TS 05266:1.0

T HR SC 01650 SP

Specification

ETCS Onboard Equipment

Issue date: 24 April 2025

Effective date: 24 April 2025

Disclaimer

This document has been prepared by Transport for NSW (TfNSW) specifically for its own use and is also available for use by NSW public transport agencies for transport assets.

Any third parties considering use of this document should obtain their own independent professional advice about the appropriateness of using this document and the accuracy of its contents. TfNSW disclaims all responsibility and liability arising whether directly or indirectly out of or in connection with the contents or use of this document.

TfNSW makes no warranty or representation in relation to the accuracy, currency or adequacy of this document or that the document is fit for purpose.

The inclusion of any third party material in this document, does not represent an endorsement by TfNSW of any third party product or service.

For queries regarding this document, please email Transport for NSW Asset Management Branch at standards@transport.nsw.gov.au or visit www.transport.nsw.gov.au

Document information

Owner:	Director Signals and Control Systems Engineering Asset Management Planning, Integration and Passenger
Mode:	Heavy rail
Discipline:	Signals and control systems

Document history

Revision	Effective date	Summary of changes
1.0	10/09/2015	First issue with designation T HR SC 01650 SP ETCS Onboard Equipment
2.0	26/08/2021	Second issue – updated to improve consistency with other documents and clarification of requirements. The changes from the previous version include the following: • Incorporation of TN 027:2017 as Section 6.0 Certification, the following sections and subsections renumbered accordingly • Revisions to align with standards produced since the publication of the previous version • Minor clarification to some of the requirements.
1.0		First issue with designation TS 05266 superseding T HR SC 01650 SP ETCS Onboard Equipment version 2.0. Revision recommenced in line with the new designation. The changes from the previous version include the following: • Inclusion of additional requirements and clarifications for ETCS Level 2 • Inclusion of normative appendix that identifies text messages to be displayed to the driver on the DMI • Update to include DSP requirements for Level 2 • Update based on stakeholder consultation.

Preface

This specification is the first issue as TS 05266:1.0 and supersedes T HR SC 01650 SP *ETCS Onboard Equipment*, version 2.0.

This document specifies the requirements for ETCS onboard equipment, its configuration and installation for TfNSW.

Specifications, standards and documentation for ETCS are available from the EU Agency for Railways (formerly known as the European Railway Agency) website.

TfNSW is deploying ETCS Level 2, without lineside signals, to support reliable, high frequency operations. These recommendations have been adopted for implementation on the TfNSW metropolitan heavy rail network, the boundaries of which are defined in TS TOC 3.

Alterations and additions for TfNSW application to the base ETCS standards have been identified as a result of stakeholder consultation and interface limitations.

The changes to content from the previous version include the following:

- inclusion of additional requirements and clarifications for ETCS Level 2 based on DSP requirements and stakeholder consultation
- Inclusion of normative appendix that identifies text messages to be displayed to the driver on the DMI
- removal of requirements for bypass functionality
- revisions to align with standards produced since the publication of the previous version.

The terms ‘normative’ and ‘informative’ are used in asset standards to define the application of the appendices to which they apply. A ‘normative’ appendix is an integral part of an asset standard, whereas an ‘informative’ appendix is only for information and guidance. Appendix A in this document is a normative appendix.

Table of contents

1 Scope

This specification sets out the requirements for ETCS onboard equipment based on the CCS TSI documentation published by the EU Agency for Railways. Some EU requirements have been tailored for application on the TfNSW metropolitan heavy rail network.

This document provides the basis for selection and approval of equipment and generic requirements for the design and application of ETCS onboard equipment to rolling stock.

This document also covers the configuration and application of ETCS onboard equipment to rolling stock for operation on the TfNSW metropolitan heavy rail network operating in ETCS Level 0, Level 1 and Level 2.

Operation in NTC is not required. Operation in Level 3 is not currently planned. ATO requirements are yet to be considered.

Specific requirements for the fitment of ETCS to maintenance vehicles (except the mechanised track patrol vehicle) or freight rolling stock have not been considered in developing this document. These requirements should be expanded for freight by the equipment provider/installer until an update of this document to include requirements developed specifically for freight and other railway vehicle types is made.

2 Application

This document applies to ETCS onboard equipment for fitment to existing rolling stock or as part of new rolling stock, and any upgrades of fitted ETCS onboard equipment. A diagram of the ETCS onboard and its interfaces is shown in Figure 1.

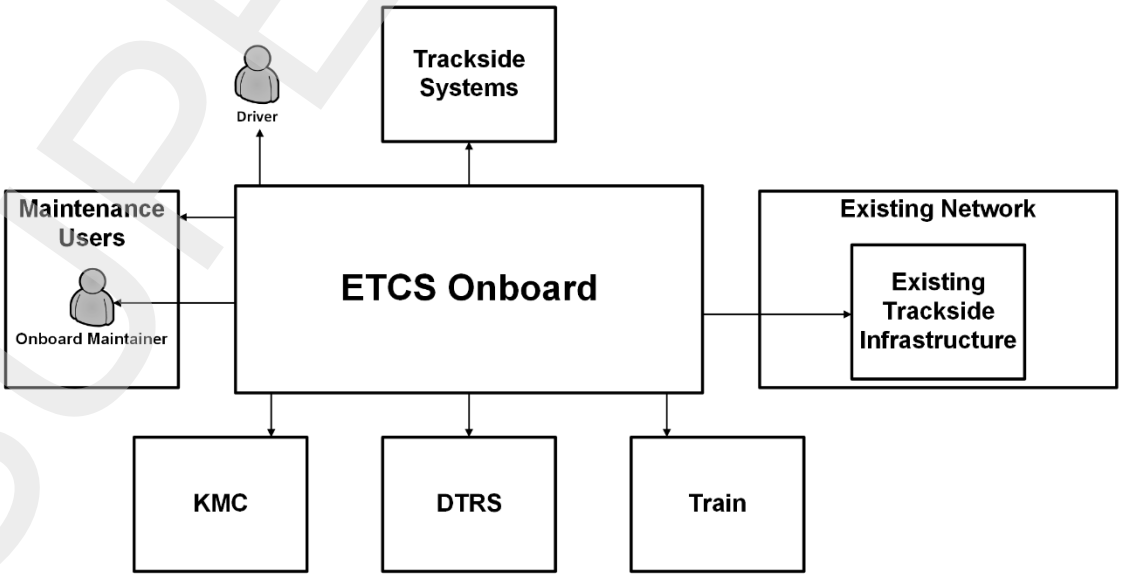

Figure 1 – ETCS onboard and interfacing systems

RSU160 of TS 04053 sets the rolling stock minimum operating standard for ATP.

This document aims to establish common ETCS onboard system requirements applicable across all fleet types.

Where clarification on the applicability of requirements is required, consultation should be undertaken with the Asset Management Branch Director of Signals & Control Systems Engineering. Clarification on the applicability of requirements for particular fleet may be needed for the following:

- New Fleet with ETCS equipment built into the train as a whole system
- Fleet not maintained by TfNSW
- Fleet that may also operate outside the TfNSW heavy rail network
- Incompatibility issues with any aspect of this standard.

3 Referenced documents

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

International standards

EN 50121 3-1 *Railway applications – Electromagnetic compatibility – Part 3-1: Rolling stock – Train and complete vehicle*

EN 50121 3-2 *Railway applications – Electromagnetic compatibility – Part 3-2: Rolling stock – Apparatus*

EN 50126 (all parts) *Railway Applications – The Specification and Demonstration of Reliability, Availability, Maintainability and Safety* (RAMS)

EN 50128 *Railway applications – Communication, signalling and processing systems – Software for railway control and protection systems*

EN 50129 *Railway applications – Communication, signalling and processing systems – Safety related electronic systems for signalling*

EN 50155 *Railway applications – Rolling Stock – Electronic equipment*

EN 50159 *Railway applications – Communications, signalling and processing systems – Safety-related communication in transmission systems*

EN 50343 *Railway applications – Rolling stock – Rules for installation of cabling*

ETSI TS 100 910 *Digital cellular telecommunications system (Phase 2+); Radio Transmission and Reception*

ETSI TS 101 349 *Digital Cellular Telecommunications System (Phase 2+); General Packet Radio Service (GPRS); Mobile Station (MS) – Base Station System (BSS) Interface; Radio Link Control/Medium Access Control (RLC/MAC) Protocol*

ETSI TS 102 933-1 *Railway Telecommunications (RT); GSM-R improved receiver parameters; Part 1: Requirements for radio reception*

ETSI TS 103 328 V1.2.2 *Railways Telecommunications (RT); GPRS/EGPRS Requirements for ETCS*

ETSI TS 136 141 *LTE; Evolved Universal Terrestrial Radio Access (E-UTRA); Base Station (BS) conformance testing*

ETSI TS 145 005 *Digital cellular telecommunications system (Phase 2+); Radio transmission and reception (3GPP TS 45.005)*

IEC 60571 *Railway applications – Electronic equipment used on rolling stock*

IEC 61709 *Electric components – Reliability – Reference conditions for failure rates and stress models for conversion*

Australian standards

AS/RISSB 7527 *Rolling Stock Event Recorders*

AS/RISSB 7722 *EMC Management*

Transport for NSW standards

TS 00026 *Ambient Environmental Conditions*

TS 00031.1 OT10 *Threat-Based Cyber Security Controls Part 1: Controls and Implementation Requirements*

TS 03984 *Electric Circuits and Equipment for Passenger Rolling Stock*

TS 03985 *Mounting and Installation of Electrical Equipment*

TS 03999 *Electronic Equipment for Rolling Stock*

TS 04000 *Cables for Passenger Rolling Stock*

TS 04002 *Environmental Conditions for Fleet Assets*

TS 04052 (T HR RS 00000 ST) *RSU 000 Series – Minimum Operating Standards for Rolling Stock – General Requirements*

TS 04053 (T HR RS 00100 ST) *RSU 100 Series – Minimum Operating Standards for Rolling Stock – General Interface Requirements*

TS 04058 (T HR RS 00600 ST) *RSU 600 Series – Minimum Operating Standards for Rolling Stock – Multiple Unit Train Specific Interface Requirements*

TS 04069 *RSU Appendix D – Train (Driver) Safety Systems*

TS 04976 (T MU HF 00001 GU) *Guide to Human Factors Integration*

TS 04977 (T HR HF 00001 ST) *Human Factors Integration – Rolling Stock*

TS 04978 (T MU HF 00001 ST) *Human Factors Integration – General Requirements*

TS 04990 (T MU SY 10010 ST) *Cybersecurity for IACS – Overview*

TS 04991 (T MU SY 10012 ST) *Cybersecurity for IACS – Baseline Technical Cybersecurity System Requirements and Countermeasures*

TS 05332 *Rolling Stock Signalling Interface Requirements*

TS 06178 (T MU MD 00005 GU) *Type Approval of Products*

TS 06208 *Time Synchronisation of Industrial Automation and Control Systems*

TS TOC 1 *Train Operating Conditions (TOC) Manual – General Instructions*

TS TOC 3 *Train Operating Conditions (TOC) Manual – Track Diagrams*

Legislation

Radiocommunications (Low Interference Potential Devices) Class Licence 2015 (Cth)

Radiocommunications (Electromagnetic Compatibility) Standard 2017 (Cth)

Other referenced documents

EIRENE UIC CODE 950, *Functional Requirements Specification*

ERA, 2020, *Opinion ERA/OPI/2020-2 of the European Union Agency for Railways to the European Commission regarding error corrections of current ERTMS baselines*

ERTMS_*Appendix-2_Glossary–EN.pdf*

European Commission, 2016, *Commission Regulation (EU) 2016/919 of 27 May 2016 on the technical specification for interoperability relating to the control-command and signalling subsystems of the rail system in the European Union*

UIC O-8664 ERTMS/GSM-R Operators Group, *ETCS in PS-mode GPRS/EGPRS Guideline 1.0*

4 Terms, definitions and abbreviations

The following terms, definitions and abbreviations apply in this document:

accelerated test test in which the stress level, or rate of stress application, exceeds that occurring under specified operational conditions, to reduce the duration required to produce a stress response (Source: IEC 60050-192:2015)

ACMA Australian Communications and Media Authority

AMB Asset management branch (a TfNSW organisation)

ASDO automatic selective door opening

ATO automatic train operation; a method of operation in which the movement of the train is automatically controlled without the intervention of a driver, who, if provided, exercises only a supervisory function (Source: IEC 60050-821:2017)

ATP automatic train protection; a system which supervises train speed and target speed, alerts the driver of the braking requirement, and enforces braking when necessary. The system may be intermittent, semi-continuous or continuous according to its track-to-train transmission updating characteristics.

Note: ATP is a generic term. ETCS is a common set of specifications for interoperable ATP products.

AUS Australia (with regards to UTC)

balise track mounted spot transmission unit that uses transponder technology. Its function is to transmit/receive messages to/from the train passing overhead. (Source: RISSB Glossary of Terms)

baseline an approved set of specifications for a system

B3 R2 commonly known as ETCS Baseline 3 Release 2 and GSM-R Baseline 1 as described in the Commission Regulation (EU) 2016/919

BP brake pressure

BTM balise transmission module

CCS control command and signalling

CENELEC European Committee for Electrotechnical Standardization

CMD cold movement detection; a system for detecting train movement when the train is powered down

DCS digital cellular system

DMI driver machine interface

DSP digital systems project

DTRS digital train radio system

EB emergency brake

EBI emergency brake intervention

EDOR ETCS data only radio

EIRENE European integrated railway radio enhanced network

EMC electromagnetic compatibility

EME electromagnetic exposure

EMI electromagnetic interference

EMPB emergency push button

EoA end of authority

ERA European railway agency

ERTMS European rail traffic management system

Note: ERTMS includes ETCS and EIRENE

ETCS European train control system

EU European Union

EVC European vital computer

FFFIS form-fit functional interface specification

FS full supervision (an ETCS mode)

field test a test carried out under user operational conditions (Source: IEC 60050-192:2015)

GPRS/EGPRS general packet radio service/enhanced general packet radio service is considered for the evolution of the transmission of ETCS Level 2

GSM global system for mobile communications

GSM-R global system for mobile communications – railways

IS isolation (an ETCS mode)

JRU juridical recording unit

KMAC authentication key (an ETCS cryptographic key)

KMC key management centre

KMS key management system

laboratory test a test made under prescribed and controlled conditions that may or may not simulate field conditions (Source: IEC 60050-192:2015)

LoA limit of authority

LRU line replaceable unit

LS limited supervision (an ETCS mode)

MART mean active repair time

MTBSAF mean time between service affecting failures

MTTRR mean time to restore redundancy

MTTRS mean time to restore services

NL non leading (an ETCS mode)

NP no power (an ETCS mode)

NTC national train control (an ETCS level)

PS-mode packet oriented data transmission that enables IP based technology

PT post trip (an ETCS mode)

RAM reliability, availability and maintainability

RAMS reliability, availability, maintainability and safety

RBC radio block centre

RIM rail infrastructure manager

RSU rolling stock unit

RISSB Rail Industry Safety and Standards Board

SB standby (an ETCS mode)

SBI service brake intervention

SF system failure (an ETCS mode)

SL sleeping (an ETCS mode)

SFAIRP so far as is reasonably practicable

SR staff responsible (an ETCS mode)

SUBSET an ETCS specification managed by the EU Agency for Railways

TCO traction cut-off

TfNSW Transport for NSW

THR tolerable hazard rate

TRN train running number

TS transport standard (TfNSW)

TSI technical specification for interoperability

UIC International Union of Railways; worldwide professional association representing the railway sector and promoting railway transport

UN unfitted (an ETCS mode)

UTC coordinated universal time

VBC virtual balise cover

5 ETCS baseline

The ATP applied to rolling stock shall be an ETCS Level 2 Class A train protection system in accordance with the CCS TSI available on the EU Agency for Railways website.

The ETCS Onboard subsystem shall comply with at minimum the mandatory specifications for ETCS Baseline 3 Release 2, listed in Commission Regulation (EU) 2016/919 CCS TSI Annex A, Table A 2.3 including the error corrections identified in the ERA technical opinion (ERA/OPI/2020-2 and others that may be issued) mentioned in Article 10 of this CCS TSI 2016/919. This is commonly known as ETCS B3 R2.

The application date for TfNSW shall be the issued date of this document instead of the dates defined in the European Commission Decisions.

The B3 R2 system is backwards compatible with B3 MR1. Later baselines may be accepted based on assurance of compatibility with the current and proposed trackside installations.

The associated supporting informative specifications in the EU Agency for Railways Guide for application of CCS TSI should be followed. The relevant version of the guide associated to the CCS TSI baseline should be used.

Suppliers of ETCS onboard equipment shall identify any deviations for their equipment for evaluation as part of type approval.

This document includes tailoring for TfNSW application for ETCS onboard requirements that shall be incorporated in the ETCS equipment on rolling stock.

TS 05332 specifies tailoring for TfNSW application related to the interface between rolling stock and trackside.

ETCS designs commenced after the issue of this document shall be based on this document and the associated ETCS baseline.

6 Certification

The generic ETCS onboard subsystem and associated equipment shall have evidence of conformity as required for operation in the EU. This may include but is not limited to the following evidence:

- certificate and report of interoperability delivered by a notified body in accordance with the European Technical Specification for Interoperability
- quality management system approval certificate based on module CH1 of the CCS TSI from a notified body

- EU design examination certificate based on module CH1 of the CCS TSI from a notified body
- evidence of conformity to CENELEC standards for railway applications that includes tailoring and application of the ETCS baseline specified in this document.

The equipment shall be supported by evidence of compliance with the standards required by this document. TfNSW-specific amendments and additions identified in this document shall be supported by an independent safety assessor.

NSW is a multi-vendor environment. Equipment that is not yet in service shall be tested to certify compatibility with existing ETCS equipment as configured for the TfNSW environment. For further information on compatibility testing, refer to TS 05332.

The equipment shall have a TfNSW type approval for use in the application in accordance with TS 06178.

7 Tailoring of ETCS baseline

7.1 General

Section 7 includes selected options, amendments and additions to the requirements defined in the ERA Baseline 3 Release 2 specification for ERTMS.

Contracts may set requirements in addition to this specification by selecting and applying options identified in the ERA subsets that are not stated in this document. Options shall be agreed with by the customer.

7.2 SUBSET-026

Table 1 specifies the tailoring of SUBSET-026 for TfNSW application.

Table 1 – Tailoring of SUBSET-026.

Relevant SUBSET clause	Topic	TfNSW requirement	Change type
2.6.2.3	Application levels – Level NTC	Operation in Level NTC shall not be implemented as it is not required to support operations on the TfNSW metropolitan heavy rail network.	Selected option
2.6.5.2.3	ETCS On-board equipment	Euroloop transmission equipment shall not be implemented.	Selected option
2.6.5.2.3	ETCS On-board equipment	Radio infill transmission equipment shall not be implemented.	Selected option

Relevant SUBSET clause	Topic	TfNSW requirement	Change type
3.13.2.3.7.2	Emergency brake	When the system has commanded an EBI, it shall not revoke the command until the train is at standstill. This requirement applies to a wider variety of EB conditions than the Q_NVEMRRLS variable does.	Selected option/ amendment
3.13.2.2.5.1	Brake deceleration	The system shall de-rate the values of the variables A_brake_service and A_brake_emergency by the same proportion as that of the number of isolated bogies to the total number of bogies. This is intended to ensure that the system's expectation of train's emergency braking performance is consistent with the cut-out state of the train's emergency brake system.	Addition
3.13.2.2.8	Traction cut-off interface	The ETCS onboard system shall have the TCO command implemented. By implementing TCO which occurs prior to EBI, the system will be able to delay EBI by assuming that acceleration due to tractive effort is not present.	Selected option
3.13.10.3.3	Driver acknowledgement	In ceiling speed monitoring the revocation of either the service brake command or the emergency brake command shall require a driver acknowledgement of the brake intervention.	Addition
3.13.10.4.10.1	Driver acknowledgement	In target speed monitoring the revocation of the emergency brake command shall require a driver acknowledgement of the brake intervention.	Addition
3.13.10.5.4	Driver acknowledgement	In release speed monitoring the revocation of the emergency brake command shall require a driver acknowledgement of the brake intervention.	Addition
3.14.1.1	Use of emergency or service brake where not specified	The ETCS onboard system shall implement the service brake and use the service brake for brake applications that do not require use of the emergency brake.	Addition
3.14.1.1	Use of emergency or service brake where not specified	Where this specification or the ERA System Requirement Specification does not explicitly identify the type of brake to be used the system shall use the SBI.	Addition

Relevant SUBSET clause	Topic	TfNSW requirement	Change type
3.14.1.2	Emergency brake in case of service brake failure	The system shall directly measure the motion of the train to determine whether its application of the service brake was effective. Other detection methods such as sensing brake system circuits or air pressures may not provide a true indication of braking effect.	Addition
3.14.1.2	Emergency brake in case of service brake failure	The national value Q_NVEMRRLS emergency brake release condition shall be met before emergency brakes applied in this case are released.	Addition
3.14.1.7.5	Text message with emergency brake command	The national value Q_NVEMRRLS emergency brake release condition shall also be met before releasing any emergency brake command due to not acknowledging a text message.	Addition
3.15.8	Cold Movement Detection	The ETCS onboard subsystem shall include a CMD system.	Selected option
3.16.2.6.1	Linking reaction response for 'no reaction'	For scenarios where the linking reaction is 'no reaction' and a linking inconsistency occurs, the driver shall be informed of the problem with the expected balise group. In ETCS Level 2 the problem shall be automatically reported to the infrastructure maintainer via the RBC. This is intended to enable drivers to detect missing or failed balise groups, or failed LEUs (or both) to support trackside maintenance action to correct the fault.	Addition
3.18.3.2.1	Automatic entry of 'Train Data' by the train	Where not practical for the train interface to provide train data directly, train data entered by the driver shall be limited to selection from a range of pre-configured values for the particular train type. To avoid unnecessary data entry by the driver, the 'train interface' should provide 'train data' as described in Section 3.18.3 of SUBSET-026 where it is practical to do so. Alternatively, train data entered by the driver shall be limited to selection from a range of pre-configured values for the particular train type as outlined in Subset clauses 3.18.3.2.1, 3.18.4.5 and 3.18.4.5.1.	Amendment

Relevant SUBSET clause	Topic	TfNSW requirement	Change type
3.18.3.2.1, 3.18.4.5	Entry of data by the driver	The inputs fields for train data entry shall only be the following: 1) train length 2) bogies cut out 3) train running number.	Amendment
3.18.3.2.1	Entry of 'Train Data' by the driver	Train data for brake degradation shall be labelled as 'Bogies cut out'. The data shall be entered in terms of the number of isolated bogies in the consist on the vehicle, not brake percentage. The default value for the data input area before driver entry shall be 0. It shall be possible to input the maximum number of bogies that can be isolated in degraded operation.	Amendment
3.18.3.2.1	Entry of 'Train Data' by the driver	Train Data for train length shall be expressed as the number of cars. It should be noted that a configuration with the same number of cars may be entered in multiple combinations. All possible configurations shall be able to be selected on the DMI. A default value shall not be proposed or displayed for train length.	Amendment
3.18.4.5.1	Entry of TRN by the driver	The ETCS onboard solution shall provide the functionality for the driver to enter the TRN manually into the DMI.	Selected option
3.18.4.6.2.1	Disable adhesion factor function	The driver-selected adhesion function is not being used in TfNSW's implementation of ETCS so the DMI adhesion menu option shall be disabled and completely suppressed from view so that it is not visible to the driver, to minimise visual clutter on the display and minimise the potential for driver confusion. Disabling, and completely suppressing the adhesion function from view shall be reversible.	Amendment
4.4.3.1.1	Method of isolating ERTMS/ETCS equipment	The device used for Isolation mode shall be physically and functionally independent of the ETCS Onboard Subsystem.	Addition

Relevant SUBSET clause	Topic	TfNSW requirement	Change type
4.4.3.1.2	Indicating to the driver that the ERTMS/ETCS equipment is in Isolation mode	The isolation status of ERTMS/ETCS equipment shall be indicated to the driver. The isolation indication shall be in the driver's normal field of view.	Addition
4.4.3.1.2	Indicating to the driver that the ERTMS/ETCS equipment is in Isolation mode	The system shall provide an Isolation mode status indication on the driver's desk, or drivers train operating and management system display (or both). This is intended to ensure that a driver gets a positive indication of the state of the system, and to avoid the need for the driver to have to indirectly infer the system's state from other cues, which may be misleading.	Addition
4.4.3.1.3	Operating procedure required for leaving Isolation mode	The special operating procedure required to leave Isolation mode shall include an engineering control that ensures the maintainer accepts that the ETCS onboard subsystem can return to service. Use of a maintainer's key is an accepted solution to enable leaving Isolation mode.	Addition
4.7.2	DMI function when driver's cabin status is 'cab not active'	If information is to be displayed on the DMI during SL mode, then the DMI shall provide output information 'train speed' when 'cab not active', except when the ETCS Onboard is in NP, SF, IS or SB.	Addition
5.4.3.2	Start of Mission sequence	Start of Mission process shall be according to the following sequence: 1. Level selection 2. RBC selection (for Level 2 only) 3. Train data 4. TRN entry 5. Mode acknowledgement (after start).	Amendment
7.5.1.88	ETCS Onboard Identity (NID_ENGINE)	The NID_ENGINE shall be unique and managed at an international level. Variables can be requested from ERA. See SUBSET-054, Section 4.1.8.	Selected option

Relevant SUBSET clause	Topic	TfNSW requirement	Change type
A.3.1	Fixed Value Data	The following Fixed Value Data is changed. All other values remain as specified in Appendix A3.1 of SUBSET-026. Name — Revised value dV_ebi_min — 10 km/h dV_ebi_max — 10 km/h dV_sbi_min — 7.5 km/h dV_sbi_max — 7.5 km/h dV_warning_min — 5 km/h Note: If integer values are required then the value is rounded up to the next integer.	Amendment
A.3.3	Virtual Balise Cover data	The ETCS Onboard shall retain VBC data after the ETCS onboard system goes into SF followed by NP. So that any erroneous VBC data is not used after system reset, the ETCS onboard shall validate any retained VBC data before using the data after system reset.	Selected option

7.3 SUBSET-027

Table 2 specifies the tailoring of SUBSET-027 for TfNSW application.

Table 2 – Tailoring of SUBSET-027

Relevant SUBSET clause	Topic	TfNSW requirement	Change type
4.3.1.1	Trigger events	The ETCS onboard shall provide a trigger event for the general message whenever the train speed sent to the DMI changes by 1 km/h or more.	Amendment

7.4 SUBSET-034

Table 3 specifies the tailoring of SUBSET-034 for TfNSW application.

Table 3 – Tailoring of SUBSET-034

Relevant SUBSET clause	Topic	TfNSW requirement	Change type
2.2.3	Non-leading input for intermediate cab	To enable NL mode in an intermediate cab, the non-leading input signal shall be in the 'non-leading permitted' state when the active cab is coupled to another set.	Addition
2.2.3	Non-leading input for active cab not coupled	To prevent NL mode from being available for use in a lead cab when the active cab is not coupled to another set the non-leading input signal shall be in the 'non-leading not permitted' state. This enables 'assisting from the rear' operations.	Addition
2.5.1	Active cab sequence	If a shared ETCS onboard system is fitted to any rolling stock class for which more than one cab car can be active (desk open), the active cab shall be the first cab to become active for as long as that cab is active.	Addition
2.2.2.3.3	Configuration of the passive shunting feature	Passive shunting shall be permanently configured as 'passive shunting not permitted'.	Selected option

7.5 SUBSET-036

Table 4 specifies the tailoring of SUBSET-036 for TfNSW application.

Table 4 – Tailoring of SUBSET-036

Relevant SUBSET clause	Topic	TfNSW requirement	Change type
6.9	Compatibility tests	TS 05332 requires specific ETCS onboard to trackside compatibility train type tests for trackside guard rail installations and balise reading in addition to SUBSET-036 requirements. Laboratory and field test reports shall be provided as evidence confirming compatibility between the ETCS onboard subsystem and the trackside subsystem installed on the operational rail network as required by TS 05332.	Addition

Relevant SUBSET clause	Topic	TfNSW requirement	Change type
General	ASDO balises	When defined by the specific project, the ETCS onboard solution shall interface with existing balises which provide ASDO functionality in accordance with ETCS Level 1 Principles, and the RIMs applicable ASDO design guidelines.	Addition

7.6 SUBSET-040

Table 5 specifies the tailoring of SUBSET-040 for TfNSW application.

Table 5 – Tailoring of SUBSET-040

Relevant SUBSET clause	Topic	TfNSW requirement	Change type
4.1.2	Balise antenna installation rules	The balise antenna mounting position specified in SUBSET-040 shall prioritise compliance with TS 05332 This may result in installation constraints. Refer to TS 05332 for details.	Amendment

7.7 SUBSET-085

Table 6 specifies the tailoring of SUBSET-085 for TfNSW application.

Table 6 – Tailoring of SUBSET-085

Relevant SUBSET clause	Topic	TfNSW requirement	Change type
B5.3.2	Guard Rails	An additional test for guard rail crosstalk is required to that specified in SUBSET-085. Refer to TS 05332 for details.	Addition

7.8 SUBSET-091

Table 7 specifies the tailoring of SUBSET-091 for TfNSW application.

Table 7 – Tailoring of SUBSET-091

Relevant SUBSET clause	Topic	TfNSW requirement	Change type
10.3.2.16	Time spent in unsupervised modes	The following amendment is applicable to Level 1 areas only. The subset requirement is unchanged for Level 2 areas. Time spent in modes without ETCS supervision of safe speed and distance (for example, unfitted and limited supervision) is < 90% instead of < 20%.	Amendment
10.3.2.16	Time spent in unsupervised modes	The amendments for SUBSET-091 shown above affect THR defined as ETCS_OB10 ETCS Auxiliary Hazard THR. Related considerations are: LS mode implementation provides supervision of train speed in accordance with trackside speed boards which provides an additional hazard barrier compared to UN mode ETCS Auxiliary Hazard THRs derived in SUBSET-118 Functional Safety Analysis of ETCS DMI for ETCS Auxiliary Hazard have a factor of 5 reduction applied due to uncertainty Suppliers of ETCS onboard systems shall provide assurance that compliance with ETCS_OB10 ETCS Auxiliary Hazard THR, manages the ETCS auxiliary hazards SFAIRP.	Addition

7.9 ERA_ERTMS_015560

Table 8 specifies the tailoring of ERA_ERTMS_015560 for TfNSW application.

Table 8 – Tailoring of ERA_ERTMS_015560

Relevant clause	Topic	TfNSW requirement	Change type
3.3.1.1	Interface technology	The ETCS onboard DMI functions shall only be controlled by touch screen. Touch screens provide a significant advantage to drivers in terms of speed, accuracy and attentional demand, and they enable a DMI screen layout that directly maps an information source over the area where the response is required (such as an acknowledge request or a menu item).	Selected option
3.3.1.1	Interface technology	It shall be acceptable for the DMI adjustments setting to be controlled by soft keys which are integrated into the DMI Unit instead of touch screen technology. The provision of external controls for settings such as brightness, contrast or volume (or both) would enable drivers to make prompt changes to these settings in response to sudden or transient changes in the external environment (such as lighting or noise) without having to proceed through the DMI menu or loss of the planning area while making adjustments.	Selected option
5	Synchronised visual and auditory warnings	Where the DMI provides both visual and auditory warning status information, both shall activate and deactivate within 0.5 seconds of each other.	Addition
5.2.2	Brightness adjustment	The effect of altering brightness controls shall be made immediately (within 100 ms) apparent to the driver visually.	Addition
5.2.2	Contrast	The contrast ratio for the screen shall be at least 500:1.	Addition
5.2.2.3	Brightness adjustment	The screen brightness shall be at least 400 cd/m² when set for maximum brightness.	Selected option

Relevant clause	Topic	TfNSW requirement	Change type
5.2.3.1	Volume adjustment	To avoid compromising safety and performance, it shall not be possible to turn auditory alerts off intentionally or inadvertently.	Addition
5.2.3.1	Volume adjustment	The volume level set by the driver shall apply to all sounds for the ETCS onboard system and be made immediately (within 100 ms) apparent to the driver visually and audibly.	Addition
5.2.3.1	Volume adjustment	The perceived sound of altering the volume level shall be linear.	Addition
5.2.3.3	Volume adjustment	The DMI volume range shall permit the volume to be configurable from an agreed minimum volume up to a maximum of 85dB(A) at the driver's position. Volume levels and alerts shall be assessed based on the cab specific design.	Selected option
5.2.3.4	Volume adjustment	Volume shall be adjustable by the driver only through the DMI controls in applicable modes as additional volume controls are unnecessary and potentially confusing.	Selected option
5.3.2.2	Action response	The DMI shall provide a separate user-detectable response for each valid action. It shall provide this response within 100 ms of the occurrence of each action. A response delay of 100ms is the limit for users to perceive that a system is reacting immediately to their input. Any processing time required by the on-board system for purposes other than providing a direct response to a user's action is excluded from this time limit.	Addition
5.3.2.5.5	Hide functions that are not used	Menu options and other functions that are not implemented in the TfNSW configuration shall be option b) 'not shown at all'.	Selected option
5.4.1.1	Acknowledgements	The system shall provide a touchscreen-based target on its DMI that can be used for acknowledgement of the system's brake commands by the driver.	Addition
5.5.1.1	Pre-configured languages	English shall be the only pre-configured ETCS onboard language.	Addition

Relevant clause	Topic	TfNSW requirement	Change type
5.5.1.2	Language window	The DMI language menu option shall be disabled and completely suppressed from view and not visible to the driver.	Amendment
7.2.4.2	Intervention Status information	When the system enters Intervention Status and commands an SBI, the overspeed visual indication and sound S2 shall deactivate simultaneously. Having both the visual and auditory warning status information activate and deactivate simultaneously ensures clarity in the provision of this information to the driver.	Amendment
8.2.1.1.3	Speed dial range	The range of the pre-configured speed dial displayed on the DMI shall be 0 km/h to 180 km/h (option c).	Selected option
8.3.3.4	Distance scale	To consistently apply a distance scale appropriate for most circumstances and to minimise the necessity for the drivers to adjust the scale range, the default range for the distance scale shall be 0 to 4000 m.	Amendment
8.3.3.4	Distance scale	To simplify the operation of the DMI and minimise the potential for errors associated with selection of incorrect ranges, the distance scale range options shall be limited to the following ranges: • 0 to 1000 m (1 km) • 0 to 2000 m (2 km) • 0 to 4000 m (4 km). This requirement is applicable for trains operating wholly within the TfNSW network.	Amendment
11	ETCS Sub-Level Windows	If information is required to be displayed on the DMI in SL mode, the driver or guard shall be able to access the following sub-level windows when the cab is inactive; brightness, volume and cleaning function windows. This ensures that ETCS functions or train data cannot be altered from an inactive cab.	Amendment

Relevant clause	Topic	TfNSW requirement	Change type
11.1.1.1	Maintenance sub-level window	The DMI shall display the actual operational status of the system's components in a maintenance screen. This is so the maintainer is able to determine through a DMI maintenance screen if any of the system's components are faulty.	Addition
11.2.1.5	Disable 'maintain shunting' functionality	The 'Maintain Shunting' functionality shall be disabled. Disabling, or completely suppressing from view the 'Maintain Shunting' function shall be reversible. Completely suppressing this button from view serves to minimise visual clutter on the display and minimise the potential for driver confusion.	Amendment
11.2.1.7	Driver ID	The DMI 'Driver ID' menu option shall be disabled and completely suppressed from view and not visible to the driver. It shall be possible to re-enable the DMI 'Driver ID' menu option via a configurable option. This is to provide flexibility for the operator to re-enable Driver ID function if the need arises without significant changes to the ETCS onboard.	Amendment
11.2.3	Disable 'SR speed / distance' and 'Train integrity' buttons	The DMI 'SR speed / distance' and 'Train integrity' menu option shall be disabled and completely suppressed from view and not visible to the driver.	Amendment
11.2.4 Table 36	Adjustment settings	If information is to be displayed on the DMI during SL mode, then the DMI brightness level shall be adjustable. This enables the DMI speed display to have appropriate levels of visibility at all times. Note: See Section 9.6 for requirement to display a speedometer in both cabs where there is an active cab.	Addition

Relevant clause	Topic	TfNSW requirement	Change type
11.2.4.5	Cleaning of DMI	The ETCS onboard DMI shall have a cleaning function that will enable the touch screen to be cleaned without inadvertently activating any on-screen touch-sensitive area. The cleaning function shall display a visual indication that the cleaning function is active.	Addition
11.2.4.5	Cleaning of DMI	The cleaning function shall only be enabled at standstill. The cleaning function shall automatically disable itself when the train moves or after a configurable time delay. The time delay shall be configurable via software parameters, selected in one second increments between 5 seconds and 30 seconds, with the default being 5 seconds.	Addition
11.2.4.5	Cleaning of DMI	The DMI cleaning function button shall be available via the Settings menu. However, if information is required to be displayed on the DMI during SL mode and the DMI is in a non-active cab, the cleaning function button shall be available on the main screen.	Addition
11.2.4.5	Cleaning of DMI	Gaining access to the cleaning button shall not require more than two (2) menu selections.	Addition
11.2.4.5	Button selection enabling conditions	Toggling the DMI cleaning mode on/off shall also be available when the system is in SL mode.	Addition
11.2.4.5	Access to menus	DMI menus for additional technical functions that are not intended for use by drivers shall be protected against access by unauthorised personnel.	Addition
11.3.2	Hide ETCS levels that are not able to be supported	The keyboard associated with the ERTMS/ETCS level shall display only the ETCS Levels the rolling stock is currently approved to operate in on the TfNSW metropolitan heavy rail network.	Addition

Relevant clause	Topic	TfNSW requirement	Change type
11.3.2	Hide ETCS levels that are not able to be supported	All ERTMS/ETCS levels not currently applicable to the current network shall be disabled and completely suppressed from view and not visible to the driver. Disabling, or completely suppressing from view any ERTMS/ETCS levels not currently applicable to the current network shall be reversible.	Amendment
11.3.10	Setting of the speed limit when in staff responsible mode	The driver functions for setting the staff responsible speed shall be either permanently disabled by configuration or disabled at the factory in a non-configurable manner prior to delivery.	Amendment
13.4.1.1	Speedo error	The ETCS system shall provide an error message immediately to the train driver if any one of the odometry systems (that is, speed detection) is found faulty and not performing correct speed calculations. Where the speedometer error cannot technically occur due to the fleet type configuration, assurance shall be provided that the error cannot occur. Where the speedometer error can technically occur due to the fleet type configuration, the speedometer error symbol, seen in Figure 2, shall be displayed on the DMI to indicate to the driver that a discrepancy between speed sensors has been detected. The symbol will prompt the driver to initiate fault management procedures. The symbol shall be 32 x 32 size (cells), positioned in the C1 location as described in Section 6 ERA_ERTMS_015560 and comply with the colours in ERA_ERTMS_015560 Section 5.2.1.3.3.  **Figure 2 – Speedometer error symbol (image is not to scale)**	Addition

Relevant clause	Topic	TfNSW requirement	Change type
14.3.2, 14.3.3	S1 and S2	To accommodate these conditions and ensure the audibility of DMI audible alerts at all times, the system shall provide an output to mute the commercial radio when either of the following occurs: • the warning sound (S1 and S2) is played on the DMI • a sound is played to which drivers shall respond.	Addition
15.1.1.1	Text messages	Any text messages related to events that the driver reports shall remain on the DMI's text message list for later viewing (this is dependent on the end conditions defined in Appendix A). Operational procedures require drivers to report any text messages conveying fault or error information. Therefore, drivers may return to the text message list at a later time in order to report (and make reference to message time stamp so that the JRU can be interrogated by maintenance).	Amendment
15.1.1.1	Text messages	Generic TfNSW text messages shall be implemented. For a list of generic core messages, see Appendix A.	Amendment
15.1.1.1	Text messages	Any additional text messages to those described in Appendix A generated by the ETCS onboard equipment for display on the DMI shall be in consultation with driver, train operator, train maintainer, network operator, and network maintainer stakeholders. Additions should be kept to a minimum.	Addition
15.1.1.1	Text messages	Partial isolation and complete isolation of brakes shall generate system status messages that can be displayed on the DMI. The ETCS onboard system shall display a 'Brake Valve Isolated' text message on the DMI when one or more of ATP brake valves are isolated. The text message shall be removed from the DMI when the ATP brake valves are no longer isolated.	Addition

Relevant clause	Topic	TfNSW requirement	Change type
15.1.1.1	Text messages	The text and associated conditions for all text messages to be displayed on the DMI shall be configurable under change management control procedures. This ensures that the information is consistent with the current operational environment.	Addition

7.10 SUBSET-137

Table 9 specifies the tailoring of SUBSET-137 for TfNSW application.

Table 9 – Tailoring of SUBSET-137

Relevant SUBSET clause	Topic	TfNSW requirement	Change type
5.3.17	NOTIF_KEY_DB_CHECKSUM	The message structure is 20 bytes in length. However, the checksum is restricted to only 16 bytes. Therefore, the first 4 bytes of the 20 byte structure shall be set to ‘0’.	Addition

8 Equipment requirements

8.1 Train compatibility

The ETCS onboard equipment shall be designed to be compatible with the traction system used by the train and the rail lines it is intended to operate on.

The ETCS onboard system’s functions for the detection of the traction and braking states of the train shall be designed according to fail-safe principles.

8.2 IEC 60571 compliance

All electrical and electronic equipment provided as part of the ETCS onboard system shall comply with IEC 60571.

Evidence of compliance with equivalent standard EN 50155 is accepted as meeting this requirement.

Compliance requirements are specified in Table 10.

Table 10 – IEC 60571 compliance

IEC 60571 clause	IEC requirement heading	TfNSW requirement
4.1.2	Ambient temperature	Equipment shall meet Class T3 unless the equipment locker is air conditioned by a system required as part of the minimum operating standard for the train type.
4.2	Special service conditions	Not required.
4.2.2	Atmospheric pollutants	None specified.
5.3	Installation	Any electrical installation requirements for the equipment shall be nominated by the supplier. Equipment shall be designed to operate with either a floating vehicle battery supply (isolated from vehicle body) or a battery negative connected to the vehicle body.
6.1.1	Predicated reliability	The supplier shall provide details of the manufacturer's predicated reliability for the equipment including the methodology used, and assumptions made.
6.1.2	Proof of reliability	The supplier shall provide proof of reliability.
6.2	Useful life	The nominated useful life is accepted. Items with a shorter useful life may be accepted provided that their limitations have been detailed prior to purchase.
6.4.1	On-vehicle diagnosis and repair	Manufacturer or supplier to provide proposal that shall meet the requirements of 6.4.1. This proposal shall be agreed by the user and manufacturer.
7.2.1	Interfacing	Galvanic isolation shall be provided for communications data links used by ETCS onboard equipment. The galvanic isolation shall be rated at 600 V DC or higher. This is intended to improve system reliability or availability (or both) by making the system more resilient to earthing faults, for example if the car body is bridged to either of the system's internal positive or negative supply. Euroantenna data links are accepted as not requiring galvanic isolation to meet RAMS requirements.
9.1.3	Polarisation or coding	LRUs shall incorporate mechanical means of polarisation or coding to prevent incorrect insertion.

IEC 60571 clause	IEC requirement heading	TfNSW requirement
9.1.5	Sockets and connectors	The use of integrated circuit sockets and edge connectors shall be minimised. Normally only CPU integrated circuits will use sockets.
9.3.5	Other connections	TS 03985 stipulates the accepted alternatives.
12.1.2	Type tests	The user shall be provided type tests repeated under the conditions nominated in this clause.
12.2.9	Radio frequency test	Both radio frequency immunity and radio frequency emission tests shall be performed as type tests.

8.3 Additional standards compliance

The ETCS onboard system shall comply with the applicable sections of the following standards:

- TS 05332
- TS 03999
- TS 04002
- TS 00026
- TS 04991
- TS 04990
- TS 04052
- TS 00031.1.

8.4 Stabling

The system should be left powered-on where possible to take advantage of its standstill supervision function, and for operational convenience. This avoids boot up delays. However, keeping the system powered on shall be balanced against preserving train batteries from unnecessary discharging when the pantograph is lowered. For trains that do not have a stabling function the ETCS onboard system shall be switched off when all cabs have been inactive for a defined time. For trains that have a stabling function, the system shall be switched off when the train is stabled, or when all cabs have been inactive for a defined time, whichever condition occurs first. To allow future modifications to take place, the defined time when the ETCS onboard system is turned OFF shall be variable between 0 minutes and 120 minutes. It shall be possible to vary the defined time when the system is turned OFF in 15 minutes, or shorter, increments.

When the ETCS onboard system has been switched off, it shall switch itself ON when an associated cab has been made active.

8.5 Odometry subsystem

Radiocommunications (Low Interference Potential Devices) Class Licence 2015 sets outs requirements that apply to odometer radars.

To ensure reliable odometry information, the system shall include diverse sources of odometry including at least one of which does not rely on wheel-rail friction.

The ETCS odometry subsystem shall not constrain the type of axle to which wheel sensors can be fitted.

8.6 Reset control

The ETCS onboard subsystem shall include a reset control in every cab car. The reset function is intended to provide an efficient means of resetting the ETCS onboard subsystem in the event of failure, as part of a diagnostic process, or as a remedial action to clear transient faults. The reset control shall only reset the system when the cab local to the control is active. The reset control shall not be within reach of a driver when they are driving.

When the ETCS onboard system is reset, it shall perform a system self-test. The system's state shall be reinitialised, similar to a transition from NP mode, when the reset control is operated.

The reset control shall be a pushbutton in order to make the switch simple to use and its functionality unambiguous.

8.7 Driver machine interface equipment

The DMI shall be designed and configured to conform to the relevant requirements set out in the following TfNSW standards:

- TS 04978
- TS 04977.

For guidance, refer to TS 04976.

The DMI shall withstand the rigours of daily use without the integrity of the touch screen being compromised. The DMI shall not be susceptible to minor damage in the course of normal use.

For a DMI in the non-active cab being used to display speed, the DMI brightness shall be adjustable enabling all DMI-relevant tasks to be undertaken by the guard under all lighting conditions.

The DMI equipment shall be configurable by design so that the minimum sound level that can be set by the driver is the level determined as part of the human factors integration for the vehicle type.

Separate switches that form part of the overall driver to ETCS interface shall comply with TS 03984. Isolation switches are separate switches that form part of the driver to ETCS interface.

8.8 Event recorder

ETCS onboard event logging shall be provided to record ETCS events for the purpose of ETCS onboard and ETCS Trackside maintenance, juridical needs, fault finding, testing and investigation.

A juridical recorder (event recorder) shall be provided for recording ETCS onboard data and collecting, storing and retrieving vital ETCS onboard information. The event recorder shall comply with survivability of data requirements of AS/RISSB 7527.

If the ETCS system's event recorder is combined with another event recorder on the train, it shall be operational except when the train is stabled or when the train's low voltage protection is operating. If the system's event recorder is a dedicated recorder, it shall be operational when the system is powered on.

If other event recorders are fitted to the vehicle in addition to the ETCS event recorder then functionality shall be provided to facilitate cross referencing events in each recorder when time references are not synchronised.

> Note: New rolling stock should be designed with a combined event recorder to alleviate time synchronisation and cross-referencing issues.

The ETCS onboard system event recorder shall:

- record GPS time and be relatable to UTC(AUS)
- record all the odometry data (for example, wheel diameter, accelerometer, wheel sensor and radar coefficient) as entered into the system DMI
- provide a facility that allows a time period of data to be extracted from the event recorder remotely such that the data can be sent off the train using wireless data transfer to reduce the likelihood of unauthorised access to event recorder data so far as is reasonably practicable
- continue to record data whilst data is being downloaded
- be able to detect the failure to record the speed information it displays to the driver
- be able to detect each instance of failure to record speed information it displays to the driver within 3 seconds of the occurrence of the failure, where the displayed speed

information is not provided by an existing rolling stock subsystem, and that speed information is not recorded by the existing event recorder(s)

- interpret every specific state transition of each of its user controls as an 'ATP operational event', except for the main circuit breakers and record all transition of state of user controls, in the event recorder
- record all text messages displayed to the driver.

8.9 Onboard telecommunications

Safety related communications between ETCS onboard system and other systems onboard shall comply with EN 50159 for the combination of equipment, transmission systems, communication protocols and configuration.

8.10 Time source

The ETCS onboard system shall comply with those clauses in TS 06208 that are applicable.

ETCS onboard equipment shall use a common time reference and be relatable to UTC(AUS). Any existing time source on the vehicle (such as GPS) should be used if reasonably practicable and relatable to UTC(AUS).

Adjustments for daylight savings shall be automatic. The time shall not require adjustment by the driver or maintainer due to drift by the time source or ETCS equipment.

A drift in the internal time source for ETCS equipment shall not exceed 2 seconds per day from actual time when the common time source is not available for synchronisation.

8.11 ETCS data only radio

The EDOR shall comply with the following requirements to support communications between the ETCS onboard and other subsystems:

- SUBSET-093, as per CCS TSI Application Guide – Informative Set of Specifications 3 (ETCS B3 R2 GSM-R B1)
- Sydney Trains ACMA Spectrum Licence No. 9460463 and 9460464 requirements
- ETCS in PS-mode GPRS/EGPRS Guideline 1.0 (UIC O-8664) as applicable to the ETCS Onboard Unit
- ETSI TS 102 933-1; for Australian Application 1800 MHz is used
- ETSI TS 103 328:2020, V1.2.2 summarised in Cl. 5.1.10, Table 1, as applicable to EDOR (the 'Mobile Station')
- ETSI TS 103 328:2020 V1.2.2 of the Mixed Packet Data Traffic Operation, summarised in Cl. 5.2.2 Table 2, as applicable to EDOR (the 'Mobile Station')

- the power levels defined in ETSI TS 100 910 Section 4.1.1
- ETSI TS 145 005 V4.0
    - in the DCS 1800 frequency band
    - in the DCS 1800 MHz frequency band subjected to LTE interferer, in accordance with Cl. 6.1.1.1: TM 1.1 BW 5 MHz of ETSI TS 136 141
- EIRENE UIC CODE 950 requirements as applicable to EDOR. In addition, the EDOR shall comply with the following optional UIC 950 requirements, by meeting them as mandatory: Cl. 4.2.2, Cl. 16.4.2 and Cl. 16.5.1
- the ETCS onboard system shall comply with ETSI TS 101 349 with respect to the Mobile Station – Base Station Subsystem interface.

The system shall operate with TfNSW's GSM-R network.

The EDOR uses the GSM-R network as a bearer for the transmission of variable data between the RBC and ETCS onboard system in ETCS Level 2.

DTRS uses the 1800 MHz band (DCS 1800) for GSM due to local spectrum availability.

The EDOR shall support a packet switched mode of communication.

A redundant EDOR arrangement shall be fitted for ETCS Level 2 implementation in accordance with the EIRENE System Requirement Specification and this document.

The system shall provide interfaces that allow connection to at least two radio transceivers. This is to avoid the issue where the provision of one transceiver can result in the train running out of movement authority as it switches between RBCs.

8.12 Key management system

To securely manage the online distribution of cryptographic keys between KMCs and from a KMC to KMAC entities, the ETCS onboard system shall comply with SUBSET-137 to interface with an Online KMS.

The ETCS onboard system shall also comply with SUBSET-114 to be able to interface with Offline KMC, so that the interface between the KMC, the trackside, and ETCS onboard equipment will not restrict the implementation of key management policies.

The ETCS onboard system shall comply with SUBSET-038 to be able to interface with offline KMC.

8.13 Rail environment

The system shall be designed and installed to meet the reliability figures cited for the ETCS equipment. The system shall also achieve the overall RAM targets in accordance with RAM requirements in this document.

Equipment mounted under-car shall be protected against damage caused by contact with flying stones, track ballast and rubbish. However, the protection shall limit the collection of such debris in accordance with TS 03985.

8.14 Electromagnetic capability and electromagnetic interference

The ETCS onboard system shall properly function when it is subjected to electromagnetic fields that it can encounter. Expected EMC fields shall be identified and managed through EMC management plans and testing.

The ETCS onboard system as a product, shall comply with the following:

- AS/RISSB 7722
- EN 50121 3-1
- EN 50121 3-2.

The ETCS onboard system's electromagnetic fields shall not interfere with the proper operation of any railway (trackside equipment) or non-railway equipment in the vicinity of the train's path. The ETCS onboard system's electromagnetic fields shall not interfere with the proper operation of other equipment on the same train, or on another adjacent train. These requirements have been included in this document as some of the railway was not defined to EN 50121.

The ETCS onboard system shall comply with Australian Communications and Media Authority requirements for EME compliance and evidencing, in accordance with Radiocommunications (Electromagnetic Compatibility) Standard 2017.

Specific installation to fleet shall be in accordance with the installation requirements specified by the ETCS onboard manufacturer to ensure correct management of EMC and EMI.

8.15 Maintenance

To safeguard against maintenance personnel installing an EVC into a train for which it was not intended or configured, the system shall only operate when fitted to the correct rolling stock class. ETCS onboard subsystem operation shall be prevented if configuration data for a different train type is incorrectly installed in the train's ETCS onboard equipment.

The fitment of the ETCS onboard system shall not inhibit access by maintenance personnel to existing equipment. The system's tachometers shall not prevent the removal or replacement of wheelsets and bogies or the machining of wheels.

To prevent the system from requiring maintainers to over-exert, or to constrain their movements, the system shall enable safe access by maintenance personnel to all of its LRUs for routine maintenance, testing, and replacement. The system shall allow clearance for maintenance personnel to exert the necessary levels of manual force where required.

8.15.1 Line replaceable unit

It shall not be possible to fit an LRU into the wrong rolling stock class if the LRU is rolling stock class specific.

To help prevent parts from being replaced with non-equivalent parts, every LRU of the system shall be clearly identified. The identification markings and labels shall be able to withstand the environment conditions which the component will be subjected to for its life. The identification shall include the following:

- legible English alpha-numeric characters
- component descriptor
- part identifier (be unique to each combination of hardware and software version of each LRU model, with the following allowable exception: if the software version of an LRU model is required to be managed (version check or upload (or both) of a different software version) by the maintainer, the part identifier is not required to be unique to each software version of the LRU model)
- serial number (unique for each instance of that LRU type).

8.16 System tests

The period between any test of the ETCS onboard system that requires the train at standstill or driver involvement, shall be greater than 24 hours. The ETCS onboard system shall generate maintenance warnings 3 hours, 2 hours and 1 hour prior to an ETCS onboard equipment test that requires the train to be at standstill. This is intended to prevent operational disruptions associated with the system's brake test from occurring while the train is in service.

The ETCS onboard system shall be configured to perform any tests that require the train to be at standstill when a driver workstation is activated for the first time after the ETCS mode transition from no power to standby. Some driver involvement in conducting these tests may be acceptable.

When a brake test is required, the ETCS onboard system shall only intervene when the train is stationary. The ETCS onboard system shall not automatically perform a brake test if a self-test is required. This is intended to prevent operational disruptions associated with the system's brake test from occurring while the train is in service.

The ETCS onboard system shall confirm the successful application of an emergency brake command.

Whenever the ETCS onboard system detects that it cannot vent the brake pipe, it shall interpret Condition 13 of Section 4.6.3 ‘The ERTMS/ETCS onboard equipment detects a fault that affects safety’ of the SUBSET-026 to be fulfilled.

8.17 Failures

For all failure modes that are detectable, the ETCS onboard system shall be able to display a configurable text message or icon (or both) on the DMI. These configurable text messages for each failure mode shall be recorded as part of the ETCS maintenance data.

8.18 Change management

The management of changes made to equipment or products shall comply with CENELEC EN 50126, EN 50128 and EN 50129.

9 Train interface and installation requirements

9.1 General

To prevent the ETCS onboard system from degrading the maintainability of existing equipment, the ETCS onboard system shall not adversely affect the function, operation, performance, integrity, safety, reliability or maintainability of existing equipment or structure. This includes the fitment of ETCS Level 2 not impairing the functionality of the train when operating in ETCS Level 1 LS and conventional signalling areas, as demonstrated through non-regression testing.

When an ETCS-fitted train is upgraded to support ETCS Level 2 operations, existing interfaces to the vehicle shall be maintained. This minimises the impact of converting the trains from ETCS Level 1 to Level 2.

> Note: System interface management is an integral part of the safety and system engineering processes, for example, the development of interface control documents and interface hazard analysis. Systems and subsystem interfaces should be planned, developed, integrated, tested and assured.

9.2 Emergency brake interface

The ETCS onboard system's emergency brake intervention command shall activate only the automatic air brake system. The emergency brake interface may control the emergency valves fitted to an existing vehicle.

The emergency brake valves (existing or additional) and relays required for ETCS shall be included in reliability, availability, maintainability and safety (RAMS) analysis.

The ETCS onboard system's emergency brake valve isolation cocks shall include a locking handle.

9.3 Traction cut off interface

The TCO control shall be arranged so that traction control is only restored after the driving control is set to a non-powering state. This may be achieved by interface circuits between the ETCS onboard equipment and the train.

The ETCS onboard system's TCO command shall not affect the operation of the electrodynamic brake system if it is fitted and requires to be applied as part of the system's SBI.

The ETCS onboard system's TCO command shall not release any driver-applied braking effort.

The ETCS onboard system's EBI command shall include the immediate disablement of the train's tractive effort.

The ETCS onboard system's TCO command shall not be affected by the pressing of the EMPB.

9.4 Train safety systems

9.4.1 General

The ETCS onboard system, irrespective of level, shall not interfere with trip gear and driver safety systems such as the operator-enable-handle or the operator-enable-pedal.

9.4.2 Vigilance system

The ETCS onboard shall not affect the functionality of the vigilance system on trains. In particular, the operation of the service brake by the ETCS system shall not cause a task-based reset of the driver safety vigilance systems.

It may not be reasonably practicable to implement this requirement on some train types where false detection by the vigilance system will cause the vigilance system’s timing cycle to be prematurely reset, and thereby partially, if not significantly, reducing the safety benefit of the vigilance system. In this case a driver acknowledgement shall be provided in addition to the defined conditions to revoke a brake intervention. This solution shall not duplicate driver acknowledgement that is already required by the ETCS standard specification. The driver acknowledgement required to release a brake intervention shall comply with Section 8.2.2.3 of ERTMS/ETCS ERA_ERTMS_015560. This solution would result in an amendment to the ERA ETCS SUBSETS and shall require an appropriate approval.

The ETCS onboard subsystem shall be implemented in accordance with TS 04977 and TS 04978.

9.5 Isolation

9.5.1 General

The ETCS onboard subsystem shall be considered a driver safety system in accordance with TS 04069.

9.5.2 Brake isolation

If any existing emergency brake solenoid valves are used by the ETCS onboard system, it shall be possible to individually pneumatically isolate each ATP brake valve. The isolation method of the pneumatic system shall not rely on the isolation of only the pilot air supply of a relay valve.

The application design of the ETCS onboard system shall detect any isolation of the emergency brake interface.

Complete isolation of the emergency brake shall switch the ETCS onboard system to the system failure mode.

The system's pneumatic isolation cock shall be positioned within the crew compartment and in a location accessible to the driver. The location and position of the isolation cock shall be clearly labelled.

9.5.3 ETCS onboard isolation

The isolation mode is an emergency means to recover from persistent ETCS equipment failures. To minimise isolation mode dependency on active equipment, all parts of the system shall be de-energised in isolation mode, unless they are required to be energised to fulfil the requirements of the specification or safe functioning of the vehicle. The ETCS onboard system shall be physically isolated from other equipment and not command any interventions when it is in isolation mode.

ETCS isolation switches shall be provided for the train driver to place the ETCS onboard into isolation mode. There shall be a system isolation control in each cab. The system isolation control shall not be within the reach of a driver when they are driving.

The ETCS onboard system shall enter isolation mode when any of that system's isolation switches are in the isolate position, irrespective of the local cab activation status.

The isolation control shall:

- be a switch that has a normal position and an isolate position
- remain in the position it is moved to when operated

- require a crew-level high-security keying system such as BiLock key to enable the position of its isolation switch to be changed from normal to isolate
- require a maintainers'-level high-security keying system such as BiLock key to move the isolation switch to the normal position.

The status of the isolation switch shall be recorded by the event recorder.

The ETCS onboard subsystem isolation switch arrangement shall be designed and installed so that it does not interfere with the operation of other driver safety systems or safety system override control.

If the ETCS onboard subsystem has been isolated, then an authorised procedure shall be applied. The authorised procedure for proceeding when ETCS is isolated shall include the engineering control specified in TS 04977 which requires any safety system overrides control to not be operable from the driving position. This engineering control is separate to the ETCS onboard isolation switch.

After ERTMS/ETCS equipment has been isolated, any ETCS-related lights indicating fault, failure, or warning in the driver's primary field of view shall be able to be extinguished either using system design or user action.

9.5.4 Emergency push button

When the ETCS onboard system is in isolation mode, or when all the ETCS brake valves have been isolated, it shall only be possible for traction to be applied when the EMPB is pressed. This is intended to prevent the train from being driven with only the driver controlling the train while the system has been isolated.

9.5.5 Circuit breakers

The system shall, where appropriate, include a main circuit breaker in every car containing the ATP cabinet to turn off as much of the system as possible. This is to allow safe system access for maintainers and to allow work near the balise antennas.

These circuit breakers shall be located in the same car as the equipment to avoid running power supplies in jumpers.

The main circuit breaker shall be able to interrupt power to all the system's components that are in the same car, with the following allowable exceptions:

- the system's event recorder(s)
- parts of the system that are not energised by the system, for example, relay coils energised by train-control circuits
- those parts of the system that enable the system to be set to isolation mode.

Circuit breakers introduced due to the installation of ETCS onboard equipment shall be consistent and compatible with the existing type of circuit breakers fitted to the vehicle.

9.6 Speedometer

A second speedometer not integrated with the ETCS onboard system shall be fitted in each driver's cabin to ensure that a backup speedometer is available in the case of an ETCS system failure, or when the ETCS onboard system is isolated. Isolation of the ETCS shall enable the speedometer. Otherwise, the speedometer function is disabled to avoid the potential for different speed information being displayed to the driver. TS 04058 sets the requirements for the independent speedometer on multiple unit trains. A vehicle's existing speedometer may be used for this purpose.

There shall be a speedometer displayed in both cabs when there is an active cab on the train for train guard use. The speedometer may either be one shown on the DMI, or a second speedometer in the cab. The speed displayed on the non-DMI speedometer shall be recorded by the existing event recorder(s), or by the ETCS system’s event recorder where the latter has replaced the former.

9.7 Driver machine interface integration

The DMI screen shall use technology designed to manage glare and reflections on the screen when installed in the vehicle cab.

The screen viewing angle shall be at least 45°/45° (left/right) and 45°/30° (up/down).

Auditory alerts shall remain detectable to the driver across the range of ambient noise conditions during expected driving conditions to ensure the audibility of DMI audible alerts at all times.

9.8 Balise antenna

The ETCS onboard antenna shall be located to maximise track clearance in order to minimise potential impacts due to objects on the track without limiting the operation or performance of the system. The position of the antenna shall comply with TS 05332.

9.9 Cold movement detection

The ETCS onboard subsystem shall include a Cold Movement Detection system.

The ETCS CMD function shall

- only be used to validate stored information if the information was known to be correct upon entry to NP
- monitor absolute movement of the rail vehicle.

The ETCS CMD system shall not

- adversely affect the DC power distribution required for onboard vital equipment
- drain the main DC supply of the host vehicle to a point that prevents the raising of the pantograph or emergency lighting. Safeguarding systems shall be in place to ensure DC supply integrity.

9.10 Spare cars

ETCS systems fitted to spare cars shall be compliant with all requirements of this document.

A set that consists of one or more ETCS-fitted spare cars shall function normally.

Spare cars design shall be provided for trains with shared ETCS systems only. Independently connected trains will be unable to determine which cab is active first.

Changes required to an ETCS-fitted spare car such that it can become functional shall not require wiring changes to be made, except for disconnection or connection of cable connectors. Changes required to be made to ETCS-fitted spare cars shall be achievable by maintenance personnel. This is to enable efficient installation of spare cars.

9.11 Physical security

ETCS onboard equipment and any associated transmission systems shall be protected from unauthorised access using physical protection. The level of physical protection provided shall be based on the risk of and the risks due to unauthorised access. Physical protection may be provided by an enclosed wiring system, as part of the construction of the cable or by use of a barrier requiring the use of a tool or key with restricted distribution to restrict access.

9.12 Installation

The requirements of TS 03985 apply to mounting and installing ETCS onboard equipment.

TS 03984 applies with the following amendments to circuits and earthing requirements:

- ETCS safety significant and safety critical circuits may switch both positive and negative legs of circuits.
- An individual circuit breaker for each circuit function shall not be required for protection of ETCS input and output circuits. However, power supply circuits shall comply with the requirement.

Terminals mounted external to ETCS equipment shall comply with TS 03985.

Relays mounted external to ETCS equipment shall comply with TS 03984 and TS 03985.

Installation design and the installation of the ETCS onboard system shall confirm that the train remains compliant with its rolling stock outline in accordance with RSU 110 of TS 04053.

9.13 Cabling

ETCS onboard cabling shall comply with the technical specifications set by the ETCS equipment supplier.

The cabling design and installation shall comply with EN 50343.

The cables shall comply with TS 04000 with the following exceptions:

- screened cables shall comply with equipment manufacturers' requirements as part of their original design
- communication cables shall comply with the ETCS equipment manufacturers' requirements as part of their original design.

  Note: The requirements for screened cables and communication cables in TS 04000 are only a recommendation for ETCS onboard subsystem installations.

10 Reliability, availability and maintainability

10.1 General

ETCS onboard systems can be installed into fleet in two ways: retrofitted to fleet which has no ETCS onboard to begin with or designed in as a complete system as part of fleet delivery.

RAM analysis shall take into account the ETCS onboard system as a complete system (including EVC, BTM, EDOR, odometry, DMI and rolling stock interfaces).

10.2 ETCS onboard system component reliability, availability and maintainability

For fleet that requires an ETCS onboard system, the following RAM requirements apply:

a. Operational availability for the ETCS Level 2 onboard system shall comply with the apportioned performance requirements. If there are no such performance requirements, the operational availability for the ETCS Level 2 onboard system shall be no less than 99.996%.

b. The theoretical mean time of hours of operation between failures of an ETCS onboard subsystem requiring the isolation of the train protection functions shall be more than 35,000 operational hours. Failure of DMI functionality will result in the ETCS onboard subsystem being isolated.

c. The minimum steady state MTBSAF of the ETCS onboard system shall be 52,000 hours. A service affecting failure has an immediate effect or restriction on the operational use of the train.

d. The ETCS onboard subsystem shall function without degradation for a minimum of 4 hours with one redundant equipment item in a failed state. This is required so that the train may continue in operational service until the end of a peak period and then return to a maintenance depot with an operational ETCS onboard system.

e. The operation from the power on of ETCS to completion of multiple missions totalling 8 hours duration shall be able to be completed with any single odometer source failed. This is required so that the train may continue in operational service until the end of the day and then return to a maintenance depot with an operational ETCS onboard system. This results in a MTTRR of 40 hours of operating time based on 16 hour days.

f. The ETCS onboard subsystem shall be able to continue to be operated as usual while one of the redundant (for availability) equipment items has failed until corrective maintenance can be performed. 90% of redundant equipment item failures shall permit corrective maintenance to be delayed for up to five days. This will allow the train to continue in operational service until the end of the working week and then return to a maintenance depot with an operational ETCS onboard system for most equipment failures. The intention is to perform the corrective maintenance at the next scheduled opportunity for access to the ETCS onboard subsystem at an appropriate location.

g. The MTTRS after an ETCS onboard failure shall be less than 1 hour for active corrective maintenance activities.

h. The accepted method for theoretical reliability prediction shall be the application of IEC 61709.

i. The theoretical availability and reliability analysis shall be supported by in-service reliability information that provides at least a 50% confidence level that the theoretical values have been achieved. If the in-service reliability information is not sufficient to meet the required confidence level, then the type approval reliability demonstration shall also include field tests, laboratory tests and accelerated tests to achieve an equivalent confidence level by reasonably practicable means.

j. Roll out commissioning of an ETCS onboard system for each first of type ETCS train shall be required using 20 hours error and warning free operation, of the fitted rolling stock under ETCS supervision on the test track. This demonstration confirms application and compatibility with the particular rolling stock type.

k. Preventative maintenance, corrective maintenance and inspection or adjustment requirements shall be less often than once every 90 days assuming the defined mission profile.

Note: Cleaning of the DMI screen by the train driver is not considered to be preventative maintenance.

l. Equipment shall include traceability information to support configuration, maintenance and investigation of hardware issues or software issues or both.

m. For both hardware and software failures, the minimum MTBSAF for the EVC shall be 137,000 hours per system installed in a cab. The minimum MTBSAF for the EDOR shall be 83,500 hours per system installed in a cab. The duty cycle for the ETCS onboard system shall be 24 hours per day 365 days a year for RAM purposes.

n. The MART for constituents of the ETCS onboard system mounted under body shall be 1hour. For constituents of the ETCS onboard system not mounted under body, the MART shall be 30 minutes.

Note 1: This may be achieved by replacement or repair of failed LRU.

Note 2: MART does not include administrations and logistics, and commissioning time.

o. The system shall support operation for at least 20 years.

p. The allowable trip delay time contribution due to onboard system's service affecting failures shall be less than 380 delay minutes in an operational service year.

Note: These are the minimum requirements based on retrofitting ETCS to an existing train. A non-redundant DMI and balise antenna configuration has been assumed.

10.3 New train (whole fleet system)

The ETCS onboard system shall be integrated into the fleet as whole during the planning, design, installation and delivery phase of the asset lifecycle. If there are specific RAM requirements for the ETCS onboard system, it shall comply with the requirements set in Section 10.2.

If the RAM requirements are not specified for the ETCS onboard system, the following shall be used:

a. ETCS onboard system’s RAM requirements shall be apportioned from higher RAM requirements such as contractual performance targets or overall fleet RAM requirements.

b. The apportioned ETCS onboard system RAM requirements should align with Section 10.2. Any deviations shall be baselined and approved by the asset owner or asset custodian.

c. ETCS onboard system’s apportioned RAM requirements shall be measured and reported regularly after the commissioning. If the ETCS onboard system performances do not comply the apportioned RAM requirements, the fleet supplier shall remedy the shortcomings.

d. When the ETCS onboard system configuration is modified such as replacement or upgrade, the new configuration shall meet or exceed the baselined RAM requirements.

11 ETCS train data

The initial source of general vehicle class data is provided in TS TOC 1.

Car length shall be defined as the longest length coupled for the particular vehicle class as detailed in TS TOC 1.

The train length shall be defined as the sum of car lengths in metres rounded up to the next integer.

Maximum speed shall be in accordance with TS TOC 1.

Train category shall be based on the vehicle's track speed signs allocation in accordance with TS TOC 1.

Detailed information shall be obtained from the rolling stock operator or owner. When setting the ETCS onboard deceleration values, correction factors and build up times, the following shall be taken into account:

- the reduced adhesion function is not being used in Level 1 territory (note: for Level 2, adhesion is sent to the onboard via Packet 71)
- the national values are being used.

Appendix A Text messages (normative appendix)

Table 11 identifies text messages that shall be displayed to the driver on the DMI where the scenario described in Table 11 occurs. If the scenario cannot occur due to the configuration of the train type, the text message shall be considered not applicable. The inclusion of any additional text messages not shown in this table shall be approved by TfNSW.

Table 11 – Generic core messages

TfNSW text message displayed on DMI	Scenario	End condition
Report_Balise Fault 1_Contact Sig	A balise group with a Eurobalise version not compatible with onboard triggers a Trip mode with emergency brake intervention.	Message displayed until post trip exited
Report_Balise Fault 2_Contact Sig	A balise group data inconsistency triggers a service brake intervention.	Displayed for 17 minutes
Report_Balise Fault 3_Contact Sig	A balise linking inconsistency triggers a service brake intervention.	Displayed for 17 minutes
Report_Balise Fault 4_Contact Sig	Two consecutive balise groups are not detected by the onboard system. This triggers a service brake intervention.	Displayed for 17 minutes
Report_Balise Fault 5_Contact Sig	Reception of two successive relocation balise groups. This triggers a service brake intervention.	Displayed for 17 minutes
Report_Balise Fault 6_Contact Sig	No Movement Authority provided triggers an emergency brake intervention.	Message displayed until post trip exited
Report_Balise Fault 7_Contact Sig	A balise group read in unexpected direction triggers an emergency brake intervention.	Message displayed until post trip exited
Report_Balise Fault 8_Contact Sig	Two consecutive balise groups crossed outside their expected window announced by linking information. This triggers a service brake intervention.	Displayed for 17 minutes
Report_Balise Fault 9_Contact Sig	Packet 254 received by onboard. No intervention by onboard.	Displayed for indefinite time until reset
Report_Balise Fault 10_Contact Sig	A balise data inconsistency without reaction. No intervention by onboard.	Displayed for 17 minutes
Report_Balise Fault 11_Contact Sig	A balise linking inconsistency without reaction. No intervention by onboard.	Displayed for 17 minutes

TfNSW text message displayed on DMI	Scenario	End condition
Report_Onboard Fault 12 EB_Contact Sig+MC	Emergency brake command error.	Displayed for indefinite time until reset
Report_Onboard Fault 13 SB_Contact Sig+MC	IO port failure. This triggers a service brake intervention.	Displayed until reset
Report_Onboard Fault 14 SB_Contact Sig+MC	Service brake command error. This triggers an emergency brake intervention.	Displayed until message acknowledged
Report_Onboard Fault 15 SB_Contact Sig+MC	Service brake command error. This triggers an emergency brake intervention.	Displayed until message acknowledged
Report_Onboard fault 16 Traction Cut-off_Contact MC	Traction cut off not detected in expected state in due time.	Displayed until message acknowledged
Report_Onboard Fault 17 EB Test_Reset ATP_Contact MC	Both emergency brake valve tests have failed. This triggers an emergency brake intervention.	Displayed for indefinite time until reset or new emergency brake test requested by driver
Report_Onboard Fault 18 UTC Time Not Available_Contact MC	UTC time not available on-board during VBC validity check.	Displayed for indefinite time until reset
Report_Onboard fault 19 VBC Time Error_Contact MC	VBC stored on-board whereas UTC time not available on-board.	Displayed for indefinite time until reset
Report_Onboard Fault 20 VBC Expired_Contact Sig	Message will appear if train has been stabled within a virtual balise cover area for a specific period following crossing of a VBC.	Displayed for indefinite time until reset
Report_Onboard Fault 21 DRU_Contact Sig+MC	Diagnostic recording unit failure.	Displayed for indefinite time until reset
Report_Onboard Fault 22 ATP Event R Failed_Contact Sig+MC	A juridical recording unit or train recorder unit failure.	Displayed for indefinite time until reset or new status of connection with juridical recording unit
Report_Onboard Fault 23 Power-up Test_Reset ATP_Contact MC	Power up test failure.	Displayed for indefinite time until reset
Report_Onboard Fault 24 EB Test_Reset ATP_Contact MC	Partial emergency brake test failed. This triggers an emergency brake intervention.	Displayed for indefinite time until reset or new emergency brake test requested by driver
Report_Onboard Fault 25 Traction Cut-off_Contact MC	Traction cut off fault. (Consult TfNSW-AMB for details).	Displayed until Message acknowledged
Report_Onboard Fault 26 Traction Cut-off_Contact MC	Traction cut off fault. (Consult TfNSW-AMB for details).	Displayed until Message acknowledged
Report_Onboard Fault 27 Traction Cut-off_Contact MC	Traction cut off fault. (Consult TfNSW-AMB for details).	Displayed until Message acknowledged
Report_Onboard Fault 28 Traction Cut-off_Contact MC	Traction cut off fault. (Consult TfNSW-AMB for details).	Displayed until Message acknowledged

TfNSW text message displayed on DMI	Scenario	End condition
Report_Onboard Fault 29 Traction Cut-off_Contact MC	Traction cut off fault. (Consult TfNSW-AMB for details).	Displayed until Message acknowledged
Report_Onboard Fault 30 Traction Cut-off_Contact MC	Traction cut off fault. (Consult TfNSW-AMB for details).	Displayed until Message acknowledged
Report_Onboard Fault 31 Traction Cut-off_Contact MC	Traction cut off fault. (Consult TfNSW-AMB for details).	Displayed until Message acknowledged
Report_Onboard Fault 32 Traction Cut-off_Contact MC	Traction cut off fault. (Consult TfNSW-AMB for details).	Displayed until Message acknowledged
Report_Onboard Fault 33 BTM_Contact Sig+MC	Balise transmission module blind. This triggers a service brake intervention.	Displayed for 17 minutes
Report_Onboard Fault 34 Radar_Contact MC	Maintenance event.	Displayed for indefinite time until reset
Report_Onboard Fault 35 Wheel Sensor_Contact MC	Maintenance event.	Displayed for indefinite time until reset
Report_Onboard Fault 36 Wheel Sensor_Contact MC	Maintenance event.	Displayed for indefinite time until reset
Report_Onboard Fault 37 Accelerometer_Contact MC	Maintenance event.	Displayed for indefinite time until reset
Report_Onboard Fault 38 – EDOR_Contact Sig+MC	This is to inform the driver that there is an ETCS data radio equipment failure (not the DTRS). Pre-emptively informs driver that onboard will not communicate with the RBC.	Displayed for indefinite time until reset
Report_System failed	EVC has a critical failure or loss of communication between DMI and EVC (or both).	N/A
Report_DMI failure	DMI failed.	Displayed until message acknowledged Note: where possible
Software configuration error	Critical software issue.	Displayed for indefinite time until reset
Key Management Centre Connecting	When the onboard system is checking if there are new encryption keys for the train.	Displayed until connection completed with KMC
Report_KMC Connection Failed_Contact Sig	Following no power mode this message will appear if the Onboard system has not been able to contact the key management centre.	Displayed for indefinite time until reset
Key Management Information Updated	When there has been an update to the onboard ETCS encryption keys.	Displayed for 60 seconds

TfNSW text message displayed on DMI	Scenario	End condition
Report_Data Radio Network Registration Failed_Contact Sig	If a registration request from the onboard fails to register within 40 secs.	Text message disappears when any button in the main window is selected by the driver.
Train Running Number Too Long	This message will appear if a driver enters a train running number that's more than 8 characters. There is no onboard reaction.	Text message disappears when TRN entered correctly by driver
Report_Data Communication Error_Contact Sig	Within a Level 2 area or trying to enter a Level 2 area, the Onboard system has lost connection with the Radio Block Centre. The service brake will automatically be applied and bring train to a standstill.	Displayed for 17 minutes from loss of connection
Entering On Sight	The on-sight message only appears when the on-sight movement authority is not long enough for the whole train to be in the section defined for the movement.	Displayed until whole train has entered the on-sight area
Report_SH Mode Request Failed_Contact Sig	This text message will appear when a driver selects shunting mode on the DMI but does not get a response from the radio block centre after 60 secs. There is no onboard reaction.	Text message disappears when any button in the main window is selected by the driver.
Report_Emergency Stop_Contact Sig	An unconditional emergency stop message is accepted by the onboard system. Possible reasons include the operator of the traffic management system implementing an unconditional emergency stop or system generated due to an interlocking failure.	Message displayed until post trip mode has been exited
DMI Function Available	This message will appear when the DMI has re-established the connection with the European vital computer and the DMI functions are available.	Displayed for 60 seconds
Entering FS	The text message will be displayed to alert the driver that the ETCS recognises that the train is in full supervision mode, but the speed profile and gradient for the entire length of the train is not known.	Displayed until whole train has entered the FS area

TfNSW text message displayed on DMI	Scenario	End condition
Report_Trackside Not Compatible_Contact Sig	This text message will appear if the trackside system (software) version is not compatible with the onboard system (software) version. This message will only occur if the trackside system version is higher than the onboard system version (for example, the trackside system is v3.0 and the onboard version is v2.1). There is no onboard reaction.	Message displayed until communication session with the incompatible trackside has terminated
Report_Train is Rejected_Contact Sig	This text message will appear if the RBC rejects the connection with the onboard system. This could occur if the train position is 'unknown', if the RBC cannot confirm an 'invalid' position, or if the RBC chooses to reject the train. There is no onboard reaction. The driver will need to complete the appropriate process for start of mission.	Text message disappears when any button in the main window is selected by the driver.
Report_Signal Passed at Stop_Press Start to Continue	The train receives a trip order from a balise group (denoting there is an end of movement authority). The train will be tripped and the emergency brake will be applied until standstill.	Message displayed until post trip exited
Report_EB_Contact Sig	Emergency brake applied due to overspeed.	Clears on standstill
Report_Loss of Movement Authority_Contact Sig	Passing of EoA/LoA.	Message displayed until post trip exited
Report_Stopped Overrun Max Distance_Contact Sig	Authorised distance in mode PT overpassed.	Message displayed until post trip exited
Stopped Due To SR Mode_Select Start to Continue	'Stop in SR' information received from trackside while in SR mode.	Message displayed until post trip exited
Report_Hours Until ATP must be Reset:	A count down message for 24 hours emergency brake test requirement. Displayed with 3, 2, 1 hour countdown.	Message displayed until final countdown
Report_ATP must Be Reset When Train Stopped	ATP must be reset due to exceeding emergency brake test requirement. Traction cut off commanded preventing traction until reset conducted.	Displayed for indefinite time until reset
Report_Roll Away Protection Applied	Unexpected movement detected. Service brake applied.	Acknowledgement of brake icon to release brakes and message removed

TfNSW text message displayed on DMI	Scenario	End condition
Report_Brake valve isolated	One brake valve has been isolated.	Displayed until valve un-isolated
Report_Both Brake Valves Isolated	Both brake valves have been isolated.	Displayed until both valves un-isolated
Wait_EB Test in Progress	Emergency brake tests are being conducted.	Displayed until emergency brake tests completed
EB Test Aborted_Restart Test	Emergency brake test has been aborted.	Displayed for indefinite time until reset
EB Test Successful	Emergency brake successfully completed.	Displayed for 60 seconds
Change Out of SH Mode	Driver tries to enter main line in shunt mode. Trip mode with EBI commanded.	Message displayed until post trip exited
Selection no Longer Available	Unauthorised DMI input.	Displayed for 60 seconds or driver selects another button
Wait_Power-up Tests in Progress	EVC starting up and conducting system tests.	Displayed until End of power-up test
Power-up Tests Successful	Power up tests successfully completed.	Displayed for 60 seconds
Power-up Test Successful With Low Availability	Power up tests successfully completed but has identified a degraded condition in one of the subsystems.	Displayed for 60 seconds
SB Applied_Overspeed Detected	Train exceeds speed profile in which service brake has been commanded.	Displayed until train at standstill or train speed under permitted speed
No Track Description	Train location in rear of static speed profile or gradient profile stored on-board. Trip mode with emergency brake commanded.	Message displayed until post trip exited
SR Distance Exceeded	Authorised distance in staff responsible mode exceeded. Trip mode with emergency brake commanded.	Message displayed until post trip exited
Default National Values Used	Default national values currently stored onboard.	Displayed until driver acknowledgement or application of national values provided by trackside
Trackside National Values Used	Application of national values provided by trackside.	Displayed until driver acknowledgement or application of national values provided by trackside
Report_ATP Event R Recovered_Contact MC	Event recorder has recovered on its own.	Displayed for 60 seconds

TfNSW text message displayed on DMI	Scenario	End condition
Report_Inconsistent Repositioning_Contact_Sig	Undetermined location of 'Repositioning information' received from trackside amongst MA sections.	Displayed for 17 minutes
Master Controller to Min Brake	Brake test instruction.	Driver Acknowledge
Master Controller to Max Brake	Brake test instruction.	Displayed for 60 seconds
Wait for BP built-up	Waiting for BP to be built up.	Displayed for 60 seconds