SUB-GROUP “EUROBALISE”
(Alstom, Bombardier, Siemens)

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The objective was to deal with EMC issues not covered by the UNISIG subset 036 defining requirements and performance for wayside and on-board Eurobalise equipment.
Eurobalise Transmission System

On-board equipment

Eurobalise antenna

Up Link

Down Link

27MHz

4.23MHz

Air gap

Equipment on track

Beacon

Remark: The Eurobalise transmission system uses magnetic field for data transmission
Extract from chapter 6.7 related to EMC requirements for ERTMS antennas

« 6.7.4 In-band Susceptibility
The Eurobalise On-board Transmission Equipment shall be able to operate compliantly with this Norm, when being exposed to the radiated noise of transient burst nature that is typically present in the air-gap during the normal train operation, due to emission from electrical traction drives, cables, and engines.

Shape of such noise bursts, time duration, and frequency distribution are among the most prominent features affecting the susceptibility characteristics of the On-board Transmission Equipment. They are strongly dependent on the type of electrification and of the electrical/electronic devices in actual use.

The noise level in the air-gap zone is generally dependent on the geometry and the position of the possible noise sources (radiating cables, reflecting surfaces, etc.), with respect to the position chosen for the Antenna Unit installation.

No harmonised standards exist to date on this kind of susceptibility issue. Therefore, each supplier of On-board Transmission Equipment shall responsibly define suitable models representing worst case susceptibility conditions and modes (with reference to the recalled ones) that may be possible within the range of application cases of his commercial interest. The definition of the noise environment and the suitability of the elaborated models are a matter of shared responsibility between suppliers of On-board Transmission Equipment, rolling stock devices, and infrastructure devices. Specific compatibility cases may be needed (to be decided on a case by case basis).

The supplier of the On-board Transmission Equipment shall then coherently prove the fulfilment of the functionality and the availability requirements for the On-board Equipment, as defined in this Norm, by adequate simulation of such worst case susceptibility conditions and modes during functional Laboratory Tests. »
Concrete objectives

- As mentioned in the subset there is no harmonized standard on the susceptibility of the Eurobalise equipment but there is either no EMC standard for limiting the emissions generated by the rolling stock at the location of the Eurobalise antenna.
- It is nevertheless with this kind of requirements that we could equip any train with any Eurobalise equipment being sure of their compatibility and without having to demonstrate again everything.
- Accordingly the concrete objectives of the Eurobalise Sub-Group was to prepare the two following documents:

  - 1st document on immunity requirements for Eurobalise on-board reception equipment
  - 2nd document on emission requirements for rolling stock

Including both limits and test methods
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Susceptibility tests

Preliminary remark:

Testing the complete system (on-board equipment + balise) does not correspond to the reality as any kind of balise can be associated with any kind of on-board equipment.

Accordingly the immunity requirements which have been proposed apply only to the on-board equipment.
Principle of susceptibility tests

Verification of functional criteria (BER, balise detection, …)

BTM

Injection clamp

Generator

Amplifier

Test signal (ERTMS telegrams) generator

Reference loop

Test signal

Wide Loop Antenna 1.2mx1.2m

Noise

current
**Principle of susceptibility tests**

Several test campaigns have been performed.

![Diagram showing a reference loop, an injection clamp, a WLA, and an antenna.](image)
Proposal of Immunity limit (on-board antenna)

<table>
<thead>
<tr>
<th>Frequency MHz</th>
<th>Immunity Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-3</td>
<td>110 dBµA/m</td>
</tr>
<tr>
<td>3-6</td>
<td>70 dBµA/m</td>
</tr>
<tr>
<td>6-9</td>
<td>40 dBµA/m</td>
</tr>
</tbody>
</table>
Emission tests

The following test instrumentation and test procedure are proposed to evaluate the disturbances generated by trains at the location of the Eurobalise on-board antenna.

- Magnetic Field Probe 200mmx200mm
- Rectifier
- Pass-band filter
- Quasi-Peak detector
- Evaluation box

Level to be compared with the threshold
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The RAILCOM documents have been already offered to UNISIG which had created in parallel to RAILCOM a working group with more or less the same task.

To avoid double works, two common UNISIG/RAILCOM meetings have been held.

During the 2nd common technical meeting held on 25 September 2008 in Brussels, the RAILCOM documents have been discussed.