Irish Railway Standard IRS-301-A

Requirements for Class B CCO and CCT Systems in the Republic of Ireland

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1 Foreword

1.1. This Irish Railway Standard:

i. cannot replace any Technical Standard for Interoperability (TSI) or other legal requirements which may be applicable to a given project;
ii. is recommended to be chosen in accordance with RFU-STR-088 as an Alternative Solution in conjunction with a TSI Parameter to demonstrate conformity with the Essential Requirements;
iii. may be called up as a code of practice in conjunction with CSM-REA 352/2009 and 402/2013;
iv. may be called up as good industry practice in conjunction with Railway Safety Act 2005;
v. may be called up as a code of practice in conjunction with the safe integration of projects within the Railway System in the Republic of Ireland as defined under 2008/57/EC Art15 or 2016/797 (EU) Art 18;
vi. may in parts or in full be called up as a National Rule (NR) for the Republic of Ireland in conjunction with 2008/57/EC or 2016/797 (EU).

1.2. Where this document is called up as a National Rule, the reason for its application shall be identified in line with EU 2016/797 Art 13(2):

i. where the TSIs do not cover, or do not fully cover, certain aspects corresponding to the Essential Requirements, including open points as referred to in 2016/797 Article 4(6);
ii. where non-application of one or more TSIs or parts of them has been notified under 2016/797 Article 7 or 2008/57/EC Art9 or Art20;
iii. where a specific case requires the application of technical rules not included in the relevant TSI;
iv. National Rules used to specify existing systems, limited to the aim of assessing technical compatibility of the vehicle with the network;
v. networks and vehicles not covered by TSIs;
vi. as an urgent temporary preventive measure, in particular following an accident.

2. Scope and Application

2.1. Scope

2.1.1. General scope

The focus of this IRS is the standardisation of the requirements for principal functional performance and principal interfaces of the CCO and the 50Hz Code CCT, 83.3Hz Code CCT, DTP CCT, DTP+50Hz Code CCT, DTP+83.3Hz Code CCT systems, in accordance with [TSI-CCS], which indicates that the definition of requirements for a Class B system are in the responsibility of the relevant Member State. This includes primarily the air gap interfaces between CCT and CCO, the interface to the driver, the interface to the trackside signalling system, the interface to the vehicle brake performance. Internal functions of the systems are only standardised as far as this is required to archive the aforementioned focus.

Note: This focus shall ensure that predictable system behaviour and performance, as well as standardised interfaces, support the safe operation of any Class B system application.

2.1.2. Scope of this version

The current version of this document only applies to CCO applications fitted in Electrical Multiple Unit passenger trains, and is limited to the definition of CCT areas uniquely equipped with 83.3Hz Code and associated unfitted depots (i.e. the current DART area), and the operation of trains in that area.

The application of this document is currently also limited to single cab CCO installations, i.e. one CCO fitted per cab. Dual cab fitment requirements will be included in a future version of this IRS.

A future version of the document will be released to specify the requirements applicable to other CCO Operating Modes and CCT configurations.

Note: During the development of the current version of this IRS and associated IRS, consideration has been given to Human Factors aspects through workshops and on train operational trials with RU staff in IRL, together with experience gained from many years of operation with the existing IRL Class B systems.
It is intended that a future expanded version of this IRS would be supported by additional Human Factors analyses.

2.2. Editing rules

- The document is divided into sections and sub-sections in which requirements are defined.
- Each requirement is identified with a unique identification number, and with an attribute, that makes the requirement *Mandatory* or *Optional*.
    - Essential Requirements shall be implemented in all CCT and new CCO installations. Any derogation from a mandatory requirement must be formally requested to the Commission for Railway Regulation, as per [DER].
    - Optional Requirements may be implemented.
- The unique identifiers are intended to support the development, verification & validation activities for the Class B equipment. The requirement identifiers are not intended to change in the next version of the document. For new requirements new identifiers would be generated in sequence and introduced between the existing ones.
- Each Requirement is allocated to a sub-system (CCT or CCO) or identified as an application condition, which shall be addressed by:

  - The Railway Undertaking, or
  - The Infrastructure Manager.
- Notes, Justifications and Examples are only informative and shall be regarded as supporting information for the understanding of the requirements. They are shown in blue italics as follows: *Notes in the text*.
- The use of terms her, his, signalman, driver, etc. in this standard is not intended to be gender specific.

2.3. Conformity Assessment

The following table identifies all sections of this Irish Railway Standard which are proposed as IRL National Rules. The rationale is identified in line with section 1.B

In each case the assessment of a product or installation against an IRL National Rule shall be performed by an IRL Designated Body (DeBo) employing the Modules stated. The assessment Modules are defined in 2010/713/EC. In this regard, the term NoBo (as used in 2010/713/EC) shall be understood to mean DeBo and references to TSIs shall be understood to mean references to IRL National Rules.

Section	Rationale		Module(s)
3 to 8	where the TSIs do not cover, or do not fully cover, certain aspects corresponding to the Essential Requirements, including open points as referred to in 2016/797 Article 4(6); National Rules used to specify existing systems, limited to the aim of assessing technical compatibility of the vehicle with the network;	i iv	For CCO: (SB+SD) or (SB+SF) or (SH1) For CCT: (SG) or (SB+SD) or (SB+SF) or (SH1)

Table 1 - National Rule Provisions

When a requirement of this IRS refers to the [IRS-EMC], the conformity assessment of this requirement shall be made in accordance with the assessment requirements specified in that [IRS-EMC] document.

3. Normative references

In the development, verification & validation, operation and management of the CCO and CCT systems the application of the following standards and legislations shall be required in conjunction with this IRS. Subsequent revisions may be used instead of the quoted revisions where these are compatible with the revision quoted.

[50126] EN50126:2017 Railway applications - The specification and demonstration of reliability, availability, maintainability and safety (RAMS) Part 1 and Part 2

[50128] EN50128:2011 Railway applications - Communication, signalling and processing systems - Software for railway control and protection systems

[50129] EN50129:2018 Railway applications - Communication, signalling and processing systems - Safety related electronic systems for signalling

[50159] EN50159:2010 Railway applications - Communication, signalling and processing systems - Safety-related communication in transmission systems

[UIC 453-2001] Procedures for air brake tests effected with a powered Unit - Provisions concerning international trains – 01/07/2001

[50155] EN 50155:2017 Railway applications - Electronic equipment used on Rolling Stock

[61375] IEC 61375-1:2012 Electronic railway equipment –Train communication network (TCN) –Part 1: General architecture
and
IEC 61375-2-12012 Electronic railway equipment – Train communication network (TCN) – Part 2-1: Wire Train Bus (WTB)

[CSM402] CSM-RA 402/2009 Commission Implementing Regulation (EU) No 402/2013 of 30 April 2013 on the common safety method for risk evaluation and assessment and repealing Regulation (EC) No 352/2009 including any related amendments.

[DER] *Code of Irish Railway Standard to be included* - CRR Derogation procedure

[ECM] COMMISSION REGULATION (EU) No 445/2011 of 10 May 2011 on a system of certification of entities in charge of maintenance for freight wagons,
or
COMMISSION IMPLEMENTING REGULATION (EU) 2019/779 of 16 May 2019 laying down detailed provisions on a system of certification of entities in charge of maintenance of vehicles.

[SUB-026] UNISIG ERTMS/ETCS SUBSET-026: System Requirements Specification, Issue 3.6.0

[SUB-035] UNISIG ERTMS/ETCS SUBSET-035: Specific Transmission Module FFFIS, issue 3.2.0

[SUB-036] UNISIG ERTMS/ETCS SUBSET-036: FFFIS for Eurobalise, Issue 3.1.0

[SUB-041] UNISIG ERTMS/ETCS SUBSET-041: Performance Requirements for Interoperability, Issue 3.2.0

[IRS-DMI] *Code of Irish Railway Standard to be included* – Driver Machine Interface for CCO, version as valid on the date of application for authorisation

[IRS-AIRGAP] *Code of Irish Railway Standard to be included* – Continuous and discontinuous signal transmission requirements for CCT and CCO Signal, version as valid on the date of application for authorisation

[IRS-EMC] IRS 203 Irish Railway Standard EMC–coordination, version as valid on the date of application for authorisation

[TSI-CCS] Technical Specification for Interoperability relating to the 'control-command and signalling' subsystems of the rail system in the European Union COMMISSION REGULATION (EU) 2016/919 including any related amendments.

[TSI-L&P] Technical Specification for Interoperability relating to the 'Rolling Stock — locomotives and passenger Rolling Stock' subsystem of the rail system in the European Union – 1302/2014, including any related amendments.

[TSI-OPE] Up to 16.05.2021: Technical Specification for Interoperability relating to the operation and traffic management subsystem of the rail system in the European Union - 2012/757/EU including any related amendments (e.g. (EU) 2015/995)
From 16.05.2021: Commission Implementing Regulation (EU) 2019/773 on the Technical Specification for Interoperability relating to the operation and traffic management subsystem of the rail system within the European Union including any related amendments.

4. Terms and Definitions

Where a Term contained in this section is used in this IRS, it shall have the associated Definition contained in this section.

Actual Train Consist	The current train composition including all its physical properties (e.g. length, load, brake performance). These properties shall reflect the true current values including any set up of equipment or presence of failed equipment or degraded performance of equipment.
Berth Track	The track circuit (or combination of track circuits), immediately on the approach to a signal. *Note: the Berth Track length corresponds to:* - *In 50Hz CCT area: the greater of the minimum sighting distance for the signal at Civil Line Speed or 300m.* - *In 83.3Hz CCT area: the braking distance from the ATP Speed of the previous track section to Standstill of the trains permitted to operate on that section of line.*
Fixed Installations	Installations and equipment of the railway network infrastructure in IRL, which comprises the infrastructure (INF), electric traction energy supply systems (ENE) and trackside control command and signalling systems (CCT).
Movement Authority	(will be defined in a future version of this document)
Operating Rule	Any Operating Rule required by this standard shall be established in accordance with [TSI OPE]. *Note: An Operating Rule required by this IRS will constitute a national Operating Rule relating to the operation of a class B CCT or CCO system according to [TSI OPE].* In accordance with [TSI-OPE] the required national rules shall be contained in the Route Book elements provided from an IM to the RUs for integration into their Rule Books for drivers. In accordance with [TSI-OPE] the required national rules shall be contained in the driver's Rule Book provided from the RUs to the drivers. In accordance with [TSI-OPE] and the IM's SMS established under the requirements of the Railway Safety Directive the Operating Rules for IM stall shall be contained in the Documentation for Infrastructure Managers' staff.
Pre-Berth Track	The track circuit (or combination of track circuits), immediately on the approach to the Berth Track.
Predefined Train Formation	A train formation of several Units coupled together, which was already pre-defined at design stage and which can be re-configured during operation without the need to use specific workshop equipment. Example: It has been pre-defined, at design stage, that a fixed formation of an (IE-Class8100 EMU plus IE-Class8300 EMU) Unit may operate with up to three other fixed formations of the same Unit type in a train.

	Note: in some fixed formations, two vehicles may share a joint element of running gear.
Speed	See definitions below
Current Train **Speed**	Current speed of the Train with respect to the track over which it is running
Maximum Unit **Speed**	The maximum speed authorised by an RU to operate a vehicle to which the CCO is fitted. This speed is pre-parametrised within the CCO.
Maximum Train **Speed**	The maximum speed authorised by an RU to operate the Actual Train Consist to which the CCO is fitted. This speed can be modified by the driver via the Full Data Entry procedure, if available.
Operationally Restricted Maximum Train **Speed**	The maximum Speed, lower than the Maximum Train Speed, authorised for the Actual Train Consist by RU for maintenance or operational reasons. If Full Data Entry procedure is available, this value can be entered by the driver as the Maximum Train Speed and monitored by the CCO. If only simple Data Entry Procedure is available, this speed cannot be monitored by the CCO and remains under full responsibility of the driver.
Operationally Restricted Line **Speed**	The maximum speed authorised by an IM Operating Rule or an order from signalman. This speed is not intended to be monitored by the CCO.
CCO Operating Mode **Speed**	The maximum speed authorised by an IM to operate in the active CCO Operating Mode. One speed value for each CCO Operating Mode is preconfigured within the CCO.
Civil Line **Speed**	The maximum speed authorised by an IM for a section of track, derived from its design (e.g. track alignment, transition curves, maximum permitted cant deficiency, axle load), and a tolerance for maintenance and operation.
Turnout **Speed**	The maximum speed authorised by an IM for a turnout, derived from its design, and a tolerance for maintenance and operation
DTP Line **Speed**	The speed limits transmitted by DTP, DTP+83.3Hz and DTP+50Hz CCT areas, directly derived from the combination of Civil Line Speed and the Train Type. It is applicable in DTP, DTP+CODE, or DTP+CODE_E modes.
DTP Signalling **Speed**	The speed limits, applicable in DTP, DTP+CODE, or DTP+CODE_E modes, and calculated by the CCO based on: - The signal aspect transmitted from CCT - The distance to the associated end of movement authority, initially transmitted from CCT and subsequently updated by CCO via odometry - The Turnout Speed and location if present within the Movement Authority, transmitted from CCT. - Applicable gradients from CCT - Braking deceleration rates and response times of the Actual Train Consist

- CCO System reaction time.

DTP Release **Speed** — The maximum speed limit under which the train is permitted to operate under defined conditions in the vicinity of the End of Movement Authority (e.g. approaching close to a red signal).
It is applicable in DTP, DTP+CODE, or DTP+CODE_E modes, and is pre-parametrised within CCO at 15km/h and may be modified by information sent from CCT. The DTP release speed monitoring is automatically activated by CCO when the DTP Signalling Speed reaches the DTP Release Speed value on the approach to the red signal.

ATP **Speed** — The maximum speed, applicable in ATP and DTP_E+ATP modes, and transmitted by an 83.3Hz CCT over a track circuit length, based on :

- The Civil Line Speed.
- The Turnout speeds, if present within the Movement Authority.
- The signal aspect.
- The location of the track circuit within the Movement Authority
- The braking deceleration rates and response times of all Actual Train Consists permitted to operate in ATP mode on that section of track.
- System reaction time.
- Applicable gradients.

This speed can be set to following values: 0, 30, 50, 75 or 100 km/h.

ATP Running Release **Speed** — The maximum speed limit under which the train is permitted to operate under defined conditions in the vicinity of the End of Movement Authority (e.g. approaching close to a red signal).

It is applicable in ATP or DTP_E+ATP modes, and is pre-parametrised within CCO at 15km/h. It is activated when the driver activates the Running_Release function on the approach to an End of Movement Authority.

Temporary Speed Restriction **Speed** — The maximum speed permitted temporarily by an IM over a section of track, in order to reduce the Civil Line Speed, because of degraded operating conditions or as part of worksite protection.

DTP Temporary Speed Restriction **Speed** — The speed limit transmitted by DTP CCT over a section of track, directly derived from the Temporary Speed Restriction Speed. DTP Temporary Speed Restriction Speeds are applicable to DTP, DTP+CODE, DTP+CODE_E, ATP, CAWS, STAFF_RESPONSIBLE, UNFITTED, and CODE_E modes.

Permitted **Speed** — The resulting speed value against which CCO is monitoring the Current Train Speed, depending on CCO mode and operating conditions

First Intervention **Speed** — The speed value, slightly higher than the Permitted Speed, depending on CCO mode and operating conditions, from which CCO shall initiate first speed reduction measures

Second Intervention **Speed**	The speed value, slightly higher than the First Intervention Speed, depending on CCO mode and operating conditions, from which CCO shall initiate safety critical speed reduction measures
Standstill	The train is considered at Standstill while the Standstill condition is met. The Standstill Condition is defined in section “7.4.17 Odometry”.
Train	An operational formation consisting of one or more Units. Operational means, in this context, that the Train is equipped with a traction system, with at least one cab from which the Train can be operated, and with all other equipment as required for its operation on the rail network.
Unit	The smallest operational element which may be integrated in a Train or taken out of a Train by operating staff without the need to use specific workshop equipment. A Unit may be composed of one or multiple individual vehicles. Examples: • An IE-Class201 locomotive, as an individual vehicle, is a Unit • A fixed formation of one IE-Class8100 EMU motorised vehicle with one IE-Class8300 EMU trailer vehicle is a Unit *Note: In some fixed formations, two vehicles may share a joint element of running gear.*
Vehicle	Composed of Rolling Stock and CCO (definition by EU legislation and guidance)

5. Symbols and Abbreviated Terms

ATP	Automatic Train Protection (name given to the IRL Class B functions which are based on 83.3Hz code airgap)
BG	Balise Group
CAWS	Continuous Automatic Warning System (name given to the IRL Class B functions which are based on 50Hz code airgap)
CCO	Command Control & signalling On-board sub-system
CCT	Command Control & signalling Trackside sub-system
CSM	Ceiling Speed Monitoring
DMI	Driver Machine Interface
DMU	Diesel Multiple Unit
DTP	Discontinuous Train Protection (name given to the IRL Class B functions based on Eurobalise airgap)
EB	Emergency Brake
ECM	Entity in Charge of Maintenance
EMU	Electric Multiple Unit
ETCS	European Train Control System
G-P-R	Goods – Passenger – Rapid brake performance rating
IM	Infrastructure Manager
IRL	Republic of Ireland
JRU	Juridical Recording Unit (Event Recorder)
NR	National Rule
PPM	Pulses Per Minute
RU	Railway Undertaking
RSM	Release Speed Monitoring
RST	Rolling Stock
SAS	Start Against Signal
SB	Service Brake
SIL	Safety Integrity Level
SRAC	Safety Related Application Condition(s)
TSI	Technical Specification for Interoperability
TSM	Target Speed Monitoring
TSR	Temporary Speed Restriction

6. System Overview

This section provides a brief description of the system features, in the form of informative notes.

The Class B Control Command System consists of CCT and CCO elements. It is provided to give Train drivers in-cab indications (audible and visual) about the status of the lineside signalling system and to demand, according to defined principles, the brakes and traction cut-off (if configured) when the driver fails to react accordingly.

The CCO provides several CCO Operating Modes and levels of functionalities, depending on the type of CCT fitment implemented in the area where the CCO fitted Train is being operated.

The system behaviour and level of protection differs from one CCO Operating Mode to another.

The IRL Class B CCO is a multi-functional signalling system which uses information received from the CCT trackside equipment systems

- *CAWS (based on track circuits with 50hz codes),*
- *or ATP (based on track circuits with 83.3Hz codes),*
- *and/or DTP (Based on balises and Encoders, with ETCS Packet 44 Telegrams)*

to present speed- and signalling- information to the driver and, in certain CCO Operating Modes and circumstances, to automatically act on the information received and to demand service brake and/or emergency brake application of the Train. This includes amongst others following nominal operational concepts:

- *ATP mode on 83.3Hz CCT areas – the Class B CCO provides speed monitoring based on the 83.3Hz codes received from the track circuits.*
- *CAWS mode on 50Hz CCT areas - The Class B CCO provides CAWS aspect acknowledgement requests to the driver based on the 50Hz codes received from the track circuits.*
- *Unfitted Area – The Class B CCO does not provide monitoring of the highest possible network Civil Line Speed.*
- *DTP mode on DTP CCT Area – The Class B CCO provides speed and distance monitoring based on the aspects of the lineside signals and the infrastructure data (speed limits, distances, divergences and gradients) received through the use of CCT Balises and encoders. Whilst the data is sent to the Train intermittently via Balises, the speed and distance protection is ensured continuously by the CCO. Fitment must be considered on an area basis, i.e. DTP cannot be fitted on isolated signals.*
- *DTP+CODE mode on DTP+83.3Hz or DTP+50Hz CCT Areas – The Class B CCO provides continuous speed and distance monitoring based on the aspects of the lineside signals and the infrastructure data (speed limits, distances and gradients) received through the use of CCT Balises, Encoders, and code (50 Hz or 83.3 Hz) received from the track circuits. Compared to DTP mode, DTP+CODE mode requires less encoders and provides the benefit of continuous communication.*

6.1. Architecture Block Diagram

The figure below provides a description of the overall CCT and CCO architecture, reflecting a single cab configuration.

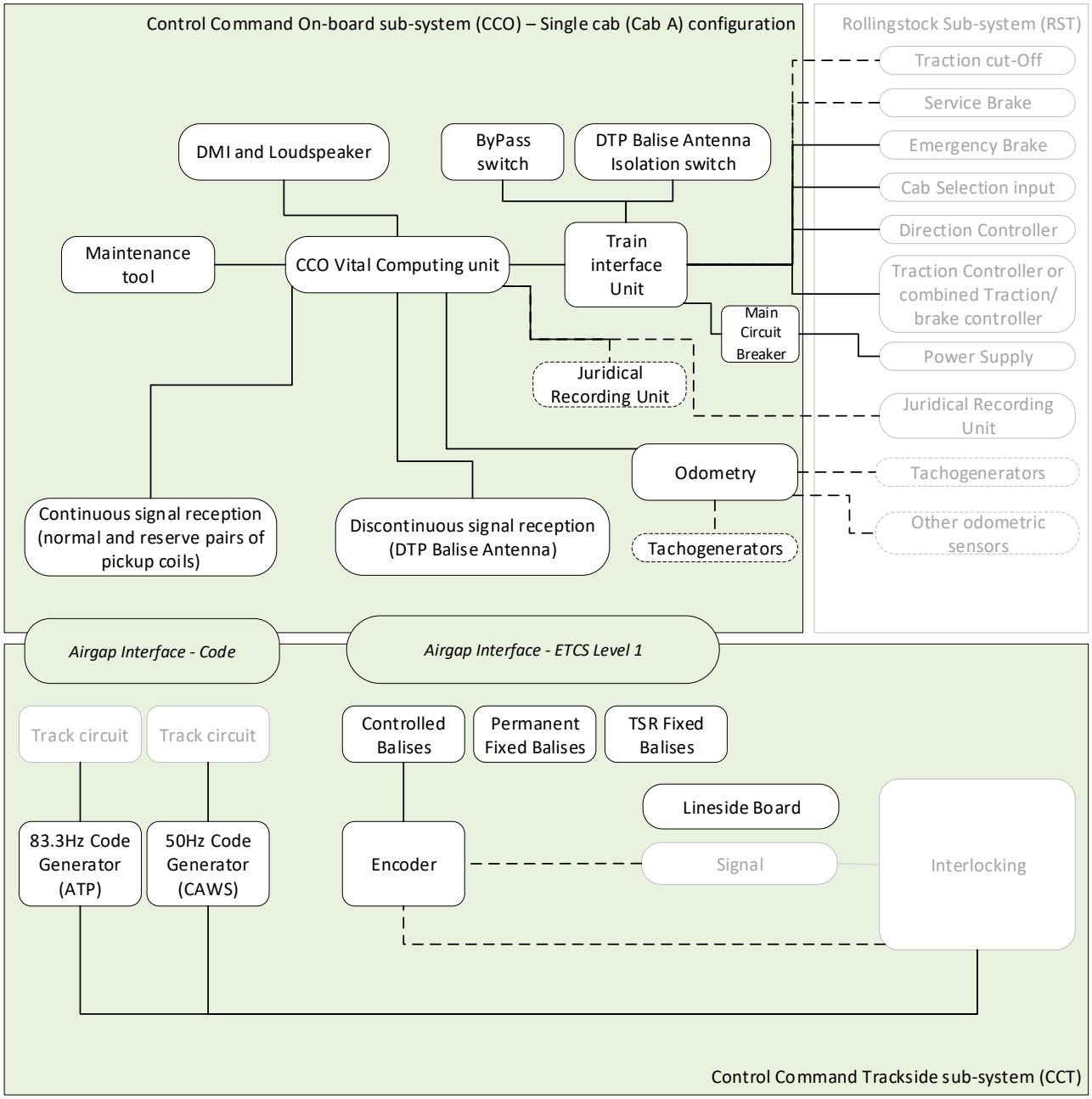


Figure 1 – CCT and CCO architecture block diagram

Note: This version of the document is limited to the definition of single cab fitment requirements. Dual cab fitment requirements will be included in a future version of this IRS.

Note: Dotted lines refers to optional or alternative configurations:

The CCO Vital Computing Unit may be connected to the "existing" Rolling Stock Juridical Recording Unit (if it satisfies the requirement of this IRS) or a dedicated CCO Juridical Recording Unit.
The odometry system may be connected to the "existing" Rolling Stock tachogenerators (if they satisfy the requirement of this IRS) or dedicated CCO tachogenerators. Other odometric sensors may be added where required to achieve the allocated SIL.

The Traction Cut-Off and Service brake connections may be configured or not.
The Encoders may be interfaced with the signal or directly with the interlocking.

6.2. Maximum Train Speed Monitoring

This feature monitors the Maximum Train Speed limit which relates to Actual Train Consist. If the Current Train Speed exceeds that limit, the CCO demands the service or emergency brake as appropriate until the Current Train Speed becomes less than the Maximum Train Speed. This may lead to a stop.

6.3. Signalling Speed Monitoring

This feature monitors the Current Train Speed against a calculated Permitted Speed so that the End of Movement Authority is not overrun and the Turnout Speeds are adhered to. If the Current Train Speed exceeds the calculated Permitted Speed, an overspeed condition occurs and the CCO demands the service or emergency brake as appropriate until the Train speed becomes less than the calculated Permitted Speed again. This may lead to a stop.

6.4. Civil Line Speed Monitoring

This feature monitors the Current Train Speed against the Civil Line Speed applicable for the Train Type. If the Current Train Speed exceeds the Civil Line Speed, an overspeed condition occurs and the CCO demands the service or emergency brake as appropriate until the Train speed becomes less than the Civil Line Speed again. This may lead to a stop.

6.5. CCO Operating Mode Speed Monitoring

This feature monitors the maximum speed limit according to the current CCO Operating Mode of the CCO. If the Train speed exceeds that limit, the CCO demands the service or emergency brake as appropriate until the Train speed becomes less than the maximum CCO Operating Mode Speed limit again. This may lead to a stop.

6.6. Buffer protection

This feature protects a buffer stop in DTP or DTP+CODE modes by providing a speed limit at which the buffer stop can be approached via balises and encoder. This requires the fitment of several balise groups on the buffer stop approach area. This is expected to lead to a stop.

6.7. Temporary Speed Restriction Speed Monitoring

This feature uses balises to monitor Temporary Speed Restriction Speed limits that are imposed on the Trains in working areas or degraded conditions of tracks, for a limited time and which are subsequently removed. This may lead to a stop.

6.8. CAWS code acknowledgement

This feature requires the driver to acknowledge 50Hz code changes which result in a more restrictive aspect. Failure to acknowledge causes an emergency brake demand until Standstill.

6.9. Start Against Signal Reminder

This feature demands a traction power cut off by the Train while it is stopped with an absence of trackside code (e.g. standing at a red signal or a buffer stop in a 50Hz or 83.3Hz CCT area) and requires the driver to acknowledge the absence of code in order to restore power and to move the Train. If, for any reason, the Train moves with the SAS Reminder is active, the Emergency Brake is demanded until Standstill.

6.10. Running Release

This feature requires the driver to acknowledge the absence of code while approaching a red signal in 83.3Hz or 50Hz CCT territory, and then monitors the Current Train Speed against the ATP Running Release Speed limit of 15 km/h when in ATP mode.

6.11. Forward shunting

This feature monitors the Current Train Speed against the maximum permitted CCO Operating Mode Speed of 15km/h when shunting forward. Activated by the driver, this feature is typically used for forward shunting movements. In accordance with the currently defined Operating Rules in IRL there is no time or distance limit for this feature to be active and CCO ignores any CCT code or balise information.

6.12. Reverse shunting

This feature monitors the Current Train Speed against the maximum permitted CCO Operating Mode Speed of 15km/h when moving in reverse direction. Activated by the driver, this feature is typically used for reverse shunting movements.

6.13. Management of transitions between different trackside configurations

This feature manages the transitions between CCT areas. The CCO automatically switches to the proper CCO Operating Mode, according to the CCT data detected by CCO. The driver must in all cases evaluate and, where appropriate, confirm this automatic transition. In absence of this confirmation, CCO will demand emergency brake until Standstill.

6.14. Train Stop

This feature ensures that a Train which passes a running signal at red without authority is immediately brought to a stop. CCO will demand the emergency brake until Standstill. This feature requires close coordination of the Train braking performance, the signalling speed approaching the signal at red and the available safe distance after a signal at red (block overlap).

6.15. Stop Override

This feature inhibits the Train Stop protection in order to allow the Train to pass an individual running signal displaying a red aspect upon having obtained authority to do so from the signalman. This requires the driver to enter a code in the DMI, which is uniquely associated with the signal being passed.

6.16. Roll-away protection

This feature protects against movements of the Train without the control of the driver. The protection consists of emergency brake demand if the movement of the Train exceeds a pre-defined distance with a low speed.

6.17. Monitoring of the efficiency of the service brake

This feature monitors the efficiency of the service brake (if SB is configured) and demands the emergency brake in ATP and DTP_E+ATP modes, if the deceleration achieved by service brake is insufficient.

6.18. Speed Display

The CCO shall display the Current Train Speed to the driver in all CCO Operating Modes except CAWS, UNFITTED, AUTOTEST, MAINTENANCE, CAB_SELECTED, and NO_CAB_SELECTED. In these modes, the speed

shall be provided to the driver through an alternative dependable source of information (e.g. a separate Rolling Stock speedometer), if the SIL level of the CCO speed display is not appropriate.

In BYPASS mode, either

- *the speed shall be provided to the driver through an alternative dependable source of information, or*
- *an operating rule shall be established to require drivers to reduce their speed to a level at which they can safely stop the Train within the distance they can see to be clear.*

6.19. CAWS Aspect Display

The CCO presents the CAWS aspect display to the driver in CAWS mode.

6.20. Permanent Test

This feature includes an automated self-test of the CCO from start-up, continuous monitoring of certain hardware (the CCO rack, pickup coils, DTP Balise Antenna, tacho-generators, Juridical Recording Unit communication link, etc.) and software during operation.

6.21. Error Management

This feature manages detected system failures and resulting errors and their acknowledgement and is enabled by the self-checking functionality of the CCO. The error management includes a broad range of on-board errors and those trackside errors that are visible to the CCO. All managed errors are logged in the Juridical Recording Unit and errors which require immediate attention are also displayed to the driver. The occurrence of certain errors will automatically lead to stop.

6.22. Bypass

In case of complete failure of the CCO, a hardware bypass switch is provided which, when activated, operates interface relays isolating the CCO from the Train, and allowing Train movement under driver responsibility.

7. Control Command and signalling On-board (CCO) Requirements

7.1. General Requirements for CCO

[REQ:IE-CLASSB_00001];[Allocation:Onboard];[Type:Mandatory]

The CCO shall not interfere adversely with any other CCT or CCO systems which are installed in IRL at the time of placing on market/in service. This shall be assessed based on following topics:

- Installation condition at application level,
- Applicable and related requirements of [TSI CCS], [IRS-EMC].

[END_REQ]

[REQ:IE-CLASSB_00002];[Allocation:Application Condition];[Type:Mandatory]

SRAC: Every SRAC indicated in this document requiring the establishment of an Operating Rule or the information or the training of staff shall, in accordance with [CSM402], be transferred to the relevant actor, through suitable means.

[END_REQ]

[REQ:IE-CLASSB_00003];[Allocation:Onboard];[Type:Mandatory]

All CCO functional requirements described in this IRS, including those specified in section 7.3, and internal CCO supporting functions shall be allocated and shall achieve SIL targets which have been established in accordance with [CSM402], [50126], [50128], and [50129]. For those functions specified in section 7.4, minimum SIL requirements have been defined in section 7.4.2 Table 7 - Functions Safety Integrity Levels.

[END_REQ]

[REQ:IE-CLASSB_00004];[Allocation:Trackside];[Type:Mandatory]

The CCO requirements indicated in this section 8 shall be read in conjunction with the CCT Requirements indicated in section 8 of this document.

[END_REQ]

7.2. CCO Pre-Parametrisation

7.2.1. General Requirements for CCO Train Data

Note: CCO requires for its correct operation values to be determined for at least the set of parameters which represents the CCO Train Data as defined in this section. These values may either be based on pre-parametrised values to be confirmed by the driver or on values directly entered by the driver during Data Entry.

[REQ:IE-CLASSB_00005];[Allocation:Onboard];[Type:Mandatory]

The values assigned to the Train Data parameters are used in safety related functions. The generation of the values shall be commensurate with the level of safety integrity required by these functions.

The values shall at any moment in time reflect the performance of the Actual Train Consist. Where required, to ensure this, the values shall be accompanied by related conditions for operation or maintenance of CCO or Rolling Stock.

[END_REQ]

Note: It may be necessary to consider for some values an adjustment to reflect possible degraded states of performance (e.g. the presence of a failure in the emergency brake system of the Train which is undetectable during operation).

[REQ:IE-CLASSB_00006];[Allocation:Onboard];[Type:Mandatory]

CCO shall be parametrised to allow either

- Simplified Data Entry, or
- Full Data Entry

by the driver.

[END_REQ]

[REQ:IE-CLASSB_00007];[Allocation:Onboard];[Type:Mandatory]

In the case of Simplified Data Entry, the CCO shall comply with both the General Requirements and the Requirements Specific to Simplified Data Entry of this section 7.2.

[END_REQ]

[REQ:IE-CLASSB_00008];[Allocation:Onboard];[Type:Mandatory]

In the case of Full Data Entry, the CCO shall comply with both the General Requirements and the Requirements Specific to Full Data Entry of this section 7.2.

[END_REQ]

[REQ:IE-CLASSB_00009];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to ensure that the process of establishing and pre-parametrisation of CCO data is commensurate with a SIL4 application. This shall follow the relevant requirements of *[EN501265], [EN50128], [EN50129] and [CSM_402]*.

[END_REQ]

7.2.2. Train Data parameter: Train Type

Note: This Train Data parameter will be defined in a future version of this document. The name of the parameter may be changed.

7.2.3. Train Data parameter: Max Unit Speed

[REQ:IE-CLASSB_00010];[Allocation:Onboard];[Type:Mandatory]

The Max Unit Speed value shall be in [km/h].

[END_REQ]

[REQ:IE-CLASSB_00011];[Allocation:Trackside];[Type:Mandatory]

At the time of installation of CCO into a Unit, the value set for the Max Unit Speed parameter shall be the most restrictive of the maximum permitted operational ceiling speeds of the vehicles forming the Unit to which CCO is fitted.

This value shall not be modifiable by the driver.

[END_REQ]

Note: The Maximum Unit Speed is a pre-configured parameter in the CCO, which is set according to the following values:

- *Where CCO is fitted to a Unit formed by an individual vehicle: The maximum permitted operational ceiling speeds of that vehicle.*
- *Where CCO is fitted to a Unit formed by a fixed consist of vehicles: The maximum permitted operational ceiling speeds of that consist.*

[REQ:IE-CLASSB_00012];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An application condition shall be established to determine the Operating Rules applicable when, for technical or operational reasons, the Unit must be limited to a speed lower than the pre-parametrised Max Unit Speed.

[END_REQ]

[REQ:IE-CLASSB_00013];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An operational rule shall be established to ensure that the authorised staff, which is permitted to adjust the Maximum Unit Speed parameter, shall be trained and made aware of the rail operation safety risks associated with incorrect values.

[END_REQ]

7.2.4. Train Data parameter: Max Train Speed

7.2.4.1. General requirements

[REQ:IE-CLASSB_00014];[Allocation:Onboard];[Type:Mandatory]

The Max Train Speed value shall be in [km/h].

[END_REQ]

[REQ:IE-CLASSB_00015];[Allocation:Onboard];[Type:Mandatory]

The value set for the Max Train Speed parameter shall be the most restrictive of the maximum permitted operational ceiling speeds of all the Units in the Actual Train Consist.

[END_REQ]

7.2.4.2. Requirements specific to Simplified Data entry

Note: This parameter cannot be modified during Simplified Data Entry

[REQ:IE-CLASSB_00016];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to ensure that a Train running under Operationally Restricted Maximum Train Speed is not supervised by CCO if the CCO is configured for Simplified Data Entry. Alternative Operating Rules shall be established for this case.

[END_REQ]

7.2.4.1. Requirements specific to Full Data entry

Note: The modification by the driver of this parameter during Full Data Entry will be defined in a future version of this document.

[REQ:IE-CLASSB_00017];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to require the driver to use the most restrictive of the maximum permitted operational ceiling speeds of all the Units in the Actual Train Consist as value for the Max Train Speed parameter.

[END_REQ]

7.2.5. Train Data parameters: Train Emergency Brake Response Time

7.2.5.1. General requirements

[REQ:IE-CLASSB_00018];[Allocation:Onboard];[Type:Mandatory]

The Train Emergency Brake Response Time value shall be in [s].

[END_REQ]

[REQ:IE-CLASSB_00019];[Allocation:Onboard];[Type:Mandatory]

The Emergency Brake response time shall be the time from Emergency Brake demand by CCO to the achievement of at least 90% of the established deceleration and shall be based on the combination of the following:

1. The Emergency Brake Response Time of the Actual Train Consist shall be associated with an Emergency Brake system which has at safety integrity level of SIL4, or comparable level of integrity, in accordance with [CSM402], [50126], [50128], and [50129]. This is also applicable, where a vehicle has multiple parallel Emergency Brake systems.
2. An Emergency Brake Response Time increase, due to undetected (or during operation undetectable) single point failures which may be present during operation. These failures and the resulting time increase shall be determined by risk assessment in accordance with [CSM402], [50126], [50128], and [50129].

   During this risk assessment, at least the following failures must be considered (non-complete listing):

   a. An unsuitable design of a vehicle's traction cut off system which may cause traction removal to be delayed or negated.
   b. An EB design with unacceptable common cause failures.
   c. An EB design with unacceptable single point failures due to a lack of redundancy.
   d. An accumulation of undetected (or undetectable) failures due to an unsuitable Emergency Brake maintenance regime.
   e. An accumulation of undetected (or undetectable) failures during operation due to an unsuitable operational testing regime for the Emergency Brake.
   f. An unsuitable bypass design which may inadvertently cause a bypass or delay to the EB demand.
3. Any necessary adjustment of the Emergency Brake Response Time associated with the actual brake performance set-up of each vehicle of the Actual Train Consist (e.g. G-P-R).
4. Any other factors which necessitate adjustment of the Emergency Brake Response Time shall be identified based on risk assessment according to [EN501265], [EN50128], [EN50129] and [CSM_402].

[END_REQ]

[REQ:IE-CLASSB_00020];[Allocation:Application Condition];[Type:Mandatory]

SRAC: The respective vehicle's EB Response Time type tests results must be determined based on the requirements defined in [TSI L&P],

- section 4.2.4.2.1 (1)+(3)+(4)+(7)+(8)+(9)+(13, first indent)+(14),
- section 4.2.4.2.2 , except topic 4 of table 3
- section 4.2.4.4.1 (3)+(4),
- section 4.2.4.5.1,
- section 4.2.4.6.1 for the Emergency brake.
- Vehicles which are newly built after 01.01.2019 shall also comply with [TSI L&P] section 4.2.4.6.2.

[END_REQ]

7.2.5.2. Requirements specific to Simplified Data entry

Note: This parameter cannot be modified during Simplified Data Entry

7.2.5.3. Requirements specific to Full Data entry

Note: The modification by the driver of this parameter during Full Data Entry will be defined in a future version of this document.

7.2.6. Train Data parameters: Train Emergency Brake Deceleration

Note: The EB deceleration rate shall not be subject to inadvertent reduction caused by any single point failure or any undisclosed accumulated failures.

7.2.6.1. General requirements

[REQ:IE-CLASSB_00021];[Allocation:Onboard];[Type:Mandatory]

The value set for the Train Emergency Brake Deceleration shall be the dependable minimum Emergency Brake deceleration of the Actual Train Consist, based on the combination of the following:

1. The deceleration delivered by the sum of the actually active Emergency Brakes of all the vehicles in the Actual Train Consist. This performance shall be the established Emergency Brake deceleration, in [m/s²], evidenced by the respective vehicle's Emergency Brake type tests.
2. The Emergency Brake deceleration used for any vehicle in the Train shall be associated with an Emergency Brake system which has at safety integrity level of SIL4, or comparable level of integrity, in accordance with [CSM402], [50126], [50128], and [50129]. This is also applicable, where a vehicle has multiple parallel Emergency Brake systems.
3. A reduction of Emergency Brake deceleration, due to undetected (or during operation undetectable) single point failures which may be present during operation. These failures and the resulting deceleration reduction shall be determined by risk assessment in accordance with [CSM402], [50126], [50128], and [50129].

   During this risk assessment at least the following failures must be considered (non-complete listing):

   a. An unsuitable design of a vehicle's traction cut off system which may cause traction to be not/ not fully removed.
   b. An EB design with unacceptable common cause failures.
   c. An EB design with unacceptable single point failures due to a lack of redundancy.
   d. An accumulation of undetected (or undetectable) failures due to an unsuitable Emergency Brake maintenance regime.
   e. An accumulation of undetected (or undetectable) failures during operation due to an unsuitable operational testing regime for the Emergency Brake.
   f. An unsuitable bypass design which may inadvertently cause a bypass or delay to the EB demand or a loss of deceleration of the Emergency Brake.
4. The Train Emergency Brake performance which has been confirmed by an Emergency Brake operational integrity test performed at intervals no greater than 24hrs, to UIC 453:2001(type A test) of the Actual Train Consist.
5. Any necessary adjustment of the Train Emergency Brake Deceleration value associated with actual load of the vehicles in the Actual Train Consist.
6. Any necessary adjustment of the Emergency Brake deceleration associated with the actual brake deceleration set-up of each vehicle of the Actual Train Consist (e.g. empty-laden; G-P-R).
7. Any necessary adjustment of the Emergency Brake deceleration associated with actual brake isolations or presence of un-braked axles in the Actual Train Consist.
8. Any other factors which necessitate adjustment of the Emergency Brake deceleration shall be identified based on risk assessment according to [EN501265], [EN50128], [EN50129] and [CSM_402].

[END_REQ]

[REQ:IE-CLASSB_00022];[Allocation:Application Condition];[Type:Mandatory]

SRAC: The respective vehicle's EB deceleration type test results must be determined based on the requirements defined in [TSI L&P],

- section 4.2.4.2.1 (1)+(3)+(4)+(7)+(8)+(9)+(13, first indent)+(14) ,
- section 4.2.4.2.2 , except topic 4 of table 3.
- section 4.2.4.4.1 (3)+(4),
- section 4.2.4.5.1,
- section 4.2.4.6.1 for the Emergency brake.
- Vehicles which are newly built after 01.01.2019 shall also comply with [TSI L&P] section 4.2.4.6.2.

[END_REQ]

7.2.6.2. Requirements specific to Simplified Data entry

[REQ:IE-CLASSB_00023];[Allocation:Onboard];[Type:Mandatory]

A 'Nominal Train Emergency Brake Deceleration' value for the Train Emergency Brake Deceleration shall be pre-parametrised. This value shall comply with the requirements of section 7.2.6.1.

This value shall include an allowance for degradation to cover most operational conditions (e.g. allowance for:

- A level of wear and tear predefined by Rolling-Stock maintenance (RU in coordination with ECM).
- A tolerably low level of brake isolation predefined by Rolling-Stock maintenance (RU in coordination with ECM)

to be potentially present in the Actual Train Consist).

[END_REQ]

[REQ:IE-CLASSB_00024];[Allocation:Onboard];[Type:Mandatory]

A 'Degraded Train Emergency Brake Deceleration' value for the Train Emergency Brake Deceleration shall be pre-parametrised. This value shall comply with the requirements of section 7.2.6.1.

[END_REQ]

Note: The 'Degraded Train Emergency Brake Deceleration' should include a level of degradation greater than the one used to determine the 'Nominal Train Emergency Brake Deceleration', to allow for degraded operation.

[REQ:IE-CLASSB_00025];[Allocation:Onboard];[Type:Mandatory]

The 'Degraded Train Emergency Brake Deceleration' value shall be determined for any permitted Actual Train Consist such that the braking distance with this 'Degraded Train Emergency Brake Deceleration' from any speed of travelling reduced by 15km/h is no greater than the braking distance with 'Nominal Train Emergency Brake Deceleration' at that speed without reduction.

[END_REQ]

[REQ:IE-CLASSB_00026];[Allocation:Onboard];[Type:Mandatory]

The permitted level of brake isolation shall be derived from the 'Degraded Train Emergency Brake Deceleration', and shall be subject to a risk assessment in accordance with [EN50126], [EN50128], [EN50129] and [CSM402].

[END_REQ]

7.2.6.3. Requirements specific to Full Data entry

To be defined in a future version of the document.

7.2.7. Train Data parameter: Train Service Brake Response Time

7.2.7.1. General requirements

[REQ:IE-CLASSB_00027];[Allocation:Onboard];[Type:Mandatory]
The Train Service Brake Response Time value shall be in [s].
[END_REQ]

[REQ:IE-CLASSB_00028];[Allocation:Onboard];[Type:Mandatory]
The Service Brake response time shall be the time from Service Brake demand by CCO to the achievement of at least 90% of the established deceleration and shall be based on the combination of the following:

1. The Service Brake Response Time of the Actual Train Consist. This time shall be evidenced by the respective vehicle's Service Brake type tests.
2. A Service Brake Response Time increase , due to undetected (or during operation undetectable) single point failures which may be present during operation. These failures and the resulting time increase shall be determined by risk assessment.

   During this risk assessment, at least the following failures must be considered (non-complete listing):

   a. An unsuitable design of a vehicle's traction cut off system which may cause traction removal to be delayed or negated.
   b. An SB design with unacceptable common cause failures.
   c. An SB design with unacceptable single point failures due to a lack of redundancy.
   d. An accumulation of undetected (or undetectable) failures due to an unsuitable Service Brake maintenance regime.
   e. An accumulation of undetected (or undetectable) failures during operation due to an unsuitable operational testing regime for the Service Brake.
   f. An unsuitable bypass design which may inadvertently cause a bypass or delay to the SB demand or a loss of performance of the Service Brake.
3. Any necessary adjustment of the Service Brake performance associated with the actual brake performance set-up of each vehicle of the Actual Train Consist (e.g. empty-laden; G-P-R).
4. Any other factors which necessitate adjustment of the Service Brake performance shall be identified based on risk assessment according to [EN501265], [EN50128], [EN50129] and [CSM_402].

[END_REQ]

[REQ:IE-CLASSB_00029];[Allocation:Application Condition];[Type:Mandatory]
SRAC: The respective vehicle's SB Response Time type tests results must be determined based on the requirements defined in [TSI L&P],

- section 4.2.4.2.1 (1)+(3)+(4)+(7)+(8)+(9)+(13, first indent)+(14),
- section 4.2.4.2.2 , except topic 4 of table 3.
- section 4.2.4.4.1 (3)+(4),
- section 4.2.4.5.1,
- Vehicles which are newly built after 01.01.2019 shall also comply with [TSI L&P] section 4.2.4.6.2.

[END_REQ]

7.2.7.2. Requirements specific to Simplified Data entry

Note: This parameter cannot be modified during Simplified Data Entry

7.2.7.3. Requirements specific to Full Data entry

Note: The modification by the driver of this parameter during Full Data Entry will be defined in a future version of this document.

7.2.8. Train Data parameter: Train Service Brake Deceleration

Note: Where the Service Brake is configured, the Train Service Brake Deceleration rate should not be subject to inadvertent reduction caused by any single point failure or any undisclosed accumulated failures.

7.2.8.1. General requirements

[REQ:IE-CLASSB_00030];[Allocation:Onboard];[Type:Mandatory]

The values set for this Train Data parameters shall be the expected minimum Service Brake deceleration of the Actual Train Consist, based on the combination of the following:

1. The performance delivered by the sum of the actually active Service Brakes of all the vehicles in the Actual Train Consist. This performance shall be the established Service Brake deceleration, in [m/s²], evidenced by the respective vehicle's Service Brake type tests.
2. Where a Service Brake does not deliver its intended performance, the CCO shall eventually demand the Emergency Brake. As the Emergency Brake is in some cases not designed for frequent application, the Service Brake used for any vehicle in the Train shall have a suitable level of availability and dependability, in order to avoid frequent underperformance (and thus frequent demand of Emergency Brake). This is also applicable, where a vehicle has multiple parallel Service Brake systems.
3. A reduction of Service Brake deceleration due to undetected (or during operation undetectable) single point failures which may be present during operation. These failures and the resulting performance reduction shall be determined by risk assessment in accordance with [CSM402], [50126], [50128], and [50129].

   During this risk assessment at least the following failures must be considered (non-complete listing):

   a. An unsuitable design of a vehicle's traction cut off system which may cause traction to be not/ not fully removed.
   b. An SB design with unacceptable common cause failures.
   c. An SB design with unacceptable single point failures due to a lack of redundancy.
   d. An accumulation of undetected (or undetectable) failures due to an unsuitable Service Brake maintenance regime.
   e. An accumulation of undetected (or undetectable) failures during operation due to an unsuitable operational testing regime for the Service Brake.
   f. An unsuitable bypass design which may inadvertently cause a bypass or delay to the SB demand or a loss of performance of the Service Brake.
4. The Train Service Brake Deceleration which has been confirmed by a Service Brake operational integrity test performed at intervals no greater than 24hrs, to UIC 453:2001(type A test) of the Actual Train Consist.
5. Any necessary adjustment of the Train Service Brake deceleration value associated with actual load of the vehicles in the Actual Train Consist.
6. Any necessary adjustment of the Train Service Brake Deceleration associated with the actual brake deceleration set-up of each vehicle of the Actual Train Consist (e.g. empty-laden; G-P-R).

7. Any necessary adjustment of the Train Service Brake Deceleration associated with actual brake isolations or presence of un-braked axles in the Actual Train Consist.
8. Any other factors which necessitate adjustment of the Train Service Brake Deceleration shall be identified based on risk assessment according to [EN501265], [EN50128], [EN50129] and [CSM_402].

[END_REQ]

[REQ:IE-CLASSB_00031];[Allocation:Application Condition];[Type:Mandatory]

SRAC: The respective vehicle's Service Brake deceleration type tests results must be determined based on the requirements defined in [TSI L&P],

- section 4.2.4.2.1 (1)+(3)+(4)+(7)+(8)+(9)+(13, first indent)+(14) ,
- section 4.2.4.2.2 ,
- section 4.2.4.4.1 (3)+(4),
- section 4.2.4.5.1,
- Vehicles which are newly built after 01.01.2019 shall also comply with [TSI L&P] section 4.2.4.6.2.

[END_REQ]

7.2.8.2. Requirements specific to Simplified Data entry

[REQ:IE-CLASSB_00032];[Allocation:Onboard];[Type:Mandatory]

A 'Nominal Train Service Brake Deceleration' value for the Train Service Brake Deceleration shall be pre-parametrised. This value shall comply with the requirements of section 7.2.7.1.

This value shall include an allowance for degradation to cover most operational conditions (e.g. allowance for:

- A level of wear and tear predefined by Rolling-Stock maintenance (RU in coordination with ECM).
- A tolerably low level of brake isolation predefined by Rolling-Stock maintenance (RU in coordination with ECM)

to be potentially present in the Actual Train Consist).

[END_REQ]

[REQ:IE-CLASSB_00033];[Allocation:Onboard];[Type:Mandatory]

A 'Degraded Train Service Brake Deceleration' value for the Train Service Brake Deceleration shall be pre-parametrised. This value shall comply with the requirements of section 7.2.7.1.

[END_REQ]

Note: The 'Degraded Train Service Brake Deceleration' should include a level of degradation greater than the one used to determine the 'Nominal Train Service Brake Deceleration', to allow for degraded operation.

[REQ:IE-CLASSB_00034];[Allocation:Onboard];[Type:Mandatory]

The 'Degraded Train Service Brake Deceleration' value shall be determined for any permitted Actual Train Consist such that the braking distance with this 'Degraded Train Service Brake Deceleration' from any speed of travelling reduced by 15km/h is no greater than the braking distance with 'Nominal Train Service Brake Deceleration' at that speed without reduction.

[END_REQ]

[REQ:IE-CLASSB_00035];[Allocation:Onboard];[Type:Mandatory]
The permitted level of brake isolation shall be derived from the 'Degraded Train Service Brake Deceleration', and shall be subject to a risk assessment in accordance with [EN50126], [EN50128], [EN50129] and [CSM402].
[END_REQ

7.2.8.3. Requirements specific to Full Data entry

To be defined in a future version of the document

7.2.9. Train Data parameter: Train Length

7.2.9.1. General requirements

[REQ:IE-CLASSB_00001];[Allocation:Onboard];[Type:Mandatory]
The Train Length value shall be in [m].
[END_REQ]

[REQ:IE-CLASSB_00036];[Allocation:Onboard];[Type:Mandatory]
The value set for this Train Length parameter shall not be less than the length of the Actual Train Consist.
[END_REQ]

7.2.9.2. Requirements specific to Simplified Data entry

[REQ:IE-CLASSB_00037];[Allocation:Onboard];[Type:Mandatory]
A 'Nominal Length of a vehicle in the pre-defined Train consist' shall be pre-parametrised in the CCO. This value shall be equal to or greater than the maximum length, including buffer, of any vehicle types/versions/variants included in the pre-determined Train consists for this CCO.
[END_REQ]

7.2.9.3. Requirements specific to Full Data entry

To be defined in a future version of the document

7.3. CCO Operating Modes

7.3.1. General CCO Operating Modes Description

Permitted normal and degraded CCO Operating Modes are defined in the Table 2 below.

[REQ:IE-CLASSB_00038];[Allocation:Application Condition];[Type:Mandatory]
SRAC: An Operating Rule shall be established to define the rules applicable to RU staff in each CCO operating CCO Operating Mode defined in this section.
[END_REQ]

[REQ:IE-CLASSB_00039];[Allocation:Application Condition];[Type:Mandatory]
SRAC: An Operating Rule shall be established to define the rules applicable to IM staff in each CCO Operating Mode defined in this section.
[END_REQ]

[REQ:IE-CLASSB_00040];[Allocation:Application Condition];[Type:Mandatory]
SRAC: Maintenance Procedures shall be produced to define the rules applicable to RUs and their chosen ECMs for maintaining the CCO equipment to ensure ongoing fulfilment of all requirements of this IRS for CCO.
[END_REQ]

No.	CCO Operating Mode	Discontinuous reception functional	Continuous reception functional	General Description
1	AUTOTEST	-	-	Standstill mode, triggered at CCO start-up when power supply to CCO becomes enabled.
2	MAINTENANCE	-	-	Standstill mode, used by the CCO maintenance team for maintenance. Shall be password protected to ensure control of access only to authorised and competent staff.
3	NO_CAB_SELECTED	-	-	Automatically triggered mode, when no cab that is connected to CCO is enabled.
4	CAB_SELECTED	-	-	Standstill mode, triggered when the driver selects one cab as active cab.
5	STAFF_RESPONSIBLE	Yes	Yes	Automatically triggered mode. Activated • at start of Train movement by driver from CAB_SELECTED mode, in absence of valid CCT information, or • after a trackside failure, or • after a signal at red is passed. It is used to monitor low CCO Operating Mode Speed of 30km/h. It also provides DTP Temporary Speed Restriction Speed monitoring if CCT is fitted with TSR balises and provides Train Stop protection if CCT is fitted with DTP balises.

No.	CCO Operating Mode	Discontinuous reception functional	Continuous reception functional	General Description
6	UNFITTED	Yes	Yes	Automatically triggered mode. Activated in unfitted area. Provides 160km/h CCO Operating Mode Speed monitoring and DTP Temporary Speed Restriction Speed monitoring, if CCT is fitted with TSR balises. *Note: At the time of writing this IRS, UNFITTED mode operation at up to 160km/h is permitted by the Operating Rules of IMs and RUs in IRL and shall therefore be available as CCO Operating Mode while the migration to a fully fitted network is ongoing.* *Note: This mode is not specified in this version of the document.*
7	FORWARD_SHUNTING	-	-	Triggered by drivers for operation in shunting areas (e.g. yards or depots). Provides 15km/h CCO Operating Mode Speed monitoring and ignores all CCT information.
8	REVERSE_SHUNTING	-	-	Triggered by drivers for reverse operation in shunting areas. Provides 15km/h CCO Operating Mode Speed monitoring and ignores all CCT information. *Note: In a future version of this document, REVERSE_SHUNTING mode and FORWARD_SHUNTING mode may be merged into one single SHUNTING mode that allows forward and reverse movements with a 15km/h speed limit.*
9	CAWS	Yes	Yes	Automatically triggered mode. Activated upon code detection in 50Hz CCT areas. Provides signal aspect repetition in driving cab, in accordance with 50Hz code received from the track circuits. When TSR balises are used in 50Hz CCT area, the DTP Temporary Speed Restriction Speed is also monitored by CCO but the CCO Operating Mode remains CAWS. *Note: This mode is not specified in this version of the document.*
10	ATP	Yes	Yes	Automatically triggered mode. Activated upon code detection in 83.3Hz CCT areas. Provides ATP Speed monitoring depending on 83.3Hz code received from the track circuits. When TSR balises are used in 83.3Hz CCT area, the DTP Temporary Speed Restriction Speed is monitored by CCO but the CCO Operating Mode remains ATP.

No.	CCO Operating Mode	Discontinuous reception functional	Continuous reception functional	General Description
11	DTP	Yes	Yes	Automatically triggered mode. Activated when reading balises in DTP CCT areas. Provides line-, signal-, and DTP Temporary Speed Restriction Speed monitoring, and provides Train Stop protection, based on intermittent CCT communication. *Note: This mode is not specified in this version of the document.*
12	DTP+CODE	Yes	Yes	Automatically triggered mode. Activated when reading both DTP and CODE in DTP+50Hz code or DTP+83.3Hz code CCT areas. Provides DTP Line Speed, DTP Signalling Speed, DTP Temporary Speed Restriction Speed monitoring, and provides Train Stop protection, based on a combination of continuous and discrete trackside signalling information. *Note: This mode is not specified in this version of the document.*
13	DTP+CODE_E	Yes	No	Means DTP functionality is operational but code functionality is Excluded. Permitted degraded mode for operation in a DTP area when only the code interface (pick up coils) has failed. Provides line, signal, and DTP Temporary Speed Restriction Speed monitoring, and supervises Train Stop protection. This mode is not permitted for operation in DTP+50Hz code or DTP+83.3Hz code CCT areas. *Note: This mode is not specified in this version of the document.*
14	CODE_E	Yes	No	Means code functionality is excluded. Permitted degraded mode for operation in 50Hz or 83.3Hz code or Unfitted CCT areas, when only the code interface (pick up coils) has failed. Provides a CCO Operating Mode Speed monitoring of 30km/h and DTP Temporary Speed Restriction Speed monitoring. Can be considered as STAFF_RESPONSIBLE with code reception excluded. This mode is not permitted for operation in DTP+50Hz code or DTP+83.3Hz code CCT areas.
15	DTP_E	No	Yes	Means DTP functionality is excluded. Permitted degraded mode for operation in DTP CCT areas, when the DTP Balise Antenna has failed or the driver has excluded it intentionally. Provides a CCO Operating Mode ceiling speed monitoring of 30km/h. Can be considered as STAFF_RESPONSIBLE with DTP reception excluded.

No.	CCO Operating Mode	Discontinuous reception functional	Continuous reception functional	General Description
16	DTP_E+CAWS	No	Yes	Means DTP functionality is excluded and CAWS functionality is operational. Permitted degraded mode for operation in DTP+50Hz code or 50Hz code areas when the balise interface is not available. It monitors low CCO Operating Mode Speed of 30km/h and requests CAWS aspects to be acknowledged by the driver. *This mode is not specified in this version of the document.*
17	DTP_E+ATP	No	Yes	Means DTP functionality is excluded and ATP is operational. Permitted degraded mode for operation in DTP+83.3Hz code or 83.3Hz code areas when the balise interface is not available. Provides same protection as ATP mode with the exclusion of DTP Temporary Speed Restriction Speed monitoring function because the DTP Balise Antenna is excluded.
18	DTP_E+CODE_E	No	No	Both DTP and code functionalities are excluded. Permitted degraded mode for operation in DTP or DTP+50Hz code or DTP+83.3Hz code CCT areas or unfitted areas. Provides only CCO Operating Mode Speed monitoring of 30km/h. Can be considered as STAFF_RESPONSIBLE with both balise and code signal reception failures.
19	BYPASS	No	No	This mode removes power from the system and bypasses the system outputs. No monitoring is provided.

Table 2 - CCO Operating Mode Description

7.3.2. AUTOTEST mode

Note: This section defines the requirements specific to the AUTOTEST mode and the requirement related to the Standstill self-tests performed in AUTOTEST mode at start up.

[REQ:IE-CLASSB_00041];[Allocation:Onboard];[Type:Mandatory]

Upon each power up or restart of the CCO, the CCO Operating Mode shall automatically switch to AUTOTEST mode to enable the system to perform, at Standstill, hardware, software and interface tests, as required by the Application Specific Safety Case's product constraints to meet safety and availability targets.

[END_REQ]

[REQ:IE-CLASSB_00042];[Allocation:Onboard];[Type:Mandatory]

The CCO shall automatically change to AUTOTEST mode when all conditions specified in Table 3 and Table 4 of section 7.3.21 are met.

[END_REQ]

[REQ:IE-CLASSB_00043];[Allocation:Onboard];[Type:Optional]

Optional: When in CAB_SELECTED mode, or NO_CAB_SELECTED mode, operating staff may be offered to switch to AUTOTEST mode via DMI.

[END_REQ]

[REQ:IE-CLASSB_00044];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to require that the CCO system shall only be powered up when the Train is at Standstill.

[END_REQ]

Note: This requirement is driven by the fact that no CCO protection is yet available and therefore no Train movement shall be performed.

[REQ:IE-CLASSB_00045];[Allocation:Onboard];[Type:Mandatory]

While in AUTOTEST mode, the CCO shall demand the traction cut off (if configured) and execute the Standstill self-tests.

[END_REQ]

[REQ:IE-CLASSB_00046];[Allocation:Onboard];[Type:Mandatory]

Upon entering AUTOTEST mode all previously entered Train Data values and stored CCT information shall have been erased.

[END_REQ]

Note: This erasure is expected to be done at power down of the CCO, therefore the data is no longer available in AUTOTEST mode.

[REQ:IE-CLASSB_00047];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to require competent staff to supervise the Standstill self-test sequence at all times, and stop any inadvertent movement of the Train occurring during that sequence.

[END_REQ]

[REQ:IE-CLASSB_00048];[Allocation:Onboard];[Type:Mandatory]

While in AUTOTEST mode, the DMI shall not display any information other than the text “AUTOTEST – DO NOT MOVE TRAIN”. The touch-screen functionality of the DMI shall be disabled.

[END_REQ]

[REQ:IE-CLASSB_00049];[Allocation:Onboard];[Type:Mandatory]

After completion of Standstill self-test in AUTOTEST mode, the CCO shall automatically switch to

- MAINTENANCE mode if the maintenance tool is connected
- CAB_SELECTED mode if only one of the cabs connected to CCO is enabled
- NO_CAB_SELECTED mode if none or more than one of the cabs connected to CCO is enabled.

[END_REQ]

[REQ:IE-CLASSB_00050];[Allocation:Onboard];[Type:Mandatory]

The set of tests to be performed during the Standstill self-test sequence shall be identified based on risk assessment according to [EN50126], [EN50128], [EN50129] and [CSM402].

[END_REQ]

[REQ:IE-CLASSB_00051];[Allocation:Onboard];[Type:Mandatory]

The complete set of hardware, software and interface tests composing the Standstill self-test sequence shall be completed within a maximum of 60 seconds.

[END_REQ]

[REQ:IE-CLASSB_00052];[Allocation:Onboard];[Type:Mandatory]

The performance of the Standstill self-test shall not be affected by any input received from CCT during the test (e.g. balise data or CCT code).

[END_REQ]

[REQ:IE-CLASSB_00053];[Allocation:Onboard];[Type:Mandatory]

The performance of the Standstill self-test shall either

- not be affected by any Train movement, or
- CCO shall abort the autotest as soon as the Standstill condition is lost and raise a fatal error (ERR_INTERNAL_TEST_FATAL).

[END_REQ]

[REQ:IE-CLASSB_00054];[Allocation:Onboard];[Type:Mandatory]

The presence of non-vital or vital errors shall be displayed and managed via the Error_Management and Error_Management_Acknowledgment functions after the Standstill self-test has been completed.

[END_REQ]

Note: The driver may decide to not proceed into service with detected failures in a CCO system and submit it to maintenance.

If AUTOTEST mode was activated during service or away from a depot, the Train should be operated under the normal or degraded CCO Operating Modes available until it is submitted to maintenance.

[REQ:IE-CLASSB_00055];[Allocation:Onboard];[Type:Mandatory]

The CCO shall be designed in a way that its Application Specific Safety Case will not require Standstill self-test to be performed more frequently than once every 24h. When this period is completed without having

performed a Standstill self-test, a fatal error (ERR_INTERNAL_TEST_FATAL) shall be raised by CCO.

[END_REQ]

[REQ:IE-CLASSB_00056];[Allocation:Onboard];[Type:Mandatory]

An alert error (ERR_INTERNAL_TEST_NOT_VITAL) shall be prompted to the driver when the time remaining before the next Standstill self-test is required reaches a predefined value.

This value shall be set through maintenance configuration menu, with a maximum interval of 21h and steps of 1h.

[END_REQ]

[REQ:IE-CLASSB_00057];[Allocation:Onboard];[Type:Optional]

Optional: Upon request from the driver the CCO shall display on the DMI the time remaining before the next Standstill self-test needs to be performed in hh:mm format.

[END_REQ]

[REQ:IE-CLASSB_00058];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to require that the Standstill self-test is performed at least once every 24hs. If a driver has no information on the time & date of the last self-test, the driver must initiate a self-test when taking charge of the Train.

[END_REQ]

Note: AUTOTEST mode is typically expected to be activated prior to start of service in a depot. Drivers should be informed about the date/time/result of the last test performed.

Note: The CCO master circuit breaker may be used to start the AUTOTEST mode by removing and reconnecting power to CCO.

7.3.3. NO_CAB_SELECTED mode

Note: NO_CAB_SELECTED mode relates to the situation, where all cabs connected to CCO are disabled.

[REQ:IE-CLASSB_00059];[Allocation:Onboard];[Type:Mandatory]

The CCO shall automatically change to NO_CAB_SELECTED mode when all conditions specified in Table 3 and Table 4 of section 7.3.21 are met.

[END_REQ]

[REQ:IE-CLASSB_00060];[Allocation:Onboard];[Type:Mandatory]

Fatal errors detected by the CCO in AUTOTEST mode, shall be displayed on the DMI(s) connected to CCO when the CCO enters NO_CAB_SELECTED mode and shall be managed in accordance with the Error_Management function.

[END_REQ]

[REQ:IE-CLASSB_00061];[Allocation:Onboard];[Type:Mandatory]

If all cabs connected to CCO become disabled while operating in any CCO Operating Mode, except AUTOTEST and MAINTENANCE, the CCO must automatically enter NO_CAB_SELECTED mode.

[END_REQ]

[REQ:IE-CLASSB_00062];[Allocation:Onboard];[Type:Mandatory]

Upon entering NO_CAB_SELECTED mode all previously entered Train Data values and stored CCT information shall be erased.

[END_REQ]

Note: This is required to permit this CCO Operating Mode to offer a form of limited reset in case of issues with any of this data.

[REQ:IE-CLASSB_00063];[Allocation:Onboard];[Type:Mandatory]

In NO_CAB_SELECTED mode the CCO shall not demand the Emergency Brake.

[END_REQ]

[REQ:IE-CLASSB_00064];[Allocation:Onboard];[Type:Mandatory]

In NO_CAB_SELECTED mode the CCO shall not demand any traction cut-off or service brake application (if configured).

[END_REQ]

Note: CCO does not demand brakes or traction cut-off when in NO_CAB_SELECTED mode. Therefore, in this CCO Operating Mode the Train systems, and established driver Operating Rules, must ensure that either the Rolling Stock parking brake is applied or that the Train is supervised by authorised staff, who are able to stop any unintended Train movement, when no cab is enabled, as per SRAC defined in section 7.4.27.

Note: the NO_CAB_SELCTED mode could be compared with two CCO Operating Modes available in ETCS class A systems:

- *SLEEPING: a remote cab and CCO in the Train is active and the brake is not demanded by the local CCO*
- *STANDBY: no cab is selected and the Standstill supervision function is active*

This distinction does not exist in historical class B CCO systems in Ireland (CAWS and ATP). The Standstill supervision in unattended cab scenarios is managed though application of parking brakes and operational procedures. Furthermore, in most typical configurations of UIC airbrake systems, the emergency brake systems are not inexhaustible due to permitted air leakage, which means that ETCS STANDBY mode, or equivalent, cannot ensure permanent immobilisation of a Train. Therefore, the existing controls referred above are to be maintained in IRL.

In order to avoid confusion, this IRL class B CCO Operating Mode is named differently from the two class A modes referred to above.

[REQ:IE-CLASSB_00065];[Allocation:Onboard];[Type:Mandatory]

In NO_CAB_SELECTED mode, the connected DMIs shall only display "CAB NOT SELECTED" or the first detected fatal error if applicable.

In this CCO Operating Mode, the CCO shall disable the DMI touch-screen functionality.

[END_REQ]

[REQ:IE-CLASSB_00066];[Allocation:Onboard]; Type:Optional]

Optional: In this CCO Operating Mode, vitality icon and brightness button may be also be displayed

[END_REQ]

[REQ:IE-CLASSB_00067];[Allocation:Onboard];[Type:Mandatory]

Upon enabling of a cab, CCO shall automatically change to CAB_SELECTED mode.

[END_REQ]

[REQ:IE-CLASSB_00068];[Allocation:Onboard];[Type:Mandatory]

If a CCO is connected to more than one cab, only that cab which was first detected as enabled shall be considered the active cab by the CCO.

Only after that first cab becomes disabled, shall the CCO accept another cab as enabled.

[END_REQ]

[REQ:IE-CLASSB_00069];[Allocation:Onboard];[Type:Mandatory]

If more than one cab is detected as enabled at the same time, CCO shall generate a fatal error (ERR_CAB_SELECTION).

[END_REQ]

7.3.4. CAB_SELECTED mode

[REQ:IE-CLASSB_00070];[Allocation:Onboard];[Type:Mandatory]

On completion of AUTOTEST mode and if exactly one connected cab has been detected as enabled, the CCO system shall automatically enter CAB_SELECTED mode.

[END_REQ]

[REQ:IE-CLASSB_00071];[Allocation:Onboard];[Type:Mandatory]

This CCO Operating Mode shall automatically be entered from NO_CAB_SELECTED if exactly one connected cab has been detected as enabled.

[END_REQ]

[REQ:IE-CLASSB_00072];[Allocation:Onboard];[Type:Mandatory]

The CCO shall only change to CAB_SELECTED mode when all conditions specified in Table 3 and Table 4 of section 7.3.21 are met.

[END_REQ]

[REQ:IE-CLASSB_00073];[Allocation:Onboard];[Type:Mandatory]

Errors detected by the CCO in AUTOTEST mode or by the permanent self-tests shall be displayed on the DMI of that cab which was first detected as enabled when the CCO enters CAB_SELECTED mode and shall be managed in accordance with the Error_Manangement function.

[END_REQ]

[REQ:IE-CLASSB_00074];[Allocation:Onboard];[Type:Mandatory]

If several DMI/PICKUP COILS/DTP BALISE ANTENNA are connected to the CCO, only the signals from the DMI/PICKUP COILS/DTP BALISE ANTENNA associated with the enabled cab shall be considered by the CCO. The signals from the other PICKUP COILS/DTP BALISE ANTENNA shall be disregarded and the other DMI shall not display any information other than the text “CAB NOT SELECTED”.

[END_REQ]

[REQ:IE-CLASSB_00075];[Allocation:Onboard];[Type:Mandatory]

The CCO shall permanently demand traction cut-off (if configured) when in CAB_SELECTED mode.

[END_REQ]

[REQ:IE-CLASSB_00076];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to require the driver to supervise the Train when CCO is in CAB_SELECTED mode, and stop any inadvertent movement of the Train.

[END_REQ]

[REQ:IE-CLASSB_00077];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to require the driver, in CAB_SELECTED mode, to perform a CCO brake connectivity test after every power-on of the CCO. This is to confirm that CCO Emergency Brake and Service Brake (if configured) demands are correctly executed by the Train braking systems when commanded by this CCO.

[END_REQ]

Note: This is to test connectivity of CCO to Train braking systems only. This test does not intend to prove that the Train braking system will decelerate the Train at a defined performance.

[REQ:IE-CLASSB_00078];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to ensure the Emergency Brake performance by the Rolling Stock maintenance and a regime of regular brake performance testing, in accordance with [UIC 453-2001].

Note: It is considered that the brake performance testing regime defined in [UIC 453-2001] represents good industry practice in Europe.

[END_REQ]

[REQ:IE-CLASSB_00079];[Allocation:Onboard];[Type:Mandatory]

In the situation where

- the driver enters CAB_SELECTED mode and
- the Brake_Connectivity_Test function's test cycle has not been completed since power-up of the CCO,

the CCO shall require the driver to activate the Brake_Connectivity_Test function, through the DMI text message "Carry out Brake Connectivity Test".

[END_REQ]

[REQ:IE-CLASSB_00080];[Allocation:Onboard];[Type:Mandatory]

On satisfactory completion of the Brake_Connectivity_Test function for the first time since power up, the driver shall be permitted by CCO to select via the DMI, without entering Train Data, FORWARD_SHUNTING or REVERSE_SHUNTING modes only, or to enter the Train Data via Data_Entry function as a basis to proceed to other CCO Operating Modes.

[END_REQ]

[REQ:IE-CLASSB_00081];[Allocation:Onboard];[Type:Mandatory]

Whenever

- the driver enters CAB_SELECTED mode and
- the Brake_Connectivity_Test function's test cycle has been completed since power-up of the CCO and
- the Train Data has not been entered and validated via the Data_Entry function since the cab has been enabled.

the CCO shall display the text message "Input Train Data or select: shunting, reverse" on the DMI,

[END_REQ]

[REQ:IE-CLASSB_00082];[Allocation:Onboard];[Type:Mandatory]

After entry, validation and confirmation of Train Data, in accordance with the Data_Entry function, the following CCO Operating Modes shall become available for automatic mode selection by CCO:

- STAFF_RESPONSIBLE
- ATP
- CODE_E
- DTP_E
- DTP_E+ATP
- DTP_E+CODE_E

[END_REQ]

[REQ:IE-CLASSB_00083];[Allocation:Onboard];[Type:Mandatory]

If no valid CCT information is received by the system, and no fatal errors, DTP Balise Antenna failure, or pickup coils failure are detected by CCO, CCO shall automatically enter STAFF_RESPONSIBLE mode and shall offer the

driver to acknowledge the change in accordance with the Mode_Transition_Acknowledgement function.

[END_REQ]

[REQ:IE-CLASSB_00084];[Allocation:Onboard];[Type:Mandatory]

As soon as valid CCT information is received, CCO shall automatically change to the appropriate CCO Operating Mode and offer the driver to acknowledge the new mode in accordance with the Mode_Transition_Acknowledgement function.

[END_REQ]

7.3.5. FORWARD_SHUNTING mode

[REQ:IE-CLASSB_00085];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to require the driver to know and observe the limits of shunting movements as authorised by the signalman, by signage or signals. The driver shall be aware, that in FORWARD_SHUNTING mode there is no CCO protection active.

[END_REQ]

Note: Observation of shunting limits by drivers without the presence of an additional technical protection is considered as a typical and acceptably safe industry procedure for forward or reverse shunting operation, based on national and international good practice and based on consultation with operational representatives in IRL Railway Undertakings.

[REQ:IE-CLASSB_00086];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to require the driver to observe a ceiling speed of 15km/h in FORWARD_SHUNTING mode.

[END_REQ]

Note: 15km/h, as a nominal speed, with an exceptional tolerance of +5km/h, is considered as a typical and acceptably safe industry value for line of sight or guided forward or reverse shunting operation, based on national and international good practice and based on consultation with operational representatives in IRL Railway Undertakings.

[REQ:IE-CLASSB_00087];[Allocation:Onboard];[Type:Mandatory]

The driver shall be able to select FORWARD_SHUNTING mode only from the following CCO Operating Modes:

- CAB_SELECTED
- STAFF_RESPONSIBLE
- ATP
- CODE_E
- DTP_E
- DTP_E+ATP
- DTP_E+CODE_E

[END_REQ]

[REQ:IE-CLASSB_00088];[Allocation:Onboard];[Type:Mandatory]

Selection and de-selection of FORWARD_SHUNTING shall only be possible when the Train is in Standstill condition, through the activation of the Entry_Forward_Shunting and Exit_Forward_Shunting functions by the driver.

[END_REQ]

[REQ:IE-CLASSB_00089];[Allocation:Onboard];[Type:Mandatory]

The CCO shall only change to FORWARD_SHUNTING mode when all conditions specified in Table 3 and Table 4 of section 7.3.21 are met.

[END_REQ]

[REQ:IE-CLASSB_00090];[Allocation:Onboard];[Type:Mandatory]

At any time of selecting FORWARD_SHUNTING mode all previously entered Train Data values and stored CCT information shall be erased.

[END_REQ]

NOTE: During shunting, it is not considered practical to attempt a correct and consecutive reception of all passed CCT DTP data or code. The loss of Train Data and return to CAB-SELECTED mode will also deter drivers from attempting an un-authorised selection of FORWARD_SHUNTING mode outside a designated shunting area.

[REQ:IE-CLASSB_00091];[Allocation:Onboard];[Type:Mandatory]

In FORWARD_SHUNTING mode, CCO functions shall be activated in accordance with Table 6 and the definitions described in section 7.4.1.

[END_REQ]

Note: The CCO_Operating_Mode_Speed_Determination function will automatically result in the monitoring of a nominal speed of 15km/h in FORWARD_SHUNTING mode.

Note: when the ceiling speed thresholds are applied, the Train could exceptionally reach a maximum speed of 20km/h before the emergency brakes are demanded.

[REQ:IE-CLASSB_00092];[Allocation:Onboard];[Type:Mandatory]

The CCO shall stop reverse movements in FORWARD_SHUNTING mode via the Reverse_Movement_Protection function.

[END_REQ]

Note: Reverse movements, exceptionally allowed for shunting movement or emergency, can only be done in REVERSE_SHUNTING mode, specified in the following section.

[REQ:IE-CLASSB_00093];[Allocation:Onboard];[Type:Mandatory]

Upon de-selection of FORWARD_SHUNTING mode CCO shall only change to CAB_SELECTED mode.

[END_REQ]

[REQ:IE-CLASSB_00094];[Allocation:Onboard];[Type:Mandatory]

When in FORWARD_SHUNTING mode, the driver shall be able to change to NO_CAB_SELECTED mode by disabling the cab.

[END_REQ]

7.3.6. REVERSE_SHUNTING mode

Note: the REVERSE_SHUNTING mode will be used for shunting movement in reverse direction, when authorised. This CCO Operating Mode may also be used for reverse movements which are exceptionally authorised on the main lines.

[REQ:IE-CLASSB_00095];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to require the driver to know and observe the limits of reverse shunting movements as authorised by the signalman or by signage or signals and the driver shall be aware, that in REVERSE_SHUNTING mode there is no CCO protection active.

[END_REQ]

Note: Observation of shunting limits by drivers without the presence of an additional technical protection is considered as a typical and acceptably safe industry procedure for forward or reverse shunting operation, based on national and international good practice and based on consultation with operational representatives in IRL Railway Undertakings.

[REQ:IE-CLASSB_00096];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to require the driver to observe a ceiling speed of 15km/h in REVERSE_SHUNTING mode.

[END_REQ]

Note: 15km/h, as a nominal speed, with an exceptional tolerance of +5km/h, is considered as a typical and acceptably safe industry value for line of sight or guided forward or reverse shunting operation, based on national and international good practice and based on consultation with operational representatives in IRL Railway Undertakings.

[REQ:IE-CLASSB_00097];[Allocation:Onboard];[Type:Mandatory]

The driver shall be able to select REVERSE_SHUNTING mode only from the following CCO Operating Modes.

- CAB_SELECTED
- STAFF_RESPONSIBLE
- ATP
- CODE_E
- DTP_E+ATP
- DTP_E+CODE_E

[END_REQ]

[REQ:IE-CLASSB_00098];[Allocation:Onboard];[Type:Mandatory]

Selection and de-selection of REVERSE_SHUNTING shall only be possible when the Train is in Standstill condition, through the activation of the Entry_Reverse_Shunting and Exit_Reverse_Shunting functions by the driver.

[END_REQ]

[REQ:IE-CLASSB_00099];[Allocation:Onboard];[Type:Mandatory]

The CCO shall only change to REVERSE_SHUNTING mode when all conditions specified in Table 3 and Table 4 of section 7.3.21 are met.

[END_REQ]

[REQ:IE-CLASSB_00100];[Allocation:Onboard];[Type:Mandatory]

At any time of selecting REVERSE_SHUNTING mode, all previously entered Train Data values and stored CCT

information shall be erased.

[END_REQ]

[REQ:IE-CLASSB_00101];[Allocation:Onboard];[Type:Mandatory]

Upon de-selection of REVERSE_SHUNTING mode CCO shall only change to CAB_SELECTED mode.

[END_REQ]

Note: During reverse shunting, it is not considered practical to attempt a correct and consecutive reception of all passed CCT DTP data or code. The loss of Train Data and return to CAB-SELECTED mode will also deter the driver from attempting an un-authorised reverse movement.

[REQ:IE-CLASSB_00102];[Allocation:Onboard];[Type:Mandatory]

In REVERSE_SHUNTING, CCO functions shall be activated in accordance with Table 6 and the definitions described in section 7.4.1.

[END_REQ]

Note: The CCO_Operating_Mode_Speed_Determination function will automatically result in the monitoring of a nominal speed of 15km/h, in REVERSE_SHUNTING mode.

Note: When the ceiling speed thresholds are applied, the Train could exceptionally reach a maximum speed of 20km/h before the emergency brakes are demanded.

[REQ:IE-CLASSB_00103];[Allocation:Onboard];[Type:Mandatory]

The CCO shall stop forward movements in REVERSE_SHUNTING mode via the Forward_Movement_Protection function.

[END_REQ]

[REQ:IE-CLASSB_00104];[Allocation:Onboard];[Type:Mandatory]

Upon de-selection of REVERSE_SHUNTING mode CCO shall only change to CAB_SELECTED mode.

[END_REQ]

[REQ:IE-CLASSB_00105];[Allocation:Onboard];[Type:Mandatory]

When in REVERSE_SHUNTING mode, the driver shall be able change to NO_CAB_SELECTED mode by disabling the cab.

[END_REQ]

7.3.7. STAFF_RESPONSIBLE mode

[REQ:IE-CLASSB_00106];[Allocation:Onboard];[Type:Mandatory]

The CCO shall automatically change to STAFF_RESPONSIBLE mode when all conditions specified in Table 3 and Table 4 of section 7.3.21 are met.

[END_REQ]

Note: After successful Train Data entry in CAB_SELECTED mode, if no fatal errors, no DTP Balise Antenna failures and no pickup coil failures are detected by CCO, and if no CCT information is available, CCO shall automatically change to STAFF_RESPONSIBLE mode.

[REQ:IE-CLASSB_00107];[Allocation:Onboard];[Type:Mandatory]

In STAFF_RESPONSIBLE mode, on every occasion when the Train goes from a Standstill to a non-Standstill condition, the driver shall be given the proposal to acknowledge the operation in STAFF_RESPONSIBLE mode in accordance with the Mode_Transition_Acknowledgement function.

[END_REQ]

Note: This acknowledgement is required, even when there is no actual change of CCO Operating Mode, to remind the driver that the Train is operated in STAFF_RESPONSIBLE mode and that the CCO is not protecting the Train operation. This concept of repetitive acknowledgement is considered acceptable for the initial application of this Class B system on EMU Trains. It may be revisited in a future version of this IRS, after human factors analyses considering the full range of functions and CCO Operating Modes have been completed.

[REQ:IE-CLASSB_00108];[Allocation:Onboard];[Type:Mandatory]

In STAFF_RESPONSIBLE mode, CCO functions shall be activated in accordance with Table 6 and the definitions described in section 7.4.1.

[END_REQ]

Note: The CCO_Operating_Mode_Speed_Determination function will automatically result in the monitoring of a nominal speed of 30km/h, in STAFF_RESPONSIBLE mode.

[REQ:IE-CLASSB_00109];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to require the driver to observe a ceiling speed of 30km/h in STAFF_RESPONSIBLE mode.

[END_REQ]

Note: The speed limit of 30km/h is for operation as line of sight driving as it permits Trains to be stopped by drivers within the line of sight distance.

[REQ:IE-CLASSB_00110];[Allocation:Onboard];[Type:Mandatory]

In STAFF_RESPONSIBLE mode the CCO shall constantly scan for CCT information from trackside codes or balises.

[END_REQ]

[REQ:IE-CLASSB_00111];[Allocation:Onboard];[Type:Mandatory]

When in STAFF_RESPONSIBLE the driver shall be able to select by DMI the following other CCO Operating Modes: FORWARD_SHUNTING and REVERSE_SHUNTING in accordance with the Entry_Forward_Shunting and Entry_Reverse_Shunting functions.

[END_REQ]

[REQ:IE-CLASSB_00112];[Allocation:Onboard];[Type:Mandatory]

When in STAFF_RESPONSIBLE the driver may change to NO_CAB_SELECTED mode by disabling the cab.

[END_REQ]

7.3.8. UNFITTED mode

To De Defined in a future version of the document

7.3.9. CAWS mode

To De Defined in a future version of the document

7.3.10. ATP mode

[REQ:IE-CLASSB_00113];[Allocation:Onboard];[Type:Mandatory]

The CCO shall automatically change to ATP mode when all conditions specified in Table 3 and Table 4 of section 7.3.21 are met.

[END_REQ]

[REQ:IE-CLASSB_00114];[Allocation:Onboard];[Type:Mandatory]

Upon confirmation of Train Data in CAB_SELECTED_MODE, CCO shall automatically change to ATP mode within 6s after reception of a valid 83.3Hz CCT carrier, with or without code.

[END_REQ]

[REQ:IE-CLASSB_00115];[Allocation:Onboard];[Type:Mandatory]

When operating in STAFF_RESPONSIBLE mode, CCO shall automatically change to ATP mode within 6s after reception of a valid 83.3 Hz CCT carrier, with or without code.

[END_REQ]

Note: For details on valid 83.3Hz carrier, refer to [IRS-AIRGAP].

[REQ:IE-CLASSB_00116];[Allocation:Onboard];[Type:Mandatory]

The driver shall be offered to acknowledge the CCO Operating Mode change to ATP in accordance with the Mode_Transition_Acknowledgement function

[END_REQ]

Note: This includes the cases:

- *Of direct static entry to ATP mode without dynamic transition where CCO was turned on in 83.3Hz CCT area and the carrier is received by CCO (changing from NO_CAB_SELECTED to CAB_SELECTED by driver and subsequent automatic transition to ATP).*
- *Where CCO was turned on in a section with no carrier and subsequently carrier became supplied again (e.g. in front of a red signal which upgraded to a different aspect) in an 83.3Hz CCT area (changing from NO_CAB_SELECTED to CAB_SELECTED by driver and subsequent automatic transition via STAFF_RESPONSIBLE to ATP mode).*
- *Where CCO Operating Mode was changed in an 83.3Hz CCT area with active carrier from NO_CAB_SELECTED to CAB_SELECTED by driver and subsequent automatic transition via STAFF_RESPONSIBLE to ATP mode.*

[REQ:IE-CLASSB_00117];[Allocation:Onboard];[Type:Mandatory]

In ATP mode, CCO functions shall be activated in accordance with Table 6 and the definitions described in section 7.4.1.

[END_REQ]

Note: These functions will automatically result in the monitoring of ATP Speed in accordance with the detected 83.3Hz codes.

[REQ:IE-CLASSB_00118];[Allocation:Onboard];[Type:Mandatory]

In ATP mode the CCO shall read codes with 83.3Hz carrier.

[END_REQ]

[REQ:IE-CLASSB_00119];[Allocation:Onboard];[Type:Mandatory]

In ATP mode, speeds associated with ATP CCT code names and maximum permitted delay for CCO to recognise and react to the changes of code shall be in accordance with the ATP_Speed_Determination function.

[END_REQ]

[REQ:IE-CLASSB_00120];[Allocation:Onboard];[Type:Mandatory]

When the CCO is in ATP mode operating in 83.3Hz CCT area, CCO shall allow the activation of the Running_Release function, to enable restricted Train movement while no code is received from the CCT. The selection of the running release function by the driver is permitted while the Train is moving or at Standstill, either in, or on the approach to, a no code area. However, the associated speed monitoring shall not be activated until the absence of code has been detected by the CCO.

[END_REQ]

Note: This is to allow a driver to approach a signal displaying a Red aspect at a low speed.

[REQ:IE-CLASSB_00121];[Allocation:Onboard];[Type:Mandatory]

When

- the CCO is in ATP mode operating in 83.3Hz CCT area, and
- the Standstill condition is met, and
- if no code is received from the CCT,

CCO shall activate the Start_Against_Signal_Reminder function.

[END_REQ]

[REQ:IE-CLASSB_00122];[Allocation:Onboard];[Type:Mandatory]

When Service Brake is configured and demanded by the CCO in ATP mode, the Service_Brake_Monitoring function shall be activated.

[END_REQ]

7.3.11. DTP mode

To De Defined in a future version of the document

7.3.12. DTP + CODE mode

To De Defined in a future version of the document

7.3.13. DTP + CODE_E mode

To De Defined in a future version of the document

7.3.14. CODE_E mode

Note: CODE_E is a degraded CCO Operating Mode which shall be provided to allow the Train to continue in operation when a failure is detected in the on-board code pickup coils or associated equipment.

[REQ:IE-CLASSB_00123];[Allocation:Onboard];[Type:Mandatory]
In the CCO shall automatically change to CODE_E mode when all conditions specified in Table 3 and Table 4 of section 7.3.21 are met.
[END_REQ]

[REQ:IE-CLASSB_00124];[Allocation:Onboard];[Type:Mandatory]
The CCO shall offer the driver to acknowledge the change to CODE_E in accordance with the Mode_Transition_Acknowledgement function.
[END_REQ]

[REQ:IE-CLASSB_00125];[Allocation:Onboard];[Type:Mandatory]
In CODE_E mode, on every occasion when the Train goes from a Standstill condition to a non-Standstill condition, the driver shall be offered to acknowledge the proposal to proceed in CODE_E CCO Operating Mode in accordance with the Mode_Transition_Acknowledgement function.
[END_REQ]

Note: This acknowledgement is required, even when there is no change of CCO Operating Mode, to remind the driver that the Train is operated in CODE_E mode and that, apart from the monitoring of the 30 km/h speed limit, the CCO is not protecting the Train. This concept of repetitive acknowledgement is considered acceptable for the initial application of this Class B system on EMU Trains. It may be revisited in a future version of this IRS, after human factors analyses considering the full range of functions and CCO Operating Modes have been completed.

[REQ:IE-CLASSB_00126];[Allocation:Onboard];[Type:Mandatory]
In CODE_E mode, CCO functions shall be activated in accordance with Table 6 and the definitions described in section 7.4.1.
[END_REQ]

Note: These functions will automatically result in the monitoring of a CCO Operating Mode Speed of 30km/h in CODE_E mode, in accordance with the CCO_Operating_Mode_Speed_Determination function.

7.3.15. DTP_E mode

[REQ:IE-CLASSB_00127];[Allocation:Onboard];[Type:Mandatory]
DTP_E is a degraded CCO Operating Mode which shall be provided to allow the Train to continue in operation when

- a fault is detected in the DTP Balise Antenna or
- a known fault is present in the DTP CCT equipment.

[END_REQ]

[REQ:IE-CLASSB_00128];[Allocation:Application Condition];[Type:Mandatory]
SRAC: An Operating Rule shall be established to specify the Operating Rules applicable to driver-instigated entry into DTP_E mode in the case where a known fault is present in the DTP CCT equipment.
[END_REQ]

[REQ:IE-CLASSB_00129];[Allocation:Onboard];[Type:Mandatory]
The CCO shall automatically change to DTP_E mode when all conditions specified in Table 3 and Table 4 of section 7.3.21 are met.

[END_REQ]

[REQ:IE-CLASSB_00130];[Allocation:Onboard];[Type:Mandatory]

The CCO shall offer the driver to acknowledge the change to DTP_E in accordance with the Mode_Transition_Acknowledgement function.

[END_REQ]

[REQ:IE-CLASSB_00131];[Allocation:Onboard];[Type:Mandatory]

In DTP_E mode, CCO functions shall be activated in accordance with Table 6 and the definitions described in section 7.4.1.

[END_REQ]

Note: These functions will automatically result in the monitoring of CCO Operating Mode Speed of 30km/h in DTP_E mode, in accordance with the CCO_Operating_Mode_Speed_Determination function.

[REQ:IE-CLASSB_00132];[Allocation:Onboard];[Type:Mandatory]

Upon entering DTP_E mode, all previously stored CCT information shall be erased.

[END_REQ]

[REQ:IE-CLASSB_00133];[Allocation:Onboard];[Type:Mandatory]

In DTP_E mode, on every occasion when the Train goes from a Standstill to a non-Standstill condition, the driver shall be required to acknowledge the DTP_E CCO mode in accordance with the Mode_Transition_Acknowledgement function.

[END_REQ]

Note: This acknowledgement is required, even when there is no change of CCO Operating Mode, to remind the driver that the Train is operated in DTP_E mode and that, apart from the monitoring of the 30 km/h CCO Operating Mode Speed limit, the CCO is not protecting the Train. This concept of repetitive acknowledgement is considered acceptable for the initial application of this Class B system on EMU Trains. It may be revisited in a future version of this IRS, after human factors analyses considering the full range of functions and CCO Operating Modes have been completed.

[REQ:IE-CLASSB_00134];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to ensure that the driver is trained and made aware of the potential consequences as a result of the fact that the protection offered by the Trainstop function is not available in this degraded DTP_E mode.

[END_REQ]

7.3.16. DTP_E+CAWS mode

To De Defined in a future version of the document

7.3.17. DTP_E+ATP mode

[REQ:IE-CLASSB_00135];[Allocation:Onboard];[Type:Mandatory]

The CCO shall automatically change to DTP_E+ATP mode when all conditions specified in Table 3 and Table 4 of section 7.3.21 are met.

[END_REQ]

Note: Table 3 - Permitted CCO Operating Mode Transitions does not specify direct automatic transition from STAFF_REPONSIBLE mode to DTP_E+ATP mode. However, this transition can occur indirectly through an intermediate automatic transition to DTP_E mode or ATP mode.

[REQ:IE-CLASSB_00136];[Allocation:Onboard];[Type:Mandatory]

The driver shall be offered to acknowledge the CCO Operating Mode change to DTP_E+ATP mode in accordance with the Mode_Transition_Acknowledgement function.

[END_REQ]

[REQ:IE-CLASSB_00137];[Allocation:Onboard];[Type:Mandatory]

In DTP_E+ATP mode, CCO functions shall be activated in accordance with Table 6 and the definitions described in section 7.4.1.

[END_REQ]

Note: These functions will result in the monitoring of the ATP Speed in accordance with the detected 83.3Hz codes.

[REQ:IE-CLASSB_00138];[Allocation:Onboard];[Type:Mandatory]

Upon entering DTP_E+ATP mode, all previously stored CCT information shall be erased.

[END_REQ]

[REQ:IE-CLASSB_00139];[Allocation:Onboard];[Type:Mandatory]

In DTP_E+ATP mode the CCO shall read codes with 83.3Hz carrier.

[END_REQ]

[REQ:IE-CLASSB_00140];[Allocation:Onboard];[Type:Mandatory]

In DTP_E+ATP mode, ATP Speeds associated with 83.3Hz CCT code names and maximum permitted delay for CCO to react to a change of code shall be in accordance with the ATP_Speed_Determination function.

[END_REQ]

[REQ:IE-CLASSB_00141];[Allocation:Onboard];[Type:Mandatory]

When the CCO is in DTP_E+ATP mode operating in 83.3Hz CCT area, CCO shall allow the activation of the Running_Release function, to enable restricted Train movement while no code is received from the CCT. The selection of the running release function by the driver is permitted while the Train is moving or at Standstill, either in, or on the approach to, a no code area. However, the associated ATP Speed monitoring shall not be activated until the absence of code has been detected by the CCO.

[END_REQ]

Note: this is to allow a driver to approach at low speed a signal displaying a Red aspect.

[REQ:IE-CLASSB_00142];[Allocation:Onboard];[Type:Mandatory]

When the CCO is in DTP_E+ATP mode operating in 83.3Hz CCT area, and the Train is at Standstill, and if no code is received from the CCT, CCO shall activate the Start_Against_Signal_Reminder function.

[END_REQ]

[REQ:IE-CLASSB_00143];[Allocation:Onboard];[Type:Mandatory]

When Service Brake is configured and is demanded by the CCO in DTP_E+ATP mode, the deceleration rate of the Train shall be monitored in accordance with the Service_Brake_Application_Monitoring function.

[END_REQ]

[REQ:IE-CLASSB_00144];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to ensure that the driver is trained and made aware of the potential consequences as a result of the fact that the protection offered by the Trainstop function is not available in this degraded DTP_E+ATP mode.

[END_REQ]

7.3.18. DTP_E+CODE_E mode

Note: DTP_E+CODE_E is a CCO Operating Mode which shall be provided to allow the Train to continue in degraded operation when faults are detected in both the on-board code pickup coils and the DTP Balise Antenna.

[REQ:IE-CLASSB_00145];[Allocation:Onboard];[Type:Mandatory]

The CCO shall automatically change to DTP_E+CODE_E mode when all conditions specified in Table 3 and Table 4of section 7.3.21 are met.

[END_REQ]

[REQ:IE-CLASSB_00146];[Allocation:Onboard];[Type:Mandatory]

The CCO shall offer the driver to confirm and acknowledge the change in accordance with the Mode_Transition_Acknowledgement function.

[END_REQ]

[REQ:IE-CLASSB_00147];[Allocation:Onboard];[Type:Mandatory]

In DTP_E+CODE_E mode, CCO functions shall be activated in accordance with Table 6 and the definitions described in section 7.4.1.

[END_REQ]

Note: These functions will automatically result in the monitoring of a CCO Operating Mode Speed at 30km/h, in DTP_E+CODE_E mode, as specified for CCO_Operating_Mode_Speed_Determination function.

[REQ:IE-CLASSB_00148];[Allocation:Onboard];[Type:Mandatory]

The CCO shall offer the driver to confirm and acknowledge the change to DTP_E+CODE_E mode when the Train starts to move, in accordance with the Mode_Transition_Acknowledgement function.

[END_REQ]

Note: This concept of repetitive acknowledgement is considered acceptable for the initial application of this Class B system on EMU Trains. It may be revisited in a future version of this IRS, after human factors analyses considering the full range of functions and operating modes have been completed.

[REQ:IE-CLASSB_00149];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to ensure that the driver is trained and made aware of the potential consequences as a result of the fact that no protection is offered by CCO in this degraded DTP_E+CODE_E mode.

[END_REQ]

7.3.19. BYPASS mode

Note: Some failures of the CCO will result in the default safe status of CCO constantly demanding an EB without the possibility of an acknowledgement. BYPASS is a permitted degraded CCO Operating Mode which shall be provided to allow degraded Train operation when there is a fatal failure of the CCO.

[REQ:IE-CLASSB_00150];[Allocation:Onboard];[Type:Mandatory]

BYPASS mode shall be entered when the driver operates the Class B CCO bypass switch to "CCO Bypass" position. This switch shall be separate from the CCO Vital Computing Unit.

While the BYPASS mode is active:

- Power shall be removed from the CCO equipment (all parts, such as CCO Vital Computing Unit, DMI, DTP Balise Antenna, pick up coils, etc.).
- The Emergency Brake, the Service Brake (if configured) and the traction cut off CCO output (if configured) relays of CCO shall be bypassed, so that Train movement becomes possible.

[END_REQ]

[REQ:IE-CLASSB_00151];[Allocation:Onboard];[Type:Mandatory]

The Bypass function performed by this CCO Operating Mode shall be designed for a target of SIL4 or comparable level of integrity in accordance with [CSM402], [50126], [50128], and [50129], to protect against inadvertent bypassing of any safety related CCO or Train control functions.

[END_REQ]

[REQ:IE-CLASSB_00152];[Allocation:Onboard];[Type:Mandatory]

The switch shall have two distinct positions which shall be labelled "CCO Active" and "CCO Bypass".

[END_REQ]

[REQ:IE-CLASSB_00153];[Allocation:Onboard];[Type:Mandatory]

The position of the switch shall be clearly and directly identifiable by eye irrespective of the position of any cover or equipment compartment door.

It shall be permitted, that this requires the driver to stop the Train and leave the driving position to operate the switch or to inspect its status.

It shall not be required for the driver to step off the vehicle for this purpose.

[END_REQ]

[REQ:IE-CLASSB_00154];[Allocation:Onboard];[Type:Mandatory]

To prevent unintended operation of the bypass switch it shall be covered and the cover shall be protected with a seal. The seal shall be breakable without tools.

[END_REQ]

[REQ:IE-CLASSB_00155];[Allocation:Onboard];[Type:Mandatory]

Operation of the Bypass switch from "CCO Bypass" to "CCO Active" shall automatically bring the CCO into AUTOTEST mode.

[END_REQ]

[REQ:IE-CLASSB_00156];[Allocation:Application Condition];[Type:Mandatory]

SRAC: Operating Rules shall be established on the use of the Bypass Switch and the degraded operation in BYPASS mode. These must reflect the absence of the speed indication on the CCO DMI and the necessity for a second competent person to observe the lineside signals and the driver reactions to them. In case of the driver not showing the required reactions, the competent person shall instruct the driver to comply and shall stop the Train by activation of an Emergency Brake where the driver still fails to perform the required reactions.

[END_REQ]

7.3.20. MAINTENANCE Mode

[REQ:IE-CLASSB_00157];[Allocation:Onboard];[Type:Mandatory]
The CCO shall automatically change to MAINTENANCE mode when all conditions specified in Table 3 and Table 4 of section 7.3.21 are met.
[END_REQ]

[REQ:IE-CLASSB_00158];[Allocation:Onboard];[Type:Mandatory]
In MAINTENANCE mode, CCO functions shall be activated in accordance with Table 6 and the definitions described in section 7.4.1.

[END_REQ]

[REQ:IE-CLASSB_00159];[Allocation:Onboard];[Type:Mandatory]
When in MAINTENANCE mode, the CCO shall display the MAINTENANCE page on the DMI as defined in [IRS-DMI].

[END_REQ]

[REQ:IE-CLASSB_00160];[Allocation:Onboard];[Type:Mandatory]
No CCO Operating Mode transitions shall be allowed while MAINTENANCE mode is active.

[END_REQ]

[REQ:IE-CLASSB_00161];[Allocation:Onboard];[Type:Mandatory]
De-activation of MAINTENANCE mode shall automatically bring the CCO into AUTOTEST mode.

[END_REQ]

7.3.21. Transition between Modes

[REQ:IE-CLASSB_00162];[Allocation:Onboard];[Type:Mandatory]
The CCO shall select the appropriate CCO Operating Mode based on information received from the CCT about the infrastructure fitment type.
[END_REQ]

[REQ:IE-CLASSB_00163];[Allocation:Onboard];[Type:Mandatory]
The permitted transitions between CCO Operating Modes shall only be made by CCO in accordance with Table 3 and Table 4.
[END_REQ]

[REQ:IE-CLASSB_00164];[Allocation:Onboard];[Type:Mandatory]
When a CCO Operating Mode change is triggered as a result of a failure, the CCO shall in the following sequence:

- Raise and manage the errors according to the Error_Management function, then:
- If the error is a vital error,
  - activate the Error_Management_acknowledgement function.
  - Then, only if the driver has acknowledged that error, perform an automatic mode change when all conditions specified in Table 3 and Table 4 below are met, then
  - activate the Mode_Acknowledgement_Transition function.
- If the error is a non-vital error,
  - perform an automatic mode change when all conditions specified in Table 3 and Table 4 below are met, then
  - activate the Mode_Acknowledgement_Transition function.

[END_REQ]

[REQ:IE-CLASSB_00165];[Allocation:Onboard];[Type:Mandatory]
The CCO shall automatically execute a CCO Operating Mode transition if all related conditions of Table 3 and Table 4 below are met, irrespective of whether a previous mode change is still pending acknowledgement by the driver.
[END_REQ]

Permitted CCO Operating Mode Transitions Table:

Table 3 shows the permitted transitions between CCO Operating Modes and the conditions under which each transition is permitted (e.g. the transition from NO_CAB_SELECTED to CAB_SELECTED is permitted only under condition 3, and the transition from CAWS to STAFF_RESPONSIBLE is permitted under condition 22 or condition 46 or condition 47). Blank cells in the table indicate that transitions are not permitted. The details of each transition condition are listed in Table 4. Table 3 must always be read first in up or down direction, secondly in right or left direction.

																		To be completed in a future version of the document
BYPASS	<-55	<-55	<-55	<-55	<-55	<-55	<-55	<-55	<-55	*<-55*	*<-55*	<-55	<-55	<-55	<-55	*<-55*	<-55	
56->	AUTO TEST	<-57	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	1->	MAINT ENANCE	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
-	2->	-	NO_CAB _SELECT ED	<-6	<-6	<-6	<-6	<-6	<-6	*<-6*	*<-6*	<-6	<-6	<-6	<-6	*<-6*	<-6	
-	3->	-	3->	CAB_SEL ECTED	-	<-7	<-10	-	-	-	-	-	-	-	-	-	-	
-	-	-	-	11->	STAFF_ RESPO NSIBLE	-	-	*<-22, <-46, <-47*	*<-22, <-46, <-47*	*<-24, <-25, <-46, <-47*	*<-46, <-47, <-53*	-	<-27	-	-	-	-	
-	-	-	-	9->	9->	FORWA RD_SH UNT ING	-	<-9	<-9	*<-9*	*<-9*	<-9	<-9	<-9	<-9	*<-9*	<-9	
-	-	-	-	8->	8->	-	REVERS E_SHU NTING	<-8	<-8	*<-8*	*<-8*	<-8	<-8	<-8	<-8	*<-8*	<-8	
-	-	-	-	4->	13->, *20->*	-	-	CAWS	*<-20*	*<-63*	*<-35, <-36*	-	-	<-27	-	-	-	
-	-	-	-	5->	14->, *19->*	-	-	*19->*	ATP	*<-64*	*<-37, <-38*	-	-	-	<-27	-	-	

-	-	-	-	-	*21->*	-	-	*61->*	*62->*	DTP	*<-12*	-	-	-	-	-	-	
-	-	-	-	-	*54->*	-	-	*18->*	*39->*	*15->*	DTP+ CODE	-	-	-	-	-	-	
-	-	-	-	50->	26->	-	-	26->	26->	-	*26->*	CODE_ E	-	-	-	*<-24, <-25, <-16, <-46, <-47*	<-60	
-	-	-	-	41->	43->, 44->	-	-	-	-	*43->, 44->*	*51->, 52->*	-	DTP_E	*<-28, <-46, <-47 Note 1*	*<-28, <-46, <-47 Note 1*	-	-	
-	-	-	-	29->	-	-	-	43->, 44->	-	-	*30->, 32->*	-	58->	DTP_E+ CAWS	-	-	-	
-	-	-	-	31->	-	-	-	-	43->, 44->	-	*33->, 34->*	-	59->	-	DTP_E+ ATP	-	-	
-	-	-	-	-	-	-	-	-	-	*26->*	-	*45->*	-	-	-	DTP+ CODE_E	-	
-	-	-	-	40->	40->	-	-	40->	40->	40->	40->	43->, 44->	26->	26->	26->	*43->, 44->*	DTP_E+ CODE_ E	
To be completed in a future version of the document																		UNFITTED
Note 1 applicable to transition 47 where indicated: This CCO Operating Mode change can only occur in the remote event of CCO in DTP+CODE mode reading a CCT Trainstop order (with or without stop override authorised by the driver), instantaneously followed a detection of a discontinuous CCT signal reception failure. The CCO would then change internally to DTP_E+ATP or DTP_E+CAWS mode for a very short period of time, until the Trainstop order message is fully processed. At this point, the CCO will automatically perform the final mode change to DTP_E.																		

Table 3 - Permitted CCO Operating Mode Transitions

Table 4 Details of each transition condition

Transition Identifier	Transition Conditions
1	The autotest cycle has been completed. The maintenance tool is connected. The Train is at Standstill.
2	The autotest cycle has been completed. The maintenance tool is not connected. No cab is selected.
3	The autotest cycle has been completed since the last CCO start up. The maintenance tool is not connected. A cab has been selected.
4	The brake connectivity tests have been performed since the last CCO start up. All necessary Train Data values have been confirmed by the driver and stored in CCO. No error related to the discontinuous signal reception of the selected cab is present. No error related to the continuous signal reception of the selected cab is present. Valid 50Hz carrier is detected. *Additional condition for future version of this IRS:* - *Trainstop function is not active*
5	The brake connectivity tests have been performed since the last CCO start up. All necessary Train Data values have been confirmed by the driver and stored in CCO. No error related to the discontinuous signal reception of the selected cab is present. No error related to the continuous signal reception of the selected cab is present. Valid 83.3Hz carrier is detected. *Additional condition for future version of this IRS:* - *Trainstop function is not active*
6	No Cab is selected.
7	The Train is at Standstill. The Exit_Forward_Shunting function has been activated by the driver
8	The brake connectivity tests have been performed since the last CCO start up. The Train is at Standstill. The Entry_Reverse_Shunting function has been activated by the driver. *Additional condition for future version of this IRS:* - *Trainstop function is not active*
9	The Brake connectivity tests have been performed since the last CCO start up. The Train is at Standstill. The Entry_Forward_Shunting function has been activated by the driver. *Additional condition for future version of this IRS:* - *Trainstop function is not active*

Transition Identifier	Transition Conditions
10	The Train is at Standstill. The Exit_Reverse_Shunting function has been activated by the driver.
11	The Brake connectivity tests have been performed since the last CCO start up. All necessary Train Data values have been confirmed by the driver and stored in CCO. No error related to the discontinuous signal reception of the selected cab is present. No error related to the continuous signal reception of the selected cab is present. No valid carrier is detected. *Additional condition for future version of this IRS:* - *Trainstop function is not active*
12	*To be defined in a future version of this IRS.*
13	Valid 50Hz carrier is detected. No error related to the discontinuous signal reception of the selected cab is present. No error related to the continuous signal reception of the selected cab is present. *Additional condition for future version of this IRS:* - *Trainstop function is not active.* - *Stop_Override function is not active Or (Stop_Override function is active and the Train has travelled the distance from the balise group to the Berth Track joint of the next signal)*
14	Valid 83.3Hz carrier is detected. No error related to the discontinuous signal reception of the selected cab is present. No error related to the continuous signal reception of the selected cab is present. *Additional condition for future version of this IRS:* - *Trainstop function is not active.* - *Stop_Override function is not active Or (Stop_Override function is active and the Train has travelled the distance from the balise group to the Berth Track joint of the next signal)*
15	*To be defined in a future version of this IRS.*
16	To be defined in a future version of this IRS.
17	Not used
18	*To be defined in a future version of this IRS.*
19	*To be defined in a future version of this IRS.*
20	*To be defined in a future version of this IRS.*
21	*To be defined in a future version of this IRS.*

Transition Identifier	Transition Conditions
22	*To be defined in a future version of this IRS.*
23	Not used
24	*To be defined in a future version of this IRS.*
25	*To be defined in a future version of this IRS.*
26	The DTP_Inclusion function has not been activated by the driver. An error related to the continuous signal reception of the selected cab has been raised.
27	No error related to the discontinuous signal reception of the selected cab is present. No error related to the continuous signal reception of the selected cab is present. The DTP_Inclusion function has been activated by the driver while the train is at standstill. *Additional condition for future version of this IRS:* - *Trainstop function is not active*
28	*To be defined in a future version of this IRS.*
29	The brake connectivity tests have been performed since the last CCO start up. All necessary Train Data values have been confirmed by the driver and stored in CCO An error related to the discontinuous signal reception of the selected cab has been raised. No error related to the continuous signal reception of the selected cab is present. Valid 50Hz carrier is detected.
30	*To be defined in a future version of this IRS.*
31	The brake connectivity tests have been performed since the last CCO start up. All necessary Train Data values have been confirmed by the driver and stored in CCO An error related to the discontinuous signal reception of the selected cab has been raised. No error related to the continuous signal reception of the selected cab is present. Valid 83.3Hz carrier is detected.
32	*To be defined in a future version of this IRS.*
33	*To be defined in a future version of this IRS.*
34	*To be defined in a future version of this IRS.*
35	*To be defined in a future version of this IRS.*
36	*To be defined in a future version of this IRS.*
37	*To be defined in a future version of this IRS.*

Transition Identifier	Transition Conditions
38	*To be defined in a future version of this IRS.*
39	*To be defined in a future version of this IRS.*
40	The brake connectivity tests have been performed since the last CCO start up. All necessary Train Data values have been confirmed by the driver and stored in CCO An error related to the discontinuous signal reception of the selected cab has been raised. An error related to the continuous signal reception of the selected cab has been raised.
41	The brake connectivity tests have been performed since the last CCO start up. All necessary Train Data values have been confirmed by the driver and stored in CCO An error related to the discontinuous signal reception of the selected cab has been raised. No error related to the continuous signal reception of the selected cab is present. No valid carrier is detected.
42	Not used
43	No error related to the continuous signal reception of the selected cab is present. The DTP_Exclusion function has been activated by the driver at standstill. *Additional condition for future version of this IRS:* - *Trainstop function is not active.* - *Stop_Override function is not active Or (Stop_Override function is active and the Train has travelled the distance from the balise group to the Berth Track joint of the next signal)*
44	An error related to the discontinuous signal reception of the selected cab has been raised. No error related to the continuous signal reception of the selected cab is present.
45	*To be defined in a future version of this IRS.*
46	*To be defined in a future version of this IRS.*
47	*To be defined in a future version of this IRS.*
48	Not used
49	Not used
50	The brake connectivity tests have been performed since the last CCO start up. All necessary Train Data values have been confirmed by the driver and stored in CCO No error related to the discontinuous signal reception of the selected cab is present An error related to the continuous signal reception of the selected cab has been raised.
51	*To be defined in a future version of this IRS.*
52	*To be defined in a future version of this IRS.*

Transition Identifier	Transition Conditions
53	*To be defined in a future version of this IRS.*
54	*To be defined in a future version of this IRS.*
55	The Bypass switch is operated to “CCO Bypass” position.
56	The Bypass switch is operated to “CCO Active” position.
57	The maintenance tool is disconnected from CCO.
58	Valid 50Hz carrier is detected. No error related to the continuous signal reception of the selected cab is present. The DTP_Inclusion function has not been activated by the driver. *Additional condition for future version of this IRS:* - *Trainstop function is not active.* - *Stop_Override function is not active Or (Stop_Override function is active and the Train has travelled the distance from the balise group to the Berth Track joint of the next signal)*
59	Valid 83.3Hz carrier is detected. No error related to the continuous signal reception of the selected cab is present. The DTP_Inclusion function has not been activated by the driver. *Additional condition for future version of this IRS:* - *Trainstop function is not active.* - *Stop_Override function is not active Or (Stop_Override function is active and the Train has travelled the distance from the balise group to the Berth Track joint of the next signal)*
60	No error related to the discontinuous signal reception of the selected cab is present. An error related to the continuous signal reception of the selected cab is present. The DTP_Inclusion function has been activated by the driver while the train is at standstill. *Additional condition for future version of this IRS:* - *Trainstop function is not active*
61	*To be defined in a future version of this IRS.*
62	*To be defined in a future version of this IRS.*
63	*To be defined in a future version of this IRS.*
64	*To be defined in a future version of this IRS.*

Table 4 - CCO Operating Mode Transition Conditions

Note: This table only reflects the necessary conditions to change from an initial CCO Operating Mode to another CCO Operating Mode. The pre-requisites to enter in the initial CCO Operating Mode are not recalled in all the subsequent transitions.

Prohibited Transitions between CCO Operating Modes

[REQ:IE-CLASSB_00166];[Allocation:Onboard];[Type:Mandatory]

The following Transitions between CCO Operating Modes shall not be permitted;

From	To
Any CCO Operating Mode different from AUTOTEST	MAINTENANCE *Note: The connection of the maintenance tool shall have no effect on the CCO if the CCO Operating Mode is different from AUTOTEST.*
CAB_SELECTED	DTP+CODE_E
STAFF_RESPONSIBLE	DTP_E+CAWS or DTP_E+ATP or DTP+CODE_E or DTP_E+CODE_E
UNFITTED	*Note: To be completed in a future version of the document*
FORWARD_SHUNTING	DTP_E+CAWS or DTP_E+CAWS or DTP_E+ATP or DTP+CODE_E or DTP_E+CODE_E
REVERSE_SHUNTING	DTP_E+CAWS or DTP_E+CAWS or DTP_E+ATP or DTP+CODE_E or DTP_E+CODE_E
CAWS	DTP_E or DTP_E+ATP or DTP+CODE_E or DTP_E+CODE_E
ATP	DTP_E or DTP_E+CAWS or DTP+CODE_E or DTP_E+CODE_E
DTP	CODE_E or DTP_E+CAWS or DTP_E+ATP or DTP_E+CODE_E
DTP+CODE	DTP+CODE_E or DTP_E+CODE_E
CODE_E	CAB_SELECTED or UNFITTED or STAFF_RESPONSIBLE or CAWS or ATP or DTP or DTP+CODE
DTP_E	CAB_SELECTED or CAWS or ATP or DTP or DTP+CODE
DTP_E+CAWS	CAB_SELECTED or UNFITTED or STAFF_RESPONSIBLE or ATP or DTP or DTP+CODE
DTP_E+ATP	CAB_SELECTED or UNFITTED or STAFF_RESPONSIBLE or ATP (in case of DTP Balise Antenna fault) or DTP or DTP+CODE *Note: DTP_E+ATP to ATP is allowed in case there is no antenna fault*
DTP+CODE_E	CAB_SELECTED or UNFITTED or STAFF_RESPONSIBLE or CAWS or ATP or DTP or DTP+CODE
DTP_E+CODE_E	CAB_SELECTED or UNFITTED or STAFF_RESPONSIBLE or CAWS or ATP or DTP or DTP+CODE
CODE_E	DTP_E or DTP_E+CAWS or DTP_E+ATP
DTP_E	DTP+CODE_E or CODE_E
DTP_E+CAWS	DTP_E+ATP or DTP+CODE_E or CODE_E
DTP_E+ATP	DTP+CODE_E or DTP_E+CAWS or CODE_E
DTP+CODE_E	DTP_E+ATP or DTP_E+CAWS
DTP_E+CODE_E	DTP+CODE_E or DTP_E+ATP or DTP_E+CAWS or DTP_E

Table 5 - Prohibited transitions between CCO Operating Modes

[END_REQ]

7.3.22. DMI information depending on CCO Operating Modes

[REQ:IE-CLASSB_00167];[Allocation:Onboard];[Type:Mandatory]
The DMI shall display the information as specified in the [IRS-DMI]
[END_REQ]

7.4. CCO Functional Requirements

7.4.1. Functions activated by CCO Operating Modes

[REQ:IE-CLASSB_00168];[Allocation:Onboard];[Type:Mandatory]
The table below lists the functions that may be activated depending on the CCO Operating Mode. The code in the table shall be read as:

- "A" : The function in the corresponding row shall be automatically started when the CCO is entering or is in the CCO Operating Mode indicated in the corresponding column
- "F" : The function shall be automatically started upon the achievement of predefined conditions via another CCO function
- "T" : The function shall be automatically started upon the reception of information communicated by the CCT subsystem
- "D": The function shall be started via an action from the driver

[END_REQ]

	CCO OPERATING MODES																		
Function	BYPASS	AUTO TEST	MAINTENANCE	NO CAB SELECTED	CAB SELECTED	UNFITTED	STAFF RESPONSIBLE	FORWARD_SHUNTING	REVERSE_SHUNTING	CAWS	ATP	DTP	DTP + CODE	CODE_E	DTP_E	DTP_E + CAWS	DTP_E + ATP	DTP + CODE_E	DTP_E + CODE_E
CCO_Operating_Mode_Speed_Determination							A	A	A	A	A	A	A	A	A	A	A	A	A
Max_Train_Speed_Determination							A			A	A	A	A	A	A	A	A	A	A
ATP_Speed_Determination											A						A		
DTP_Signalling_Speed_Determination												A	A					A	
DTP_Line_Speed_Determination												A	A					A	
DTP_Temporary_Speed_Restriction_Speed_Determination							T			T	T	T	T	T				T	
Train_Speed_Monitoring							A	A	A	A	A	A	A	A	A	A	A	A	A
Running_Release										D	D						D		
Stop_Override							D			D	D	D	D	D				D	
Train_Stop							T			T	T	T	T	T				T	
Balise_Group_Management					A		A			A	A	A	A	A				A	
Continuous_Code_Management					A		A			A	A	A	A		A	A	A		
Odometry				A	A		A	A	A	A	A	A	A	A	A	A	A	A	A
Braking_Management							F	F	F	F	F	F	F	F	F	F	F	F	F
Entry_Forward_Shunting					D		D			D	D	D	D	D	D	D	D	D	D
Exit_Forward_Shunting								D											
Entry_Reverse_Shunting					D		D			D	D	D	D	D	D	D	D	D	D
Exit_Reverse_Shunting									D										
DTP_Exclusion							D			D	D	D	D	D				D	
DTP_Inclusion															D	D	D		D
Brake_Connectivity_Test					D		D			D	D	D	D	D	D	D	D	D	D
Permanent_Test		A	A	A	A		A	A	A	A	A	A	A	A	A	A	A	A	A

	CCO OPERATING MODES																		
Function	BYPASS	AUTO TEST	MAINTENANCE	NO CAB SELECTED	CAB SELECTED	UNFITTED	STAFF RESPONSIBLE	FORWARD_SHUNTING	REVERSE_SHUNTING	CAWS	ATP	DTP	DTP + CODE	CODE_E	DTP_E	DTP_E + CAWS	DTP_E + ATP	DTP + CODE_E	DTP_E + CODE_E
Roll_Away_Protection					A		A	A	A	A	A	A	A	A	A	A	A	A	A
Direction_Controller_Supervision							A	A	A	A	A	A	A	A	A	A	A	A	A
Reverse_Movement_Protection							A	A		A	A	A	A	A	A	A	A	A	A
Forward_Movement_Protection									A										
Data_Entry					D		D			D	D	D	D	D	D	D	D	D	D
Start_Against_Signal_Reminder										F/T	F/T					F/T	F/T		
CODE_Carrier_Reset																D	D		
Mode_Transition_Acknowledgement							A				A			A	A		A		A
CAWS_Mode_Transition_Acknowledgement										A						A			
Error_Management		F	F	F	F		F	F	F	F	F	F	F	F	F	F	F	F	F
Error_Management_Acknowledgement		F	F	F	F		F	F	F	F	F	F	F	F	F	F	F	F	F
Service_Brake_Application_Monitoring							F	F	F	F	F	F	F	F	F	F	F	F	F
Juridical_Recording				A	A		A	A	A	A	A	A	A	A	A	A	A	A	A
Speed_Display							A	A	A		A	A	A	A	A		A	A	A
CAWS_Aspect_display										A						A			

Table 6 - Functions per CCO Operating Mode

7.4.2. SIL targets for functions

[REQ:IE-CLASSB_00169];[Allocation:Onboard];[Type:Mandatory]
CCO functions described in this section, as well as any internal CCO functions supporting these functions, shall achieve the SIL targets provided in Table 7, in accordance with [CSM402], [50126], [50128], and [50129].
[END_REQ]

[REQ:IE-CLASSB_00170];[Allocation:Onboard];[Type:Mandatory]
Any other CCO functions shall be allocated and shall achieve SIL targets which have been established in accordance with [CSM402], [50126], [50128], and [50129].
[END_REQ]

CCO Function Name	SIL TARGET
ATP_Speed_Determination	SIL4
DTP_Signalling_Speed_Determination	SIL4
DTP_Line_Speed_Determination	SIL4
CCO_Operating_Mode_Speed_Determination	SIL4
Max_Train_Speed_Determination	SIL4
DTP_Temporary_Speed_Restriction_Speed_Determination	SIL4
Train_Speed_Monitoring	SIL4
ATP_Running Release	SIL4
Stop_Override	SIL4
Train_Stop	SIL4
Balise_Group_Management	SIL4
Continuous_Code_Management	SIL4
Odometry	SIL4
Braking_Management	SIL4
Entry_Forward_Shunting	SIL4
Exit_Forward_Shunting	SIL4
Entry_Reverse_Shunting	SIL4
Exit_Reverse_Shunting	SIL4
DTP_Inclusion	SIL4
DTP_Exclusion	SIL4
Brake_Connectivity_Test	SIL4 (Emergency Brake Connectivity test shall be SIL4, Service Brake Connectivity test may be SIL0)
Permanent_Test	SIL4 (SB, TCO and JRU communications checks may be SIL0)
Roll_Away_Protection	SIL4
Direction_Supervision	SIL4
Reverse_Movement_Protection	SIL4
Forward_Movement_Protection	SIL4
Data_Entry	SIL4
Start_Against_Signal_Reminder	SIL4
CODE_Carrier_Reset	SIL4

CCO Function Name	SIL TARGET
Mode_Transition_Acknowledgement	SIL4
CAWS_Mode_Transition_Acknowledgement	SIL4
Error_Management	Error detection and management and EB demands associated with vital or fatal errors shall be SIL4. Error detection and management may be SIL0 for non-vital errors.
Error_Management_Acknowledgement	SIL4
Service_Brake_Efficiency	SIL4
Juridical_Recording	SIL0
Speed_Display	No minimum SIL requirements are defined in this standard. An appropriate SIL shall be identified by risk assessment in accordance with [CSM402], [50126], [50128], and [50129] at project level. *Note: No speed indication is present when running in UNFITTED or CAWS modes. Other CCO Operating Modes are either fully monitored or monitored to a low speed (15 or 30 km/h).* *In future version of this IRS, it may become acceptable to operate in STAFF_RESPONSIBLE at higher speed during temporary degraded operation. If Current Train Speed above 30km/h were to be displayed on the DMI in these circumstances, the necessary level of integrity of that speed display would have to be further assessed (considering e.g. that a driver must be able to obey the lineside speed boards)*
CAWS_Aspect_Display	No minimum SIL requirements are defined in this standard. These shall be identified by risk assessment in accordance with [CSM402], [50126], [50128], and [50129] at project level.

Table 7 - Functions Safety Integrity Levels

7.4.3. Compatibility of CCO functions with CCT areas

[REQ:IE-CLASSB_00171];[Allocation:Trackside];[Type:Mandatory]
Table 12 in section 8.1.4 shows the required compatibility of CCO functions with CCT types of fitment, that shall be enabled by CCO.
[END_REQ]

7.4.4. Priorities between functions

[REQ:IE-CLASSB_00172];[Allocation:Onboard];[Type:Mandatory]
The Error_Management function shall take priority over any other active function when the error managed by the CCO is vital or fatal. This means that Emergency brake shall be immediately demanded when a vital or fatal error is raised.
[END_REQ]

[REQ:IE-CLASSB_00173];[Allocation:Onboard];[Type:Mandatory]
The priority of all other CCO functions, including functions involving a driver interaction, shall be determined based on risk assessment made in accordance with [CSM402], [50126], [50128], and [50129].
[END_REQ]

[REQ:IE-CLASSB_00174];[Allocation:Onboard];[Type:Mandatory]
The proposals for acknowledgement of errors shall be presented to the driver according to the following priority levels:

- Priority level 1: Acknowledgements requested by Error_Management_Acknowledgement function
- Priority level 2. Acknowledgements requested by Train_Stop function
- Priority level 3. Acknowledgements requested by Continuous_Code_Management function
- Priority level 3. Acknowledgements requested by Mode_Transition_Acknowledgement function
- Priority level 3. Acknowledgements requested by CAWS_Mode_Transition_Acknowledgement function
- Priority level 3. Acknowledgements associated with functions activated by an action from the driver (refer to Table 6 in section 7.4.1)
- Priority level 4. Acknowledgements associated with any other functions which are not listed in Priority level1 to 3.

[END_REQ]

[REQ:IE-CLASSB_00175];[Allocation:Onboard];[Type:Mandatory]
If a request for acknowledgement of higher priority level occurs while a lower priority level acknowledgement request is in process, the lower priority level acknowledgement request shall be aborted and the higher priority level acknowledgement request shall be presented to the driver.
[END_REQ]

[REQ:IE-CLASSB_00176];[Allocation:Onboard];[Type:Mandatory]
If several acknowledgement requests of the same priority level occur concurrently, they shall be presented in their order of occurrence.
[END_REQ]

7.4.5. CCO_Operating_Mode_Speed_Determination

NOTE: The purpose of the function is to determine a CCO Operating Mode Speed. In accordance with the active CCO Operating Mode of the CCO.

[REQ:IE-CLASSB_00177];[Allocation:Onboard];[Type:Mandatory]

The following CCO Operating Mode Speeds shall be set while the related CCO Operating Mode is active:

- STAFF_RESPONSIBLE: 30 km/h
- REVERSE_SHUNTING: 15 km/h
- FORWARD_SHUNTING: 15 km/h
- UNFITTED: 160 km/h
- ATP: 100 km/h
- CAWS: 160 km/h
- CODE_E: 30 km/h
- DTP_E: 30 km/h
- DTP_E+ATP: 100 km/h
- DTP_E+CAWS: 30 km/h
- DTP_E+CODE_E: 30 km/h

[END_REQ]

Note: In CCO Operating Modes where no speed limit is transmitted from CCT to CCO, the CCO Operating Mode Speed shall be limited to no more than 30km/h.

Exceptions:

The CCO Operating Mode Speed for DTP_E+ATP of 100 km/h shall be reviewed as part of permitting the use of CCO on further types of Trains (light engine, freight, OTM, etc.) where these differ in braking performance from the EMU vehicle types for which this version of the IRS is optimised. It shall also be reviewed when TSR balises are considered for introduction.

In CAWS and UNFITTED CCO operation modes a higher CCO Operating Mode Speed had been previously authorised by the then relevant authority before 1990. These CCO Operating Modes should be employed only while the migration to a fully fitted network is ongoing, and their area of use within the network should not be extended beyond the CCT areas where they are in use on 01.01.2020.

7.4.6. Max_Train_Speed_Determination

[REQ:IE-CLASSB_00178];[Allocation:Onboard];[Type:Mandatory]

The CCO shall set the value of the Max Train Speed parameter to the value entered by the driver via the Data_Entry function in case of full data entry.

[END_REQ]

[REQ:IE-CLASSB_00179];[Allocation:Onboard];[Type:Mandatory]

The CCO shall set the value of the Max Train Speed parameter to the value of Max Unit Speed in case of simplified data entry.

[END_REQ]

7.4.7. ATP_Speed_Determination

[REQ:IE-CLASSB_00180];[Allocation:Onboard];[Type:Mandatory]

The CCO shall determine the ATP Speed on the basis of CCT codes received with 83.3Hz carrier only.

[END_REQ]

[REQ:IE-CLASSB_00181];[Allocation:Onboard];[Type:Mandatory]

The CCO system shall evaluate ATP Speed based on code names detected in the following way:

- When no code is detected (with or without presence of carrier):
    - ATP Speed = 0 km/h while the driver has not activated the Running_Release function
    - ATP Speed = ATP Running Release Speed = 15 km/h if the driver has activated the Running_Release function
- When code 50 is detected: ATP Speed = 30 km/h
- When code 75 is detected: ATP Speed = 30 km/h
- When code 120 is detected: ATP Speed = 50 km/h
- When code 180 is detected: ATP Speed = 50 km/h
- When code 270 is detected: ATP Speed = 75 km/h
- When code 420 is detected: ATP Speed = 100 km/h

[END_REQ]

[REQ:IE-CLASSB_00182];[Allocation:Onboard];[Type:Mandatory]

The CCO shall decrease the ATP Speed values given above by an amount equal to 15km/h while all of the following conditions are met:

- The driver has entered “Yes” for the Status of Brake Isolation via the simplified Data_Entry function.
- Code 75, Code 180, Code 420 (permitted with Green Signal Aspect) or Code 270 (permitted with Double Yellow Signal Aspect) or Code 50, Code 120 (permitted with Yellow Signal Aspect) is detected.

[END_REQ]

Note: For many types of Unit and Trains, when operated under the Status of Brake Isolation (during which the Train brake performance is equal to or better than a defined permitted reduced brake performance) and with the 15km/h speed decrease, it is possible to achieve at least the same braking distance, when compared with the braking distance achieved from ‘un-decreased’ ATP Speed with full braking performance.

[REQ:IE-CLASSB_00183];[Allocation:Application Condition];[Type:Mandatory]

SRAC: For the case of operation under the Status of Brake Isolation in ATP mode, the permitted level of brake performance reduction shall be determined for each Unit or Train, where this operation is intended, (e.g. as a maximum percentage of brake performance isolation per Train) such that the increase in braking distance is fully compensated by the 15km/h ATP Speed decrease. This shall be demonstrated by a risk assessment in accordance with [EN50126], [EN50128], [EN50129] and [CSM402].

[END_REQ]

[REQ:IE-CLASSB_00184];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An operating instruction shall require the drivers to be trained to enter "Yes" for the Status of Brake Isolation via simplified data entry, only when they consider that the situation is appropriate to do so. This may include the requirement to obtain authority from the signalman. They shall be trained to understand the consequence of this action and to evaluate the current brake performance of the Train.

[END_REQ]

7.4.8. DTP_Signalling_Speed_Determination

To be defined in a future version of the document.

7.4.9. DTP_Line_Speed_Determination

To be defined in a future version of the document.

[REQ:IE-CLASSB_00185];[Allocation:Onboard];[Type:Mandatory]

In the event of an increase from a DTP Line Speed restriction to a less restrictive DTP Line Speed, the DTP_Line_Speed_Determination function shall extend the length of the initial speed restriction by the Train length as entered via the Data_Entry function to ensure that the first restriction is respected for the entire length of the Train.

[END_REQ]

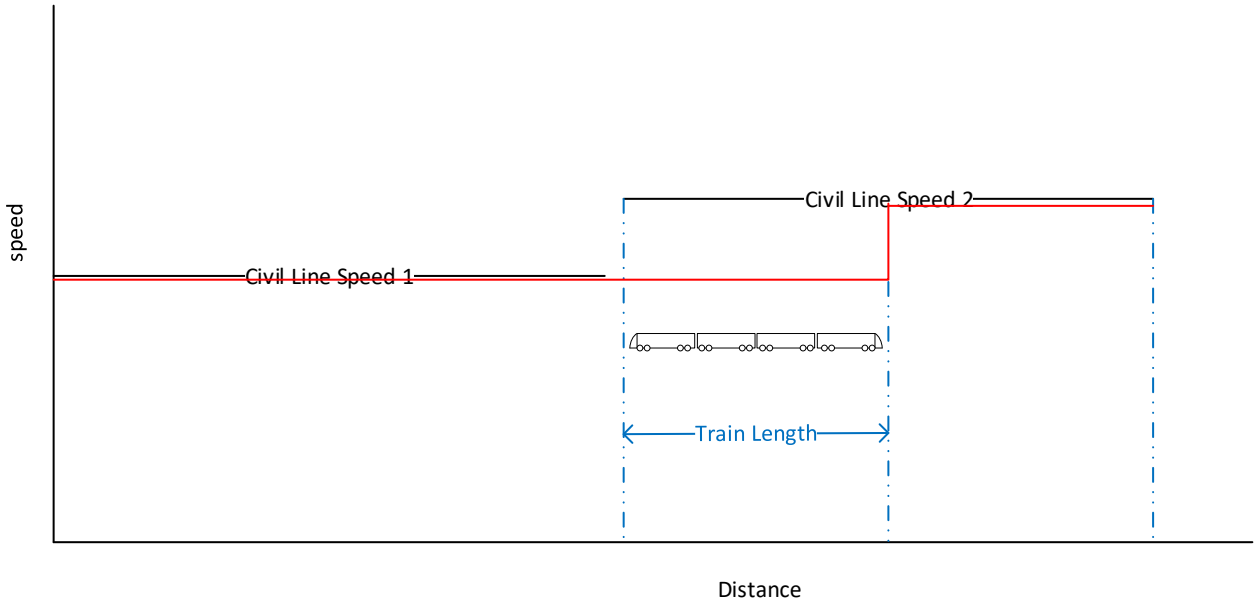


Figure 2 –Applicable DTP Line Speed restriction in the event of Civil Line Speed increase

Note: No such adjustment is required in connection with the ATP Speed because the Train length is in that case taken into consideration in the trackside design.

Note: in a future version of the IRS, a similar requirement will be developed in the DTP_Temporary_Speed_Restricion_Speed_Determination function to address the speed profile extension principle applicable to that function.

7.4.10. DTP_Temporary_Speed_Restriction_Speed_Determination

To be defined in a future version of the document

7.4.11. Train_Speed_Monitoring

Note: This version of the document only addresses identification of the applicable ceiling speeds and their monitoring through the demand and revocation of the Emergency Brake or Service Brake in case of over speed. A future version of the document will also define the target speed monitoring principle applicable in CCO Operating Modes other than ATP or DTP_E+ATP.

[REQ:IE-CLASSB_00186];[Allocation:Onboard];[Type:Mandatory]

Whenever a requirement of the Train_Speed_Monitoring function demands an emergency brake or a service brake application, this shall be done in accordance with the Braking_Management function.

[END_REQ]

[REQ:IE-CLASSB_00187];[Allocation:Onboard];[Type:Mandatory]

When the Train_Speed_Monitoring function is active, it shall continuously compare the Current Train Speed against the three following speed values:

- The Permitted Speed
- The First Intervention Speed
- The Second Intervention Speed

[END_REQ]

[REQ:IE-CLASSB_00188];[Allocation:Onboard];[Type:Mandatory]

The Train_Speed_Monitoring function shall differentiate between the following three different monitoring principles:

- The Ceiling Speed Monitoring (CSM) which shall be active while a constant speed restriction is to be monitored by CCO.

  CSM applies to all CCO Operating Modes, except AUTOTEST, NO_CAB_SELECTED, CAB_SELECTED, BYPASS and MAINTENANCE.
- The Target Speed Monitoring (TSM) which shall be active while defined braking curves are to be monitored to bring the Train from a previous constant speed restriction
  - to a lesser constant speed restriction which applies from a target point, or
  - to a speed of 0km/h at the end of a movement authority.

  TSM only applies to the CCO operation modes:
  - DTP, DTP + CODE and DTP + CODE_E
  - ATP, CAWS, STAFF_RESPONSIBLE, UNFITTED, CODE_E when the Train must decelerate to

a DTP Temporary Speed Restriction Speed, if CCT is fitted to support this function.

- The Release Speed Monitoring (RSM) which shall be active while the DTP Release Speed of a Train is to be monitored. RSM applies to the CCO operation modes DTP, DTP + CODE, and DTP + CODE_E.

[END_REQ]

Note: In Ceiling Speed Monitoring, the constant speed restriction is monitored by the CCO for the entire Train length, i.e. the Train can only re-accelerate to a higher speed when the rear of the Train has passed the end of the speed restriction. For DTP, DTP+CODE, DTP+CODE_E modes, this is ensured by the DTP_Line_Speed_Determination function. For ATP and DTP_E+ATP modes this functionality is supported in an alternative approach via the trackside design and configuration.

A future version of this document shall describe the conditions under which CCO shall switch between CSM, TSM and RSM.

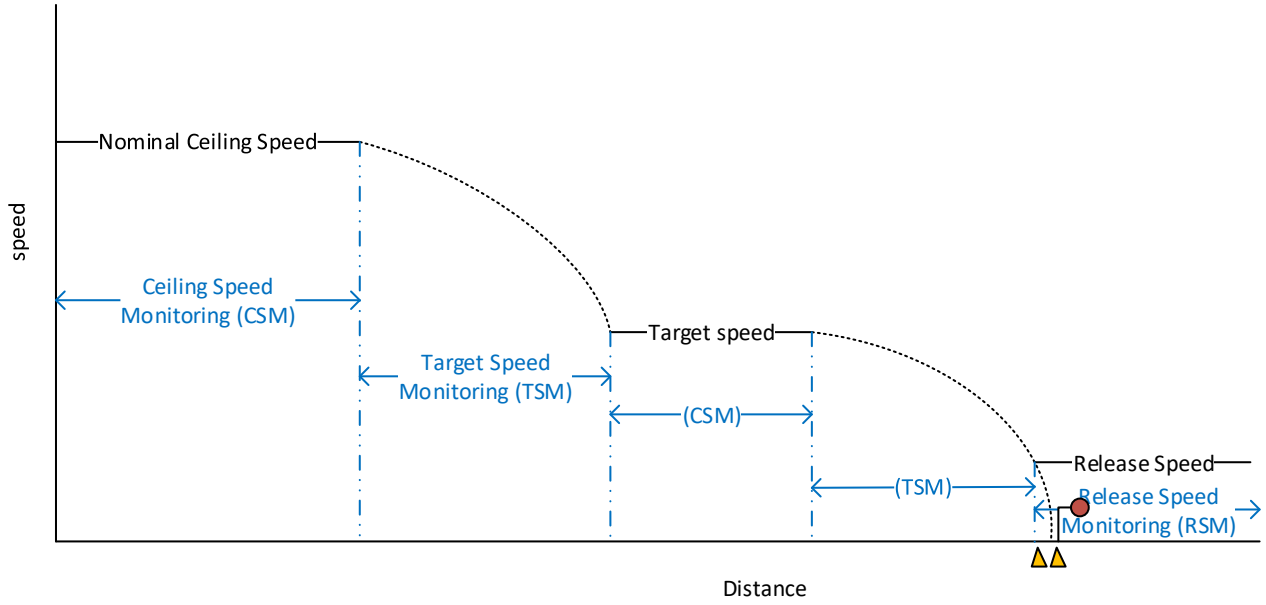


Figure 3 – Ceiling Speed, Target Speed Monitoring, and Release Speed Monitoring principles

Note: This figure illustrates Ceiling Speed Monitoring, Target Speed Monitoring to a target speed different than zero, Target Speed Monitoring to a target speed equal to zero and Release Speed Monitoring.

7.4.11.1. Ceiling speed Monitoring (CSM)

Note: The following requirements describe how the CCO shall monitor the Permitted Speed, First Intervention Speed and Second Intervention Speed in Ceiling Speed Monitoring

[REQ:IE-CLASSB_00189];[Allocation:Onboard];[Type:Mandatory]

The Nominal Ceiling Speed shall be the most restrictive of the ceiling speeds determined at any point in time via the following functions:

- CCO_Operating_Mode_Speed_Determination
- Max_Train_Speed_Determination
- ATP_Speed_Detemination
- DTP_Line_Speed_Determination

- DTP_Signalling_Speed_Determination
- DTP_Temporary_Speed_Restriction_Speed_Determination

[END_REQ]

[REQ:IE-CLASSB_00190];[Allocation:Onboard];[Type:Mandatory]

With the exception of when the Running_Release function is active, CCO shall define the following two thresholds.

- First Intervention Ceiling Speed = Nominal Ceiling Speed + 3 km/h
- Second Intervention Ceiling Speed = Nominal Ceiling Speed + 5 km/h

[END_REQ]

[REQ:IE-CLASSB_00191];[Allocation:Onboard];[Type:Mandatory]

While the CCO Operating Mode is DTP_E+ATP or ATP and the Running_Release function is active, CCO shall define the following two thresholds.

- First Intervention Ceiling Speed = Nominal Ceiling Speed + 2 km/h
- Second Intervention Ceiling Speed = Nominal Ceiling Speed + 4 km/h

[END_REQ]

[REQ:IE-CLASSB_00192];[Allocation:Onboard];[Type:Mandatory]

While the CCO Operating Mode is DTP_E+ATP or ATP, then:

- When a change to a more restrictive Nominal Ceiling Speed occurs and the Current Train Speed is greater than or equal to this more restrictive Nominal Ceiling Speed + 5km/h, the CCO shall set
  - First Intervention Ceiling Speed = Nominal Ceiling Speed after change + 3km/h
  - Second Intervention Ceiling Speed = Nominal Ceiling Speed **BEFORE** change + 5km/h
- When the Current Train Speed first becomes lower than Nominal Ceiling Speed after change + 5km/h, the CCO shall set
  - First Intervention Speed = Nominal Ceiling Speed after change + 3km/h
  - Second Intervention Ceiling Speed = Nominal Ceiling Speed **AFTER** change + 5km/h

While the CCO Operating Mode is DTP_E+ATP or ATP and the Running_Release function is active, the 3km/h threshold mentioned in this requirement shall be replaced by a threshold of 2km/h, and the 5km/h threshold shall be replaced by a threshold of 4km/h.

[END_REQ]

Note: This requirement only applies to Ceiling Speeds in ATP or DTP_E+ ATP operating mode because these CCO Operating Modes do not monitor the compliance with braking curves during the approach to the more restrictive target speed. Without this feature, the emergency brake would be demanded instead of service brake at most changes to a lower Nominal Ceiling Speed, which is not a desirable outcome.

[REQ:IE-CLASSB_00193];[Allocation:Onboard];[Type:Mandatory]

While Ceiling Speed Monitoring is active, the CCO shall continuously set:

- Permitted Speed equal to Nominal Ceiling Speed
- First Intervention Speed equal to First Intervention Ceiling Speed
- Second Intervention Speed equal to Second Intervention Ceiling Speed

[END_REQ]

7.4.11.2. Target Speed Monitoring (TSM)

To be defined in a future version of this document

7.4.11.3. Release Speed Monitoring (RSM)

To be defined in a future version of this document

7.4.11.4. Brake Intervention Management

Note: The following requirements describe the actions to be taken by the CCO when comparing the Current Train speed with the Permitted Speed, the First Intervention Ceiling, and the Intervention Speed.

[REQ:IE-CLASSB_00194];[Allocation:Onboard];[Type:Mandatory]

CCO shall continuously compare the Current Train Speed with the Permitted Speed, the First Intervention Ceiling, and the Intervention Speed and act as follows:

- While Current Train Speed <= Permitted Speed, any previous demands for service brake (if configured) and traction cut-off (if configured) and emergency brake by the Train_Speed_Monitoring function shall be revoked.
- While Permitted Speed< Current Train Speed < First Intervention Speed, the service brake (if configured) and traction cut-off (if configured) and emergency brake, if previously demanded by the Train_Speed_Monitoring function, shall remain demanded
- While First Intervention Speed <= Current Train Speed < Second Intervention Speed, the service brake (if configured) and traction cut-off (if configured) or emergency brake (if service brake is not configured) shall be demanded via the Braking_Management function
- While Current Train Speed >= Second Intervention Speed, the emergency brake shall be demanded

[END_REQ]

[REQ:IE-CLASSB_00195];[Allocation:Onboard];[Type:Mandatory]

The CCO shall activate the Service_Brake_Monitoring function while a service brake application is demanded by the CCO.

[END_REQ]

[REQ:IE-CLASSB_00196];[Allocation:Onboard];[Type:Mandatory]

When demanded by Train_Speed_Monitoring function, the Emergency Brake demand or, the Service Brake demand (if configured) and traction cut-off demand (if configured), shall be revoked only if:

- The Current Train Speed comes below the Permitted Speed, and
- The traction controller (or combined traction/brake controller) status corresponds to an absence of traction demand.

[END_REQ]

[REQ:IE-CLASSB_00197];[Allocation:Onboard];[Type:Mandatory]

After release of the Emergency Brake or Service Brake, the CCO shall allow the Train to continue in operation in the same CCO Operating Mode.

[END_REQ]

[REQ:IE-CLASSB_00198];[Allocation:Onboard];[Type:Mandatory]

In CCO Operating Modes where a speed indication is displayed by the DMI, the CCO shall, in accordance with the speed indication displays defined in [IRS-DMI], allow the driver to distinguish the following situations:

- Current Train Speed < Permitted Speed
- Permitted Speed <= Current Train Speed < First Intervention Speed
- Current Train Speed > = First Intervention Speed

[END_REQ]

[REQ:IE-CLASSB_00199];[Allocation:Onboard];[Type:Mandatory]

The CCO shall activate a 'Warning Sound' while Current Train Speed > Permitted Speed), and silence it while Current Train Speed<= Permitted Speed), in accordance with [IRS-DMI]

[END_REQ]

[REQ:IE-CLASSB_00200];[Allocation:Onboard];[Type:Mandatory]

The CCO shall activate a 'Service Brake Sound' while the service brake is demanded by CCO, in accordance with [IRS-DMI].

[END_REQ]

[REQ:IE-CLASSB_00201];[Allocation:Onboard];[Type:Mandatory]

The CCO shall activate an 'Emergency Brake Sound' while the Emergency Brake is demanded by CCO, in accordance with [IRS-DMI].

[END_REQ]

7.4.12. Running_Release

Note: The purpose of this function is to allow a driver to move the Train close to a signal which is displaying a stop aspect, within an area fitted with CCT 83.3Hz or CCT 50Hz, and in the case that unmodulated carrier or absence of carrier is received from the CCT.

In ATP or DTP_E+ATP modes, the activation of this function will automatically result in the monitoring of a 15km/h ATP Speed limit through the ATP_Speed_Determination function.

[REQ:IE-CLASSB_00202];[Allocation:Onboard];[Type:Mandatory]

While in ATP, DTP_E+ATP, CAWS, or DTP_E+CAWS modes, CCO shall permit the driver to activate the Running_Release function through the 'Running Release' button on the DMI (B_REL).

[END_REQ]

[REQ:IE-CLASSB_00203];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to require the drivers to be trained to activate the Running_Release function only when they consider that the situation is appropriate to do so. This may include the requirement to obtain authority from the signalman. Drivers shall be trained to understand the consequence of activating this function.

[END_REQ]

[REQ:IE-CLASSB_00204];[Allocation:Onboard];[Type:Mandatory]

The activation of the Running_Release function may be requested by the driver by pressing the 'Running Release' button on the DMI (B_REL).

[END_REQ]

[REQ:IE-CLASSB_00205];[Allocation:Onboard];[Type:Mandatory]

When the driver requests the activation of the Running_Release function, the CCO shall display the 'Running Release Acknowledgement' button (B_REL_ACK) on DMI, surrounded by a flashing frame in accordance with [IRS-DMI], and shall start a 7-second timer for driver confirmation of his intent to activate the Running_Release function.

- If the driver decides not to press the 'Running Release Acknowledgement' button before the expiry of the timer, the CCO shall cancel the request for activation of Running_Release function and shall stop displaying the button and flashing frame.
- If the driver presses the 'Running Release Acknowledgement' button before the expiry of the 7-second timer, the CCO shall stop displaying the button and flashing frame.
    - The CCO shall then require a second confirmation of the intent to activate the Running_Release function by the driver, by displaying one of the following text messages on the DMI surrounded by a flashing frame.
        - "Entering Running Release" if the Current CCO Operational Mode is ATP or DTP_E+ATP, and the Train is not at standstill.
        - "Enabling Traction" if the Current CCO Operational Mode is CAWS or DTP_E+CAWS or ATP or DTP_E+ATP, and the Train is at Standstill.
    - If the driver decides not to press the text message before the expiry of the 7-second timer, the CCO shall cancel the request for activation of the Running_Release function and shall stop displaying the text message.
    - If the driver re-confirms his intention by pressing the "Entering Running Release" text message before the expiry of the 7-second timer the CCO shall stop displaying the text message.
- If an absence of code is not received by CCO within 15 seconds after the "Entering Running Release" text message has been pressed, the Running_Release function activation request shall be cancelled.
- If within 15s after the "Entering Running Release" text message has been pressed, an absence of code is received by CCO, the CCO shall activate the Running_Release function, and shall display the 'Release Procedure Activated' icon on the DMI accompanied by the 'Running Release Sound'.

[END_REQ]

[REQ:IE-CLASSB_00206];[Allocation:Onboard];[Type:Mandatory]

A request for activation of the Running_Release function shall be cancelled by CCO if, during the activation process, CCO detects a change from the Current CCO Code to any of the following code names:

- 75 Code, 180 Code, 420 Code (permitted with Green Signal Aspect) or
- 270 Code (permitted with Double Yellow Signal Aspect).

[END_REQ]

Note: If during the activation process, before CCO detects an absence of code, the Current CCO Code changes from yellow to a less restrictive code, the request to activate the function would be cancelled.

[REQ:IE-CLASSB_00207];[Allocation:Onboard];[Type:Mandatory]

The Running_Release function, if active, shall be de-activated automatically by CCO, when either

- a valid code other than No Code is received by the CCO, or
- where the Running_Release function was activated with the Train in motion and the Standstill condition is subsequently met, or
- where the Running_Release function was activated with the Train at Standstill and where within 15-seconds the Standstill condition was lost and where the Standstill condition is subsequently met again, or
- where the Running_Release function was activated with the Train at Standstill, the Standstill condition is not lost within 15-seconds.

[END_REQ]

7.4.13. Stop_Override

To be defined in a future version of the document

7.4.14. Train_Stop

To be defined in a future version of the document

7.4.15. Balise_Group_Management

To be defined in a future version of the document

7.4.16. Continuous_Code_Management

Note: The purpose of the function is to decode the CCT 83.3Hz code names received via the pickup coils.

Requirements for CCT 50 Hz code names will be included in a future version of this standard.

[REQ:IE-CLASSB_00208];[Allocation:Onboard];[Type:Mandatory]
The CCO shall read code only from the pickup coils associated with the active cab.
[END_REQ]

[REQ:IE-CLASSB_00209];[Allocation:Onboard];[Type:Mandatory]
Each pickup coil shall be made of two receivers. On each occasion when the CCO is powered on, it shall alternate between the two receivers, designating them as normal and reserve receivers.
[END_REQ]

[REQ:IE-CLASSB_00210];[Allocation:Onboard];[Type:Mandatory]
For the 83.3 Hz carrier the CCO shall, at any moment in time, determines as Current CCO Code one of the following code names, in accordance with [IRS-AIRGAP] requirements:

- 50 Code
- 75 Code
- 120 Code
- 180 Code
- 270 Code
- 420 Code
- No Code (absence of valid code, including unmodulated carrier, or absence of valid carrier)

[END_REQ]

Note: For each code name the nominal code rate and associated tolerances can be found in [IRS-AIRGAP]

[REQ:IE-CLASSB_00211];[Allocation:Onboard];[Type:Mandatory]

For the numbered code names (50, 75, 120, 180, 270, and 420 Codes) CCO shall only consider valid a CCT code which complies with the requirements specified in [IRS-AIRGAP].

[END_REQ]

[REQ:IE-CLASSB_00212];[Allocation:Onboard];[Type:Mandatory]

Unmodulated carrier, absence of carrier, and invalid code shall be interpreted as 'No Code'. Invalid code means where carrier or code are not complying with the tolerances defined in [IRS-AIRGAP].

[END_REQ]

[REQ:IE-CLASSB_00213];[Allocation:Onboard];[Type:Mandatory]

When the CCO detects a CCT signal in the airgap interface which is different from the Current CCO Code Name, a code transition shall start.

The code transition shall be completed when, from the start of the transition, the new CCT code is decoded as a valid code, according to [IRS-AIRGAP], for at least Min Detection Duration, and not longer than Max Detection Duration.

Code Name	Min Detection Duration [s]	Max Detection Duration [s]
No Code	4.0	4.5
50 Code	4.0	5.0
75 Code	2.5	3.5
120 Code	2.5	3.5
180 Code	2.0	3.0
270 Code	2.0	3.0
420 Code	2.0	3.0

Table 8 – Code detection durations

[END_REQ]

Note: The difference between the Min Detection Duration and Max Detection Duration allows the signals to initially stabilize before the CCO detects a valid code, as illustrated in Figure 4.

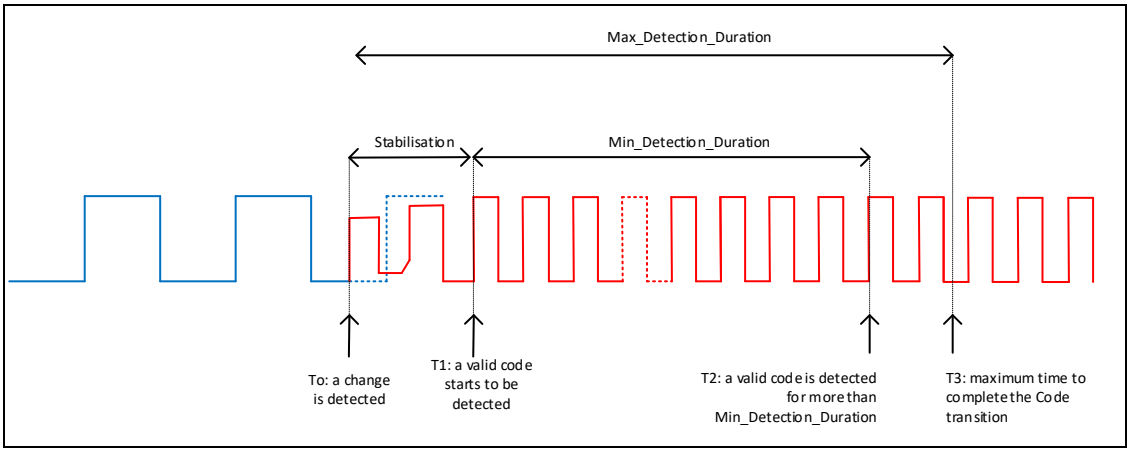


Figure 4 – Illustration of code change

[REQ:IE-CLASSB_00214];[Allocation:Onboard];[Type:Mandatory]

In the event of a code transition, the CCO:

- Shall not change the Current CCO Code until the code transition is completed.
- Shall, on completion of the code transition consider the new CCT code name as the Current CCO Code.
- Shall abort the code transition if not completed within 7 seconds after the first change of signal in the airgap, if the signal changes more than once, and shall assume the 'No Code' as the new Current CCO Code.

[END_REQ]

Note: With regards to the third bullet point, this 7s period may elapse if the detected CCT code changes again before the code transition has been completed, or aborted.

7.4.17. Odometry

[REQ:IE-CLASSB_00215];[Allocation:Onboard];[Type:Mandatory]

The CCO shall determine the

- instantaneous Current Train Speed,
- distance travelled from a reference point,
- instantaneous acceleration or deceleration and
- current direction of travel

with a SIL level in accordance with *Table 7 - Functions Safety Integrity* Levels, even in the presence of slipping or sliding events of the axles which carry the tachogenerators.

[END_REQ]

[REQ:IE-CLASSB_00216];[Allocation:Onboard];[Type:Mandatory]

The odometry function shall have at least the following accuracy of instantaneous Current Train Speed determination:

- For speeds less than or equal to 50 km/h, the error shall be less than 1 km/h
- For speeds greater than 50 km/h, the error shall be less than 2%.

[END_REQ]

[REQ:IE-CLASSB_00217];[Allocation:Onboard];[Type:Mandatory]

The odometry function shall provide an accuracy of determination of distance travelled from a reference point to be equal to or better than the requirements in Table below.

Distance (D)	Accuracy
D > 1000 m	6%
500 m < D <= 1000 m.	60 m.
200 m. < D <= 500m.	40 m.
D<= 200 m.	20 m.

D= Distance travelled from a reference point (e.g. a balise group position or a point at which CCO did reset the distance determination as a result of a CCO Operating Mode change)

Table 9 - Odometry distance determination accuracy

[END_REQ]

[REQ:IE-CLASSB_00218];[Allocation:Onboard];[Type:Mandatory]

The odometry function shall have an accuracy of at least 2% for instantaneous acceleration and deceleration determination.

[END_REQ]

[REQ:IE-CLASSB_00219];[Allocation:Onboard];[Type:Mandatory]

The CCO shall consider the Train to be in the Standstill condition if its Current Train Speed (v) is in the range 0 km/h <= v <2 km/h.

[END_REQ]

[REQ:IE-CLASSB_00220];[Allocation:Onboard];[Type:Mandatory]
CCO shall reset the distance measurement in any of the following situations:

- At switch-on of CCO
- On entering or exiting FORWARD_SHUNTING or REVERSE_SHUNTING modes

Note: List to be completed in a future version of this document

[END_REQ]

7.4.18. Braking_Management

[REQ:IE-CLASSB_00221];[Allocation:Onboard];[Type:Mandatory]
If the Service Brake is configured and while it is demanded by CCO, the CCO shall apply the following actions:

- Demand Traction Cut Off.
- Demand Service Brake.
- Command 'Service Brake Sound' as defined in [IRS-DMI].
- Display 'Service Brake Intervention' icon (I_SB) as defined in [IRS-DMI].
- Trigger the Service_Brake_Application_Monitoring function.

[END_REQ]

[REQ:IE-CLASSB_00222];[Allocation:Onboard];[Type:Mandatory]
If a requirement of this document results in a demand of Service Brake by CCO, and the Service Brake is not configured, the CCO shall instead demand the Emergency Brake.
[END_REQ]

[REQ:IE-CLASSB_00223];[Allocation:Onboard];[Type:Mandatory]
While the Emergency Brake application is demanded by CCO, the CCO shall apply the following actions:

- Demand Traction Cut Off (if configured).
- Demand Service Brake (if configured).
- Demand Emergency Brake.
- Command 'Emergency Brake Sound' as defined in [IRS-DMI].
- Display 'Emergency Brake Intervention' icon (I_EB) as defined in [IRS-DMI].
- Disable all DMI buttons except the following:
    - B_BRIGHTNESS, B_TEXT_ERROR_ACK, B_TSP_ACK and
    - B_REL, only while in ATP and DTP_E+ATP mode.

[END_REQ]

[REQ:IE-CLASSB_00224];[Allocation:Onboard];[Type:Mandatory]

If the Service Brake is configured and CCO demands its release, the CCO shall apply the following actions, only if the status of traction controller (or combined traction/brake controller) corresponds to an absence of traction demand:

- Cancel demand for Traction Cut Off (if configured).
- Cancel demand for Service Brake.
- Cancel the 'Service Brake Sound' as defined in [IRS-DMI].
- Hide 'Service Brake Intervention' icon (I_SB) as defined in [IRS-DMI].

[END_REQ]

[REQ:IE-CLASSB_00225];[Allocation:Onboard];[Type:Mandatory]

If a requirement of this document results in a release of a previous Service Brake demand by CCO, and the Emergency Brake was demanded because the Service Brake is not configured, the CCO shall instead revoke the Emergency Brake demand which was demanded in place of Service Brake demand.

[END_REQ]

[REQ:IE-CLASSB_00226];[Allocation:Onboard];[Type:Mandatory]

If the CCO demands the release of Emergency Brake, CCO shall apply the following actions, only if the status of traction controller (or combined traction/brake controller) corresponds to an absence of traction demand:

- Cancel demand for Traction Cut Off (if configured).
- Cancel demand for Service Brake (if configured).
- Cancel demand for Emergency Brake.
- Cancel 'Emergency Brake Sound' as defined in [IRS-DMI].
- Hide 'Emergency Brake Intervention' icon (I_EB) as defined in [IRS-DMI].
- Enable all DMI buttons.

[END_REQ]

Note: The requirements above ensure that a release of the service brake demand (or emergency brake demand if service brake is not configured) will only be effective if there is a willing action from the driver (placing of traction controller or traction/ brake controller in coast/brake position).

This

- *prevents the Braking_Management function from being perceived as a "cruise control" function by drivers,*
- *ensures that the Train will be brought to a stop if the driver becomes incapacitated while the traction controller (or combined traction/brake controller) is in traction status, and*
- *provides an additional mitigation against the possible exhaustion of the air or vacuum brake where Trains are fitted with revocable emergency brakes.*

[REQ:IE-CLASSB_00227];[Allocation:Onboard];[Type:Mandatory]

The demand for Service Brake (if configured) shall be released by CCO only when all CCO functions, which demanded the service brake application have revoked their demands.

[END_REQ]

[REQ:IE-CLASSB_00228];[Allocation:Onboard];[Type:Mandatory]

The demand for Emergency Brake shall be released by CCO only when all CCO functions, which demanded the emergency brake application have revoked their demands.

[END_REQ]

7.4.19. Entry_Forward_Shunting

[REQ:IE-CLASSB_00229];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to require the driver to only initiate and perform the two step confirmation for changing the CCO Operating Mode to FORWARD_SHUNTING in locations and under conditions which are defined in the IM rules and regulations (including the Route Book).

[END_REQ]

[REQ:IE-CLASSB_00230];[Allocation:Onboard];[Type:Mandatory]

While the Train is at Standstill, the CCO shall allow the driver to activate the Entry_Forward_Shunting function by the following procedure.

- If the driver presses the 'Forward Shunting' button (B_SHU), the CCO shall activate a 7-second timer and display the 'Forward Shunting Acknowledgement' (B_SHU_ACK) button surrounded by a flashing frame in accordance with [IRS-DMI].
- If the driver presses the 'Forward Shunting Acknowledgement' button, before the expiry of the 7-second timer, the CCO shall stop displaying the button and flashing frame.
    - The CCO shall then require a second confirmation of the intent to change to FORWARD_SHUNTING mode by the driver, by displaying an "Entering Forward Shunting Mode" text message on the DMI surrounded by a flashing frame.
    - If the driver decides not to press this text message before the expiry of the 7-second timer, the CCO shall cancel the request for change to FORWARD_SHUNTING mode and shall stop displaying the text message.
    - If the driver re-confirms his intention by pressing the "Entering Forward Shunting Mode" text message before the expiry of the 7-second timer, the CCO shall stop displaying the text message, activate the Entry_Forward_Shunting function and end the procedure.
- If the 7-second timer elapses before the driver has completed the procedure, the CCO shall abort the procedure and hide the 'Forward Shunting Acknowledgement' button or the "Entering Forward Shunting Mode" text message, if displayed.
- If the Standstill condition is lost before this procedure is completed, the CCO shall abort the procedure and hide the 'Forward Shunting Acknowledgement' button or the "Entering Forward Shunting Mode" text message, if displayed.

[END_REQ]

[REQ:IE-CLASSB_00231];[Allocation:Onboard];[Type:Mandatory]

After activation of the Entry_Forward_Shunting function by the driver, the CCO shall change the CCO Operating Mode to FORWARD_SHUNTING and de-activate the Entry_Forward_Shunting function.

[END_REQ]

7.4.20. Exit_Forward_Shunting

[REQ:IE-CLASSB_00232];[Allocation:Onboard];[Type:Mandatory]

When the Train is at Standstill, the CCO shall allow the driver to activate the Exit_Forward_Shunting function by the following procedure.

- If the driver presses the 'Forward Shunting' button (B_SHU), the CCO shall activate a 7-second timer and display the 'Forward Shunting Acknowledgement' button (B_SHU_ACK) surrounded by a flashing frame in accordance with [IRS-DMI].
- If the driver presses the 'Forward Shunting Acknowledgement' button (B_SHU_ACK), before the expiry of the 7-second timer, the CCO shall stop displaying the button and flashing frame.
    - The CCO shall then require a second confirmation of the intent to exit from FORWARD_SHUNTING mode by the driver, by displaying an "Exiting Forward Shunting Mode" text message on the DMI surrounded by a flashing frame.
    - If the driver decides not to press the text message before the expiry of the 7-second timer, the CCO shall cancel the request to exit FORWARD_SHUNTING mode and shall stop displaying the text message.
    - If the driver re-confirms his intention by pressing the "Exiting Forward Shunting Mode" text message before the expiry of the 7-second timer, the CCO shall stop displaying the text message, activate the Exit_Forward_Shunting function and end the procedure.
- If the timer elapses before the driver has completed this procedure, the CCO shall abort the procedure and hide the 'Forward Shunting Acknowledgement' button or the "Exiting Forward Shunting Mode" text message, if displayed.
- If the Standstill condition is lost before the procedure is completed, the CCO shall abort the procedure and hide the 'Forward Shunting Acknowledgement' button or the "Exiting Forward Shunting Mode" text message, if displayed.

[END_REQ]

[REQ:IE-CLASSB_00233];[Allocation:Onboard];[Type:Mandatory]

After activation of the Exit_Forward_Shunting function by the driver, the CCO shall change the CCO Operating Mode to CAB_SELECTED when all conditions specified in Table 3 and Table 4 of section 7.3.21 are met, and de-activate the Exit_Forward_Shunting function.

[END_REQ]

7.4.21. Entry_Reverse_Shunting

[REQ:IE-CLASSB_00234];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to require the driver to only initiate and perform the two step confirmation for changing the CCO Operating Mode to REVERSE_SHUNTING in locations and under conditions which are defined in the IM rules and regulations.

[END_REQ]

[REQ:IE-CLASSB_00235];[Allocation:Onboard];[Type:Mandatory]

While the Train is at Standstill, the CCO shall allow the driver to activate the Entry_Reverse_Shunting function by the following procedure.

- If the driver presses the 'Reverse Shunting' button (B_REV), the CCO shall activate a 7-second timer and display the 'Reverse Shunting' Acknowledgement button (B_REV_ACK) surrounded by a flashing frame in accordance with [IRS-DMI].
- If the driver presses the acknowledgement button, before the expiry of the 7-second timer, the CCO shall stop displaying it and the associated flashing frame.
    - The CCO shall then require a second confirmation of the intent to change to REVERSE_SHUNTING mode by the driver, by displaying an "Entering Reverse Shunting Mode" text message on the DMI surrounded by a flashing frame.
    - If the driver decides not to press the text message before the expiry of the 7-second timer, the CCO shall cancel the request for change to REVERSE_SHUNTING mode and shall stop displaying the text message.
    - If the driver re-confirms his intention by pressing the "Entering Reverse Shunting Mode" text message before the expiry of the 7-second timer and the CCO shall stop displaying the text message, activate the Entry_Reverse_Shunting function and end the procedure.
- If the 7-second timer elapses before the driver has completed the procedure, the CCO shall abort the procedure and hide the 'Reverse Shunting Acknowledgement' button (B_REV_ACK) or the "Entering Reverse Shunting Mode" text message, if displayed.
- If the Standstill condition is lost before the procedure is completed, the CCO shall abort the procedure and hide the 'Reverse Shunting Acknowledgement' button or the "Entering Reverse Shunting" text message, if displayed.

[END_REQ]

[REQ:IE-CLASSB_00236];[Allocation:Onboard];[Type:Mandatory]

After activation of the Entry_Reverse_Shunting function by the driver, the CCO shall change the CCO Operating Mode to REVERSE_SHUNTING, and de-activate the Entry_Reverse_Shunting function.

[END_REQ]

7.4.22. Exit_Reverse_Shunting

[REQ:IE-CLASSB_00237];[Allocation:Onboard];[Type:Mandatory]

When the Train is at Standstill, the CCO shall allow the driver to activate the Exit_Reverse_Shunting mode by the following procedure.

- If the driver presses the 'Reverse Shunting' button (B_REV), the CCO shall activate a 7 second timer and display the 'Reverse Shunting Acknowledgement' button (B_REV_ACK) surrounded by a flashing frame in accordance with [IRS-DMI].
- If the driver presses the 'Reverse Shunting Acknowledgement' button (B_REV_ACK), before the expiry of the 7-second timer, the CCO shall stop displaying the button and flashing frame.
    - The CCO shall then require a second confirmation of the intent to exit from REVERSE_SHUNTING mode by the driver, by displaying an "Exiting Reverse Shunting Mode" text message on the DMI surrounded by a flashing frame.
    - If the driver decides not to press the text message before the expiry of the 7-second timer, the CCO shall cancel the exit from REVERSE_SHUNTING mode and shall stop displaying the text message.
    - If the driver re-confirms his intention by pressing the "Exiting Reverse Shunting Mode" text message before the expiry of the 7-second timer and the CCO shall stop displaying the text message, activate the Exit_Reverse_Shunting function and end the procedure.
- If the timer elapses before the driver has completed the procedure, the CCO shall abort the procedure and hide the 'Reverse Shunting Acknowledgement' button or the "Exiting Reverse Shunting Mode" text message, if displayed.
- If the Standstill condition is lost before the procedure is completed, the CCO shall abort the procedure and hide the 'Reverse Shunting Acknowledgement' button or the "Exiting Reverse Shunting Mode" text message, if displayed.

[END_REQ]

[REQ:IE-CLASSB_00238];[Allocation:Onboard];[Type:Mandatory]

After activation of the Exit_Reverse_Shunting function by the driver, the CCO shall change the CCO Operating Mode to CAB_SELECTED when all conditions specified in Table 3 and Table 4 of section 7.3.21 are met, and de-activate the Exit_Reverse_Shunting function.

[END_REQ]

7.4.23. DTP_Exclusion

Note: The purpose of the function is to allow the driver to disable the DTP functionality of the CCO under the authority of the signalman. This allows the Train to continue operation in cases where BGs are faulty or in an area where BGs are being installed but are not yet in operation. Exclusion of the DTP functionality will result in a change of CCO Operating Mode which, in many cases, will result in a lower level of protection being available from the CCO and should therefore only be used where no other alternatives are practicable.

[REQ:IE-CLASSB_00239];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to require the driver to only activate the DTP_Exclusion function if authorisation has been given to the driver, through a controlled information channel by the IM, to exclude DTP in a specific track area (e.g. in an area where balises are known to be defective, or are being installed but are not yet commissioned).

[END_REQ]

[REQ:IE-CLASSB_00240];[Allocation:Onboard];[Type:Mandatory]

When the Train is at Standstill, the CCO shall allow the driver to activate the DTP_Exclusion function by the following procedure.

- If the driver presses the 'DTP Exclusion' button (B_DTP_E), the CCO shall activate a 7-second timer and display the 'DTP Exclusion Acknowledgement' button (B_DTP_E_ACK) surrounded by a flashing frame in accordance with [IRS-DMI].
- If the driver presses the 'DTP Exclusion Acknowledgement' button (B_DTP_E_ACK), before the expiry of the 7-second timer, the CCO shall stop displaying the button and flashing frame.
    - The CCO shall then require a second confirmation of the intent to exclude the DTP functionality by the driver, by displaying a "Disabling DTP" text message on the DMI surrounded by a flashing frame.
    - If the driver decides not to press the text message before the expiry of the 7-second timer, the CCO shall cancel the request to exclude the DTP functionality and shall stop displaying the text message.
    - If the driver re-confirms his intention by pressing the "Disabling DTP" text message before the expiry of the 7-second timer, the CCO shall stop displaying the text message, activate the DTP_Exclusion function, display the 'Trackside Error' Icon (I_TRK_ERROR), and end the procedure.
- If the timer elapses before the driver has completed the procedure, the CCO shall abort the procedure and hide the 'DTP Exclusion Acknowledgement' button, or the "Disabling DTP" text message, if displayed.
- If the Standstill condition is lost before the DTP Exclusion procedure is completed, the CCO shall abort the procedure and hide the 'DTP Exclusion Acknowledgement' button or the "Disabling DTP" text message, if displayed.

[END_REQ]

[REQ:IE-CLASSB_00241];[Allocation:Onboard];[Type:Mandatory]

After activation of the DTP_Exclusion function, The CCO shall change the CCO Operating Mode to DTP_E or DTP_E+ATP or DTP_E+CODE_E, when all conditions specified in Table 3 and Table 4 of section 7.3.21 are met.

[END_REQ]

[REQ:IE-CLASSB_00242];[Allocation:Onboard];[Type:Mandatory]

While the DTP_Exclusion function is active, the discontinuous signal reception shall be inactive and CCO shall

not accept information from any CCT balise groups.

[END_REQ]

[REQ:IE-CLASSB_00243];[Allocation:Onboard];[Type:Mandatory]
The DTP_Exclusion function shall be de-activated if the CCO Operating Mode is AUTOTEST, NO_CAB_SELECTED, FORWARD_SHUNTING, REVERSE_SHUNTING, or BYPASS.
[END_REQ]

[REQ:IE-CLASSB_00244];[Allocation:Onboard];[Type:Mandatory]
The DTP_Exclusion function shall be deactivated if the DTP_Inclusion function is activated by the driver.
[END_REQ]

7.4.24. DTP_Inclusion

Note: The purpose of the function is to allow the driver to re-enable the DTP functionality of the CCO. When the DTP_Inclusion function is activated, the CCO shall cancel the effect of the DTP_Exclusion function and shall again accept all information from CCT balise groups.

[REQ:IE-CLASSB_00245];[Allocation:Onboard];[Type:Mandatory]
The CCO shall only allow the activation of the DTP_Inclusion function if no fault related to the discontinuous signal reception has been detected.

[END_REQ]

[REQ:IE-CLASSB_00246];[Allocation:Onboard];[Type:Mandatory]
When the Train is at Standstill, the CCO shall allow the driver to activate the DTP_Inclusion function by the following procedure.

- If the driver presses the 'DTP Exclusion' button (B_DTP_E), the CCO shall activate a 7-second timer and display the 'DTP Exclusion Acknowledgement' button (B_DTP_E_ACK) surrounded by a flashing frame in accordance with [IRS-DMI].
- If the driver presses the 'DTP Exclusion Acknowledgement' button (B_DTP_E_ACK), before the expiry of the 7-second timer, the CCO shall stop displaying the button and flashing frame.
    - The CCO shall then require a second confirmation of the intent to include the DTP functionality by the driver, by displaying an "Enabling DTP" text message on the DMI surrounded by a flashing frame.
    - If the driver decides not to press the text message before the expiry of the 7-second timer, the CCO shall cancel the request to include the DTP functionality and shall stop displaying the text message.
    - If the driver re-confirms his intention by pressing the "Enabling DTP" text message before the expiry of the 7-second timer, the CCO shall stop displaying the text message, activate the DTP_Inclusion function, hide the message and 'Trackside Error' (I_TRK_ERROR) icon, and end the procedure.
- If the timer elapses before the driver has completed the procedure, the CCO shall abort the procedure and hide the 'DTP Exclusion Acknowledgement' button (B_DTP_E_ACK) or the "Enabling DTP" text message, if displayed and leave the 'Trackside Error' icon displayed.
- If the Standstill condition is lost before the procedure is completed, the CCO shall abort the procedure and hide the 'DTP Exclusion Acknowledgement' button or the "Enabling DTP" text message, if displayed.

[END_REQ]

Note: As mentioned in the previous section the activation of the DTP_Inclusion function leads to the de-activation of the DTP_Exclusion function

[REQ:IE-CLASSB_00247];[Allocation:Onboard];[Type:Mandatory]

After activation of the DTP_Inclusion function, the CCO shall change to an appropriate CCO Operating Mode when all conditions specified in Table 3 and Table 4 of section 7.3.21 are met.

[END_REQ]

[REQ:IE-CLASSB_00248];[Allocation:Onboard];[Type:Mandatory]

The CCO shall offer the driver to confirm the CCO Operating Mode change in accordance with the Mode_Transition_Acknowledgement function.

[END_REQ]

7.4.25. Brake_Connectivity_Test

Note: The purpose of the Brake_Connectivity_Test function is to test the interface between CCO and Emergency Brake and Service Brake (where configured), and guide the driver through the process.

[REQ:IE-CLASSB_00249];[Allocation:Onboard];[Type:Mandatory]

The CCO shall permit the driver to activate the Brake_Connectivity_Test function via the DMI button (B_TEST) in accordance with Table 6.

[END_REQ]

[REQ:IE-CLASSB_00250];[Allocation:Application Condition];[Type:Mandatory]

The CCO shall only allow the driver to activate the Brake_Connectivity_Test function via the DMI button (B_TEST) when the Train is at Standstill.

[END_REQ]

[REQ:IE-CLASSB_00251];[Allocation:onboard];[Type:Mandatory]

If the Standstill condition is lost while the Brake_Connectivity_Test function is active, the CCO shall raise a vital error (ERR_NO_MOTION), according to the Error_Management function.

[END_REQ]

[REQ:IE-CLASSB_00252];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to require the driver to ensure that the Train remains at Standstill while the connectivity between CCO and Service and Emergency Brakes is tested.

[END_REQ]

[REQ:IE-CLASSB_00253];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to require the IMs in Ireland and RUs operating in Ireland to define the conditions under which the brake connectivity tests can be triggered by the driver, taking into consideration the risk of the Train rolling-away while the tests are performed.

[END_REQ]

[REQ:IE-CLASSB_00254];[Allocation:Onboard];[Type:Mandatory]

After the driver has activated the Brake_Connectivity_Test function the CCO shall display the ‘CCO Brake Interface Test’ page on the DMI in accordance with [IRS-DMI].

Where the Service Brake is configured, CCO shall propose the Service Brake connectivity test by displaying SB Test Request button (B_SB_TEST) and the “Execute Service Brake Connectivity Test” text message.

After the Service Brake connectivity test has been completed, or where the Service Brake is not configured, CCO shall propose the Emergency Brake connectivity test by displaying EB Test Request button (B_EB_TEST) and the “Execute Emergency Brake Connectivity Test” text message.

[END_REQ]

[REQ:IE-CLASSB_00255];[Allocation:Onboard];[Type:Mandatory]

Where the Service Brake is configured: While the driver presses and maintains pressed the related SB Connectivity Test Request button (B_SB_TEST) on the DMI, CCO shall

- demand Service Brake,
- display the ‘Service Brake’ icon (I_SB),
- generate the ‘Service Brake Sound’.

When the driver releases that button, CCO shall

- revoke the Service Brake demand,
- hide the ‘Service Brake’ icon (I_SB),
- stop the ‘Service Brake Sound’.

[END_REQ]

[REQ:IE-CLASSB_00256];[Allocation:Onboard];[Type:Mandatory]

While the driver presses and maintains pressed the related EB Connectivity Test Request button (B_EB_TEST) on the DMI, CCO shall

- demand Emergency Brake,
- display the ‘Emergency Brake’ icon (I_EB),
- generate the ‘Emergency Brake Sound’.

When the driver releases that button, CCO shall

- revoke the Emergency Brake demand,
- hide the ‘Emergency Brake’ icon (I_EB),
- stop the ‘Emergency Brake Sound’.

[END_REQ]

[REQ:IE-CLASSB_00257];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be defined which contains the detailed requirements for the connectivity test procedure. Detailed requirements for the connectivity test procedure and pass/fail criteria of this safety related test shall be developed for each individual integration of CCO into a vehicle.

This shall consider whether Service Brake is configured or not.

This shall also consider how it shall be ensured that, during the performance of this connectivity test no other vehicle functions demand the Emergency Brake (e.g. timing out of a driver vigilance device) and thus create an inconclusive test result.

Where Service Brake is configured the driver shall press and maintain pressed the SB Connectivity Test Request button (B_SB_TEST) for as long as necessary to assure himself that the Service Brake has applied.

The driver shall only consider and subsequently confirm that the connectivity test has passed, if, as a minimum, the following criteria have been met:

- The application of Service Brake by the Train began within one second of the driver pressing the test button.
- The Service Brake remained applied while the test button remained pressed.
- The release of the Service Brake by the Train began within one second of the driver releasing the test button.

For the Emergency Brake the driver shall press and maintain pressed the EB Connectivity Test Request button (B_EB_TEST) for as long as necessary to assure himself that the Emergency Brake has applied.

The driver shall only consider and subsequently confirm that the connectivity test has passed, if, as a minimum, the following criteria have been met:

- The application of Emergency Brake by the Train began within one second of the driver pressing the test button.
- The Emergency Brake remained applied while the test button remained pressed.
- The release of the Emergency Brake by the Train began within one second of the driver releasing the test button.

[END_REQ]

[REQ:IE-CLASSB_00258];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to require the driver to be Trained on the safety critical nature of the connectivity test, on the pass/ fail criteria of the test for the type of vehicle concerned and that he shall only confirm the test as passed in case of a correct performance and result of the test.

[END_REQ]

[REQ:IE-CLASSB_00259];[Allocation:Onboard];[Type:Mandatory]

Where Service Brake is configured: When the driver releases the SB Connectivity Test Request button (B_SB_TEST), CCO shall request the driver to confirm via the DMI whether the connectivity test has passed or failed by displaying the “Service Brake Connectivity Test Passed?” text message, and the ‘Yes Answer’ (B_CONFIRM_DATA) and ‘No Answer’ (B_NOT_CONFIRM_DATA) buttons.

[END_REQ]

[REQ:IE-CLASSB_00260];[Allocation:Onboard];[Type:Mandatory]

Where Service Brake is configured: If the driver presses the ‘No Answer’ button, after the Service Brake test, the CCO shall propose to the driver to repeat the test by displaying the “Repeat Service Brake Test?“ text message and the ‘Yes Answer’ (B_CONFIRM_DATA) and ‘No Answer’ (B_NOT_CONFIRM_DATA) buttons.

If the driver decides not to repeat the test by pressing the ‘No Answer’ button, the CCO shall determine that the CCO connectivity to Service Brake has failed and shall propose to perform the Emergency Brake connectivity test.

If the driver decides to repeat the connectivity test by pressing the ‘Yes Answer’ button, the CCO shall propose to perform the Service Brake connectivity test again.

[END_REQ]

[REQ:IE-CLASSB_00261];[Allocation:Onboard];[Type:Mandatory]

When the driver releases the Emergency Brake Connectivity Test Request button (B_EB_TEST) CCO shall request the driver to confirm via the DMI whether the connectivity test has passed or failed by displaying the “Emergency Brake Connectivity Test Passed?” text message, and the ‘Yes Answer’ (B_CONFIRM_DATA) and ‘No Answer’ (B_NOT_CONFIRM_DATA) buttons.

[END_REQ]

[REQ:IE-CLASSB_00262];[Allocation:Onboard];[Type:Mandatory]

If the driver presses the 'No Answer' button, after the EB Connectivity test, the CCO shall propose to the driver to repeat the test by displaying the "Repeat Emergency Brake Connectivity Test?" text message and the 'Yes Answer' (B_CONFIRM_DATA) and 'No Answer' (B_NOT_CONFIRM_DATA) buttons.

If the driver decides not to repeat the test by pressing the 'No Answer' button, the CCO shall determine that the CCO connectivity to Emergency Brake has failed.

If the driver decides to repeat the connectivity test by pressing the 'Yes Answer' button, the CCO shall propose to perform the Emergence Brake test again.

[END_REQ]

[REQ:IE-CLASSB_00263];[Allocation:Onboard];[Type:Mandatory]

On driver declaration of a failed Service Brake connectivity test, the CCO shall generate the error ERR_SB_DRIVER_TEST in accordance with Error_Mangement function and display the "Service Brake Connectivity Test Abandoned" text message on DMI in accordance with [IRS-DMI].

If the driver declares the Service Brake connectivity test as passed, the CCO shall determine that the CCO to Service Brake connectivity is present.

[END_REQ]

[REQ:IE-CLASSB_00264];[Allocation:Onboard];[Type:Mandatory]

On driver declaration of a failed Emergency Brake connectivity test, the CCO shall generate the error ERR_EB_DRIVER_TEST in accordance with Error_Mangement function and display the "Emergency Brake Test Abandoned" text message on DMI in accordance with [IRS-DMI].

If the driver declares the Emergency Brake connectivity test as passed, the CCO shall determine that the CCO to Emergency Brake connectivity is present.

[END_REQ]

Note: The ERR_SB_DRIVER_TEST is non-vital and the ERR_EB_DRIVER_TEST is fatal.

[REQ:IE-CLASSB_00265];[Allocation:Onboard];[Type:Mandatory]

On conclusion of the connectivity tests, the Brake_Connectivity_Test function shall be de-activated, and CCO shall, in the cases where this is possible, permit operation to proceed in the current CCO Operating Mode.

[END_REQ]

7.4.26. Permanent_Test

[REQ:IE-CLASSB_00266];[Allocation:Onboard];[Type:Mandatory]

In addition to Standstill self-testing performed in AUTOTEST mode, supplementary hardware and software self-tests shall be permanently performed while CCO is switched on, to evaluate the ongoing fulfilment of functional and technical requirements by the CCO system.

[END_REQ]

Note: These self-test functions should typically include amongst other aspects the evaluation of connectivity between:

- *CCO and the Train Emergency Brake system(s)*
- *DMI(s) and CCO main Unit*
- *DTP Balise Antenna(s) and CCO main Unit*
- *Code pickup coils and CCO main Unit*
- *odometric sensors and CCO main Unit*
- *Juridical Recording Unit and CCO main Unit*

[REQ:IE-CLASSB_00267];[Allocation:Onboard];[Type:Mandatory]

The identification of failures which must be detected, categorised and managed as errors by CCO shall result from risk assessment according to [EN50126], [EN50128], [EN50129] and [CSM402].

[END_REQ]

[REQ:IE-CLASSB_00268];[Allocation:Onboard];[Type:Mandatory]

This identification must include at least:

- Failures leading to the errors listed in section 7.4.36.
- Failures related to the reception of discontinuous CCT information.
- Failures related to the reception of continuous CCT information.

[END_REQ]

[REQ:IE-CLASSB_00269];[Allocation:Onboard];[Type:Mandatory]

Any connectivity failures between the CCO and any of the Train Emergency Brake systems, DMI, DTP Balise Antenna(s), code pickup coils, or odometric sensors shall be detected with a maximum delay of 1 second after their occurrence.

[END_REQ]

[REQ:IE-CLASSB_00270];[Allocation:Onboard];[Type:Mandatory]

Any connectivity failures between the CCO and the Juridical Recording Unit shall be detected with a maximum delay of 10 seconds after their occurrence.

[END_REQ]

[REQ:IE-CLASSB_00271];[Allocation:Onboard];[Type:Mandatory]

Failures detected by hardware and software self-tests shall be risk assessed according to [EN50126], [EN50128], [EN50129] and [CSM402] to determine if their detection requires the application of the emergency brake. Where this is necessary, this application shall be demanded by the CCO in accordance with the Braking_Management function, no more than 0.5 s after the failure detection, and the associated error message shall be displayed on the DMI no more than 0.5 s after this demand.

[END_REQ]

[REQ:IE-CLASSB_00272];[Allocation:Onboard];[Type:Mandatory]

On non-successful completion of any self-test the CCO shall manage any resulting errors in accordance with the Error_Management function.

[END_REQ]

7.4.27. Roll_Away_Protection

Note: The purpose of the Roll_Away_Protection function is to stop any inadvertent Train movement (i.e. which has not been authorised or demanded by the driver).

[REQ:IE-CLASSB_00273];[Allocation:Onboard];[Type:Mandatory]

The Roll_Away_Protection function shall be active in CCO Operating Modes as defined in Table 6 of section 7.4.1.

[END_REQ]

[REQ:IE-CLASSB_00274];[Allocation:Onboard];[Type:Mandatory]

The CCO shall raise a vital error (ERR_ROLL_AWAY) in accordance with the Error_Management function if either:

- The Train is detected by CCO to be in Standstill condition and it moves at a low speed in any direction for a distance greater than 20 m without losing the Standstill condition.

  Or

- The direction control lever in the active cab is set neither to forward nor to reverse and the Train moves in any direction, having lost the standstill condition, for a distance greater than 5m.

[END_REQ]

Note: This vital error will demand the Emergency Brake.

In most Trains the Emergency Brake air brakes may because of inherent system leakage not hold a Train for an unlimited time, and therefore cannot replace, or act as a backup for, the application of the permanent parking brake or other permanently acting protection against roll-away, for times when the driver is not in the cab.

[REQ:IE-CLASSB_00275];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to require the driver to ensure the application of the permanent parking brake or other permanently acting protection against roll-away, for times when the cab is unattended. When the cab is attended by authorised staff, the supervision of Train movements shall be under their responsibility and they shall have the means to stop any inadvertent Train movements.

[END_REQ]

7.4.28. Direction_Controller_Supervision

Note: The purpose of the Direction_Controller_Supervision function is to demand Emergency Brake on detection of any Train movement whose direction is inconsistent with the position of the Direction Control Lever in the active cab. This section will be reviewed in a future version of this document, in relation to fitment of CCO to freight Trains.

[REQ:IE-CLASSB_00276];[Allocation:Onboard];[Type:Mandatory]

In a CCO Operating Mode in which the function is active according to Table 6 of section 7.4.1, the CCO shall

- raise a vital error (ERR_ROLL_BACK) in accordance with the Error_Management function if the direction control lever in the active cab is set to forward and the Train moves from Standstill in the reverse direction for a distance greater than 5m, or
- raise a vital error (ERR_ROLL_FORWARD) in accordance with the Error_Management function if the direction control lever is set to reverse and the Train moves from Standstill in the forward direction for a distance greater than 5m, or
- if the Train is moving and the position of the direction control lever becomes inconsistent with the direction of travel obtained from the odometry, raise an error (ERR_DIRECTION_CONSISTENCY) in accordance with the Error_Management function. This error shall be non-vital while the Train is still moving, and shall become fatal when the Train comes to Standstill.

[END_REQ]

Note: This error, where vital or fatal, will demand the Emergency Brake. In most Trains the Emergency Brake air brakes may because of inherent system leakage not hold a Train for an unlimited time, and therefore cannot replace, or act as a backup for, the application of the permanent parking brake or other permanently acting protection against roll-away, for times when the driver is not in the cab.

The SRAC defined in the section Roll_Away_Protection function also covers this scenario.

7.4.29. Reverse_Movement_Protection

Note: The purpose of the Reverse_Movement_Protection function is to demand the emergency brake when the direction of the Train movement selected by the driver is inconsistent with the direction allowed by the CCO Operating Mode when that direction is forward. This can occur in cases of incorrect driver action. This section will be reviewed in a future version of this document, in relation to fitment of CCO to freight Trains

[REQ:IE-CLASSB_00277];[Allocation:Onboard];[Type:Mandatory]

In a CCO Operating Mode in which the Reverse_Movement_Protection function is active according to Table 6 of section 7.4.1, i.e. the CCO Operating Modes in which the permitted direction of travel is forward, the CCO shall raise a vital error (ERR_DIRECTION_MODE) in accordance with the Error_Management function, if the following conditions are true:

- the direction controller in the active cab is set to Reverse and
- the Train moves in the reverse direction for a distance greater than 5 m.

[END_REQ]

7.4.30. Forward_Movement_Protection

Note: The purpose of the Forward_Movement_Protection function is to demand the emergency brake when the direction of the Train movement selected by the driver is inconsistent with the direction allowed by the CCO Operating Mode when that direction is reverse. This can occur in case of incorrect driver action. This section will be reviewed in a future version of this document in relation to fitment of CCO to freight Trains

[REQ:IE-CLASSB_00278];[Allocation:Onboard];[Type:Mandatory]

In REVERSE_SHUNTING mode CCO shall raise a vital error (ERR_DIRECTION_MODE) in accordance with the Error_Management function, if the following conditions are true if the following conditions are true;

- the direction controller in the active cab is set to Forward and
- the Train moves in the forward direction for a distance greater than 5 m.

[END_REQ]

7.4.31. Data_Entry

Note: The Data_Entry function is used by CCO to assign the appropriate values to the Train Data parameters defined in section 7.2, via driver input on the DMI.

7.4.31.1. General requirements for Data Entry

[REQ:IE-CLASSB_00279];[Allocation:Onboard];[Type:Mandatory]

The driver may activate the Train Data_Entry function by pressing the related DMI button (B_DATA) in those CCO Operating Modes in which this function is available according to Table 6 of section 7.4.1. The CCO shall only accept this request while the Standstill condition is valid.

[END_REQ]

[REQ:IE-CLASSB_00280];[Allocation:Onboard];[Type:Mandatory]

If at any time while the Data_Entry function is active the Standstill condition is lost, CCO shall raise a vital error in accordance with the Error_Management function, erase any previously stored Train Data values, and re-start the data entry procedure.

[END_REQ]

[REQ:IE-CLASSB_00281];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to ensure that the driver shall only enter Train Data values while at Standstill.

[END_REQ]

[REQ:IE-CLASSB_00282];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to ensure that during operation the driver shall always and at real time be aware about the Train Data values of the Actual Train Consist.

[END_REQ]

[REQ:IE-CLASSB_00283];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to ensure the driver enters correct Train Data values in CCO at start of a mission and re-enters Train Data values immediately after any need arises for the modification of such values which may occur during operation. This shall include handover of this information to and from ECM or RU depot staff, and during changeover between drivers.

[END_REQ]

[REQ:IE-CLASSB_00284];[Allocation:Onboard];[Type:Mandatory]

Values for the determination of Train Data parameters by CCO may be directly typed as inputs via the DMI touchscreen keypad or may be selected by the driver from a list of predefined values. For reference, see [IRS-DMI].

[END_REQ]

[REQ:IE-CLASSB_00285];[Allocation:Onboard];[Type:Mandatory]

If the values are typed by the driver via the DMI touchscreen keypad, the CCO shall validate the entered data, ensuring that they are within a permitted range.

[END_REQ]

[REQ:IE-CLASSB_00286];[Allocation:Onboard];[Type:Mandatory]

If values are selected from a range presented to the driver, this permitted range shall have been validated in accordance with the requirements of [EN501265], [EN50128], [EN50129] and [CSM_402], at the time of their pre-parametrisation in CCO.

[END_REQ]

[REQ:IE-CLASSB_00287];[Allocation:Onboard];[Type:Mandatory]

Where values are typed by the driver via the DMI touchscreen keypad, the permitted data ranges for each affected parameter and for each CCO specific application shall be defined based on a risk assessment compliant with the requirements of [EN501265], [EN50128], [EN50129] and [CSM_402].

Unless this risk assessment identifies a need for tighter validation limits in specific applications, the following generic range limits shall be used for the three parameters listed below:

- Max Train Speed: The lower validation limit value shall be 15km/h and the upper 200km/h.
- Train Emergency Brake Deceleration: The lower validation limit value shall be 0.27m/s² and the upper limit shall be 1.1m/s²
- Train Length: The Lower validation limit value shall be 10m and the upper 900m.

[END_REQ]

[REQ:IE-CLASSB_00288];[Allocation:Onboard];[Type:Mandatory]

If the CCO validation of a Train Data value fails, the CCO shall not accept the value, inform the driver on DMI about this non-acceptance, and offer the driver to enter the value again.

[END_REQ]

[REQ:IE-CLASSB_00289];[Allocation:Onboard];[Type:Mandatory]

In order to ensure that an entered value is correct, the CCO system shall after the validation first internally store the value and then read the stored value and re-display it to the driver for confirmation.

[END_REQ]

[REQ:IE-CLASSB_00290];[Allocation:Onboard];[Type:Mandatory]

When the Data_Entry_Function is activated by the driver CCO shall display the ‘Global Data Entry’ page in accordance with [IRS-DMI].

[END_REQ]

[REQ:IE-CLASSB_00291];[Allocation:Onboard];[Type:Mandatory]

For each value which is required to be entered by the driver, CCO shall display an associated button on the 'Global Data Entry' page. Upon activation of such a button CCO shall open the associated single data entry page in accordance with [IRS-DMI].

[END_REQ]

[REQ:IE-CLASSB_00292];[Allocation:Onboard];[Type:Mandatory]

When all required values have been entered by the driver, the CCO shall request the driver to confirm the values, via the the (B_GLOBAL_DATA_OK) button which shall display the message "Confirm Train Data?".

[END_REQ]

[REQ:IE-CLASSB_00293];[Allocation:Onboard];[Type:Mandatory]

The driver shall then be offered the option of replying using 'Yes Answer' (B_CONFIRM_DATA) or 'No Answer' (B_NOT_CONFIRM_DATA) buttons.

[END_REQ]

[REQ:IE-CLASSB_00294];[Allocation:Onboard];[Type:Mandatory]

If the driver presses the 'No Answer' button, the CCO shall erase the stored values and allow the driver to re-enter the values.

[END_REQ]

[REQ:IE-CLASSB_00295];[Allocation:Onboard];[Type:Mandatory]

If the driver selects 'Yes Answer' button, the CCO shall use the stored values for operation and deactivate the Data_Entry function.

[END_REQ]

[REQ:IE-CLASSB_00296];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to request the driver to be, based on training, fully aware about the risks associated with entering incorrect Train Data values into the DMI or confirming incorrect Train Data values where such incorrect Train Data values are re-displayed by DMI.

[END_REQ]

Note: The re-confirmation process for the stored data is important because the use of SIL 0 equipment during Data Entry may otherwise potentially result in incorrect values being used by CCO.

[REQ:IE-CLASSB_00297];[Allocation:Onboard];[Type:Mandatory]

The driver shall be able to deactivate the Data_Entry function at any point by disabling and re-enabling the cab.

[END_REQ]

[REQ:IE-CLASSB_00298];[Allocation:Application Condition];[Type:Mandatory]

SRAC: Operating Rules for IMs and RUs shall be established to address the situations where drivers cannot enter and/or confirm Train Data values that are a correct reflection of the Actual Train Consist.

[END_REQ]

Note: This could occur, for example in the event of a Train operated with Simplified Data Entry rescuing a Train of other types of vehicles. This could also occur in the event of a Train being restricted, for technical reasons, to a lower vehicle speed than that given in the Train Data.

[REQ:IE-CLASSB_00299];[Allocation:Application Condition];[Type:Mandatory]
The display of Train Data entry screens shall be in accordance with [IRS-DMI].
[END_REQ]

7.4.31.2. Specific requirements for Simplified Data Entry

Note: In Simplified Data Entry, pre-parametrisation of CCO reduces the requirement for entry of values by the driver to a subset of Train Data parameters, as specified in this sub-section.

This reduces flexibility in forming a Train, as operation is only permitted where the performance of the Actual Train Consist is equal to or more conservative than the performance reflected by the pre-parametrised values.

The Simplified Data Entry thus introduces constraints on the operation and formation of Trains. These constraints are not present when the Full Data Entry is configured. The operation is limited in the case of Simplified Data Entry to Predefined Train Formations.

[REQ:IE-CLASSB_00300];[Allocation:Onboard];[Type:Mandatory]
If the CCO is configured for Simplified Data Entry, the CCO shall use the pre-parametrised values, as defined in section 7.2, for the following Train Data parameters:

- 'Train Type'.
- 'Max Unit Speed'.
- 'Max Train Speed'.
- 'Train Emergency Brake Response Time'.
- 'Train Service Brake Response Time'.

[END_REQ]

[REQ:IE-CLASSB_00301];[Allocation:Onboard];[Type:Mandatory]
If the CCO is configured for Simplified Data Entry, the CCO shall display the following buttons on the 'Global Data Entry' page:

- 'Brake Isolated' button (B_EMU_DMU_BRAKES_ISOLATED).
- 'Number of Vehicles' button (B_NUMBER_OF_VEHICLES).

In accordance with [IRS-DMI].
[END_REQ]

[REQ:IE-CLASSB_00302];[Allocation:Onboard];[Type:Mandatory]
In Simplified Data Entry the values for 'Train Service Brake Deceleration' and 'Train Emergency Brake Deceleration' parameters used by the CCO shall depend on the Status of Brake Isolation as entered and confirmed by the driver:

- If the driver selects 'Yes' via the 'Brake Isolated' button the CCO shall use
  - the 'Degraded Train Service Brake Deceleration' value for the 'Train Service Brake Deceleration' parameter, and

- the 'Degraded Train Emergency Brake Deceleration' value for the 'Train Emergency Brake Deceleration' parameter.

- If the driver selects 'No' via the 'Brake Isolated' button, the CCO shall use
  - the 'Nominal Train Service Brake Deceleration' value for the 'Train Service Brake Deceleration' parameter, and
  - the 'Nominal Train Emergency Brake Deceleration' value for the 'Train Emergency Brake Deceleration' parameter.

The principles for determination of these values are specified in section 7.2.6.2 and 7.2.8.2 of this IRS.

[END_REQ]

[REQ:IE-CLASSB_00303];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to determine the rules for training of drivers and for Train operation in relation to isolation of brakes. This shall include the following instructions:

- When no brakes in the Train are isolated beyond the allowance included in the 'Nominal Train Emergency Brake Deceleration' or the 'Nominal Train Service Brake Deceleration' values, the driver shall select "No" for the Status of Brake Isolation.
- When brakes are isolated in the Train, beyond the allowance included in the 'Nominal Train Emergency Brake Deceleration' or the 'Nominal Train Service Brake Deceleration' values and up to the maximum level of brake isolations as determined for 'Degraded Train Service Brake Deceleration' and 'Degraded Train Emergency Brake Deceleration' values of that Train type, the driver shall select "Yes" for the Status of Brake Isolation.
- When brakes are isolated in the Train, exceeding the maximum level of brake isolations as determined for 'Degraded Train Service Brake Deceleration' and 'Degraded Train Emergency Brake Deceleration' values of that Train type, the driver shall activate SHUNTING mode where this is permitted by Operating Rules under the prevailing circumstances.

[END_REQ]

[REQ:IE-CLASSB_00304];[Allocation:Onboard];[Type:Mandatory]

In Simplified Data Entry the value for the 'Train Length' parameter shall be equal to the value for 'Nominal Length of a vehicle in the pre-defined Train consist' as defined in section 7.2.9.2, multiplied with the value for 'Number of Vehicles Composing the Actual Train Consist' as entered and confirmed by the driver via the 'Number of Vehicles' button.

[END_REQ]

[REQ:IE-CLASSB_00305];[Allocation:Onboard];[Type:Mandatory]

The CCO shall only allow 'Number of Vehicles Composing the Actual Train Consist' values between 1 and 30.

[END_REQ]

[REQ:IE-CLASSB_00306];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be defined to ensure that only a Train consist made of pre-defined formations of compatible types/versions/variants of vehicles with

- compatible Emergency Brake deceleration and Emergency Brake response time,
- compatible Service Brake deceleration and Service Brake response time,
- compatible Degraded Emergency Brake deceleration,
- compatible Degraded Service Brake deceleration, and
- compatible length of vehicle,

shall be operated with Train Data parameters set through the "Simplified Data Entry" function.

[END_REQ]

[REQ:IE-CLASSB_00307];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to ensure that where an EMU or DMU vehicle was fitted before 01.01.2020 with a historical Class B CCO application, it shall only be allowed to be operated with other vehicles, where these are compatible.

[END_REQ]

7.4.31.1. Specific requirements for Full Data Entry

Notes: In Full Data Entry, the driver may enter values for the full set of Train Data parameters. This provides full flexibility, as the values can be matched closely with the performance of the Actual Train Consist.

The Full Data Entry requirements for the Data_Entry function will be further defined in a future version of this document.

7.4.32. Start_Against_Signal_Reminder

Note: The purpose of the Start_Against_Signal_Reminder function is to prevent in defined circumstances a driver from starting a Train from Standstill e.g. at a Red signal, without taking note of the signal aspect.

[REQ:IE-CLASSB_00308];[Allocation:Onboard];[Type:Mandatory]

In the CCO Operating Modes where the Start_Against_Signal_Reminder function may be activated in accordance with Table 6 of section 7.4.1, CCO shall activate the function when the Train comes to Standstill condition at a location in 83.3Hz CCT area where No Code is being received, e.g. at a red signal.

[END_REQ]

[REQ:IE-CLASSB_00309];[Allocation:Onboard];[Type:Mandatory]

While the Start_Against_Signal_Reminder function is active the CCO shall constantly demand traction cut-off.

[END_REQ]

[REQ:IE-CLASSB_00310];[Allocation:Onboard];[Type:Mandatory]

If the driver moves the traction controller (or combined traction/brake controller) to a traction demand position while the Start_Against_Signal_Reminder function is active, the CCO shall display the “SAS Reminder -Traction Disabled” text message to the driver via the DMI, accompanied by the ‘Traction Inhibition Reminder Sound’, in accordance with [IRS-DMI].

[END_REQ]

[REQ:IE-CLASSB_00311];[Allocation:Onboard];[Type:Mandatory]

The Start_Against_Signal_Reminder function shall be automatically deactivated when a valid 83.3Hz CCT code other than No Code, is provided by CCT and recognised by CCO.

[END_REQ]

[REQ:IE-CLASSB_00312];[Allocation:Onboard];[Type:Mandatory]

If, while the Start_Against_Signal_Reminder function is active, the CCO detects loss of the Standstill condition, it shall raise and manage the ‘ERR_NO_MOTION‘ vital error, in accordance with the Error_Management function.

[END_REQ]

[REQ:IE-CLASSB_00313];[Allocation:Onboard];[Type:Mandatory]

While the Start_Against_Signal_Reminder function is active and the Train is at Standstill, the driver shall be permitted to de-activate the Start_Against_Signal_Reminder function through the activation of the Running_Release function.

[END_REQ]

7.4.33. CODE_Carrier_Reset

Note: This function is not required as long as this version of the IRS only permits operation of CCO in 83.3Hz CCT area. It will be further defined in a future version of this IRS. This must consider the use of TSR balises. This may lead to a future withdrawal of this function if it no longer fits to the overall system concept.

[REQ:IE-CLASSB_00314];[Allocation:Application Condition];[Type:Mandatory]

SRAC: Until this SRAC is removed in a future version of this document, an Operating Rule shall be defined which instructs drivers not to use this function in the 83.3Hz CCT area.

[END_REQ]

Note: This function is described in this first release of the document because the functionality will be available on the DMI.

7.4.34. Mode_Transition_Acknowledgement

Note: As a principle, the driver shall remain in charge of the Train driving including the management of CCO Operating Modes. In order to maintain this principle when CCO performs an automatic change of CCO Operating Mode, the driver shall be informed about the fact that an automatic change has happened and what the resulting CCO Operating Mode is. The driver shall be provided with a suitable time window to take notice of this, consider if the automatic change is acceptable at this time and situation, and eventually choose to confirm the change through acknowledgment or not. If CCO does not receive an acknowledgement within the time window, for example for any of the following reasons:

- *The driver decides not to confirm the change, or*
- *the driver fails to confirm, or*
- *where there is a technical problem, e.g. the display or feedback button on the DMI has failed,*

CCO shall raise a vital error and bring the Train to a Standstill.

Note: for comprehensive understanding of the system's behaviour, refer also to trackside requirement (section 8) related to transition between CCT areas.

[REQ:IE-CLASSB_00315];[Allocation:Onboard];[Type:Mandatory]

As part of a transition to any of the following CCO Operating Modes, CCO shall within 0.75s after all CCT information for the transition has been received from the CCT and all required conditions for the transition are met, change the CCO Operating Mode automatically and activate the Mode_Transition_Acknowledgement function by proposing to the driver to acknowledge and confirm a performed change of CCO Operating Mode to:

- STAFF_RESPONSIBLE
- ATP

- CODE_E
- DTP_E
- DTP_E+ATP
- DTP_E+CODE_E

[END_REQ]

Note: In a future version of the document, the requirements for CCO Operating Mode transition acknowledgements may be changed.

[REQ:IE-CLASSB_00316];[Allocation:Onboard];[Type:Mandatory]

In the CCO Operating Modes where the Mode_Transition_Acknowledgement function may be activated in accordance with Table 6 of section 7.4.1, CCO shall activate the function as soon as the transition to the CCO Operating Mode has been performed by CCO. This function and associated procedure shall consist of:

- Activation of a 7 seconds timer, sending the 'Acknowledgement Sound' to the driver and displaying the acknowledgement button related to the new CCO Operating Mode surrounded by a flashing frame on the DMI, as per 'Acknowledgement Buttons Reference Table' of the [IRS-DMI].
    - If the driver presses the acknowledgement button, the CCO shall hide it and display the text message related to the relevant CCO Operating Mode surrounded by a flashing frame on the DMI, as per 'Labels for other Acknowledgement Buttons' table of the [IRS-DMI].
    - If the driver confirms the mode transition by pressing the text message, the CCO shall hide it, silence the sound, de-activate the Mode transition Acknowledgement function and end the procedure.
- If the timer elapses before the driver has completed the procedure, the CCO shall de-activate the function, hide the acknowledgement button or the text message, if displayed, silence the sound, and shall raise and manage the 'ERR_OP_MODE_ACKN' vital error in accordance with the Error_Management function and subsequently the Error_Management_Acknowledgement function.

[END_REQ]

[REQ:IE-CLASSB_00317];[Allocation:Onboard];[Type:Mandatory]

After the acknowledgment of the error 'ERR_OP_MODE_ACKN', the driver shall again be offered by the CCO to acknowledge the automatic change of CCO Operating Mode.

[END_REQ]

[REQ:IE-CLASSB_00318];[Allocation:Onboard];[Type:Mandatory]

CCO shall again raise and manage the 'ERR_OP_MODE_ACKN' vital error if within 7 seconds of offering the acknowledgment of change of CCO Operating Mode, no acknowledgment was received.

[END_REQ]

Note: The driver may end the loop of proposal and non-agreement by disabling the cab, which would result in NO_CAB_SELECTED mode, or the driver may change to BYPASS mode.

[REQ:IE-CLASSB_00319];[Allocation:Onboard];[Type:Mandatory]

After the acknowledgement of change of CCO Operating Mode has been completed by the driver, CCO shall display the mode icon in accordance with [IRS-DMI] indicating that the new CCO Operating Mode is active, and deactivate the Mode_Transition_Acknowledgement function.

[END_REQ]

[REQ:IE-CLASSB_00320];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established which requires the driver to only acknowledge and confirm a change of CCO Operating Mode,

- for a transition at a border between CCT areas: if this coincides in location with a lineside CCT area change marker board.
- for a transition at a border between CCT areas: if the new CCO Operating Mode is compatible with the CCT area which is indicated on the lineside CCT area change marker board.
- for a transition inside a CCT area: if the CCO Operating Mode is compatible with the CCT area in which the Train is currently operating.

[END_REQ]

[REQ:IE-CLASSB_00321];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established which requires the driver to be always informed - based on route knowledge - about the fitment of CCT areas and their demarcations.

[END_REQ]

[REQ:IE-CLASSB_00322];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established which requires the driver to be competent on which CCO Operating Modes are compatible with operation in the various types of CCT areas.

[END_REQ]

[REQ:IE-CLASSB_00323];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established which requires that in cases where the driver cannot agree with the CCO automatic mode change (e.g. due to incompatibility of new CCO Operating Mode and CCT area) the driver shall not acknowledge and shall bring the Train to Standstill.

[END_REQ]

Note: The deadman or driver vigilance devices installed in IRL may have delay settings of up to 90s before demanding an Emergency Brake. The distance travelled with an incompatible CCO Operating Mode into a CCT area at speeds of currently up to 160km/h for 90s (=4000m) plus considering the additional braking distance would not be acceptable. Therefore a maximum time delay of 7 seconds was defined (which would cause a distance of =311m at 160km/h or 389m at 200km/h). Further, the CCO shall automatically perform the initial change, so that directly from the transition point CCO protection is available, even if the driver is incapacitated.

Note: The driver must always be informed on the current CCO Operating Mode and any automatic CCO Operating Mode changes. Therefore the acknowledgement and confirmation by the driver is required

[REQ:IE-CLASSB_00324];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to require that in cases where CCO demanded Emergency Brake because the driver purposely did not acknowledge or confirm an automatic CCO Operating Mode change, the driver shall seek authorisation from the signalman prior to commencing any further Train movement.

[END_REQ]

7.4.35. CAWS_Mode_Transition_Acknowledgment

To Be Defined in a future version of the document.

7.4.36. Error_Management

7.4.36.1. General Requirements

[REQ:IE-CLASSB_00325];[Allocation:Onboard];[Type:Mandatory]

Whenever a requirement of the Error_Management function calls for the CCO to demand or to revoke a demand for the emergency brake or the service brake, this shall be done in accordance with the Braking_Management function.

[END_REQ]

[REQ:IE-CLASSB_00326];[Allocation:Onboard];[Type:Mandatory]

The Error_Management function shall be activated whenever a requirement of this IRS calls for the CCO to raise an error in accordance with the Error_Management function.

[END_REQ]

[REQ:IE-CLASSB_00327];[Allocation:Onboard];[Type:Mandatory]

The term 'error' is defined as a software reaction taken by CCO as a result of a detection of a failure. A failure is defined as

- a fault in a CCO component or equipment, or
- a missing, incorrect or inconsistent input to CCO from any of its interfaces to staff, Rolling Stock, or CCT, or
- the absence of an expected acknowledgement or confirmation from the driver via the DMI.

[END_REQ]

[REQ:IE-CLASSB_00328];[Allocation:Onboard];[Type:Mandatory]

Errors shall be categorised according to the following categories:

- Fatal.
- Vital.
- Non-vital (to be displayed to driver as 'Alert').
- Non-vital (for internal storage by JRU, not to be displayed to the driver).

[END_REQ]

Note: Non-vital Alert errors do not require the demand of a brake application, but must always be displayed to the driver, e.g. the need for a periodic reset of the CCO.

[REQ:IE-CLASSB_00329];[Allocation:Onboard];[Type:Mandatory]

If an error occurs when in AUTOTEST mode, the CCO shall manage it as soon as CCO switches to CAB_SELECTED or NO_CAB_SELECTED modes.

[END_REQ]

7.4.36.2. Requirements Specific to fatal and vital errors

[REQ:IE-CLASSB_00330];[Allocation:Onboard];[Type:Mandatory]

When a fatal error is raised, the CCO shall continuously demand the Emergency Brake.

[END_REQ]

Note: The only way to attempt CCO recovery from a fatal error shall be to shut down and restart the CCO which will also deactivate this function.

[REQ:IE-CLASSB_00331];[Allocation:Onboard];[Type:Mandatory]

When one or more vital errors are raised, the CCO shall demand the Emergency Brake until all vital errors are acknowledged at Standstill by the driver, in accordance with the Error_Management_Acknowledgement function.

[END_REQ]

[REQ:IE-CLASSB_00332];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to require the meaning of CCO errors to be clearly indicated in the drivers' CCO user manuals.

[END_REQ]

[REQ:IE-CLASSB_00333];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to require that drivers shall only acknowledge an error after they have assessed the situation and have decided that it is safe to do so.

[END_REQ]

[REQ:IE-CLASSB_00334];[Allocation:Onboard];[Type:Mandatory]

At Standstill, the DMI shall display fatal and vital errors as well as the cause of the errors in short descriptive and pre-configured text messages to the driver in accordance with [IRS-DMI]. Each individual text message shall be configurable by authorised maintenance staff within a length of 54 characters.

[END_REQ]

Note: The limit of 54 characters is related to the available display space for this information. The table below defines the error and consequence in plain text.

[REQ:IE-CLASSB_00335];[Allocation:Onboard];[Type:Mandatory]

Each error shall have an associated four-character alphanumeric code, which shall be displayed on the DMI. The numeric part shall define the nature of the error in accordance with Table 10 below, and the alphabetic part shall identify the nature and source of the error in more detail.

The 1st and 2nd digits are numeric and shall be the digits indicated in the first column of Table 10. The 3rd and 4th digits are alphabetic and shall be defined by the CCO supplier or the operating RU.

ERR. CODE PREFIX	ERROR NAME	ERROR CATEGORY	DESCRIPTION	DMI MESSAGE
01	ERR_LINKING_NOT_VITAL	Non-Vital	Linked BG not correctly received in the expected window.	Balise Group Linking Error
02	ERR_LINKING_VITAL	Vital	Linked BG not correctly received in the expected window.	Balise Group Linking Error
03	ERR_EARLY_BG	Non-Vital	Linked BG received before the expected window.	Balise Group Received Early
04	ERR_LINKING_TSR	Non-Vital	Linked BG (with TSR data) not received in the expected window.	TSR Balise Group Not Received
05	ERR_BG_TSR	Vital	Error in the DTP data received from a BG with TSR data in STAFF_RESPONSIBLE, CAWS, ATP, DTP, DTP+CODE, DTP+CODE_E, CODE_E	Possible TSR Not Managed
		Non-vital	Error in the DTP data received from a BG with TSR data in modes other than STAFF_RESPONSIBLE, CAWS, ATP, DTP, DTP+CODE, DTP+CODE_E, CODE_E	

ERR. CODE PREFIX	ERROR NAME	ERROR CATEGORY	DESCRIPTION	DMI MESSAGE
06	ERR_BG_DATA_NOM	Non-Vital	Error in the DTP data received from a BG in nominal direction.	Balise Data Error
07	ERR_BG_DATA_REV	Non-Vital	Error in the DTP data received from a BG in reverse direction.	Balise Data Error
08	ERR_BG_DATA_UNKN	Non-Vital	Error in the DTP data received from a BG in unknown direction.	Balise Data Error
09	ERR_BG_LOST	Non-Vital	BG lost (in nominal direction)	Missed Balise Group
10	ERR_TWO_BG_IN_ERROR	Vital	Two consecutive BG in error.	Two Balise Groups Received with Errors
11	ERR_TELEGRAM_STATUS	Non-Vital	DTP Trackside degradation	Trackside DTP Error
25	ERR_INTERNAL_TEST_FATAL	Fatal	CCO internal error. Displayed in several circumstances, including when maximum autotest period is elapsed	On-Board internal error
26	ERR_INTERNAL_TEST_NOT_VITAL	Non-Vital	CCO internal error.	On-Board internal error
		Alert	When maximum autotest alert period is elapsed	Autotest Required
27	ERR_INTERNAL_TEST_VITAL	Vital	CCO internal error.	On-Board internal error
28	ERR_PICK_UP_COIL_N_CAB_A	Non-Vital	Normal Pickup coil cab A failure	Normal Pickup Coil Failed - Cab A
29	ERR_PICK_UP_COIL_N_CAB_B	Non-Vital	Normal pickup coil cab B failure	Normal Pickup Coil Failed - Cab B
30	ERR_PICK_UP_COILS_CAB_A_LOST	Vital	Reserve Pickup coil cab A failure (code reception function permanently lost in Cab A) In STAFF_RESPONSIBLE, DTP+CODE, DTP_E, DTP_E+ATP, DTP_E+CAWS, ATP or CAWS mode, the error is Vital if cab A is enabled, In DTP, CODE_E, DTP+CODE_E or DTP_E+CODE_E mode, the error is Vital if cab A is enabled and Train is at Standstill.	Reserve Pickup Coil Failed - Cab A
		Non-Vital	Reserve Pickup coil cab A failure (code reception function permanently lost in Cab A) In STAFF_RESPONSIBLE, DTP+CODE, DTP_E, DTP_E+ATP, DTP_E+CAWS, ATP or CAWS mode, the error is Non-Vital if cab A is not enabled. In DTP, CODE_E, DTP+CODE_E or DTP_E+CODE_E mode, the error is Non-Vital if cab A is not enabled and/or the Train is moving. In CAB_SELECTED, FORWARD_SHUNTING and REVERSE_SHUNTING CCO Operating Modes, the error is Non-Vital.	
31	ERR_PICK_UP_COILS_CAB_B_LOST	Vital	Reserve Pickup coil cab B failure (code reception function permanently lost in Cab B) In STAFF_RESPONSIBLE, DTP+CODE, DTP_E, DTP_E+ATP, DTP_E+CAWS, ATP or CAWS mode, the error is Vital if cab B is enabled, In DTP, CODE_E, DTP+CODE_E or DTP_E+CODE_E mode, the error is Vital if cab B is enabled and Train is at Standstill.	Reserve Pickup Coil Failed - Cab B

ERR. CODE PREFIX	ERROR NAME	ERROR CATEGORY	DESCRIPTION	DMI MESSAGE
		Non-Vital	Reserve Pickup coil cab B failure (code reception function permanently lost in Cab B) In STAFF_RESPONSIBLE, DTP+CODE, DTP_E, DTP_E+ATP, DTP_E+CAWS, ATP or CAWS mode, the error is Non-Vital if cab B is not enabled. In DTP, CODE_E, DTP+CODE_E or DTP_E+CODE_E mode, the error is Non-Vital if cab B is not enabled and/or the Train is moving. In CAB_SELECTED, FORWARD_SHUNTING and REVERSE_SHUNTING CCO modes, the error is Non-Vital.	
32	ERR_DTP_ANTENNA_LOST	Vital	DTP Balise Antenna failure. DTP function lost. In STAFF_RESPONSIBLE, CAWS, ATP, DTP, DTP+CODE, DTP+CODE_E or CODE_E mode, the error is Vital.	Balise Antenna Failed
		Non-Vital	DTP Balise Antenna failure. DTP function lost. In modes other than STAFF_RESPONSIBLE, CAWS, ATP, DTP, DTP+CODE, DTP+CODE_E or CODE_E modes, the error is non-Vital.	
33	ERR_DMI_CAB_A_LOST	Fatal	Communication lost with DMI Cab A. Fatal if Cab A is enabled	DMI Communications Failure - Cab A
		Non-Vital	Communication lost with DMI Cab A. Non-Vital if Cab A is not enabled.	
34	ERR_DMI_CAB_B_LOST	Fatal	Communication lost with DMI Cab B. Fatal if Cab B is enabled	DMI Communications Failure - Cab B
		Non-Vital	Communication lost with DMI Cab B. Non-Vital if Cab B is not enabled.	
35	ERR_BY_PASS	Fatal	Failure of the Bypass switch read-back	Bypass Circuit Failure
50	ERR_JRU_LOST	Vital	Communication lost with JRU. Vital if the Train is at Standstill.	TELOC Communications Failure
		Non-Vital	Communication lost with JRU. Non-Vital if the Train is not at Standstill.	
51	ERR_DIRECTION_EVALUATION	Fatal	Speed sensor failure or direction information from odometry lost. Fatal if the Train is at Standstill.	Train Direction Not Available
		Non-Vital	Speed sensor failure or direction) information from odometry lost. Temporary Non-Vital if the Train is not at Standstill. As soon as the Train reaches a Standstill, the error becomes fatal	
52	ERR_ODOMETRY_LOST	Fatal	Whole Odometry function lost.	No Odometry
53	ERR_CAB_SELECTION	Fatal	Both cabs are selected.	Two Cabs Selected
54	ERR_SB_MONITORING	Vital	SB performance degradation Vital in ATP or DTP_E+ATP modes.	Service Brake Degraded
		Non-Vital	SB performance degradation Non-Vital in modes other than ATP or DTP_E+ATP.	
55	ERR_SB_DRIVER_TEST	Non-Vital	The driver confirmed that the SB test failed and does not want to repeat the test.	Service Brake Test Abandoned
56	ERR_EB_DRIVER_TEST	Fatal	The driver confirmed that the EB test failed and does not want to repeat the test.	Emergency Brake Test Abandoned

ERR. CODE PREFIX	ERROR NAME	ERROR CATEGORY	DESCRIPTION	DMI MESSAGE
57	ERR_DELTA_AXLES_SPEED	Vital	Speed difference between two axles fitted with tachogenerators exceeds a threshold predefined for specific CCO application.	Axle Speed Difference Error
58	ERR_DIRECTION_SELECTION	Fatal	Both FORWARD and REVERSE are selected	Forward / Reverse Controller Error
59	ERR_DIRECTION_CONSISTENCY	Fatal	Odometry direction not coherent with FORWARD/REVERSE input. Fatal if the Train is at Standstill.	Movement in direction opposite to Controller position
		Non-Vital	Odometry direction not coherent with FORWARD/REVERSE input. Temporary Non-Vital if the Train is not at Standstill. As soon as the Train reaches a Standstill, the error shall become fatal	
75	ERR_ROLL_AWAY	Vital	The Train moves above the no-motion threshold (i.e. Standstill condition is lost) for more than a configurable distance (pre-defined to 5 m) when the Direction Controller is neither in Forward nor Reverse, or the Train moves below the no motion threshold for more than a configurable distance (pre-defined to 20m)	Roll-Away Detected
76	ERR_ROLL_BACK	Vital	Train moves in reverse direction for more than a configurable distance (pre-defined to 5m), when forward direction is selected by the Direction Controller.	Roll-Back Detected
77	ERR_ROLL_FORWARD	Vital	Train moves in forward direction for more than a configurable distance (pre-defined to 5m), when reverse direction is selected by the Direction Controller.	Roll-Forward Detected
78	ERR_DIRECTION_MODE	Vital	Train movement not coherent with the CCO Operating Mode direction.	Movement in direction forbidden by CCO Operating Mode
79	ERR_NO_MOTION	Vital	Train moves, when it should not move. Typically during a procedure where the Train shall remain at Standstill.	Un-commanded Train Movement
80	ERR_BUTTON	Vital	Button always pressed.	DMI Button Continuously Pressed
81	ERR_CODE_ACKN	Vital	CAWS Code Downgrade not acknowledged.	Code Downgrade Not Acknowledged
82	ERR_OP_MODE_ACKN	Vital	CCO Operating Mode Change not acknowledged.	Mode Change Not Acknowledged
98	ERR_ONBOARD_NON_VITAL	Non-Vital	Would be available if non vital errors would be displayed. It has been decided to not display non-vital error therefore this error would never be raised.	Non-Vital On-Board Error
99	ERR_TRACKSIDE_NON_VITAL	Non-Vital	Would be available if non vital errors would be displayed. It has been decided to not display non-vital error therefore this error would never be raised.	Non-Vital Trackside Error

Table 10 - Errors, DMI messages, and meaning
[END_REQ]

[REQ:IE-CLASSB_00336];[Allocation:Onboard];[Type:Mandatory]
The list of errors in Table 10 shall be completed with CCO application specific errors, as applicable, and included in drivers' user manuals of the CCO.
[END_REQ]

[REQ:IE-CLASSB_00337];[Allocation:Onboard];[Type:Mandatory]

Information about all errors shall be sent by CCO to the Juridical Recording Unit. At least date, time (by second) and four-character alphanumeric code of each individual failure must be identifiable.

[END_REQ]

[REQ:IE-CLASSB_00338];[Allocation:Application Condition];[Type:Mandatory]

SRAC: The error message texts shall be defined in co-operation with representatives of the RUs operating in IRL at the time of defining new/updated text messages and shall be subject to a human interface analysis.

[END_REQ]

[REQ:IE-CLASSB_00339];[Allocation:Onboard];[Type:Mandatory]

With the exception of when the CCO Operating Mode is AUTOTEST or MAINTENANCE, if a fatal error occurs the CCO shall demand the Emergency Brake and shall activate the Error_Management_Acknowledgement function, when the Train reaches the Standstill condition.

[END_REQ]

Note: Although a fatal error cannot be acknowledged (only a reset of the CCO is possible after addressing the failure leading to the error), the Error_Management_Acknowledgement function needs to be activated because it addresses the display of that fatal error which occurred first on the DMI.

[REQ:IE-CLASSB_00340];[Allocation:Onboard];[Type:Mandatory]

With the exception of when the CCO Operating Mode is AUTOTEST or MAINTENANCE, if a vital error occurs the CCO shall demand the Emergency Brake and, when the Train reaches Standstill condition and when a cab is selected, the CCO shall activate the Error_Management_Acknowledgement function.

[END_REQ]

Note: CCO shall deactivate the Error_Management function through the Error_Management_Acknowledgement function.

7.4.36.1. Requirements Specific to non-vital errors

[REQ:IE-CLASSB_00341];[Allocation:Onboard];[Type:Mandatory]

When one or more non-vital errors is raised, the CCO shall not demand any brake application and shall not display these errors to the driver, but the errors shall be recorded in the Juridical Recording Unit for maintenance purpose. The Error_Management function shall be deactivated when the errors have been sent to JRU.

[END_REQ]

[REQ:IE-CLASSB_00342];[Allocation:Onboard];[Type:Mandatory]

If a failure resulting in a non-vital error is persistent, the CCO shall continuously raise the error. If the circumstances change such that the non-vital error becomes vital or fatal, the CCO shall react accordingly.

[END_REQ]

Note: Some errors can be fatal, vital or non-vital depending on the operational circumstances and CCO Operating Mode, as described in Table 10.

For example, an odometry direction consistency error (error code prefix 59) which occurs while the Train is moving, is non-vital until the Train comes to a Standstill (based on the consideration, that the direction of travel

can not change, while the Train is still moving) but becomes fatal at Standstill (as there is now uncertainty about the direction of further Train movement).

7.4.37. Error_Management_Acknowledgement

[REQ:IE-CLASSB_00343];[Allocation:Onboard];[Type:Mandatory]

Whenever a requirement of the Error_Management_Acknowledgement function calls for the CCO to demand or to revoke a demand for the emergency brake or the service brake, this shall be done in accordance with the Braking_Management function.

[END_REQ]

[REQ:IE-CLASSB_00344];[Allocation:Onboard];[Type:Mandatory]

When the Error_Management_Acknowledgement function is active, the CCO shall display in accordance with [IRS-DMI]:

- The information related to the first fatal error if any, or
- all the vital errors in sequence of occurrence.

[END_REQ]

[REQ:IE-CLASSB_00345];[Allocation:Onboard];[Type:Mandatory]

The CCO shall display in accordance with [IRS-DMI] the text messages related to all alert errors which occurred (if any).

[END_REQ]

[REQ:IE-CLASSB_00346];[Allocation:Onboard];[Type:Mandatory]

If a vital error occurs, the CCO shall disable the DMI buttons, with the exception of the B_BRIGHTNESS and B_TEXT_ERROR_ACK buttons, and shall display the 'On-Board Vital Error' icon (I_OB_ERROR) on the DMI.

[END_REQ]

[REQ:IE-CLASSB_00347];[Allocation:Onboard];[Type:Mandatory]

If a fatal error occurs, the CCO shall disable the DMI buttons, with the exception of the B_BRIGHTNESS button, and display the 'On Board Fatal Error icon' (I_OB_FATAL_ERROR) on the DMI.

[END_REQ]

[REQ:IE-CLASSB_00348];[Allocation:Onboard];[Type:Mandatory]

If an error related to the continuous signal reception of the selected cab occurs, the CCO shall display the 'On Board CODE Error' icon (I_CODE_OB_ERROR) on the DMI.

[END_REQ]

[REQ:IE-CLASSB_00349];[Allocation:Onboard];[Type:Mandatory]

If an error related to the discontinuous signal reception of the selected cab occurs, the CCO shall display the 'On Board DTP Error' icon (I_DTP_OB_ERROR) on the DMI.

[END_REQ]

[REQ:IE-CLASSB_00350];[Allocation:Onboard];[Type:Mandatory]

When in NO_CAB_SELECTED mode, the CCO shall display the fatal error message of that fatal error which occurred first (if any) on all DMIs connected to the CCO.

[END_REQ]

[REQ:IE-CLASSB_00351];[Allocation:Onboard];[Type:Mandatory]

When CCO is operating in a CCT area fitted with DTP and the Error_Management_Acknowledgement function is active, the error message shall include, as per [IRS-DMI], the Track Identifier label (i.e. the ID of the last Balise Group read) and the Error Distance label (distance travelled from that last Balise Group to the location at which the error was detected).

[END_REQ]

[REQ:IE-CLASSB_00352];[Allocation:Onboard];[Type:Mandatory]

When entering in NO_CAB_SELECTED mode, the CCO shall reset the values of the Track Identifier and the Error Distance.

[END_REQ]

[REQ:IE-CLASSB_00353];[Allocation:Onboard];[Type:Mandatory]

While the Error_Management_Acknowledgement function is active, the CCO shall inform the driver about the nature of the error and propose the driver to acknowledge each vital error displayed (if any) by the following procedure.

- The CCO shall display on the DMI the text message linked to the first vital error which occurred, surrounded by a flashing frame.
- If the driver acknowledges the error by pressing the message, the CCO shall hide it and display the text messages related to the following vital errors which occurred (if any).

[END_REQ]

[REQ:IE-CLASSB_00354];[Allocation:Onboard];[Type:Mandatory]

After all the vital errors are acknowledged, the CCO shall:

- Hide the 'Vital Error' Icon and the text message linked to the last vital error which occurred and
- revoke the Emergency Brake demand, and
    - if no alert error has occurred, de-activate the Error_Management_Acknowledgement function.
    - If alert errors have occurred, display and propose the acknowledgement of the alert error in sequence of occurrence, and de-activate the Error_Management_Acknowledgement function when all alert errors have been acknowledged.
- Deactivate the Error_Management_Function.

[END_REQ]

[REQ:IE-CLASSB_00355];[Allocation:Onboard];[Type:Mandatory]

The Error_Management_Acknowledgement function shall be performed at Standstill. If the Train's Standstill condition is lost while the Error_Management_Acknowledgement function is active, the CCO shall raise an ERR_NO_MOTION vital error.

[END_REQ]

Note: CCO Operating Mode transition acknowledgement may be required after an error acknowledgement procedure is completed. To prevent the Train from moving in a CCO Operating Mode not acceptable to the driver, it is therefore necessary to maintain the Train at Standstill until the error management is completed.

[REQ:IE-CLASSB_00356];[Allocation:Application Condition];[Type:Mandatory]
SRAC: An Operating Rule shall be established to ensure that the driver records in the vehicle logbook the "date/time/error code/error message" associated with fatal and vital errors before acknowledging them on the DMI.
[END_REQ]

[REQ:IE-CLASSB_00357];[Allocation:Application Condition];[Type:Mandatory]
SRAC: An Operating Rule shall be established to ensure that the driver reports the complete CCO status and errors to another driver to whom the Train is handed over.
[END_REQ]

[REQ:IE-CLASSB_00358];[Allocation:Application Condition];[Type:Mandatory]
SRAC: An Operating Rule shall be established to ensure that a driver only acknowledges an error and any subsequent change of the CCO Operating Mode, if the driver considers it safe to do so based on

- the driver's evaluation of the state of the CCO system,
- the configuration of the Actual Train Consist,
- the CCT fitment of the area in which the Train is operating,
- the operational circumstances,
- any orders from the signalman,
- consideration of any advice obtained (remotely) from maintenance or company staff.

[END_REQ]

Note: It is already established in the IRL industry, that in case of complex failure scenarios the driver may consult, via telecommunication, with remote specialist or maintenance staff for advice. The final decision must remain however with the driver.

7.4.38. Service_Brake_Application_Monitoring

Note: The objective of this function is to evaluate whether or not a Service Brake demand by CCO has been applied by the Train, in order to confirm the connectivity between the CCO and the Train Service Brake. The objective is not to measure the actual Service Brake performance (i.e. deceleration rate) of the Train.

This is achieved through the measurement of a predefined deceleration rate. This rate is measured a predefined time after Service Brake has been demanded by CCO.

[REQ:IE-CLASSB_00359];[Allocation:Onboard];[Type:Mandatory]
The Service_Brake_Application_Monitoring function shall be active in the applicable CCO Operating Modes, as defined in Table 6 of section 7.4.1 when the service brake is configured and demanded by another function.
[END_REQ]

[REQ:IE-CLASSB_00360];[Allocation:Onboard];[Type:Mandatory]
After the Train Service Brake Response Time and Service Brake Monitoring Delay Time have elapsed, the CCO shall raise an ERR_SB_MONITORING error in accordance with the Error_Management function if one of the following conditions is met:

- The traction controller (or combined traction/brake controller) status corresponds to a presence of traction demand, or

- the Current Train Speed is greater than 5km/h (1.39 m/s) and the actual measured Service Brake deceleration rate is lower than the 'Service Brake Monitoring Threshold', or
- the Current Train Speed is equal to or lower than 5km/h and after a time defined as (1.39 m/s divided by 'Service Brake Monitoring Threshold'), the standstill condition is not met.

[END_REQ]

Note: After the Train Service Brake Response Time has elapsed, the Service Brake Monitoring Delay Time is added, to allow the Train to establish a stable service brake deceleration rate before the CCO monitoring of Service Brake application starts.

[REQ:IE-CLASSB_00361];[Allocation:Onboard];[Type:Mandatory]

The nominal Service Brake Monitoring Delay Time shall be 1 second.

This value may be increased or decreased via pre-parametrisation for each CCO application by up to 50%, based on a risk assessment carried out in accordance with [CSM402], [50126], [50128], and [50129].

[END_REQ]

[REQ:IE-CLASSB_00362];[Allocation:Onboard];[Type:Mandatory]

The 'Service Brake Monitoring Threshold' shall be defined as 0.67m/s^2.

[END_REQ]

Note: This value had been defined as part of the original ATP specification since 1984. This value has been used and no reason for changing it has been raised by operators.

[REQ:IE-CLASSB_00363];[Allocation:Onboard];[Type:Mandatory]

When the CCO Operating Mode is ATP or DTP_E+ATP, the ERR_SB_MONITORING error shall be vital.

[END_REQ]

[REQ:IE-CLASSB_00364];[Allocation:Onboard];[Type:Mandatory]

In all CCO Operating Modes other than ATP or DTP_E+ATP, the ERR_SB_MONITORING error shall be non-vital.

[END_REQ]

7.4.39. Juridical_Recording

[REQ:IE-CLASSB_00365];[Allocation:Onboard];[Type:Mandatory]

CCO shall provide an interface to enable information to be sent to the Juridical Recording Unit.

[END_REQ]

[REQ:IE-CLASSB_00366];[Allocation:application condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to ensure that recorded data in the Juridical Recording Unit can be readily made available in a readable format to operating Railway Undertakings, National Safety Authorities, and National Investigation Bodies.

[END_REQ]

[REQ:IE-CLASSB_00367];[Allocation:Onboard];[Type:Mandatory]

The CCO shall provide to the Juridical Recording Unit for recording the date and time of occurrence in order of occurrence, with a resolution of at least one second, of every instance of the following events and the resulting status/ value:

i. The raising of any errors and their status by CCO and when their status (non-vital/ vital/ fatal) changes.
ii. The activation and the deactivation of any sound provided by CCO.
iii. Any change of CCO Operating Mode, except for BYPASS mode.
iv. The reception of CCT signal aspect data from CCT balise groups (to be defined in a future version of this document).
v. The reception of CCT Balise group ID (to be defined in a future version of this document).
vi. The status of all currently displayed DMI objects and any change to that status.
vii. Any change and the status of the current values of all Train Data parameters as described in sections 7.2.1 and 7.4.31, and any change to that status.
viii. Any Balise group ID entered by driver in Stop_Override function.

The following signals which are continuously present shall be sampled and recorded at a frequency of at least once per second:

ix. Current running direction with respect to the active cab obtained from odometry.
x. Distance travelled since last CCO system power-on.
xi. Current status of Standstill condition (Standstill/No Standstill).
xii. Current Train Speed obtained from odometry.
xiii. Current Train Speed as shown on DMI.
xiv. Current continuous code carrier as received by CCO (no carrier/ C1/ C2).
xv. Current CCT 50Hz or 83.3Hz code name as received by CCO.
xvi. Current status of Warning curve exceedance (to be defined in a future version of this document).
xvii. Current status of Intervention curve exceedance (to be defined in a future version of this document).
xviii. Current status of Emergency Brake demand by CCO (present/not present).
xix. Current status of Service Brake demand by CCO (present/not present) (where configured).
xx. Current status of Traction Cut Off demand by CCO (present/not present) (where configured).
xxi. Current status of Data Entry function (active/not active).
xxii. Current status of Running Release function (active/not active).
xxiii. Current status of Train_Stop function (active/not active) (to be defined in a future version of this

document).

xxiv. Current status of Stop Override function (active/not active) (to be defined in a future version of this document).

xxv. Current status of Cab A selection as detected by CCO (selected/ not selected).

xxvi. Current status of Cab B selection as detected by CCO (selected/ not selected) (where configured).

xxvii. Current status of Driver traction controller or combined traction/brake controller in the active cab as detected by CCO (Traction/ Absence of traction).

xxviii. Current status of Cab Forward / Reverse controller in the active cab as detected by CCO (Neutral/ Forward/ Reverse).

xxix. Current Permitted Speed as used by CCO.

xxx. Current First Intervention Speed as used by CCO.

xxxi. Current Second Intervention Speed as used by CCO.

xxxii. Current Permitted Speed as shown on DMI.

xxxiii. Current Target Speed shown on DMI (to be defined in a future version of this document).

xxxiv. Current Target Distance shown on DMI (to be defined in a future version of this document).

xxxv. Current DTP Release Speed used by CCO (to be defined in a future version of this document).

xxxvi. Current DTP Release Speed as shown on DMI (to be defined in a future version of this document).

xxxvii. Current status of the CCO Bypass Switch.

When an item in the lists above refers to “shown on the DMI”, it refers to the actual value displayed on the DMI for use by the driver, not the value sent from the Vital Computer to the DMI.
[END_REQ]

Note: As explained in the Error_Management function, the error code can be identical for a same error of a different category (fatal, vital, non-vital, alert), because the category of the error depends on the context of occurrence of the corresponding failure (CCO Operating Mode in particular). For incident investigation purpose, the differentiation between error categories can in these cases be made via the status of the Error Icons displayed on the DMI and recorded in the JRU:

In the case of a Fatal Error, the On-board Fatal Error icon (I_OB_FATAL_ERROR) and the Emergency Brake Intervention icon (I_EB) will be displayed on the DMI and the display of these two icons will be recorded in the JRU, together with the error code.
In the case of a Vital Error, the On-board Vital Error icon (I_ OB_ERROR) and the Emergency Brake Intervention icon (I_EB) will be displayed on the DMI and the display of these two icons will be recorded in the JRU, together with the error code.
In the case of a non-vital error, neither the On-board Fatal Error icon, the On-board Vital Error icon nor the Emergency Brake Intervention icon will be displayed on the DMI, but the error code will be recorded in the JRU.

[REQ:IE-CLASSB_00368];[Allocation:Onboard];[Type:Mandatory]

The Juridical Recording Unit shall timestamp the recorded items with a date and time in accordance with an internal system time. The internal system time used by the Juridical Recording Unit shall have a maximum difference from UTC of 5 seconds.

[END_REQ]

[REQ:IE-CLASSB_00369];[Allocation:Onboard];[Type:Optional]

Optional: The Juridical Recording Unit may provide the ability to automatically change to and from summer time. If available the activation of this feature shall be configurable to “automatic summer time change” or “manual summer time change”.

[END_REQ]

[REQ:IE-CLASSB_00370];[Allocation:Onboard];[Type:Mandatory]

The Juridical Recording Unit shall have sufficient memory so that recorded data is available for at least 1 months before becoming overwritten by fresh data.

[END_REQ]

7.4.40. Speed_Display

[REQ:IE-CLASSB_00371];[Allocation:Onboard];[Type:Mandatory]

The DMI shall display the Current Train Speed in all CCO Operating Modes except CAWS, UNFITTED, AUTOTEST, NO_CAB_SELECTED, CAB_SELECTED, MAINTENANCE, and BYPASS in accordance with the [IRS-DMI]

[END_REQ]

Note: in a future version of this IRS, the permitted speed in STAFF_RESPONSIBLE mode may be increased in some specific operating conditions. The display or not of the Current Train Speed on the DMI in these circumstances shall consider the allocated SIL Level for this function.

[REQ:IE-CLASSB_00372];[Allocation:Onboard];[Type:Optional]

Optional: The DMI may display the Current Train Speed in CAWS and UNFITTED modes if the SIL level of the Speed_Display function can be demonstrated to be appropriate, in accordance with Table 7.

[END_REQ]

[REQ:IE-CLASSB_00373];[Allocation:Onboard];[Type:Optional]

Optional: In BYPASS mode the speed may be provided to the driver through an alternative dependable source of information

[END_REQ]

[REQ:IE-CLASSB_00374];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to ensure that drivers drive:

- when operating in CAWS, UNFITTED or BYPASS CCO Operating Modes according to
  - either a non-DMI speedometer which shall be provided by the Rolling Stock subsystem or
  - Line of Sight operation, at a speed which allows the driver to observe the infrastructure and stop the Train well in advance of any upcoming danger point or obstacle.
- according to the DMI speedometer when operating in CCO Operating Modes other than CAWS, UNFITTED or BYPASS.

[END_REQ]

[REQ:IE-CLASSB_00375];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An application condition shall be established to define the safety integrity level of the non-DMI speedometer which shall be provided by the Rolling Stock subsystem.
No minimum SIL requirements are defined in this standard and the SIL for the functions of the non-DMI speedometer shall be identified based on risk assessment carried out in accordance with [CSM402], [50126], [50128], and [50129].

[END_REQ]

7.4.41. CAWS_Aspect_Display

To be defined in a future version of the document

7.5. Interface Requirements

7.5.1. Airgap

[REQ:IE-CLASSB_00376];[Allocation:Onboard];[Type:Mandatory]

The CCO system shall be compliant and compatible with the requirements and interfaces described in [IRS-AIRGAP].

[END_REQ]

Note: In a future version of this document, a requirement specification related to the possible adjustment of the sensitivity of the CCT code signal reception by CCO may be provided.

7.5.2. Driver Interface

[REQ:IE-CLASSB_00377];[Allocation:Onboard];[Type:Mandatory]

The CCO system shall display information and provide sounds to the driver via the DMI and its loudspeaker in accordance with the other requirements specified in this IRS and in accordance with [IRS-DMI].

[END_REQ]

[REQ:IE-CLASSB_00378];[Allocation:Onboard];[Type:Mandatory]

The requirements for the DMI to display objects (such as buttons, icons, messages and sounds), mentioned in this document are defined in [IRS-DMI].

[END_REQ]

[REQ:IE-CLASSB_00379];[Allocation:Onboard];[Type:Mandatory]

The DMI shall provide a vitality icon, constantly in movement, to enable the driver to check for possible screen freeze. The vitality icon shall be designed to not distract the driver from operating the Train or the CCO. The suitability of this design shall be assessed by a human factors analysis.

[END_REQ]

[REQ:IE-CLASSB_00380];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to require that drivers shall consider the vitality icon to evaluate a potential screen freeze. The Operating Rule shall also contain procedures on how to proceed, in case of the driver noticing a frozen DMI screen.

[END_REQ]

[REQ:IE-CLASSB_00381];[Allocation:Onboard];[Type:Mandatory]

Where a vehicle has only one cab connected to the CCO, this cab shall be associated with “CAB A”. Where a vehicle has two cabs connected to the CCO, each cab shall be permanently correlated to either the «CAB A» or «CAB B» parameter of the CCO.

[END_REQ]

[REQ:IE-CLASSB_00382];[Allocation:Onboard];[Type:Mandatory]

A human factor analysis shall demonstrate that the DMI layout and its object sequencing are made such that the driver is not misled into unintentionally acknowledging an object (e.g. a message, a button, an icon)

different from the one intended to be acknowledged. The analysis shall systematically cover all possible combination of objects and all possible sequencing.

[END_REQ]

7.5.3. Braking Curve

This section shall be completed in a future version of this document.

This first version of the document does not require the definition of the braking curves because the STAFF_RESPONSIBLE, ATP and DTP_E+ATP modes do not require braking curves to be calculated by CCO as a basis for monitoring the Current Train speed or the distance to a target point.

However, the braking performance of the CCO fitted Train running over 83.3Hz fitted CCT areas needs to be considered for the compatible configuration of coded track circuits.

[REQ:IE-CLASSB_00383];[Allocation:Onboard];[Type:Mandatory]
For operation in ATP and DTP_E+ATP mode on 83.3Hz CCT area any Unit to which CCO is installed must ensure a Set of Minimum ATP Performance Values for the parameters

- Train Emergency Brake Response Time,
- Train Emergency Brake Deceleration,
- Train Service Brake Response Time,
- Train Service Brake Deceleration.

These minimum values shall be defined based on a risk assessment compliant with the requirements of [EN501265], [EN50128], [EN50129] and [CSM_402] in such a way, that safe operation on 83.3Hz CCT area is ensured.
[END_REQ]

7.5.4. Interfaces to Rolling Stock, to Train, and to Environment

[REQ:IE-CLASSB_00384];[Allocation:Onboard];[Type:Mandatory]
The Interface between CCO and Rolling Stock shall ensure that for each connected cab an input indicating whether the cab is enabled or disabled is provided from Rolling Stock to CCO.
[END_REQ]

[REQ:IE-CLASSB_00385];[Allocation:Application Condition];[Type:Mandatory]
SRAC: The Rolling Stock design into which CCO is integrated must ensure that only one of the cabs connected to the CCO may be enabled at the same time. It shall not be possible from any other cab to drive the Train or delay, degrade, release or suppress an Emergency Brake demand by CCO or the subsequent Emergency Brake performance.
[END_REQ]

[REQ:IE-CLASSB_00386];[Allocation:Application Condition];[Type:Mandatory]
SRAC: This Rolling Stock design shall be suitable to support the permanent availability and trainwide execution of the values applied during CCO operation and entered via CCO Pre-Parametrisation and the Data Entry function for

- Train Emergency Brake Response Time and

- Train Emergency Brake Deceleration.

The Rolling Stock design shall ensure that the availability of these values, for each CCO application, shall achieve either SIL4 or a comparable level of safety integrity, in accordance with [CSM402], [50126], [50128], and [50129].

[END_REQ]

[REQ:IE-CLASSB_00387];[Allocation:Onboard];[Type:Mandatory]

The CCO Subsystem shall only consider a Cab Enabled input as stable if its status persists for more than 600 ms.

[END_REQ]

[REQ:IE-CLASSB_00388];[Allocation:Onboard];[Type:Mandatory]

The CCO system shall be installed in such a way that loss of power supply to CCO will by default result in an Emergency Brake demand by CCO.

[END_REQ]

[REQ:IE-CLASSB_00389];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to require that the formation of any Actual Train Consist shall ensure a trainwide execution of the CCO emergency brake demand at a performance equal or better than the values entered via CCO Pre-Parametrisation and the Data Entry function for

- Train Emergency Brake Response Time and
- Train Emergency Brake Deceleration.

at either SIL4 or a comparable level of safety integrity, in accordance with [CSM402], [50126], [50128], and [50129].

[END_REQ]

[REQ:IE-CLASSB_00390];[Allocation:Application Condition];[Type:Mandatory]

SRAC: The Rolling Stock design into which CCO is integrated must ensure that CCO emergency brake demands automatically result in a trainwide Traction Cut Off within the Train Emergency Brake Response Time which has been established for CCO operation via the Data Entry function. This shall be achieved at either SIL4 or a comparable level of safety integrity, established in accordance with [CSM402], [50126], [50128], and [50129].

[END_REQ]

[REQ:IE-CLASSB_00391];[Allocation:Application Condition];[Type:Mandatory]

SRAC: This Rolling Stock design shall be suitable to support the permanent availability and trainwide execution of the values entered via CCO Pre-Parametrisation and the Data Entry function for

- Train Service Brake Response Time and
- Train Service Brake Deceleration.

The Rolling Stock design shall ensure that the availability of these values, for each CCO application, shall achieve either SIL0 or a comparable level of safety integrity, in accordance with [CSM402], [50126], [50128], and [50129].

[END_REQ]

[REQ:IE-CLASSB_00392];[Allocation:Application Condition];[Type:Mandatory]

SRAC: The Rolling Stock design into which CCO is integrated must ensure that the Traction Cut-Off (if configured) demands from CCO are executed trainwide, at either SIL0 or better, within the Train Emergency

Brake Response Time which has been established for CCO operation via the Data Entry function.

[END_REQ]

[REQ:IE-CLASSB_00393];[Allocation:Application Condition];[Type:Mandatory]

SRAC: If Service Brake is configured and the CCO demands the application of both Service Brake and Emergency Brake simultaneously, the Rolling Stock design shall ensure that unacceptable compounding of the Service Brake and Emergency Brake is prevented.

[END_REQ]

[REQ:IE-CLASSB_00394];[Allocation:application condition];[Type:Mandatory]

SRAC: The Rolling Stock design into which CCO is integrated must ensure that CCO emergency brake demands from any CCO in the Train are executed trainwide via all emergency brake systems present in the Train.

[END_REQ]

Note: This could include, as applicable, any parallel pneumatic, electric, electro-pneumatic, electronic brake systems, etc.

[REQ:IE-CLASSB_00395];[Allocation:Application Condition];[Type:Mandatory]

SRAC: The Rolling Stock design into which CCO is integrated must ensure that when simultaneous CCO emergency brake and service brake demands occur, at least the Emergency Brake is executed trainwide and that no un-acceptable compounding of Service Brake and Emergency Brake braking is present in the Train.

[END_REQ]

[REQ:IE-CLASSB_00396];[Allocation:Onboard];[Type:Mandatory]

The CCO shall read, for each connected cab, two inputs for detecting the status of the Forward and Reverse signals related to the selected direction of travel by the driver. Absence of both inputs shall be considered by CCO as Neutral position.

[END_REQ]

[REQ:IE-CLASSB_00397];[Allocation:Onboard];[Type:Mandatory]

The CCO shall consider the Forward and Reverse input as stable if the status persists for more than 600 ms.

[END_REQ]

[REQ:IE-CLASSB_00398];[Allocation:Onboard];[Type:Mandatory]

The CCO shall read, for each connected cab, an input indicating whether traction is demanded or not by the driver.

[END_REQ]

[REQ:IE-CLASSB_00399];[Allocation:Onboard];[Type:Mandatory]

The CCO shall consider the traction demand input as stable if the status persists for more than 600 ms.

[END_REQ]

[REQ:IE-CLASSB_00400];[Allocation:Onboard];[Type:Mandatory]

The CCO shall include or be interfaced to a Juridical Recording Unit for storing the data sent by CCO.

[END_REQ]

[REQ:IE-CLASSB_00401];[Allocation:Onboard];[Type:Optional]

Optional: The CCO may be interfaced to the Juridical Recording Unit via MVB Bus. In that case, the MVB interface/protocol between the CCO Rack and the Juridical Recording Unit shall be compliant to EMD Class 3 standard, as per [61375].

[END_REQ]

[REQ:IE-CLASSB_00402];[Allocation:Onboard];[Type:Mandatory]

The CCO shall be powered from the battery of the Unit to which it is fitted, via a separate Main Circuit Breaker, which is only feeding this class B CCO equipment. This circuit breaker shall be accessible and operable by the driver without the need for using tools.

[END_REQ]

[REQ:IE-CLASSB_00403];[Allocation:Onboard];[Type:Mandatory]

It shall be possible to interface the CCO to Nominal Voltages of 24, 72 and 110 V DC power supply. CCO shall tolerate variations to the nominal values as defined in [50155].

[END_REQ]

[REQ:IE-CLASSB_00404];[Allocation:Onboard];[Type:Mandatory]

It is not permitted to use the Rolling Stock body as negative return path to the battery.

[END_REQ]

[REQ:IE-CLASSB_00405];[Allocation:Onboard];[Type:Mandatory]

Earthing and bonding must adequately protect against electric shocks, based on a risk assessment compliant with the requirements of [EN501265], [EN50128], [EN50129] and [CSM_402].

[END_REQ]

[REQ:IE-CLASSB_00406];[Allocation:Onboard];[Type:Mandatory]

Earthing and bonding must adequately protect against EMC/EMI threats, in accordance with [IRS-EMC].

[END_REQ]

[REQ:IE-CLASSB_00407];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established by the IM for determining a priority for retention of CCO functionality when load shedding is performed by the Unit to which CCO is fitted, to retain essential functions when the on-board electric power supply is depending on battery power only.

[END_REQ]

[REQ:IE-CLASSB_00408];[Allocation:Application Condition];[Type:Mandatory]

Where Simplified Data Entry is configured the actual length, including buffer, of all vehicles types/versions/variants in the Unit to which CCO is fitted must be equal or smaller than the pre-configured value for the parameter 'Nominal Length of a vehicle in the pre-defined Train consist'.

[END_REQ]

[REQ:IE-CLASSB_00409];[Allocation:Application Condition];[Type:Mandatory]

The actual vehicle length shall be measured between mating faces of buffers and/or centre couplers and/or the centre points of vehicle articulations.

[END_REQ]

[REQ:IE-CLASSB_00410];[Allocation:Application Condition];[Type:Mandatory]

SRAC: For each individual CCO application, an Operating Rule shall be established to ensure in cases where the Simplified Data Entry is used during operation,

- that the individual length of all vehicles in a Train is equal or smaller than the pre-configured value for the parameter 'Nominal Length of a vehicle in the pre-defined Train consist',
- that any Train which is formed is contained within the permitted pre-defined Train consists.

[END_REQ]

[REQ:IE-CLASSB_00411];[Allocation:Onboard];[Type:Mandatory]

The electromagnetic characteristics for the CCO (EMC and EMI requirements) shall be according to [IRS-EMC].

[END_REQ]

[REQ:IE-CLASSB_00412];[Allocation:Application Condition];[Type: Mandatory]

SRAC: The electromagnetic characteristics (EMC and EMI requirements) of the vehicle in which the CCO is fitted shall be demonstrated to be compliant with [IRS-EMC].

[END_REQ]

[REQ:IE-CLASSB_00413];[Allocation:Onboard];[Type:Mandatory]

All CCO equipment shall be compliant with the requirements of [TSI-L&P] for fire safety.

The CCO equipment shall meet the same Fire Category as the Unit to which it is fitted.

[END_REQ]

[REQ:IE-CLASSB_00414];[Allocation:Onboard];[Type:Mandatory]

All CCO equipment shall be compliant with the requirements of [TSI-L&P] associated with electrical hazards.

[END_REQ]

[REQ:IE-CLASSB_00415];[Allocation:Onboard];[Type:Mandatory]

All CCO equipment shall be compliant with the requirements of [TSI-L&P] for environmental conditions.

The CCO equipment shall meet the same Categories for environmental conditions as the Unit to which it is fitted.

[END_REQ]

[REQ:IE-CLASSB_00416];[Allocation:Onboard];[Type:Mandatory]

All modification to the Unit to which CCO is fitted as well as their impact on non-modified elements of the vehicle shall be compliant with the requirements of [TSI-L&P].

Note: This includes e.g. effects on vehicle mass and balance, effects on the bogie structure, the structural safety of CCO mounting equipment, the effects of the DMI introduction to the interior layout of the cab, etc.

[END_REQ]

7.5.5. Maintenance Interface

[REQ:IE-CLASSB_00417];[Allocation:Onboard];[Type:Mandatory]

The Maintenance Staff shall be able to interact with the CCO by means of dedicated tools. These tools shall:

- Be protected for use by authorised staff only.
- Allow maintenance staff to upload updated configuration data.
- Allow the download of CCO detected errors.
- Allow the performance of failure diagnostics to identify the root cause of the errors.

[END_REQ]

[REQ:IE-CLASSB_00418];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to ensure that the Wheel Diameter parametrised in the CCO is equal to or greater than the diameter of the actual wheels on the axles to which the CCO tachogenerators are fitted. This Operating Rule shall include the update of the CCO parameters after wheels are turned or changed by maintenance staff.

[END_REQ]

[REQ:IE-CLASSB_00419];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to ensure that prior to undertaking any work or inspection near the DTP Balise Antenna, that the DTP Balise Antenna Isolation Switch is in 'Isolated' position and that the switch is protected against inadvertent turning on by means of an appropriate locking mechanism.

[END_REQ]

Note: The DTP Balise Antenna is an active antenna which should be considered to emit electromagnetic energy at any time while CCO connected to its power supply.

For reasons of health and safety, the RUs and ECMs that control staff working / persons being present in the vicinity of the DTP Balise Antenna are required to perform an associated risk assessment in accordance with the relevant health and safety legislation and standards.

[REQ:IE-CLASSB_00420];[Allocation:Application Condition];[Type:Mandatory]

Maintenance requirements, tasks and intervals shall be defined based on a risk assessment compliant with the requirements of [EN501265], [EN50128], [EN50129] and [CSM_402].

[END_REQ]

Note: CCO is legally defined as being a part of a 'vehicle' and is as such subject to the relevant requirements of the Railway Safety Directive. This includes the requirement for maintenance to be performed by an ECM.

Note: [ECM] sets mandatory minimum requirements for maintenance files and maintenance management systems of freight vehicles. It is highly recommended, that at least the same minimum requirements should be applied to maintenance of the CCO.

7.6. Architecture Requirements for CCO

[REQ:IE-CLASSB_00421];[Allocation:Onboard];[Type:Mandatory]

The architecture of the CCO shall comply with the architecture block diagram defined in section 6.1and must include as stand-alone Class B solution the following components:

- CCO Vital Computing Unit.
- Cab A Driver-Machine Interface (DMI) and associated loudspeaker.
- Cab B Driver-Machine Interface (DMI) and associated loudspeaker (in dual cab configuration).
- Cab A pair of pickup coils, each consisting of normal and reserve receivers.
- Cab B pair of pickup coils, each consisting of normal and reserve receivers (in dual cab configuration).
- Cab A DTP Balise Antenna.
- Cab B DTP Balise Antenna (in dual cab configuration).
- Odometry, including tachogenerators and/or other odometric sensors.
- Emergency brake demand contacts.
- Emergency brake demand output relay read-back contacts.
- Service brake demand contact (if configured).
- Traction cut-off demand contact (if configured).
- Cab A direction controller forward input contact.
- Cab B direction controller forward input contact (in dual cab configuration).
- Cab A direction controller reverse input contact.
- Cab B direction controller reverse input contact (in dual cab configuration).
- Cab A traction controller (or combined traction/brake controller) contact for traction active status.
- Cab B traction controller (or combined traction/brake controller) contact for traction active status (in dual cab configuration).
- Cab A selection input contact.
- Cab B selection input contact (in dual cab configuration).
- Cab A Bypass-switch.
- Cab B Bypass-switch (in dual cab configuration).
- Juridical Recording Unit.
- Power supply input.
- Main Circuit Breaker.
- DTP Balise Antenna Isolation Switch (isolating all DTP Balise Antennae connected to CCO).

[END_REQ]

[REQ:IE-CLASSB_00422];[Allocation:Onboard];[Type:Mandatory]

The following equipment may be shared, or partially shared, between CCO subsystem functions and Rolling Stock subsystem functions, as long as they meet both the requirements from this IRS, and any related Rolling Stock requirements:

- Tachogenerators or other odometric sensors.
- Service brake.
- Traction cut-off.
- Emergency brake.

- Cab selection.
- Traction controller or combined traction/brake controller.
- Direction controller.
- Juridical Recording Unit.

[END_REQ]

[REQ:IE-CLASSB_00423];[Allocation:Onboard];[Type:Mandatory]

The CCO Vital Computing Unit, DMI, DTP Balise Antenna must be permanently marked with a serial number, a hardware version and a software version baseline (BL), which must always match with the actual CCO hardware or software. It must be possible to identify this information without the need to use tools or to extract equipment from its mounting position.

[END_REQ]

[REQ:IE-CLASSB_00424];[Allocation:Onboard];[Type:Mandatory]

The CCO subsystem shall comply with the response time requirements defined in section 5.2 of [Subset-041] in relation to DTP Balise Antenna functionality.

[END_REQ]

[REQ:IE-CLASSB_00425];[Allocation:Onboard];[Type:Mandatory]

A secured DTP Balise Antenna Isolation Switch shall be installed to ensure that the DTP Balise Antenna can be powered off, and can be powered on only by authorised personnel, when maintenance or inspections are undertaken in the vicinity of the DTP Balise Antenna.

[END_REQ]

[REQ:IE-CLASSB_00426];[Allocation:Onboard];[Type:Mandatory]

The DTP Balise Antenna Isolation Switch shall present two positions: 'Balise Antenna Isolated' and 'Balise Antenna Active'. DTP Balise Antenna shall not be powered when the isolation switch is in 'Balise Antenna Isolated' position.

[END_REQ]

7.7. Reliability Requirements for CCO

Note: The operation of CCO in degraded condition (e.g. BYPASS or DTP_E modes) is considered to have an impact on the overall safety level of the Railway System. It is therefore necessary to specify a minimum requirement for reliability of CCO.

[REQ:IE-CLASSB_00427];[Allocation:Onboard];[Type:Mandatory]

The CCO shall comply with the following minimum Mean Time Between Failures affecting the operational service:

- The theoretical mean time of hours of operation between failures of a CCO requiring the entry into BYPASS mode shall be more than 43,500 operational hours.
- The theoretical mean time of hours of operation between service affecting failures of a CCO shall be more than 21,750 operational hours. A service affecting failure is defined as failure which has an immediate effect or restriction on the operational use of the train.

[END_REQ]

7.8. Requirements for Class B Specific Transmission Module

[REQ:IE-CLASSB_00428];[Allocation:Onboard];[Type:Mandatory]

A Specific Transmission Module shall fulfil:

- All the requirements for CCO interfaces to the CCT Class B system as defined in this IRS.
- All the requirements for functions and CCO Operating Modes of the CCO as defined in this IRS.
- All the requirements for the interface between the driver and CCO as defined in this IRS.

[END_REQ]

Note: This considers both the requirements of Class B and Class A systems as mentioned in section 3.2.1.6 of [SUB-035].

8. Control Command and Signalling Trackside (CCT) Requirements

8.1. Requirements applicable to ALL CCT Areas

8.1.1. General Requirements for CCT

[REQ:IE-CLASSB_00429];[Allocation:Trackside];[Type:Mandatory]
The CCT requirements indicated in this section shall be read in conjunction with the CCO requirements indicated in sections 6 and 7 of this document.
[END_REQ]

[REQ:IE-CLASSB_00430];[Allocation:Trackside];[Type:Mandatory]
The CCT shall not interfere adversely with any other Class A or Class B CCO or CCT systems, which are operated in IRL at the time of placing CCT in service. This shall be demonstrated based on the relevant requirement of [TSI-OPE], [TSI-CCS], [IRS-EMC], and consider the actual application of these systems.
[END_REQ]

[REQ:IE-CLASSB_00431];[Allocation:Application Condition];[Type:Mandatory]
Every SRAC indicated in this document requiring information or training of staff shall, in accordance with [CSM402], be transferred to the relevant actors, through suitable means.
[END_REQ]

[REQ:IE-CLASSB_00432];[Allocation:Application Condition];[Type:Mandatory]
SRAC: An Operating Rule shall be established to ensure that IMs inform all RUs operating on their network at least six months before a change to the technical or operation requirements related to CCO becomes effective.
[END_REQ]

Note: This could relate to a change of CCO pre-configured parameters or the introduction of a change of CCT area fitment, or the introduction of a new / modified CCO functionality.

This would usually be driven by a preceding modification of this IRS.

[REQ:IE-CLASSB_00433];[Allocation:Application Condition];[Type:Mandatory]
SRAC: Maintenance Procedures shall be produced to define the rules applicable to IMs for maintaining the CCT equipment to ensure ongoing fulfilment of all requirements of this IRS for CCT.
[END_REQ]

8.1.2. CCT fitment and transitions between CCT areas

[REQ:IE-CLASSB_00434];[Allocation:Trackside];[Type:Mandatory]
All areas on the network in IE shall be fitted with one of the CCT equipment types as defined in this IRS: DTP, DTP+ 50Hz CODE, DTP + 83.3Hz CODE, 83.3Hz CODE, 50Hz CODE, or be Unfitted.
[END_REQ]

[REQ:IE-CLASSB_00435];[Allocation:Trackside];[Type:Mandatory]
CCT fitment areas shall always be large, systematic and integrated sections of the network, in order to facilitate the drivers to maintain the associated route knowledge.

[END_REQ]

[REQ:IE-CLASSB_00436];[Allocation:Trackside];[Type:Mandatory]
CCT fitment on single isolated signals, buffer stops or small areas of track shall not be permitted.
[END_REQ]

Note: Fitting isolated signals does not provide efficient protection unless at least the previous signal is also fitted.

[REQ:IE-CLASSB_00437];[Allocation:Trackside];[Type:Mandatory]
All transition locations between CCT areas (and where relevant between CCT areas and neighbouring IM networks) must be fitted with the necessary CCT transition equipment as defined in this IRS.
[END_REQ]

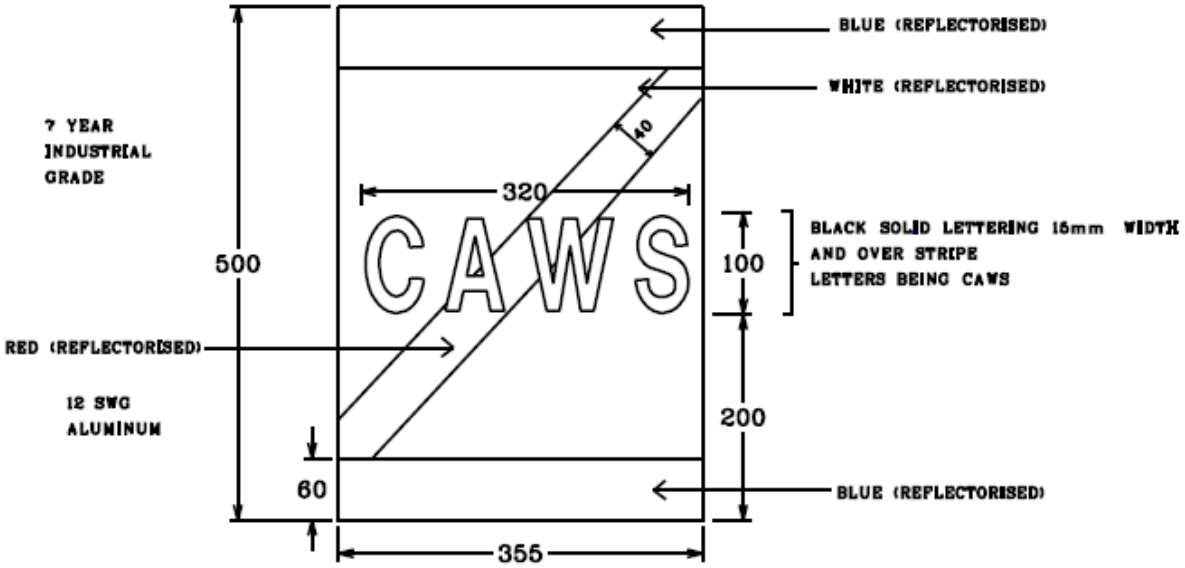
[REQ:IE-CLASSB_00438];[Allocation:Application Condition];[Type:Mandatory]
SRAC: An Operating Rule shall be established to ensure that all CCT areas and transition locations between these CCT areas (and where relevant between these CCT areas and neighbouring IM networks) are published in the IM network statements and made available for the preparation of the Route Book according to [TSI-OPE].
[END_REQ]

[REQ:IE-CLASSB_00439];[Allocation:Application Condition];[Type:Mandatory]
SRAC: An Operating Rule shall be established to ensure that any change to the fitment of an area or the location of the CCT area transitions shall be published in the IM Network Statement at least 6 months before the change becomes effective.
[END_REQ]

[REQ:IE-CLASSB_00440];[Allocation:Trackside];[Type:Mandatory]
From the date of publication of this IRS, any new fitment or modification of CCT areas of the Railway Network shall only create DTP, DTP+50Hz CODE or DTP+83.3Hz CODE CCT areas.
[END_REQ]

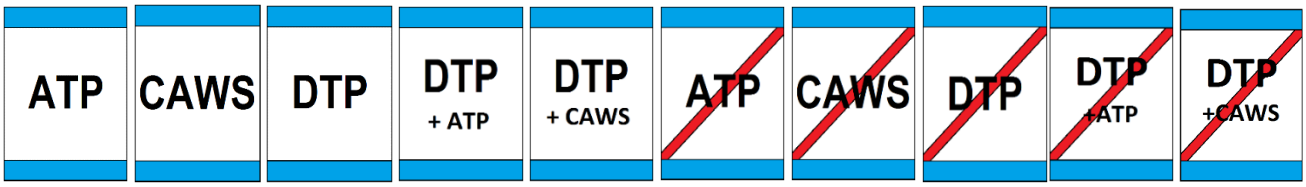
[REQ:IE-CLASSB_00441];[Allocation:Trackside];[Type:Mandatory]
Lineside CCT area change marker boards shall be fitted at all transition locations. The position of the marker boards shall be such that the CCO reaction to the transition and the sighting of the marker board by the driver occur at approximately the same time, to the extent that this is practical.
[END_REQ]

[REQ:IE-CLASSB_00442];[Allocation:Trackside];[Type:Mandatory]
The lineside marker board located at the transition location shall follow the definitions illustrated in the following drawing (all dimensions in mm):



[END_REQ]

Note: In a future version of this IRS, the complete set of lineside marker boards will be developed and may consider the following illustrative designs:



[REQ:IE-CLASSB_00443];[Allocation:Trackside];[Type:Mandatory]

The retroreflective colours (other than white) of the CCT lineside marker boards shall be Diamond Grade reflectivity. Retroreflective white should be High Intensity Grade reflectivity.

[END_REQ]

[REQ:IE-CLASSB_00444];[Allocation:Trackside];[Type:Mandatory]

The following colour specifications shall be used for the CCT lineside marker boards:

- Red = Signal Red to BS381C-537 with RGB = 183, 61, 55.
- Blue = Middle Blue to BS381C-109 with RGB = 46, 96, 124.
- White = RGB 255, 255, 255

[END_REQ]

[REQ:IE-CLASSB_00445];[Allocation:Trackside];[Type:Mandatory]

Transition Balise Groups shall be fitted at all CCT transitions, except for transition from UNFITTED to 50Hz or to 83.3Hz CCT areas.

[END_REQ]

Note: Positions and information sent from the transition balise groups will be specified in a future version of this IRS.

[REQ:IE-CLASSB_00446];[Allocation:Trackside];[Type:Mandatory]

The location of transitions between CCT areas shall be chosen such that no CCT information, other than the

information associated with the transition, is transmitted to the CCO until the transition is completed.

[END_REQ]

Note: The full definition of transition fitment requirements will be given in a future version of this document (e.g. time, speed, braking performance and location relationships).

[REQ:IE-CLASSB_00447];[Allocation:Trackside];[Type:Mandatory]

At transitions from Unfitted to 83.3Hz CCT areas, beginning at the point of transition, the code transmitted on the track circuits of a track section of minimum length 300m and normally not longer than 350m, shall be associated with both:

- The most restrictive applicable ATP Speed over each track circuit transmitting a code, and
- A green signal aspect.

This requires a systematic integration of transition points into the network.

[END_REQ]

Note: In 83.3 Hz CCT areas, 75, 180, and 420 PPM code names relate to a "green" aspect. CCT needs to transmit this aspect to permit Trains operated with historical CAWS CCO equipment existing before the release of this IRS, to perform the transition into the 83.3Hz CCT area.

8.1.3. CCO Operating Mode per CCT Area

[REQ:IE-CLASSB_00448];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to ensure that drivers are trained and made aware of the safety implication of operating a Train in each permitted CCO Operating Mode.
Table 11 below cross is a summarising overview of the compatibility of the CCO Operating Modes with the CCT areas.

These shall also consider additional conditions and Operating Rules for Train operation, which may be have been defined in this IRS or in [TSI-OPE], or from other sources.

	Unfitted	50Hz	83.3 Hz	DTP	DTP+ 50Hz CODE	DTP+ 83.3Hz CODE
CCO Operating Modes which are compatible with any CCT area						
AUTOTEST	✓	✓	✓	✓	✓	✓
MAINTENANCE	✓	✓	✓	✓	✓	✓
NO_CAB_SELECTED	✓	✓	✓	✓	✓	✓
CAB_SELECTED	✓	✓	✓	✓	✓	✓
FORWARD_SHUNTING	✓	✓	✓	✓	✓	✓
REVERSE_SHUNTING	✓	✓	✓	✓	✓	✓
STAFF_RESPONSIBLE	✓	✓	✓	✓	✓	✓
DTP_E	✓	✓	✓	✓	✓	✓
BYPASS	✓	✓	✓	✓	✓	✓
CCO Operating Modes which are only compatible with specific CCT areas						
UNFITTED	✓					
CAWS		✓				

	Unfitted	50Hz	83.3 Hz	DTP	DTP+ 50Hz CODE	DTP+ 83.3Hz CODE
ATP			✓			
DTP				✓		
DTP+CODE					✓	✓
DTP+CODE_E				✓		
DTP_E+ATP			✓(1)			
Permitted degraded CCO Operating Modes which are only compatible with specific CCT areas						
DTP_E+CAWS		✓			✓	
Notes: (1) DTP_E+ATP mode is only compatible with 83.3Hz CCT area based on the limited scope of application covered by this version of this IRS. This will be reconsidered in a future version of the document.						

Table 11 - Compatibility of CCO Operating Mode with CCT areas
[END_REQ]

8.1.4. Design requirements for CCT areas to support CCO functions

[REQ:IE-CLASSB_00449];[Allocation:Trackside];[Type:Mandatory]
Table 12 provides the list of functions that shall be made available to the CCO by the CCT design depending on the type of CCT area.
CCT shall provide all the necessary information for the referenced CCO functions.

	Unfitted	50Hz	83.3 Hz	DTP	DTP+ 50Hz	DTP+ 83.3Hz
ATP_Speed_Determination			✓			
DTP_Signalling_Speed_Determination				✓	✓	✓
DTP_Line_Speed_Determination				✓	✓	✓
CCO_Operating_Mode_Speed_Determination	✓	✓	✓	✓	✓	✓
Max_Train_Speed_Determination	✓	✓	✓	✓	✓	✓
DTP_Temporary_Speed_Restriction_Speed_Determination				✓	✓	✓
Train_Speed_Monitoring	✓	✓	✓	✓	✓	✓
Running_Release		✓	✓			
Stop_Override				✓	✓	✓
Train_Stop				✓	✓	✓
Balise_Group_Management	✓	✓	✓	✓	✓	✓
Continuous_Code_Management		✓	✓		✓	✓
Odometry	✓	✓	✓	✓	✓	✓
Braking_Management	✓	✓	✓	✓	✓	✓
Entry_Forward_Shunting	✓	✓	✓	✓	✓	✓
Exit_Forward_Shunting	✓	✓	✓	✓	✓	✓
Entry_Reverse_Shunting	✓	✓	✓	✓	✓	✓
Exit_Reverse_Shunting	✓	✓	✓	✓	✓	✓
DTP_Inclusion	✓	✓	✓	✓	✓	✓

	Unfitted	50Hz	83.3 Hz	DTP	DTP+ 50Hz	DTP+ 83.3Hz
DTP_Exclusion	✓	✓	✓	✓	✓	✓
Brake_Connectivity_Test	✓	✓	✓	✓	✓	✓
Permanent_Test	✓	✓	✓	✓	✓	✓
Roll_Away_Protection	✓	✓	✓	✓	✓	✓
Direction_Supervision	✓	✓	✓	✓	✓	✓
Reverse_Movement_Protection	✓	✓	✓	✓	✓	✓
Forward_Movement_Protection	✓	✓	✓	✓	✓	✓
Data_Entry	✓	✓	✓	✓	✓	✓
Start_Against_Signal_Reminder		✓	✓			
CODE_Carrier_Reset		✓	✓		✓	✓
Mode_Transition_Acknowledgement	✓	✓	✓	✓	✓	✓
CAWS_Mode_Transition_Acknowledgement		✓				
Error_Management	✓	✓	✓	✓	✓	✓
Error_Management_Acknowledgement	✓	✓	✓	✓	✓	✓
Service_Brake_Efficiency	✓	✓	✓	✓	✓	✓
Juridical_Recording	✓	✓	✓	✓	✓	✓
Speed_Display			✓	✓	✓	✓
CAWS_Aspect_Display		✓				

Table 12 - Compatibility of CCO functions with CCT areas

[END_REQ]

[REQ:IE-CLASSB_00450];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An operating rule shall be established to ensure that the enforcement of Temporary Speed Restrictions rely on Operational Rules and the use of DTP Temporary Speed Restriction Balise Groups shall not be authorised until a future version of this IRS is released and specifies its application conditions.

[END_REQ]

8.1.5. Safety integrity for CCT requirements

[REQ:IE-CLASSB_00451];[Allocation:Trackside];[Type:Mandatory]

The CCT requirements shall be implemented with a level of safety integrity which is necessary to support the SIL targets of the related CCO functions, as identified in Table 7. The allocation and demonstration of SIL achievement shall follow the requirements of [CSM402], [50126], [50128], and [50129].

[END_REQ]

[REQ:IE-CLASSB_00452];[Allocation:Trackside];[Type:Mandatory]

The level of safety integrity associated with any other CCT requirement shall be allocated and its achievement shall be demonstrated in accordance with the requirements of [CSM402], [50126], [50128], and [50129].

[END_REQ]

8.1.6. Airgap

[REQ:IE-CLASSB_00453];[Allocation:Trackside];[Type:Mandatory]

The CCT system shall be compliant and compatible with the requirements and interfaces described in [IRS-AIRGAP].
[END_REQ]

8.2. 83.3Hz CCT Area Requirements

[REQ:IE-CLASSB_00454];[Allocation:Trackside];[Type:Mandatory]
In an 83.3Hz area, the CCT shall send to the CCO the code associated with:

- The ATP Speed, as defined in section 7.4.7.
- A signal aspect as defined in other requirements of this sub section.
- A stop demand (No Code) caused by
    - a technical fault,
    - a revocation of a movement authority.

This information shall be sent in accordance with [IRS-AIRGAP], through coded track-circuits.
[END_REQ]

[REQ:IE-CLASSB_00455];[Allocation:Trackside];[Type:Mandatory]
Where a route has been set from a first signal to a second signal and a Train has passed the first signal with a "proceed" aspect, the code on the track circuits beyond that first signal, and up to the beginning of the Berth Track circuit of the second signal, shall be associated with both:

- The most restrictive applicable ATP Speed over each track circuit transmitting a code.
- The signal aspect that was displayed in the first signal when the front of Train passed it.

Where the aspect of the second signal changes after the Train has passed the first signal, the code on the track circuits beyond that first signal, and up to the beginning of the Berth Track of the second signal, shall be changed to reflect both:

- The most restrictive applicable ATP Speed over each track circuit transmitting a code.
- The signal aspect that would have been displayed in the first signal if the Train had not already passed it.

[END_REQ]

Note: the term "Berth Track" is defined in section 0.

[REQ:IE-CLASSB_00456];[Allocation:Trackside];[Type:Mandatory]
Where a signal is displaying a stop aspect, No Code shall be sent on the Berth Track associated with that signal.
[END_REQ]

[REQ:IE-CLASSB_00457];[Allocation:Trackside];[Type:Mandatory]
Where a signal is displaying a "proceed" aspect, the code on the Berth Track of this signal shall be associated with both:

- The most restrictive applicable ATP Speed over each track circuit of that Berth Track transmitting the code.
- The signal aspect that is displayed by that signal.

[END_REQ]

[REQ:IE-CLASSB_00458];[Allocation:Trackside];[Type:Mandatory]

Where a signal is displaying a stop aspect, the code on the Pre-Berth Track of that signal shall be associated with both following conditions:

- The most restrictive applicable ATP Speed (50km/h or 30km/h) over each track circuit of that pre-berth track transmitting the code.
- A yellow signal aspect.

[END_REQ]

Note: the term "pre-berth" track is defined in section 4.

[REQ:IE-CLASSB_00459];[Allocation:Trackside];[Type:Mandatory]

Where 83.3Hz CCT is fitted for ATP operation only (i.e. not DTP + 83.3Hz CCT fitment), the following elements shall be defined in accordance with the requirements of [CSM402], [50126], [50128], and [50129]:

- The distance from each code downgrade location to the associated red signal.
- The ATP speed at each code downgrade location.
- A Set of Minimum ATP Performance Values, required for compatibility with any Actual Train Consist operating in ATP or DTP_E+ATP mode, consisting of
    - Train Emergency Brake Response Time,
    - Train Emergency Brake Deceleration,
    - Train Service Brake Response Time,
    - Train Service Brake Deceleration.

The calculation shall take into consideration the CCO system reaction times, including code detection and evaluation times.

[END_REQ]

Note: A standard definition for the Set of Minimum ATP Performance Values will be included in the future version of this document.

[REQ:IE-CLASSB_00460];[Allocation:Application Condition];[Type:Mandatory]

SRAC: An Operating Rule shall be established to ensure that any Train operating in ATP or DTP_E+ATP mode meets the Set of Minimum ATP Performance Values.

[END_REQ]

[REQ:IE-CLASSB_00461];[Allocation:Trackside];[Type:Mandatory]

The signals positions, the aspect sequences, and associated locations for code downgrades shall be compatible with the Set of Minimum ATP Performance Values, and risk assessed at project level in accordance with the requirements of [CSM402], [50126], [50128], and [50129].

[END_REQ]

Note: Inside 83.3Hz CCT area, the positioning of the signals and the aspects of these signals should be defined such that CAWS warnings are provided with sufficient anticipation to the drivers of trains operating any Actual Train Consist which is fitted with the historic Class B CAWS system. This intends to reduce the likelihood of such Trains overrunning the point protected by the signalling system if the driver does not acknowledge an aspect downgrade.

[REQ:IE-CLASSB_00462];[Allocation:Trackside];[Type:Mandatory]

The CCT shall send the applicable ATP Speed and signal aspect information to the CCO, in accordance with [IRS-AIRGAP], through 83.3Hz C2 carrier. The modulation of the C2 carrier shall respect the following table.

C2 – 83.3Hz Carrier		
Code Name	ATP Speed [km/h]	Signal Aspect
No Code (with or without carrier)	0	Red
50 Code	30	Yellow
75 Code	30	Green
120 Code	50	Yellow
180 Code	50	Green
270 Code	75	Double Yellow
420 Code	100	Green

Table 13 - 83.3Hz code interpretation

[END_REQ]

[REQ:IE-CLASSB_00463];[Allocation:Onboard];[Type:Mandatory]

At locations in 83.3Hz CCT areas where a Train passes a point at which there is an increase in ATP Speed because of an increase in the Civil Line Speed, the trackside design shall ensure that the higher ATP Speed is not transmitted to the Train until the rear of the Train has passed the point at which the Civil Line Speed increases.

This shall be done by defining an appropriate location for that track circuit boundary, beyond the actual Civil Line Speed increase point, at which the increase is transmitted to the Train.

[END_REQ]

[REQ:IE-CLASSB_00464];[Allocation:Trackside];[Type:Mandatory]

No Balise shall be installed within a CCT 83.3Hz area until a future version of this IRS is produced. For the avoidance of doubt, this restriction forbids the installation of Balise Groups for ordering CCO Operating Mode transitions or enforcing DTP Temporary Speed Restrictions.

[END_REQ]

8.3. 50Hz CCT Area Requirements

To be further defined in a future version of the document

[REQ:IE-CLASSB_00465];[Allocation:Onboard];[Type:Mandatory]

The CCT shall send the applicable signal aspect information to the CCO, in accordance with [IRS-AIRGAP], through 50Hz C1 carrier. The modulation of the carrier C1 shall respect the following table.

C1 – 50 Hz Carrier	
Code Name	Signal Aspect
No Code (with or without carrier)	Red
50 Code	Yellow
120 Code	Double Yellow
180 Code	Green

Table 14 - 50Hz code interpretation

[END_REQ]

8.4. DTP CCT Area Requirements

To be defined in a future version of the document

8.5. DTP + 83.3Hz CCT Area Requirements

To be defined in a future version of the document

8.6. DTP + 50Hz CCT Area Requirements

To be defined in a future version of the document

9. Further Clarification

Further clarification can be sought from the CRR by phone at +353 1 206 8110 or by email info@crr.ie.

10. List of Participants

The participants for each revision of this IRS are shown below in Table 15.

Table 15 - List of Participants by Revision

Participant Name and Organisation		**Involved in Issue A**		
Francois Pignard	IÉ-IM	✓		
Michael Neale	CRR	✓		
Maik Wuttke	CRR	✓		
Paraic O'Lochlainn	IÉ-IM	✓		