Specification

ETCS Trackside Equipment

Version 1.0

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Standard governance

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Document history

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Preface

The Asset Standards Authority (ASA) is a key strategic branch of Transport for NSW (TfNSW). As the network design and standards authority for NSW Transport Assets, as specified in the ASA Charter, the ASA identifies, selects, develops, publishes, maintains and controls a suite of requirements documents on behalf of TfNSW, the asset owner.

The ASA deploys TfNSW requirements for asset and safety assurance by creating and managing TfNSW’s governance models, documents and processes. To achieve this, the ASA focuses on four primary tasks:

- publishing and managing TfNSW’s process and requirements documents including TfNSW plans, standards, manuals and guides
- deploying TfNSW’s Authorised Engineering Organisation (AEO) framework
- continuously improving TfNSW’s Asset Management Framework
- collaborating with the Transport cluster and industry through open engagement

The AEO framework authorises engineering organisations to supply and provide asset related products and services to TfNSW. It works to assure the safety, quality and fitness for purpose of those products and services over the asset's whole-of-life. AEOs are expected to demonstrate how they have applied the requirements of ASA documents, including TfNSW plans, standards and guides, when delivering assets and related services for TfNSW.

Compliance with ASA requirements by itself is not sufficient to ensure satisfactory outcomes for NSW Transport Assets. The ASA expects that professional judgement be used by competent personnel when using ASA requirements to produce those outcomes.

About this document

This specification defines the requirements for the European train control system (ETCS) trackside subsystem equipment along with specific configuration and installation requirements.

This specification supersedes the RailCorp specification SPG 1610 ETCS Level 1 Trackside Equipment, version 1.0.

The requirements from the RailCorp specification that are incorporated into this specification have been rewritten to meet an expanded scope and the new ETCS baseline.

This specification is a first issue.
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1. Introduction

The TfNSW rail systems strategy has adopted deployment of European train control system (ETCS) on the TfNSW metropolitan passenger heavy rail network. ETCS provides a common set of specifications for interoperable automatic train protection (ATP) products.

ETCS is made up of a trackside subsystem and an onboard subsystem.

Specifications, standards and documentation for ETCS are available from the European Union Agency for Railways via their website www.era.europa.eu. ETCS forms part of the European rail traffic management system (ERTMS). Documentation for ETCS is included as part of ERTMS.

The amendments to the adopted ETCS baseline defined in this document have been identified as a result of stakeholder consultation, strategy, interface requirements, compatibility issues and 'open points' in the ETCS standards.

2. Purpose

This document adopts the requirements for ETCS trackside subsystem equipment based on the documentation published by European Union Agency for Railways. Amendments required for the interface and application on the TfNSW metropolitan passenger heavy rail network are defined with reference to the ETCS baseline where appropriate.

This document provides the basis for selection and approval of equipment and generic requirements for the design and application of ETCS trackside equipment to the trackside infrastructure.

2.1. Scope

This document covers the signals and control systems selection criteria, configuration and application of new ETCS trackside equipment to the TfNSW metropolitan passenger heavy rail network. ETCS trackside equipment forms part of the trackside subsystem defined in the ERTMS/ETCS system requirements specification.

ETCS level 2 requirements are not fully defined as level 2 is not planned for implementation using the currently nominated baseline.

Forecast requirements for potential implementation of automatic train operation (ATO) are not covered by this document. Specific requirements for ATO will be defined after the inclusion of ATO into the ETCS documents published by the European Union Agency for Railways.

All ETCS trackside subsystem equipment and support tools are covered by this document, irrespective of the ETCS level, mode, functionality or configuration being provided.
2.2. **Application**

This document applies to new applications of ETCS to trackside infrastructure. Alterations made to existing ETCS installations apply the ETCS baseline for that installation or update the installation to current standards and specifications based on asset maintenance considerations.

This specification applies to the heavy rail transport mode.

3. **Reference documents**

The following documents are cited in the main section of this document. For dated references, only the cited edition applies. For undated references, the latest edition of the referenced document applies.

**European Union Commission Decision**

CCS technical specification for interoperability (TSI) as defined in European Union Commission Decision 2015/14 using Set of specifications # 2 (ETCS baseline 3 and GSM-R baseline 0)

*Note: The specifications are available from the European Union Agency for Railways website.*

**International standards**

IEC 60050-161 International electrotechnical vocabulary – Part 161: Electromagnetic compatibility

IEC 60050-192 International electrotechnical vocabulary – Part 192: Dependability

IEC 60050-821 International electrotechnical vocabulary – Part 821: Signalling and security apparatus for railways

IEC 60228 Conductors of insulated cables

IEC 62236-4 Railway Applications – Electromagnetic compatibility – Part 4: Emission and Immunity of the signalling and telecommunications apparatus

IEC 62278 Railway Applications – The Specification and Demonstration of Reliability, Availability, Maintainability and Safety (RAMS)

IEC 62279 Railway applications – Communication, signalling and processing systems – Software for railway control and protection systems

IEC 62280 Railway Applications – Communications, Signalling and Processing Systems – Safety-related Communication in Transmission System

IEC 62425 Railway applications – Communication, signalling and processing systems – Safety related electronic systems for signalling
4. Terms and definitions

The following terms and definitions apply in this document:

- **ATO** automatic train operation (IEC 60050-821, 821-09-01)
- **ATP** automatic train protection (IEC 60050-821, 821-08-01)
- **baseline** an approved set of specifications for a system
- **BRB 930** a signalling safety relay built to a British rail specification
- **CBI** computer-based interlocking (for railway signalling)
  
  *Note: CBI is also known by the general abbreviation for railway interlocking IXL.*
- **CCS** control-command and signalling
- **CENELEC** European Committee for Electrotechnical Standardization
- **current legal reference** the latest CCS TSI adopted by the European Union by a Commission decision
EC European Commission

EMC electromagnetic compatibility (IEC 60050-161, 161-01-07]

EMI electromagnetic interference (IEC 60050-161, 161-01-06)

ERIENE European integrated railway radio enhanced network

ERTMS European rail traffic management system – includes ETCS and ERIENE

ETCS European train control system

ETCS B3 MR1 ETCS baseline 3 maintenance release 1

ETCS B3 R2 ETCS baseline 3 release 2

European Union Agency for Railways successor to the European Railway Agency (ERA)

GSM-R global system mobile for railways

IEC International Electrotechnical Commission

IP internet protocol

IP ingress protection (AS 60529)

ISA independent safety assessor

LEU lineside electronic unit

LSZH low smoke zero halogen

MTBF mean time between failures, also known as mean operating time between failures (IEC 60050-192, 192-05-13)

Note: MTBF is used as the general term. Mean time to failure (MTTF) (IEC 60050-192, 192-05-11) is the applicable term if the equipment is not repairable.

RAM reliability, availability and maintainability

RAMS reliability, availability, maintainability and safety (IEC 62278)

RBC radio block centre

RISSB Rail Industry Safety and Standards Board

SUBSET an ETCS specification

TMS traffic management system

THD total harmonic distortion

TSI technical specification for interoperability

UVR ultra violet radiation
5. **European train control system baseline**

All ETCS trackside equipment shall comply with the European Union 'technical specification for interoperability (TSI) relating to the control-command and signalling subsystems (CCS TSI)' with amendments and additional requirements defined in this specification.

The current baseline for ETCS trackside equipment is the European Union Commission Decision 2015/14 that amends Decision 2012/88/EU. Set of specifications #2 (ETCS baseline 3 and GSM-R baseline 0) are applied. This is commonly known as ETCS B3 MR1 (SRS3.4.0).

The application date for TfNSW shall be the issued date of this document instead of the dates defined in Article 1, section 7.3.3 and article 3 of the European Union Commission Decision.

This document will be reviewed when the current legal reference for ERTMS is updated on the European Union Agency for Railways website. The aim of the review is to consider adoption of the revised current legal reference as the ETCS baseline. Compatibility with the existing trackside infrastructure will be the primary consideration for adoption of the revised current legal reference for ERTMS. ETCS B3 R2 has been considered and not yet adopted due to the potential impact on current ETCS implementation projects.

Compliance with the associated ‘supporting informative specifications’ for the TSI CCS Application Guide as published on the European Union Agency for Railways website is expected. Suppliers of ETCS trackside equipment shall identify any non-compliances for their equipment for evaluation as part of type approval.

This document includes amendments and additions for trackside requirements that shall be incorporated in the ETCS equipment fitted to the trackside infrastructure.

Amendments to the ETCS baseline are only made by TfNSW standards and specifications that specifically nominate the requirements as amending the TfNSW implementation of ETCS baseline.

T HR SC 00006 ST Rolling Stock Signalling Interface Requirements also defines amendments and additions related to the interface between rolling stock and trackside. Requirements stated in T HR SC 00006 ST take precedence over this document in the case of conflict.

6. **Certification**

The equipment shall have evidence of conformity as required for operation in the European Community. This typically includes the following evidence:

i. EC declaration of conformity for the interoperability constituents of the CCS TSI by the manufacturer

ii. quality management system approval certificate based on module CH1 from a notified body
iii. EC design examination certificate based on module CH1 from a notified body

iv. evidence of conformity to CENELEC Railway Standards produced by an independent certification body

The equipment shall be supported by evidence of compliance with the standards required by this specification.

Equipment that is not in-service as part of a multi-vendor ETCS rail environment shall be tested to certify compatibility with existing ETCS equipment as configured for the TfNSW environment.

The equipment shall have a TfNSW type approval for use in the application. Type approval is in accordance with T MU MD 00005 GU Type Approval of Products.

7. Common requirements amendments

Requirements that are common for a range of equipment are specified in T HR SC 01000 SP Common Signals and Control Systems Equipment Requirements. Common equipment requirements apply to individual equipment types unless specifically excluded or amended for the particular equipment type.

7.1. Reliability, availability, maintainability and safety framework

The reliability, availability, maintainability and safety (RAMS) framework for the design, manufacturing, supply and repair of the ETCS equipment shall be performed in accordance with the ETCS baseline requirements. Particular performance requirements not defined in the ETCS baseline requirements are defined in T HR SC 01000 SP and the section in this document applicable to the equipment.

7.2. Electromagnetic compatibility framework

The electromagnetic compatibility (EMC) framework set by the ETCS baseline shall take precedence over the EMC framework specified in T HR SC 01000 SP in the case of conflict between the requirements. The EMC requirements defined in T HR SC 01000 SP and the equipment specific part of this document detail compatibility requirements for the interface to the TfNSW heavy rail network.

7.3. Human factors framework

ETCS equipment has been designed and certified in compliance with the human factors framework required by the ETCS baseline. Meeting the additional human factors framework requirements defined in T HR SC 01000 SP is not expected to require alteration to ETCS equipment. This is only expected to affect the application and configuration of the equipment for use on the TfNSW metropolitan passenger heavy rail network.
7.4. **On-line support tools**

The lineside electronic unit (LEU) and Eurobalise equipment shall have portable on-line support tools for configuration, diagnostics and maintenance that comply with T HR SC 01000 SP.

The radio block centre (RBC); key management and interface to the transmission system shall have permanently installed on-line support tools for configuration, diagnostics, maintenance, event recording and management of alarms and warnings. These on-line support tools shall comply with T HR SC 01000 SP.

7.5. **Off-line support tools**

Off-line support tools shall be available for the creation, maintenance, assurance and testing ETCS trackside data. The off-line support tools shall be configurable to comply with TfNSW specific application rules.

Off-line support tools shall be available for the simulation testing of ETCS trackside data in combination with the ETCS onboard configuration data. The off-line support tool for simulation testing shall provide for comprehensive testing of a wide range of operational scenarios.

The off-line support tools shall comply with T HR SC 01000 SP.

8. **Lineside electronic unit**

An LEU controls the telegrams transmitted to the train through the controlled Eurobalises.

The LEU is railway-specific equipment. The LEU shall comply with Section 5, Section 6 of this specification and the common requirements defined in T HR SC 01000 SP.

RAMS for the LEU shall include the compiler for application data and the supporting process for configuring an LEU with the application data for a particular site.

The LEU equipment shall be designed to meet the RAMS and expected life requirements when installed in a cubicle, shelter or building providing the environment defined in IEC 62498-3 *Railway Applications – Environmental conditions for equipment – Part 3: Equipment for signalling and telecommunications*. The environmental conditions clarifications in T HR SC 01000 SP apply. Temperature control is not normally provided in shelter style locations.

Physically, the LEU shall comply with the following:

i. be designed for use in a location case which provides a degree of protection to IP23 or better in accordance with AS 60529

ii. fit in an existing single width location case that is half full with existing equipment

*Note: The maximum size to fit in an existing single width location case is estimated as 330 mm deep, 450 mm wide and 600 mm high.*
Note: interface equipment able to be mounted separately is not included in this volume.

The LEU power load shall be less than 40 VA under worst case loading for the LEU, with six inputs on, one Eurobalise output active and all telecommunication links active.

The LEU shall have inputs to detect the status of safety critical functions. These inputs can be local direct inputs, local signal light current detection inputs, remote inputs from another LEU or remote inputs from a computer-based interlocking (CBI).

In general, the inputs shall comply with the following:

iii. react to input changes from off to on and from on to off in less than one second
iv. have a configuration option for the stability time for inputs
v. Unstable inputs transition to a failed state after the stability time expires
vi. update the telegram sent to the Eurobalise within two seconds of the actual source input change
vii. be rated for insulation coordination in accordance with IEC 62497-1 *Railway Applications – Insulation Coordination – Part 1: Basic Requirements – Clearances and Creepage Distances* for all parts of the LEU
viii. be configured or configurable for timing characteristics of input responses of the signalling safety system
ix. have safety critical usage and constraints detailed in the supplier’s documentation
x. support a minimum of six independent inputs of the same type

Local direct digital inputs interface shall have the following features:

xi. detect the ‘made’ and ‘not made’ state of BRB 930 series Signalling Safety relay contacts
xii. provide sufficient wetting current and potential to maintain BRB 930 relay contacts in good order

*Note: Wetting current is considered to be 2 mA at 120 V ac, 5 mA at 50 V dc, 10 mA at 24 V dc, or 20 mA at 12 V dc initially, then at least 1 mA under steady state conditions while the circuit is energised.*

xiii. use input voltages of 12 V nominal or higher
xiv. have twice the number of inputs as the required independent inputs if complementary pair inputs are required for safety critical use
xv. support safety-critical input circuits that run external to a location case in a 1500 V dc electric traction environment
Note: Use of external cabling may need both legs of the input circuit to be switched to meet safety constraints.

xvi. have the electrical supply for contact detection or an input arrangement that is electrically isolated from the rest of the LEU

xvii. detect and react to a fault condition within three seconds

Local signal light current inputs shall comply with the following:

xviii. have signal light ac current detection threshold settings with two configurations either in the range of 120% of the maximum current in a failed state to 80% of the minimum fault-free current of each signal light type to be detected or at a value to confirm that the signalling interlocking control is requesting the illumination of the signal light

Note: Signal light current waveforms can vary from 50 Hz sine wave to two pulses rectified and irregular due to the use of LED signal lights. Up to 20% total harmonic distortion (THD) can occur on the supply voltage.

Note: Signal light currents for the existing types of signal light circuits range from 30 mA to 1000 mA.

xix. support maximum ac light currents of up to 2 A and circuit fusing of 4 A

xx. have supplier’s documentation providing evidence that there is no reduction in the integrity of signalling safety circuitry due to the use of the current sense arrangement

Note: Evidence is to include EMC considerations for inductive coupled and capacitive coupled currents and their potential impact on CBI light proving and CBI integrity tests.

xxi. have leakage currents between LEU and signal light circuit due to any and all coupling modes that are not able to affect the signal light circuit reliability or safety

Note: Supporting evidence is to consider capacitive coupling, inductive coupling, galvanic coupling and specific power supply arrangements. CBI equipment is the equipment most likely affected when it is used in the signal light circuit.

xxii. detect flashing light periods in the range of 860 ms to 1200 ms with an on duty cycle in the range of 57% to 75% for signal lights directly controlled by a CBI

xxiii. detect and respond in a predefined manner to inputs that are not in a valid state

xxiv. provide or support a facility to maintain signal light operation when the LEU is removed from service

xxv. detect and react a fault condition within 5 seconds

Note: Configurations that use LEU signal light current inputs as direct digital inputs are accepted.
Note: Fault condition reaction time for signal light inputs is longer than that for local direct inputs as these inputs need to support a flashing input state.

Remote inputs shall meet the following requirements:

xxvi. use a protocol that is included in the LEU safety case for use on both category 1 and category 2 networks in accordance with IEC 62280 Railway Applications – Communications, Signalling and Processing Systems – Safety-related Communication in Transmission System and supported by an independent safety assessor (ISA)

Note: The safety case requirements are defined in Section 7.1 the RAMS framework.

xxvii. add no more than one second delay to the response times for local inputs

The Eurobalise interface shall not require a circuit fuse for cable distances up to 1000 m in a 1500 V dc Electric Traction environment.

The LEU shall be able to manage at least 32 telegrams of the maximum telegram length.

The LEU shall continue to operate without any detrimental effect when a BRB 930 QN1 50 V dc relay is repeatedly ‘picked’ and ‘dropped’ within 50 mm of the LEU by means of two wires being scratched together. The position of the relay and wiring will be moved to test the full range of EMC coupling mechanisms. If the LEU is to use inputs driven by a power supply that also powers BRB 930 series relays, then the EMI caused from coupling by the means of that arrangement shall also be tested.

LEU maintainability shall be supported by the following:

xxviii. a hazard control measure shall be built into the LEU to prevent operation of the LEU when application data intended for a different LEU is installed

xxix. a hazard control measure shall be provided to prevent operation of the LEU when an incorrect version of the application data is installed

xxx. LEU configuration settings that may need to be set or checked by a maintainer during equipment replacement shall be clearly labelled

xxxi. LEUs shall provide active indications of correct operation without use of additional equipment

LEU reliability, availability and maintainability (RAM) performance shall satisfy the following requirements when installed in the environment defined unless varied by a particular requirement:

xxxii. The theoretical mean time between failures (MTBF) of the minimum compliant LEU configuration for failures that will delay a train moving through the area covered by the equipment shall be more than 20 years.

xxxiii. The mean active corrective maintenance time (MACMT) shall be less than 20 minutes. This includes all configuration, verification and validation activities.
The combined preventative maintenance and inspection or adjustment requirements shall be less often than once per year assuming the defined mission profile with less than 30 minutes duration per visit.

9. **Eurobalise**

Eurobalises transmit telegrams to the ETCS onboard subsystem fitted to trains. Telegrams can either be stored in the Eurobalise or provided by an LEU. Eurobalises are also known as balises. Eurobalises are installed on the rail track between the running rails.

Eurobalises are railway-specific equipment. Requirements for the acceptance, cabling and mounting of Eurobalises are defined in Section 9.1 through to Section 9.3.

9.1. **Acceptance criteria**

Specific Eurobalise acceptance criteria are as follows:

i. The Eurobalise shall be reduced size compliant with the requirements of class B in SUBSET-036.

   *Note: Class A Eurobalise is accepted. Mounting will be to class B requirements.*

   *Note: Controlled Eurobalise (also known as transparent, variable, commutable) may have fixed or pluggable cable connections.*

   *Note: RAM performance defined in SUBSET-036 applies.*

   *Note: Eurobalise interface ‘C4’ Eurobalise Blocking Signal Output is not required*

ii. Eurobalise shall support programming by means of the A5 interface (Airgap).

iii. The Eurobalise shall not require configuration via wiring, links or switches during maintenance or installation activities. Maintenance activities include Eurobalise replacement.

iv. Controlled (transparent, variable, commutable) Eurobalises with a fixed cable connection shall have a fixed cable length between 5.5 m and 8 m.

v. The Eurobalise shall be compatible with transverse mounting on a concrete bearer with fixings on the centre line of the long axis of the bearer. Transverse mounting has the shortest sides of the Eurobalise parallel with the rails.

   *Note: The smallest flat central part of a concrete bearer is 500 mm long and 250 mm wide. The flat part can be 55 mm below the foot of the rail. This means up to 225 mm below the top of rail level for 60 kg rail*

vi. Fixing holes shall be on the centre line of the long axis of the Eurobalise. The maximum bolt size for fixing shall be 16 mm diameter or less.
vii. Maximum depth/height of the Eurobalise shall be less than 65 mm.

viii. The Eurobalise shortest side shall be less than 1.5 times the concrete bearer width. That is, 375 mm.

ix. Meet the functional and the RAMS requirements when connected to any compliant LEU via a cable distance ranging from 10 m to 1000 m. The signal at the Eurobalise shall meet the SUBSET-036 requirements.

Note: If a cable distance longer that 1000 m is required then the solution shall be based on LEU, Eurobalise and maintenance AEO constraints and covered by a specific type approval.

x. RAMS for the Eurobalise includes the compiler for application data and the supporting process for configuring a Eurobalise with the application data for a particular site.

xi. The Eurobalise shall be supported by evidence that it meets life requirements in the ultraviolet radiation (UVR) from the sunlight environmental conditions defined in T HR SC 01000 SP.

Note: The cable between the LEU and Eurobalise is qualified by the Eurobalise supplier.

9.2. **Cable**

Cables from the LEU to the Eurobalise shall meet the following requirements:

i. designed for outdoor use in either pit and pipe or direct burial cable routes

ii. resistant to rodent and insect attack

iii. qualified by the Eurobalise supplier for operation with the cable distance between LEU and Eurobalise ranging from 10 m to 1000 m

Note: The connected LEU may not be from the same supplier as the Eurobalise.

Note: Total cable distance is to allow for a terminal arrangement to change between cable types on exit from LEU location; a terminal arrangement to change between cable types at a trackside location in close proximity to the Eurobalise; plus allowance for one joint in the fixed cable during the asset maintenance phase of the life cycle.

Note: An allowance of 20% of qualified distance for a single cable joint is accepted.

Note: Up to three different cable types may be used from the LEU to the Eurobalise. Up to 10 m of cable in the location, 1000 m of cable in a cable route and 30 m of cable from a trackside termination surface run to the Eurobalise mounted on track.

iv. have a fire safe; low smoke zero halogen (LSZH) version suitable for tunnel installations
v. have IEC 60228 class 2 stranded conductors or Class 5 flexible conductors when used in fixed cable routes  
vi. have IEC 60228 class 5 flexible conductors when used wholly within a location and for any surface run connection to a Eurobalise  
vii. have a minimum conductor size of 0.5 mm² to support existing termination practice  
viii. the static bending radius for fixed installation in cable routes shall be < 400 mm  
ix. the static bending radius for surface run cable shall be < 100 mm  
x. the static bending radius for use fully within locations shall be < 80 mm  
xi. have UVR protection if the cable could be exposed to sunlight due to its expected installation arrangement  
xii. be suitable for use within 3 m of running rails on a railway with 1500 V dc electric traction and traction currents of up to 4000 A for the qualified distance

9.3. Mounting

The Eurobalise mounting is used in a ground stationary, non-weather protected environment. It will be in permanent use with a daily thermal cycle. The operating environment is defined in ESC 200 Track System. The daily thermal variation is due to ambient temperature changes and solar radiation. A 30 °C rise due to solar radiation shall be provided for in the design. The Eurobalise mounting fixings shall be designed so that it is unlikely that they will need to be retightened during the operating life in the specified environmental conditions when correctly installed.  

To provide resistance against vandalism the fixings shall require the use of a tool for removal.  

The Eurobalise mounting arrangement shall be resistant to vandalism in accordance with the common requirements defined in T HR SC 01000 SP. At the completion of the tests, the arrangement will have passed if the Eurobalise is still securely mounted in compliance with the installation tolerances, and operational.  

The mounting arrangement shall be designed for a life equal to or better than the specified life for a fixed data Eurobalise as per Subset 036. Therefore, a minimum operational lifetime of 30 years is expected.  

The material used as part of the Eurobalise mounting system shall comply with Subset 036 requirements for the metal free volume surrounding the Eurobalise.  

The design shall control the impact of corrosion on fixings so that it is unlikely for a fixing to become seized and therefore that the Eurobalise or Eurobalise mounting cannot be removed normally when required during the operating life in the specified environmental conditions.
Shock and vibration shall be tested for the on sleeper track side position with the Eurobalise fitted.

Electrical insulation shall be provided as part of the Eurobalise mounting or inherently in the mounting arrangement.

If either end of the Eurobalise mounting is to be installed within 100 mm of a rail and the mounting system is longer than 750 mm, then electrical insulation shall be provided as part of the Eurobalise mounting. The electrical insulation shall be rated for 250 V ac based on IEC 62497-1 for outdoor use. The electrical insulation shall be provided as one continuous piece, at least 750 mm long or two separate pieces at least 750 mm apart. Each electrical insulation piece shall meet the full rating.

The Eurobalise mounting shall position the Eurobalise as specified in Subset 036.

Mounting position shall include an allowance for vertical rail wear and lateral rail wear. Rail wear limits are defined in ESC 220.

The Eurobalise shall be mounted in accordance with the tolerance for general application unless an exception for narrow curves installation or proximity metal masses is being applied.

A metallic cover over the Eurobalise is used in some situations to suppress the operation of the Eurobalise. The Eurobalise mounting shall not prevent use of a Eurobalise cover or be damaged due to fitting of a cover up to 5 kg in weight.

The Eurobalise mounting arrangement shall either support securing of the Eurobalise cable or not prevent securing the Eurobalise cable against damage.

The Eurobalise mounting shall comply with one of the following requirements:

- Support uninterrupted operation of mechanised track resurfacing machines (tamper, ballast regulator, stabiliser) and rail grinder through the section of track that has the Eurobalise fitted without damage to the Eurobalise or mounting arrangement.

- Provide easy removal and restoration with potential human error during restoration managed by the means of the human factors framework. Easy restoration actions shall be less than 5 minutes by one person for a Eurobalise that does not have a cable.

Eurobalise mounting in proximity to guard rails shall have insulated rail joints with 20 mm end posts fitted in each guard rail instead of the 20 mm air gap. The general arrangement shall be in accordance with Subset 036.

ESC 215 defines the structure gauge at rail level. Track maintenance limits permit guard rail height to be higher than the running rails. Subset 036 requires guard rails not to be higher than running rails.

Note: Specific installation controls are required to manage the guard rail height near a Eurobalise.
10. **Radio block centre**

The RBC provides messages to the ETCS onboard subsystem fitted to trains primarily based on information received from the signalling safety system.

RBCs are not planned for use without the application of ETCS B3 R2 or a later baseline.

The RBC is railway-specific equipment. The RBC equipment shall comply with Section 5 and have supporting certification as defined in Section 6 of this specification.

The RBC equipment shall comply with the common requirements defined in T HR SC 01000 SP with the following amendments.

The RBC equipment shall be designed to meet the RAMS and expected life requirements when installed in a shelter or building providing the environment defined in IEC 62498-3 with temperature control.

*Note: Temperature control may need to be provided to make the shelter or building suitable for the equipment.*

The RBC particular RAM performance shall satisfy the following requirements when installed in the environment defined above:

i. The theoretical MTBF for failures that will delay a train moving through the area covered by the equipment shall be more than 150 years.

ii. The theoretical MTBF for failures that require corrective action by the maintainer or operator shall be more than 3 months.

The protocol used between the RBC and the intended CBI shall meet the following:

iii. be IP-based

iv. be included the RBC safety case produced in accordance with IEC 62278, IEC 62279 and IEC 62425 that supports use on both category 1 and category 2 networks according to IEC 62280 that is supported by an ISA

v. be supported by both RBC and CBI without the use of a gateway or protocol conversion

vi. support redundant telecommunication links between the equipment for availability

vii. be tolerant of a 1 second reconvergence of the IP network as a result of disruption, equipment failure or transmission system failure on one of the redundant telecommunications links

*Note: A subset 098 based protocol is typically used.*

*Note: The RBC to CBI protocol requirements defined above assume that they are separate equipment items. If they are integrated as the one equipment item then these requirements are not applicable.*
The CBI is defined in T HR SC 00719 SP Computer-Based Interlocking Equipment.

The transmission system that provides the telecommunication links is specified in T HR SC 01256 ST Telecommunication Transmission Systems for Signalling and Control Systems.

The RBC shall provide an interface to a traffic management system (TMS). This interface is to provide information about trains in the RBC area and support emergency messages. The RBC equipment supplier shall share information with the provider of a TMS being used by TfNSW or being procured by TfNSW to enable an interface protocol supported by the RBC equipment to be used for the interface between the RBC and TMS.

The RAMS for the RBC shall include the compiler for application data and the supporting process for configuring an RBC with the application data for a particular site.

A hazard control measure shall be built into the RBC to prevent operation of the RBC when application data intended for a different RBC is installed.

A hazard control measure shall be provided to prevent operation of the RBC when an incorrect version of the application data is installed.

Application data for a particular site shall be able to be stored and used from a separate storage medium.

The RBC shall have facilities to support maintenance and investigation of incidents. The facility shall be a single integrated facility that covers the trackside subsystem equipment, the key management, the interface to the transmission system, the telecommunication link status and the information reported by the onboard subsystem. All event records shall be retained for at least 90 days. The maintenance facility shall provide graphical displays and text-based displays to support the maintainer carrying out corrective action.

11. Key management

Key management provides the cryptographic keys used for the radio communications between the RBC and ETCS onboard subsystems.

Key management is not intended for use without the application of ETCS B3 R2 or a later baseline.

The key management equipment shall comply with the common requirements defined in T HR SC 01000 SP with the following additions and amendments.

The key management equipment shall be designed to meet the RAM and expected life requirements when installed in a building providing the environment defined in IEC 62498-3.
The key management equipment particular RAM performance shall satisfy the following requirements when installed in the environment defined above:

i. The theoretical MTBF for failures that would delay a train moving through the area covered by the equipment shall be more than 300 years.

ii. The theoretical MTBF for failures that require corrective action by the maintainer or operator shall be more than 6 months.

The key management equipment shall comply with Section 5 with certification as defined in Section 6.

Application data for a particular site shall be able to be stored and used from a separate storage medium.

12. Interface to transmission system

The interface to transmission system equipment is either separate to the RBC or integrated as part of the RBC.

The RBC combined with the interface to the transmission system shall support a mixed fleet of ETCS fitted trains with some having circuit switched global system mobile for railways (GSM-R) connections and others having packet switched GPRS, VHF or similar TCP-IP based connections.

*Note: RBCs are not planned for use without the application of ETCS B3 R2 or a later baseline.*

The interface to the transmission system equipment shall comply with the common requirements defined in T HR SC 01000 SP with the following additions and amendments.

The transmission system interface equipment shall be designed to meet the RAM and expected life requirements when installed in a shelter or building providing the environment defined in IEC 62498-3 with temperature control.

*Note: Temperature control may need to be provided to make the shelter or building suitable for the equipment.*

The transmission system interface equipment particular RAM performance shall satisfy the following requirements when installed in the environment defined above:

i. The theoretical MTBF for failures that would delay a train moving through the area covered by the equipment shall be more than 300 years.

ii. The theoretical MTBF for failures that require corrective action by the maintainer or operator shall be more than 6 months.

The equipment providing the interface to the transmission system shall comply with Section 5 with certification as defined in Section 6.
Application data for a particular site shall be able to be stored and used from a separate storage medium.

13. **Additional functionality**

The utilisation of ETCS level 2 to provide functionality beyond that defined in the ETCS baseline is being analysed.

The additional functionality most likely to be requested that may impact ETCS trackside equipment is as follows:

i. ETCS level 2 equipment shall support functionality to implement and manage temporary speed restrictions from a centralised location.

ii. ETCS level 2 equipment shall support functionality to restrict movement of trains operating in ETCS Level 2 into worksites on the rail network. This functionality is to protect workers from the hazard of being hit by a train.