WHITE PAPER

York EMC Services

Fixed Installations and the EMC Directive.

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Fixed Installations

This summer, I travelled on a railway which had no need for my services. *Le p'tit Train de Saint-Trojan* is a single-track, narrow-gauge, tourist line with three stations and big, painted wooden tokens for the drivers of the two diesel-engined locos to hand over as they shuttle back and forth all day. Most railways, however, are sufficiently complex that ignoring EMC is not a risk that can be taken by their operators.

The EMC requirements for Fixed Installations, including railways, stations and depots are regulated by the current EMC Directive (2004/108/EC), and its successor (2014/30/EU).

Network Rail standards set out the approach for effective management of EMC and the documentation of compliance; most other railways in the UK (for example, London Underground) have similar, explicit requirements. Rather than any one set of specific requirements, this article considers the overall philosophy of railway EMC management, which we've successfully applied to projects worldwide.

History – EMC and the Excluded Installation

Electromagnetic compatibility, the ability for all the systems in a particular environment to successfully operate within defined parameters, has been a special concern for railways ever since electrification. Running traction power for mile after mile down narrow corridors, in parallel with signalling and telecommunications cables, breaks one of the cardinal rules of EMC. This has been recognised for decades; BR 13422 was published in 1979.

Fast-forward to 1989 and the first EMC directive was focussed solely on apparatus. The UK's EMC Regulations referred to "excluded installations" (installations were *excluded* from the CE -marking requirements for apparatus), but it was left to non-binding guidance to flesh out what an installation operator needed to do to assure EMC. Not until the current Directive, 2004/108/EC, did the term Fixed Installation make an appearance, with its statutory, harmonised requirements.

Fixed Installations in the Railway

A railway is a complex set of interdependent systems with widely disparate requirements; they are shoehorned into long, narrow strips of land and expected to work together safely, reliably and effectively. A mainline loco might draw 200A from the overhead and simultaneously induce tens of volts into line-side cabling connected to safety-critical signalling assets or carrying low-level telecommunications. DC electrification, while protected from the gross effects of AC induction, brings its own issues, mainly surrounding stray

current (but the rectification process often causes ripple currents at 600 or 1200Hz, which can severely perturb baseband audio signals for PA or station's remote help systems). Without proactive management of compatibility, issues are simply being saved up for the flurry of activity that marks the commissioning phase.

The EMC directive requires that a Fixed Installation be suitably (non-) emissive for its environment, suitably immune for its purpose, that it is installed using good engineering practices and respecting the information on the intended use of its components, and that the good engineering practices are documented, with the documentation held at the disposal of the relevant national authorities for inspection for as long as the installation is in operation. By the way, don't be fooled by the reshuffle in the new directive; in 2014/30/EU, the documentation requirements for installations have

simply been moved (from Annex I to Article 19), and are as binding as the documentation requirements for apparatus.

However, the documentation requirements are not comprehensively set out, and differing interpretations from various stakeholders, and differing on-the-ground requirements for each particular project mean that there isn't a simple, template that can be used to extrude uniform EMC documentation for each project. Unfortunately, this occasionally means that EMC is ignored, postponed or forgotten until a few weeks before, or (in extreme cases) after, commissioning. At this point, the phrases you hope not to hear from your emergency EMC consultant are similar to those from an emergency plumber: “who put that there?”, “well, I wouldn't have done it like that”, and “it's no good, it'll all have to come out”.

Assuring EMC for a Railway Project

The latest Network Rail philosophy for managing EMC prefers explicit input from the early stages (GRIP 2 or 3), while there is still a level of fluidity about how the project will be successfully achieved. The EMC consultant will be involved with setting and assessing EMC hazards in the risk register. An EMC strategy can set overall goals, constraints and direction at this stage.

At GRIP 4, a multi-disciplinary hazard identification workshop will re-evaluate the EMC hazards on the risk register, and an EMC management plan can specify appropriate standards for both procurement and design, and controls to manage third-party and legacy assets. At this stage, the EMC consultant can provide targeted, specific advice which can still be heeded before the design is finalised. EMC procurement specifications can also be set *before* off-the-shelf components are chosen, or contracts with sub-contractors are signed: technical and documentation requirements for suppliers can be more easily made a contractual matter.

GRIP 5 should see any design risks closed out, possibly

with cable studies to model induced voltages. Ideally, procurement review should occur as systems and suppliers are chosen – with the most complex sub-systems undergoing a microcosm of this EMC management. However, this may be more difficult in situations where there is an abrupt hand-over from GRIP 5 designer to GRIP 6 contractor.

On-site EMC measurements, that most conspicuous of EMC activities, may be required. This depends on whether there are specific risks in the register which are most effectively closed via such measurements. As well as measurements to EN 50121, measurements of induced longitudinal and transverse (including psophometric) voltages may be required on line-side cables. On DC railways, measurements of stray currents may be required. The commissioning phase can be fraught; having the EMC testing requirements specified, agreed, booked and confirmed well in advance pays dividends all round.

The final stage of EMC documentation ensures that no issues remain open, but also summarises the activities and the documentation; this helps any EMC lessons to surface, which in turn helps ensure the safety, reliability and effectiveness of the railway.

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Want to learn more?

Why not consider attending our **EMC in Railways** training course. This 5 day course is designed to deliver an in-depth study of EMC in the complex railway environment. It provides an understanding of the importance of managing EMC from project concept to completion.

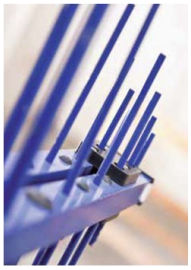
The legal EMC requirements will be explained and how these are satisfied by use of standards and the Technical Documentation.

The course includes general EMC background topics such as EM waves and radiation, decibels, the EMC Directive and commercial standards. Railway specific topics include an introduction to railway EMC standards, overview of signalling, threats and AC and DC traction.

The course also covers technical documentation, interoperability and EMC management throughout the project.

The New Legislative Framework (NLF), and the new EMC Directive 2014/30/EU which comes into force on 20th April 2016, are also presented, bringing you fully up to date with current and future requirements.

For more information please visit our website www.yorkemc.com.



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