

# CONTROL COMMAND AND SIGNALLING

**COMMISSION REGULATION (EU) NO 2016/919**  
ENTRY INTO FORCE: 27/05/2016

## WHAT DOES IT CONCERN TO?

This TSI concerns the control command and signalling on-board and trackside subsystems. It applies to control-command and signalling on-board subsystems of vehicles which are (or are intended to be) operated on and control-command and signalling trackside subsystems of the rail network of the EU.

## ESSENTIAL REQUIREMENTS

- Safety
- Reliability and availability
- Health
- Environmental protection
- Technical compatibility
- Accessibility

## WHAT DOES IT CONTAIN?

- Introduction with the technical, risk, and geographical scopes
- Definitions of the subsystem and of the scope
- Essential requirements
- Characteristics of the subsystem, particularly the functional and technical specifications of the subsystem and of the interfaces
- Interoperability constituents
- Assessment of conformity and/or suitability for use of the constituents and verification of the subsystem
- Implementation

## PARTICULAR CASES DEPENDING ON THE COUNTRY

They are divided in 'Permanent' and 'Temporary' cases.

Belgium, France, Lithuania, Poland, Sweden, The Netherlands, UK.

## FUNCTIONAL AND TECHNICAL SPECIFICATIONS

### ETCS-ID MANAGEMENT

It specifies the concerns the ETCS-identities (ETCS-IDs) for equipment in Control-Command and Signalling Trackside and On-board Subsystems. The requirements are specified in Index 23 ([SoS#1](#), [SoS#2](#), [SoS#3](#)).

### VISIBILITY OF TRACKSIDE CCS OBJECTS

It describes the characteristics of retro-reflecting signs to ensure correct visibility and the characteristics of interoperable marker boards. See Index 38 ([SoS#1](#), [SoS#2](#), [SoS#3](#))

## TECHNICAL SCOPE

The CCS TSI concerns the Control Command and Signalling On-board Subsystem and the Control-Command and Signalling Trackside Subsystem of vehicles which are one of the following types:

- locomotives and passenger rolling stock, including thermal or electric traction units, self-propelling thermal or electric passenger trains, and passenger coach, if equipped with a driving cab.
- special vehicles, such as on-track machines, if equipped with a driving cab and intended to be used in transport mode on its own wheels.

## ASSESSING THE CONFORMITY AND/OR SUITABILITY FOR USE OF THE CONSTITUENTS AND VERIFYING THE SUBSYSTEMS

### INTEROPERABILITY CONSTITUENTS

**Trackside Subsystem/ On-board subsystem:**

**The Specific Transmission Module(STM):**

For verifying the CCS Trackside Subsystem, the applicant may choose either:

- Module SB: For the design and development phase;
- Module SD: For the production phase;
- Module SF: For the product verification procedure;
- Module SG: unit verification procedure;
- Module SH1: For the design examination procedure

### SPECIAL ISSUES

**Mandatory tests for the on-board ETCS:** Particular attention shall be given to assessing the conformity of the on-board ETCS interoperability constituent, since it is complex and plays a key role in achieving interoperability.

**The Specific Transmission Module(STM):**

Each Member State shall be responsible for verifying that STMs conform to its national requirements.

## GEOGRAPHICAL SCOPE

The geographical scope of this TSI is the network of the whole rail system.

The TSI shall apply to networks with the following track gauges:

- 1435 mm;
- 1520 mm;
- 1524 mm;
- 1600 mm;
- 1668 mm.

It shall not apply to short border crossing lines with 1520 mm track gauges that are connected to the network of third countries.

### PRINCIPLES FOR TESTING ETCS AND GSM-R

**Requirements for Operational test scenarios** shall be sufficient to describe all intended system operations relevant for the Trackside CCS Subsystem in normal and identified degraded situations.

**Requirements for ETCS System Compatibility:**

- IMs, with the support of the ETCS suppliers for their network, shall submit to the Agency the definition of the necessary checks on their network by 16 January 2020 at the latest.
- IMs shall classify the ETCS lines according to ESC types in RINF.
- IMs shall submit to the Agency any changes on the referred checks for their network.

**Requirements for Radio System Compatibility:**

- IMs, with the support of the GSM-R suppliers for their network, shall submit to the Agency the definition of the necessary checks on their network by 16 January 2020 at the latest.
- IMs shall classify their lines according to RSC types for voice and, if applicable, ETCS data in RINF.
- IMs shall submit to the Agency any changes on the referred checks for their network.

### MAINTENANCE RULES

The responsibility of the applicant for subsystem verification is:

- Ensure that the maintenance requirements are defined for all components of whether or not they are interoperability constituents;
- Complete the above requirements taking into account the risks arising from interactions between different components of the subsystem and interfaces to other subsystems.

What is a TSI? Is a document that defines the technical and operational standards which must be met by each subsystem or part of subsystem in order to meet the essential requirements and ensure the interoperability of the railway system of the European Union.

For each of those subsystems, the essential requirements need to be specified and the technical specifications determined, particularly in respect of constituents and interfaces, in order to meet those essential requirements. <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016L0797&from=EN>

This document is for information purposes only, for official information go to [https://www.era.europa.eu/activities/technical-specifications-interoperability\\_en](https://www.era.europa.eu/activities/technical-specifications-interoperability_en)

In case of doubt please contact [tecsteam@eimrail.org](mailto:tecsteam@eimrail.org)

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## FUNCTIONAL AND TECHNICAL SPECIFICATIONS

### CCS RELIABILITY, AVAILABILITY AND SAFETY CHARACTERISTICS RELEVANT TO INTEROPERABILITY

To ensure interoperability the following provisions shall be respected:

- The design, implementation and use of a Control-Command and Signalling On-board or Trackside subsystem shall not export any requirements:
  - across the interface between Control-Command and Signalling On-board and Trackside subsystems in addition to the requirements specified in the CCS TSI;
  - to any other subsystem in addition to the requirements specified in the corresponding TSIs.
- Safety and reliability shall be respected

### ON-BOARD ETCS FUNCTIONALITY

The primary function is to provide automatic train protection and cab signalling:

- setting the train characteristics;
- selecting the supervision mode on the basis of information from trackside;
- performing odometry functions;
- locating the train in a coordinate system based on Eurobalise locations;
- calculating the dynamic speed profile for its mission on the basis of train characteristics and of information from trackside;
- supervising the dynamic speed profile during the mission;
- providing the intervention function.

These functions shall be implemented in accordance to Index 1 (SoS#1), Index 4 (SoS#1, SoS#2, SoS#3), Index 13 (SoS#1, SoS#2, SoS#3), Index 15 (SoS#1) and Index 60 (SoS#2, SoS#3). Their performance shall conform to Index 14 (SoS#1, SoS#2, SoS#3)

The requirements for tests are specified in Index 31 (SoS#1, SoS#2, SoS#3), Index 37b (SoS#1, SoS#2, SoS#3), Index 37c (SoS#1, SoS#2, SoS#3), Index 37d (SoS#1, SoS#2, SoS#3).

### KEY MANAGEMENT

It specifies requirements for the management of cryptographic keys used for the protection of data transmitted via radio. Its requirements are specified in Index 11 (SoS#1, SoS#2, SoS#3) Index 79 (SoS#2, SoS#3) and Index 83 (SoS#3).

### TRACKSIDE ETCS FUNCTIONALITY

The main functionality to provide a safe path is:

- locating a specific train in a coordinate system based on Eurobalise locations;
- translating the information from trackside signalling equipment into a standard format for the Control-Command and Signalling On-board Subsystem;
- sending movement authorities including track description and orders assigned to a specific train.

These functions shall be implemented in accordance with Index 1 (SoS#1), Index 4 (SoS#1, SoS#2, SoS#3), Index 13 (SoS#1, SoS#2, SoS#3), Index 15 (SoS#1) and Index 60 (SoS#2, SoS#3). Their performance shall conform to Index 14 (SoS#1, SoS#2, SoS#3).

The main functionality is supported by the following specifications, to which previous specifications also apply:

- communicating with the CCS On-board Subsystem. This includes:
  - Eurobalise data transmission;
  - Euroloop data transmission is only relevant in level 1, in which it is optional;
  - Radio data transmission for radio infill which is only relevant to level 1, in which it is optional.
  - Radio data transmission which is only relevant to level 2 and 3.
- generating information/orders to the on-board ETCS. The implementation of this functionality is optional for trackside; it can however be required by other applicable TSIs or national rules or the application of risk evaluation and assessment to ensure safe integration of subsystems;
- managing the transitions between areas supervised by different Radio Block Centres (RBCs) only relevant for level 2 and level 3.

### MOBILE COMMUNICATION FUNCTIONS FOR RAILWAYS GSM-R

This basic parameter describes the radio communication functions that shall be implemented On-board and Trackside subsystems.

**Basic communication function:**

The general requirements are specified in Index 64 (SoS#1, SoS#2, SoS#3) and Index 65 (SoS#1, SoS#2, SoS#3)

The following specifications shall be respected:

- ASCII features, see Index 66 (SoS#1, SoS#2, SoS#3);
- SIM card, see Index 67 (SoS#1, SoS#2, SoS#3)
- location-dependent addressing, see Index 73 (SoS#1, SoS#2, SoS#3) and Index 74 (SoS#1, SoS#2, SoS#3).

**Voice and operational communication applications:**

For the general requirements see Index 32 (SoS#1, SoS#2, SoS#3) and Index 33 (SoS#1, SoS#2, SoS#3).

The following specifications shall be respected:

- confirmation of high priority calls, see Index 69 (SoS#1, SoS#2, SoS#3) and Index 70 (SoS#1, SoS#2, SoS#3).
- functional addressing, see Index 71 (SoS#1, SoS#2, SoS#3) and Index 72 (SoS#1, SoS#2, SoS#3).
- presentation of functional numbers, see Index 75 (SoS#1, SoS#2, SoS#3) and Index 76 (SoS#1, SoS#2, SoS#3).
- User-to-User Signalling, see Index 68 (SoS#1, SoS#2, SoS#3).

**Data communication applications for ETCS:**

For the general requirements see Index 32 (SoS#1, SoS#2, SoS#3) and Index 33 (SoS#1, SoS#2, SoS#3).

The 'data radio communication' part of the On-board Subsystem shall be able to support the establishment of at least two simultaneous communication sessions with the Trackside Subsystem.

This functionality is mandatory only in the case of ETCS level 2 and level 3 and radio in-fill applications.

### TRACKSIDE TRAIN DETECTION SYSTEMS

It specifies the interface requirements between the trackside train detection systems and rolling stock, related to vehicle design and operation.

The interface requirements to be respected by the train detection systems are specified in Index 77 (SoS#1, SoS#2, SoS#3).

### ELECTROMAGNETIC COMPATIBILITY BETWEEN ROLLING STOCK AND CCS TRACKSIDE EQUIPMENT

It specifies the interface requirements for electromagnetic compatibility between rolling stock and trackside CCS train detection equipment.

The interface requirements to be respected by the train detection system are specified in Index 77 (SoS#1, SoS#2, SoS#3).

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## FUNCTIONAL AND TECHNICAL SPECIFICATIONS

### ETCS AND GSM-R AIR GAP INTERFACES

This basic parameter specifies the air gap requirements between Trackside and On-board subsystems.

#### Radio communications with the train:

Class A radio communication interfaces shall operate in the frequency band specified in Index 64 ([SoS#1](#), [SoS#2](#), [SoS#3](#)) Index 65 ([SoS#1](#), [SoS#2](#), [SoS#3](#)) Index 32 ([SoS#1](#), [SoS#2](#), [SoS#3](#)) and Index 33 ([SoS#1](#), [SoS#2](#), [SoS#3](#)).

On-board Subsystems shall be protected against interference, fulfilling the requirements specified in Index 32 ([SoS#1](#), [SoS#2](#), [SoS#3](#)) and Index 33 ([SoS#1](#), [SoS#2](#), [SoS#3](#)).

For data communication the protocols shall comply with Index 10 ([SoS#1](#), [SoS#2](#), [SoS#3](#)) Index 39 ([SoS#1](#), [SoS#2](#), [SoS#3](#)) and Index 40 ([SoS#1](#), [SoS#2](#), [SoS#3](#)).

Where radio in-fill is implemented, the requirements stated in Index 19 ([SoS#1](#), [SoS#2](#), [SoS#3](#)) and Index 20 ([SoS#1](#), [SoS#2](#), [SoS#3](#)) shall be respected.

**Eurobalise communication with the train** shall comply with Index 9 ([SoS#1](#), [SoS#2](#), [SoS#3](#)) and Index 43 ([SoS#1](#), [SoS#2](#), [SoS#3](#)).

**Euroloop communication with the train** shall comply Index 16 ([SoS#1](#), [SoS#2](#), [SoS#3](#)) and Index 50 ([SoS#2](#), [SoS#3](#)).

### GSM-R DMI (DRIVER-MACHINE INTERFACE)

It describes the information provided from GSM-R to the driver and entered into the GSM-R on-board by the driver. See Index 32 ([SoS#1](#), [SoS#2](#), [SoS#3](#)) and Index 33 ([SoS#1](#), [SoS#2](#), [SoS#3](#)).

### INTERFACE TO DATA RECORDING FOR REGULATORY PURPOSES

It describes data exchange between the on-board ETCS and the rolling stock recording device, communication protocols, and physical interface. See Index 5 ([SoS#1](#), [SoS#2](#), [SoS#3](#)).

### ON-BOARD INTERFACES INTERNAL TO CCS

#### ETCS and Class B train protection

Where ETCS and Class B train protection functions are installed on-board, the transitions between them can be managed with a standardised interface as specified in Index 8 ([SoS#1](#), [SoS#2](#), [SoS#3](#)) Index 25 ([SoS#1](#), [SoS#2](#), [SoS#3](#)) Index 26 ([SoS#1](#), [SoS#2](#), [SoS#3](#)) Index 36c ([SoS#1](#), [SoS#2](#), [SoS#3](#)) Index 49 ([SoS#1](#), [SoS#2](#), [SoS#3](#)) Index 52 ([SoS#1](#), [SoS#2](#), [SoS#3](#)).

The K interface is specified in Index 29 ([SoS#1](#), [SoS#2](#), [SoS#3](#)) and Index 45 ([SoS#1](#), [SoS#2](#), [SoS#3](#)). The G interface is specified in Index 46 ([SoS#1](#), [SoS#2](#), [SoS#3](#)). Implementation of Interface 'K' is optional, but if implemented it should comply with all the previous specifications.

#### Interface between GSM-R Radio Data Communication and ETCS

The requirements for the interface between the Class A radio and the on-board ETCS functionality are specified in Index 34 ([SoS#1](#), [SoS#2](#), [SoS#3](#)).

Where radio in-fill is implemented the requirements stated in Index 20 ([SoS#1](#), [SoS#2](#), [SoS#3](#)) shall be respected.

### ETCS AND GSM-R AIR GAP INTERFACES

This basic parameter specifies the air gap requirements between Trackside and On-board subsystems.

#### Radio communications with the train:

Class A radio communication interfaces shall operate in the frequency band specified in Index 64 ([SoS#1](#), [SoS#2](#), [SoS#3](#)) Index 65 ([SoS#1](#), [SoS#2](#), [SoS#3](#)) Index 32 ([SoS#1](#), [SoS#2](#), [SoS#3](#)) and Index 33 ([SoS#1](#), [SoS#2](#), [SoS#3](#)).

On-board Subsystems shall be protected against interference, fulfilling the requirements specified in Index 32 ([SoS#1](#), [SoS#2](#), [SoS#3](#)) and Index 33 ([SoS#1](#), [SoS#2](#), [SoS#3](#)).

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Where radio in-fill is implemented, the requirements stated in Index 19 ([SoS#1](#), [SoS#2](#), [SoS#3](#)) and Index 20 ([SoS#1](#), [SoS#2](#), [SoS#3](#)) shall be respected.

**Eurobalise communication with the train** shall comply with Index 9 ([SoS#1](#), [SoS#2](#), [SoS#3](#)) and Index 43 ([SoS#1](#), [SoS#2](#), [SoS#3](#)).

**Euroloop communication with the train** shall comply Index 16 ([SoS#1](#), [SoS#2](#), [SoS#3](#)) and Index 50 ([SoS#2](#), [SoS#3](#)).

### TRACKSIDE INTERFACES INTERNAL TO CCS

**Functional interface between RBCs** defines the data to be exchanged between neighbouring RBCs to allow the safe movement of a train from one RBC area to the next:

- Information from the 'Handing Over' RBC to the 'Accepting' RBC.
- Information from the 'Accepting' RBC to the 'Handing Over' RBC.

The requirements are specified in Index 12 ([SoS#1](#), [SoS#2](#), [SoS#3](#)).

**RBC/RBC** is the technical interface between two RBCs. The requirements are specified in Index 62 ([SoS#1](#)) and Index 63 ([SoS#1](#), [SoS#2](#), [SoS#3](#)).

**GSM-R/trackside ETCS** is the interface between the Class A radio system and the trackside ETCS functionality. The requirements are specified in Index 34 ([SoS#1](#), [SoS#2](#), [SoS#3](#)).

**Eurobalise/LEU** is the interface between Eurobalise and the LEU. The requirements are specified Index 9 ([SoS#1](#), [SoS#2](#), [SoS#3](#)).

**Euroloop/LEU** is the interface between Euroloop and the LEU. The requirements are specified in Index 16 ([SoS#1](#), [SoS#2](#), [SoS#3](#)).

### ETCS DMI (DRIVER-MACHINE INTERFACE)

It describes the information provided from ETCS to the driver and entered into the on-board ETCS by the driver. See Index 6 ([SoS#1](#), [SoS#2](#), [SoS#3](#)).

### ETCS AND RADIO SYSTEM COMPATIBILITY

Due to the different possible implementations and the status of the migration to fully compliant CCS Subsystems, checks shall be performed in order to demonstrate the technical compatibility between the on-board and trackside CCS Subsystems.

**ETCS System Compatibility (ESC)** shall be the recording of technical compatibility between ETCS on-board and the trackside parts ETCS of the CCS subsystems within an area of use.

**Radio System Compatibility (RSC)** shall be the recording of technical compatibility between voice or data radio on-board and the trackside parts of GSM-R of the CCS subsystems.

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## IMPLEMENTATION

### UPGRADING OR RENEWING THE CC SUBSYSTEMS OR PARTS OF THEM

Changes to an existing On-Board subsystem:

Apply in case of any change(s) to an existing on-board subsystem or on-board subsystem type, including renewal or upgrade. It does not apply to a change that does not introduce a deviation from the technical files accompanying the EC declarations for verification for the subsystems.

There is a set of 14 rules to manage changes in on-board CCS subsystems.

## ETCS SPECIFIC IMPLEMENTATION RULES

### Trackside installations

Trackside shall not install and operate the Euroloop and radio infill data transmission, except on already existing installations or planned projects that use those data transmissions. Such planned projects shall be notified to the European Commission by 30 June 2020.

- High-speed network: It is mandatory to fit ETCS trackside when:
  - installing for the first time the train protection part of a CCS Trackside Subsystem;
  - upgrading the existing train protection part of a CCS Trackside Subsystem, where this would change the functions, performance and/or interoperability-relevant interfaces of the existing legacy system. This does not apply to modifications deemed necessary to mitigate safety-related defects in the legacy installation.

### On-board installations

- New vehicles:
  - New vehicles, including vehicles authorised in conformity to a type shall be equipped with ETCS in accordance with Annex A of the CCS TSI and shall comply with SoS#2 or SoS#3.
  - It does not apply to construction and maintenance equipment, new shunting locomotives or other new vehicles not intended for operating on high-speed lines.
  - All vehicle type authorisations granted based on conformity to SoS#1 shall not remain valid for authorising new vehicles in conformity to those vehicle types.
- Upgrading and renewal of existing vehicles: It is mandatory to fit ETCS on-board existing vehicles if installing any new train protection part of a CCS on-board subsystem on existing high-speed vehicles.
- Application of the CCS TSI requirements for new vehicles during a transition phase:
  - Some projects or contracts, which started before the date of application of the CCS TSI, may lead to apply for an authorisation to put on the market of new vehicles equipped with ETCS complying with SoS#1. For vehicles concerned by those projects or contracts, a transition phase is defined, during which the application of Section "New vehicles" is not mandatory.
  - This transition phase applies to new vehicles authorised in conformity to a vehicle type authorised before **1 January 2019** in any MS on the basis of conformity to set of SoS#1 up to December 31 2020.
  - The transition phase is:
    - to December 31 2020: In order to be placed on the market those new vehicles shall be equipped with ETCS in accordance with SoS#1, SoS#2 or SoS#3.
    - If SoS#1 is used, a condition for use shall be included in their authorisation to put on the market enforcing compliance with SoS#2 or SoS#3 within a period of time not exceeding 1 July 2023.

## TRAIN DETECTION SYSTEMS SPECIFIC IMPLEMENTATION RULES

Train detection system means the equipment installed trackside, which detects the presence or absence of vehicles either on an entire line of route or on a local point of it.

Implementing a train detection system that is compliant with the requirements of the CCS TSI can be done independently of the installation of ETCS or GSM-R.

The requirements of the CCS TSI relating to train detection systems shall be respected when:

- upgrading the train detection system;
- renewing the train detection system, provided that respecting the requirements of the CCS TSI does not imply unwanted modifications or upgrades of other trackside or on-board systems;
- renewing the train detection system, where this is required by the upgrade or renewal of trackside systems that use information from the train detection system;
- removing Class B train protection systems where the train detection and train protection systems are integrated.

In the migration phase care shall be taken to ensure that installing a TSI-compliant train detection system has a minimal negative impact on the existing non-TSI-compliant rolling stock.

To achieve this, it is recommended that the Infrastructure Manager selects a TSI-compliant train detection system that, at the same time, is compatible with the non-TSI-compliant rolling stock already operating on that infrastructure.