR/L2/SIG/30041 *EMC Assurance Process for Network Rail*.

The production of these EMC deliverables spans the project lifecycle and delivers the evidence required by the EMC Regulations.

The responsibilities of the EMC NST include the following activities with respect to NR's obligations under the EMC Regulations:

- Assisting projects in demonstrating compliance with the EMC Directive through advice on the process for EMC management.
- Developing knowledge of the EMC performance of railway systems and other hazards, and provide advice on any necessary action to prevent risks to safety or reliability due to EMI.
- Providing advice on standards and best practices to be used to demonstrate compliance, or to address issues arising in-service from EMI.

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- Supporting the development of project deliverables (EMC Strategy, EMC Control Plan and EMC Project File) as part of the Project Safety Case and the Project Health and Safety File.
- Checking that relevant standards have been used to mitigate or avoid hazards.

11 Summary remarks

This EMC strategy is intended as a high level policy document. Adherence to it will allow Network Rail to claim conformity to the EMC Directive. Compliance with the essential protection requirements of the EMC Directive is possible by considering the implications of the electromagnetic environment on the safety performance of the equipment (reliability and availability), identifying the best practice guides applicable to fixed installations and adequately addressing interference between individual railway systems.

Evidence produced in accordance with NR/L2/SIG/30041: *EMC Assurance Process for Network Rail* is required to satisfy the requirements of the EMC Regulations 2006.

Standards Briefing Note



Ref: NR/L1/SIG/30040	Issue: 1	Publication Date: 26/08/2008	Compliance Date: 01/12/2008
Title: Emc Strategy For Network Rail			
Standard Owner: Signal Engineering			
Non-Compliance rep (NRNC): Head Of Signal Engineering			

<p>Purpose: The purpose of this project is to address Network Rail's legal obligations under the EMC Directive and set high level EMC compliance statement.</p>	<p>The following teams require awareness briefing:</p> <ul style="list-style-type: none"> Executive Management Group <input type="checkbox"/> Commercial Property <input checked="" type="checkbox"/> Contracts and Procurement <input checked="" type="checkbox"/> Strategic Change <input type="checkbox"/> CTRL <input type="checkbox"/> 				
<p>Scope: The purpose of this Company Standard is to set out the strategy and responsibilities for the management of Electromagnetic Compatibility (EMC) related issues for Network Rail, to deliver compliance status with the EMC Regulations 2006.</p>	<p>Engineering</p> <ul style="list-style-type: none"> Asset Management <input type="checkbox"/> Civil Engineering <input type="checkbox"/> E&P Engineering <input checked="" type="checkbox"/> Enhancements Engineering <input checked="" type="checkbox"/> Ergonomics <input type="checkbox"/> Future Railway Programme <input checked="" type="checkbox"/> Ops Principles & Standards <input type="checkbox"/> Rail Vehicle Engineering <input checked="" type="checkbox"/> Railway Systems <input checked="" type="checkbox"/> Telecoms Engineering <input type="checkbox"/> Track Engineering <input type="checkbox"/> Signal Engineering <input checked="" type="checkbox"/> 				
<p>What's New/Changed: New Standard</p>	<ul style="list-style-type: none"> Finance <input type="checkbox"/> Funding <input type="checkbox"/> Govt & Corp Affairs <input type="checkbox"/> Human Resources <input type="checkbox"/> Information Management <input type="checkbox"/> Infrastructure Investment Crossrail <input type="checkbox"/> Track <input checked="" type="checkbox"/> Programme Management <input type="checkbox"/> Contracts & Procurement <input type="checkbox"/> HSEA <input type="checkbox"/> Sig. Power & Comms <input checked="" type="checkbox"/> WCRM <input checked="" type="checkbox"/> Construction <input type="checkbox"/> FTN/GSM-R <input checked="" type="checkbox"/> Thameslink <input checked="" type="checkbox"/> Enhancements <input checked="" type="checkbox"/> 				
<p>Affected documents:</p> <table border="0"> <thead> <tr> <th style="text-align: left;"><i>Reference</i></th> <th style="text-align: left;"><i>Impact</i></th> </tr> </thead> <tbody> <tr> <td>HEALTH AND SAFETY MANAGEMENT SYSTEM</td> <td>EMC Regs (2006) added</td> </tr> </tbody> </table>	<i>Reference</i>	<i>Impact</i>	HEALTH AND SAFETY MANAGEMENT SYSTEM	EMC Regs (2006) added	<ul style="list-style-type: none"> Legal Services <input checked="" type="checkbox"/>
<i>Reference</i>	<i>Impact</i>				
HEALTH AND SAFETY MANAGEMENT SYSTEM	EMC Regs (2006) added				
<p>Implementation requirements: <i>The following posts have specific responsibilities within this standard and shall receive technical briefing as part of the Implementation Programme:</i> Designated Project Engineers, Maintenance Engineers</p>	<p>Infrastructure Maintenance</p> <ul style="list-style-type: none"> Maintenance Areas <input checked="" type="checkbox"/> Operational Property <input type="checkbox"/> Overhead Condition <input type="checkbox"/> Renewals <input type="checkbox"/> 				
<p>For further information contact: Name: Maya Petkova Contact number: 085 78051 Email: Maya.petkova@networkrail.co.uk</p>	<ul style="list-style-type: none"> National Delivery Service <input type="checkbox"/> Network Development <input checked="" type="checkbox"/> Operations & Customer Services <input checked="" type="checkbox"/> Planning & Regulation <input type="checkbox"/> Safety and Compliance <input checked="" type="checkbox"/> Westwood <input type="checkbox"/> 				