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AMENDMENT RECORD

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1. INTRODUCTION

1.1. TECHNICAL SCOPE

This TSI concerns the Control Command and Signalling Subsystem.

1.2. GEOGRAPHICAL SCOPE

The geographical scope of this TSI is the trans-European rail system, i.e., the trans-European conventional and high-speed rail systems as set out in Annex I to Directive 2008/57/EC, points 1 and 2.

1.3. CONTENT OF THIS TSI

In accordance with Article 5(3) of Directive 2008/57/EC, this TSI:

1. indicates its intended scope — Chapter 2 (Subsystem Definition and Scope);
2. lays down essential requirements for the Control-Command and Signalling Subsystem and its interfaces vis-a-vis other subsystems — Chapter 3 (The Essential Requirements of The Control-Command and Signalling Subsystem);
3. establishes the functional and technical specifications to be met by the Subsystem and its interfaces vis-à-vis other Subsystems — Chapter 4 (Characterisation of the Subsystem);
4. determines the interoperability constituents and interfaces which must be covered by European specifications, including European standards, which are necessary to achieve interoperability within the trans-European rail system — Chapter 5 (Interoperability Constituents);
5. states, in each case under consideration, which procedures are to be used in order to assess the conformity or the suitability for use of the interoperability constituents, on the one hand, or the EC verification of the subsystem, on the other hand— Chapter 6 (Assessment of Conformity and/or Suitability For Use of the Constituents and Verification of the Subsystem);
6. indicates the strategy for implementing this TSI. — Chapter 7 (Implementation of the TSI Control-Command and Signalling Subsystem);
7. indicates, for the staff concerned, the professional competences and health and safety conditions at work required for the operation and maintenance of the Subsystem concerned, as well as for the implementation of the TSI — Chapter 4 (Characterisation of the Subsystem).

In accordance with Article 5(5) of the Directive 2008/57/EC, provisions for specific cases are indicated in Chapter 7 (Implementation of the TSI Control-Command and Signalling Subsystem).

This TSI also sets out, in Chapter 4 (Characterisation of the Subsystem), the operating and maintenance rules specific to the scope indicated in paragraphs 1.1 and 1.2 above.

2. SUBSYSTEM DEFINITION AND SCOPE

2.1. INTRODUCTION

The Control-Command and Signalling Subsystem is defined as “all the equipment necessary to ensure safety and to command and control movements of trains authorised to travel on the network”.

The Control-Command and Signalling Subsystem is divided into two parts: Onboard Assembly and Track-side Assembly.

The features of the Control-Command and Signalling Subsystem are:

1. the functions that are essential for the safe control of the railway traffic, and that are essential for the operation, including those required under degraded modes¹,
2. the interfaces,
3. the level of performance required to meet the essential requirements.

2.2. SCOPE

The TSI Control-Command and Signalling specifies only those requirements which are necessary to assure the interoperability of the trans-European rail system and the compliance with the essential requirements.

The Control-Command and Signalling subsystem includes:

1. train protection,
2. radio communication,
3. train detection.

Within each of the above items two classes are defined:

1. Class A: The unified Control-Command and Signalling functions, interfaces and performances, specified in this TSI,
2. Class B: Control-Command and Signalling functions, interfaces and performances existing before the entry in force of this TSI, under the responsibility of the corresponding Member State.

The Class A train protection system is ERTMS/ETCS whilst the Class A radio system is GSM-R.

For Class A train detection this TSI only specifies the requirements for the interface with other subsystems.

For Class B train protection, Specific Transmission Modules (STMs) installed on board allow a train equipped with ERTMS/ETCS to operate on lines fitted with Class B train protection systems.

The requirements for the Onboard Assembly are specified in relation to:

1. Class A radio mobiles,

¹ *Degraded modes: modes of operation to deal with faults, which have been anticipated in the design of the Control-Command and Signalling Subsystem*

2. Class A train protection, including requirements for the interface to be respected by STMs; if solutions other than the use of a standard STM interface are used, a specific (non standard) interface must be implemented for the Class A functions.

The requirements for the Trackside Assembly are specified in relation to:

1. Class A radio network,
2. Class A train protection,
3. Interface requirements for train detection systems, to ensure their compatibility with rolling stock.

2.3. APPLICATION LEVELS (ERTMS/ETCS)

The interfaces specified by this TSI define the means of data transmission to, and where appropriate, from trains. The ERTMS/ETCS specifications referenced by this TSI provide options (application levels) from which a trackside implementation may choose the means of transmission that meet its requirements.

This TSI defines the requirements for all application levels.

A train equipped with Class A On-board train protection for a given application level shall be able to operate on that level and any lower one.

3. THE ESSENTIAL REQUIREMENTS OF THE CONTROL-COMMAND SUBSYSTEM

3.1. GENERAL

The Interoperability Directive 2008/57/EC requires that the Subsystems and the Interoperability Constituents including interfaces meet the Essential Requirements set out in general terms in Annex III to the Directive.

The Essential Requirements are:

1. Safety,
2. Reliability and Availability,
3. Health,
4. Environmental Protection,
5. Technical compatibility.

The Essential Requirements for Class A systems are described below.

The requirements for Class B systems are the responsibility of the relevant Member State.

3.2. SPECIFIC ASPECTS FOR THE CONTROL-COMMAND AND SIGNALLING SUBSYSTEM

3.2.1. Safety

Every project to which this specification is applied shall put into effect the measures necessary to demonstrate that the level of risk of an incident occurring that is within the scope of the Control-Command and Signalling Subsystem, is not higher than the objective for the service. To ensure that the solutions to achieve safety do not jeopardise interoperability the requirements of the basic parameter defined in section 4.2.1 (Control-Command and Signalling safety characteristics relevant to interoperability) shall be respected.

For the ERTMS/ETCS Class A system the global safety objective for the Subsystem is apportioned between the On-board and Track-side Assemblies. The detailed requirements are specified in the Basic Parameter defined in section 4.2.1 (Control-Command and Signalling safety characteristics relevant to interoperability). This safety requirement must be met together with the availability requirements as defined in Section 3.2.2 (Reliability and Availability).

3.2.2. Reliability and Availability

For the Class A system, the global reliability and availability objectives for the Subsystem are apportioned between the On-board and Track-side Assemblies. The detailed requirements are specified in the Basic Parameter defined in section 4.2.1 (Control-Command and Signalling safety characteristics relevant to interoperability).

The level of risk shall be controlled as constituents of the subsystem age and wear. The requirements for maintenance stated in section 4.5 shall be respected.

3.2.3. Health

According to the European regulations and to the national regulations which are compatible with the European legislation, precautions shall be taken to ensure that the materials used in and the design of Control-Command and Signalling Subsystems do not constitute a health hazard to persons having access to them.

3.2.4. Environmental Protection

According to the European regulations and to the national regulations which are compatible with the European legislation:

1. the Control-Command and Signalling equipment, if subjected to excessive heat or fire, shall not exceed limits for the emission of fumes or gases which are harmful to the environment,
2. the Control-Command and Signalling equipment shall not contain substances which may abnormally contaminate the environment during their normal use,
3. the Control-Command and Signalling equipment shall be subject to the European legislation in force controlling the limits to the emission of and the susceptibility to electromagnetic interference along the boundaries of railway property,
4. the Control-Command and Signalling equipment shall comply with existing regulations on noise pollution,
5. the Control-Command and Signalling equipment shall not give rise to any inadmissible level of vibration which could jeopardise the integrity of the infrastructure (when the infrastructure is in the correct state of maintenance).

3.2.5. Technical Compatibility

Technical compatibility includes the functions, interfaces and performances required to achieve interoperability.

The requirements of technical compatibility are subdivided in the following three categories:

1. The first category sets out the general engineering requirements for interoperability namely environmental conditions, internal electromagnetic compatibility (EMC) within the railway boundaries, and installation. These compatibility requirements are defined in this Chapter,
2. The second category describes how the Control Command and Signalling Subsystem has to be applied technically and what functions it has to perform in order that interoperability is achieved. This category is defined in Chapter 4,

3. The third category describes how the Control Command and Signalling Subsystem has to be operated in order that interoperability is achieved. This category is defined in Chapter 4.

3.2.5.1. Engineering Compatibility

3.2.5.1.1 Physical Environmental Conditions

Control Command and Signalling equipment shall be capable of operating under the climatic and physical conditions which exist along the relevant part of the trans-European rail system.

The requirements of the basic parameter 4.2.16 (Environmental conditions) shall be respected.

3.2.5.1.2 Railway Internal Electromagnetic Compatibility

According to the European regulations and to national regulations which are compatible with the European legislation, the Control Command and Signalling equipment shall neither interfere with nor be interfered by other Control Command and Signalling equipment or other Subsystems.

The Basic Parameter related to Electromagnetic Compatibility between Rolling Stock and Control Command and Signalling track-side equipment is described in section 4.2.12 (Electromagnetic Compatibility).

3.2.5.2. Control-Command and Signalling Compatibility.

Chapter 4, supported by Annexes A and B, defines the requirements for the interoperability of the Control Command and Signalling Subsystem.

In addition, this TSI ensures, as far as the Control Command and Signalling Subsystem is concerned, the technical interoperability between trans-European high speed rail and conventional rail systems when both are fitted with Class A systems.

4. CHARACTERISATION OF THE SUBSYSTEM

4.1. INTRODUCTION

In accordance with the relevant Essential Requirements, the Control-Command and Signalling Subsystem is characterised by the following Basic Parameters:

1. Control-Command and Signalling safety characteristics relevant to interoperability (section 4.2.1)
2. On-board ERTMS/ETCS functionality (section 4.2.2)
3. Track-side ERTMS/ETCS functionality (section 4.2.3)
4. Mobile communication functions for railways – GSM-R (section 4.2.4)
5. ERTMS/ETCS and GSM-R air gap interfaces (section 4.2.5)
6. On-Board Interfaces Internal to Control-Command and Signalling (section 4.2.6)
7. Track-side Interfaces Internal to Control-Command and Signalling (section 4.2.7)
8. Key Management (section 4.2.8)
9. ETCS-ID Management (section 4.2.9)
10. Train Detection Systems (section 4.2.10)
11. Electromagnetic Compatibility between rolling stock and Control-Command and Signalling track-side equipment (section 4.2.11)
12. ERTMS/ETCS DMI (driver machine interface) (section 4.2.12)
13. GSM-R DMI (driver machine interface) (section 4.2.13)
14. Interface to data recording for regulatory purposes (section 4.2.14)
15. Visibility of track-side Control-Command and Signalling objects (section 4.2.15)
16. Environmental conditions (sections 4.2.16)

All requirements in section 4.2 (Functional and technical specifications of the Subsystem) to fulfil these basic parameters shall be applied to the Class A system.

Requirements of Class B systems as well as of STMs (which enable the Class A On-board to operate over Class B infrastructure) are the responsibility of the appropriate Member State.

To achieve interoperability it is not necessary to standardise all the functions within the whole Control-Command and Signalling Subsystem.

The functions to be standardised and specified in the following sections are:

1. on-board functions, ensuring that every train will react to data received from track-side in a predictable way,
2. track-side functions, able to process data from national interlocking and signalling systems and to translate such data into standard messages for the trains,
3. track-side functions, able to process requests/information received from the On-board,
4. interfaces for track-to-train and train-to-track communication.

The Control-Command and Signalling functions are classified in categories indicating whether they are optional (O) or mandatory (M). The categories are defined in Annex A, 4.1a for ERTMS/ETCS and Annex A, 4.1b for GSM-R and the classification of the functions are indicated within their text.

Annex A, 4.1c provides the Glossary of ERTMS/ETCS terms and definitions, which are used in the specifications referred to in Annex A.

According to section 2.2 (Scope) the Control-Command and Signalling subsystem includes three parts and is split between the On-board and Track-side Assemblies. The following table indicates which basic parameters are relevant for each part.

Assembly	Part	Basic Parameters
On-board	train protection	4.2.1, 4.2.2, 4.2.5, 4.2.6, 4.2.8, 4.2.9, 4.2.12, 4.2.14, 4.2.16
	radio communication	4.2.4, 4.2.5, 4.2.6, 4.2.13, 4.2.14, 4.2.16
Trackside	train protection	4.2.3, 4.2.5, 4.2.7, 4.2.8, 4.2.9, 4.2.15, 4.2.16
	radio communication	4.2.4, 4.2.5, 4.2.7, 4.2.16
	train detection	4.2.10, 4.2.11, 4.2.16

With respect to the essential requirements in Chapter 3, the functional and technical specifications of the Control-Command and Signalling Subsystem are as follows.

4.2. FUNCTIONAL AND TECHNICAL SPECIFICATIONS OF THE SUBSYSTEM

4.2.1. Control-Command and Signalling safety characteristics relevant to interoperability

This Basic Parameter describes the requirements for On-board assemblies and Track-side assemblies with reference to section 3.2.1 (Safety) and section 3.2.2 (Availability and Reliability).

In order to achieve interoperability, for the implementation of Control-Command and Signalling on-board and track-side assemblies the process specified in the Commission Regulation (EC) 352/2009 shall be applied with the following conditions:

1. The design, implementation and use of a Control-Command and Signalling on-board or track-side assembly shall not imply any additional requirement for other assemblies, which is not compatible with, or exceeds the requirements specified in, this TSI.
2. The requirements in the sections 4.2.1.1 and 4.2.1.2 below shall be respected.

4.2.1.1. Safety

The on-board and trackside assemblies shall respect the requirements for ERTMS/ETCS equipment and installations stated in this TSI. The safety requirements are defined in Annex A 4.2.1 a.

4.2.1.2. Availability / Reliability

The on-board and track-side assemblies shall respect the requirements stated in this TSI. The availability / reliability requirements are defined in Annex A 4.2.1 b.

The level of risk shall be controlled during the life of the assemblies. The requirements for maintenance stated in section 4.5 (Maintenance rules) shall be respected.

4.2.2. On-board ERTMS/ETCS functionality

The Basic Parameter for ERTMS/ETCS on board functionality describes all of the functions to run a train in a safe way. The primary function is to provide automatic train protection and cab signalling:

1. setting the train characteristics (e.g., maximum train speed, braking performance),
2. selecting the supervision mode on the basis of information from track-side,
3. performing odometry functions,
4. locating the train in a co-ordinate system based on Eurobalise locations,
5. calculating the dynamic speed profile for its mission on the basis of train characteristics and of information from track-side,
6. supervising the dynamic speed profile during the mission,
7. providing the intervention function.

These functions shall be implemented in accordance with Annex A 4.2.2 b and their performance shall conform to Annex A 4.2.2 a.

The requirements for tests are specified in Annex A 4.2.2c.

The ETCS identities of equipment shall be managed in accordance with section 4.2.9 (ETCS-ID management).

The main functionality is supported by other functions, to which Annex A 4.2.2a and Annex A 4.2.2b apply as well, together with the additional specifications indicated below:

1. Communication with the Control-Command and Signalling Track-side Assembly.
 - a) Eurobalise data transmission. See section 4.2.5.2 (Eurobalise communication with the train).
 - b) Euroloop data transmission. See section 4.2.5.3 (Euroloop communication with the train). This functionality is optional on-board unless Euroloop is installed track-side in ERTMS/ETCS Level 1 and the release speed is set to zero for safety reasons (e.g., protection of danger points).
 - c) Radio data transmission for radio infill. See Annex A, 4.2.2 d, section 4.2.5.1 (Radio communications with the train), section 4.2.6.2 (Interface between GSM-R Radio Data Communication and ERTMS/ETCS) and section 4.2.8 (Key Management). This functionality is optional on-board unless Radio data transmission for radio infill is installed track-side in ERTMS/ETCS Level 1 and the release speed is set to zero for safety reasons (e.g., protection of danger points).
 - d) Radio data transmission. See section 4.2.5.1 (Radio communications with the train), section 4.2.6.2 (Interface between GSM-R Radio Data Communication and ERTMS/ETCS) and section 4.2.8 (Key Management). Only mandatory on-board for ERTMS/ETCS Level 2 or ETCS Level 3 applications.
2. Communicating with the driver. See Annex A, 4.2.2 e and section 4.2.12 (ERTMS/ETCS DMI).
3. Communicating with the STM. See section 4.2.6.1 (Interface between ERTMS/ETCS and STM). This function includes:
 - a) managing the STM output,
 - b) providing data to be used by the STM,
 - c) managing STM transitions.
4. Managing information about the completeness of the train (train integrity) — mandatory for level 3, not required for level 1 or 2.

5. Equipment health monitoring and degraded mode support. This function includes:
 - a) initialising the on-board ERTMS/ETCS functionality,
 - b) providing degraded mode support,
 - c) isolating the on-board ERTMS/ETCS functionality.
6. Support data recording for regulatory purposes. See section 4.2.14 (Interface to Data Recording for Regulatory Purposes).
7. Forwarding information/orders and receiving state information from rolling stock:
 - a) to the DMI. See section 4.2.12 (ERTMS/ETCS DMI)
 - b) to/from the train interface unit. See Annex A, 4.2.2 f.

4.2.3. Track-side ERTMS/ETCS functionality

This Basic Parameter describes the ERTMS/ETCS track-side functionality. It contains all ERTMS/ETCS functionality to provide a safe path to a specific train. The main functionality is:

1. locating a specific train in a co-ordinate system based on Eurobalise locations (levels 2 and 3),
2. translating the information from track-side signalling equipment into a standard format for the Control-Command and Signalling On-board Assembly,
3. sending movement authorities including track description and orders assigned to a specific train.

These functions shall be implemented in accordance with Annex A, 4.2.3b and their performance shall conform to Annex 4.2.3a.

The requirements for tests are specified in Annex A 4.2.3c.

The ETCS identities of equipment shall be managed in accordance with section 4.2.9 (ETCS-ID management).

The main functionality is supported by other functions, to which Annex A 4.2.3a and Annex A 4.2.32b also apply, together with the additional specifications indicated below:

1. communicating with the Control-Command and Signalling On-board Assembly. This includes:
 - a) Eurobalise data transmission. See section 4.2.5.2 (Eurobalise communication with the train) and section 4.2.7.4 (Eurobalise/Line-side Electronic Unit (LEU)),
 - b) Euroloop data transmission. See section 4.2.5.3 (Euroloop communication with the train) and section 4.2.7.5 (Euroloop/LEU). Euroloop is only relevant in level 1 in which it is optional,
 - c) Radio data transmission for radio infill. See Annex A, 4.2.3d, section 4.2.5.1 (Radio communications with the train), section 4.2.7.3 (GSM-R/track-side ETCS functionality) and section 4.2.8 (Key Management). Radio in-fill is only relevant in level 1 in which it is optional,
 - d) Radio data transmission. See section 4.2.5.1 (Radio communications with the train), section 4.2.7.3 (GSM-R/track-side ETCS functionality) and section 4.2.8 (Key Management). Radio data transmission is only relevant to level 2 and level 3.
2. generating information/orders to the on-board ERTMS/ETCS, e.g., information related to closing/opening the air flaps, lowering/raising the pantograph,

opening/closing the main power switch, changing from traction system A to traction system B. Implementation of this functionality is optional for track-side.

3. managing the transitions between areas supervised by different Radio Block Centres (RBCs) (only relevant for level 2 and level 3). See section 4.2.7.1 (Functional interface between RBCs) and section 4.2.7.2 (Technical interface between RBCs).

4.2.4. Mobile communication functions for railways - GSM-R

This basic parameter describes the radio communication functions. Such functions shall be implemented in the on-board assembly and in the track-side assembly, according to the specifications indicated below.

4.2.4.1. Basic communication function

The general requirements are specified in Annex A 4.2.4a.
In addition the following specifications shall be respected:

1. ASCI features; Annex A 4.2.4b,
2. SIM card; Annex A 4.2.4c,
3. User to User Signalling; Annex A 4.2.4d.

4.2.4.2. Voice and operational communication applications

The general requirements are defined in Annex A 4.2.4e.
The requirements for tests are specified in Annex A 4.2.4f
In addition the following specifications shall be respected:

1. confirmation of high priority calls; Annex A 4.2.4g,
2. functional addressing; Annex A 4.2.4h,
3. location dependent addressing; Annex A 4.2.4j,
4. presentation of functional numbers; Annex A 4.2.4m.

4.2.4.3. Data communication applications for ETCS

The general requirements are defined in Annex A 4.2.4e.
The requirements for tests are specified in Annex A 4.2.4f.
This functionality is only mandatory in case of ETCS level 2 and 3 and radio in-fill applications.

4.2.5. ERTMS/ETCS and GSM-R air gap interfaces

This Basic Parameter specifies the requirements for the air gap between track-side and on-board Control-Command and Signalling Assemblies and has to be taken into account in conjunction with the requirements for the interfaces between ERTMS/ETCS and GSM-R equipment, as specified in section 4.2.6 (on-Board Interfaces Internal to Control-Command and Signalling) and section 4.2.7 (track-side Interfaces Internal to Control-Command and Signalling).

This Basic Parameter includes:

1. the physical, electrical and electromagnetic values to be respected to allow safe functioning,
2. the communication protocol to be used,
3. the availability of the communication channel.

The applicable specifications are listed below.

4.2.5.1. Radio communications with the train

Class A radio communication interfaces shall operate in the GSM-R Band - see Annex A, 4.2.5a.

The protocols shall comply with Annex A 4.2.5b.

In case radio in-fill is implemented, the requirements stated in Annex A 4.2.5c shall be respected.

4.2.5.2. Eurobalise communication with the train

Eurobalise communication interfaces shall comply with Annex A 4.2.5d.

4.2.5.3. Euroloop communication with the train

Euroloop communication interfaces shall comply with Annex A 4.2.5e.

4.2.6. On-Board Interfaces Internal to Control-Command and Signalling

This Basic Parameter consists of three parts.

4.2.6.1. ERTMS/ETCS and Class B train protection

In case ERTMS/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 Annex A, 4.2.6 a.

Annex A, 4.2.6b specifies the K interface (to allow certain STMs to read information from Class B balises through the ERTMS/ETCS on-board antenna) and Annex A 4.2.6c the G interface (air gap between ETCS on-board antenna and Class B balises).

Implementation of the Interface 'K' is optional, but if done it must be in accordance with Annex A, 4.2.6b.

Furthermore, if Interface 'K' is implemented, the on-board transmission channel functionality shall be able to handle the properties of Annex A, 4.2.6c.

In case the transitions between ERTMS/ETCS and Class B train protection on-board are not managed according to the standardised interface specified in Annex A, 4.2.6 a, it has to be ensured that the solution adopted does not impose any additional requirements to the trackside assembly.

4.2.6.2. Interface between GSM-R Radio Data Communication and ERTMS/ETCS

The requirements for the interface between the Class A radio and the on-board ERTMS/ETCS functionality are specified in Annex A 4.2.6d.

In case radio in-fill is implemented the requirements stated in Annex A 4.2.6e shall be respected.

4.2.6.3. Odometry

The interface between the odometry function and ETCS on-board shall meet the requirements of Annex A, 4.2.6f. This interface only contributes to this Basic Parameter when odometry equipment is supplied as a separate interoperability constituent (see section 5.2.2, Grouping of interoperability constituents).

4.2.7. Track-side Interfaces Internal to Control-Command and Signalling

This Basic Parameter consists of five parts.

4.2.7.1. Functional interface between RBCs

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

1. Information from the 'Handing Over' RBC to the 'Accepting' RBC,
2. Information from the 'Accepting' RBC to the 'Handing Over' RBC,

The requirements are specified in Annex A, 4.2.7a.

4.2.7.2. RBC/RBC

This is the technical interface between two RBCs. The requirements are specified in Annex A, 4.2.7b.

4.2.7.3. GSM-R/track-side ETCS

This is the interface between the Class A radio system and the track-side ETCS functionality. The requirements are specified in Annex A, 4.2.7c.

4.2.7.4. Eurobalise/LEU

This is the interface between Eurobalise and the LEU. The requirements are specified in Annex A, 4.2.7d.

This interface only contributes to this Basic Parameter when Eurobalise and LEU are supplied as separate interoperability constituents (see section 5.2.2, Grouping of interoperability constituents).

4.2.7.5. Euroloop/LEU

This is the interface between Euroloop and the LEU. The requirements are specified in Annex A, 4.2.7e.

This interface only contributes to this Basic Parameter when Euroloop and LEU are supplied as separate interoperability constituents (see section 5.2.2, Grouping of interoperability constituents).

4.2.8. Key Management

This Basic Parameter specifies requirements for the management of cryptographic keys used for the protection of data transmitted via radio.

Infrastructure managers and rolling stock keepers shall have a management system that controls and manages the keys, including the procedures and tools to install them in equipment belonging to the respective Control-Command and Signalling assembly.

Each item of ERTMS/ETCS equipment requiring a cryptographic key shall be associated to one Key Management Centre (KMC). This KMC is known as the Home-KMC. All key operations on this equipment shall be handled through its Home-KMC.

A key management interface is required:

1. between the Home-KMC for on-boards and the on-board equipment,
2. between the Home-KMC for track-side and the track-side equipment,
3. between the KMC of the rolling stock keeper and the KMC of the infrastructure managers,
4. between the KMCs of two different infrastructure managers if trains containing only a single key run on both infrastructures).

The requirements are specified in Annex A 4.2.8a. Only requirements related to the interfaces of Control-Command and Signalling equipment are in the scope of this TSI.

4.2.9. ETCS-ID Management

This Basic Parameter concerns the unique ETCS-identities (ETCS-IDs) for equipment in track-side and on-board assemblies.

1. The European Railway Agency shall allocate values to Member States and suppliers of ERTMS/ETCS on-board equipment.
2. Member States shall manage the allocation of values to Infrastructure Managers.
3. Infrastructure Managers shall manage the values for track side assemblies until the putting into service and during the operation of the assembly.
4. Suppliers of on-board Control-Command and Signalling equipment shall manage the values for that equipment until placing it on the market.
5. Rolling Stock keepers shall manage the values as assigned to the Control-Command and Signalling on-board assemblies of their rolling stock from the time of putting it into service and during the whole life of the assembly.

The requirements are specified in Annex A, 4.2.9a. The allocation of variables is defined in Annex A 4.2.9b.

4.2.10. Track-side Train Detection Systems

This Basic Parameter describes the interface between the track-side train detection systems and rolling stock.

The interface requirements to be respected are specified in Annex A 4.2.10a.

4.2.11. Electromagnetic Compatibility between Rolling Stock and Control-Command and Signalling track-side equipment

This basic parameter specifies the requirements for electromagnetic compatibility between rolling stock and track-side Control-Command and Signalling equipment.

The interface requirements to be respected are specified in Annex A 4.2.11a

4.2.12. ERTMS/ETCS DMI (Driver Machine Interface)

This Basic Parameter describes the information provided from ERTMS/ETCS to the driver and entered into the ERTMS/ETCS on-board by the driver. See Annex A, 4.2.12a.

It includes:

1. ergonomics (including visibility),
2. ERTMS/ETCS functions to be displayed,
3. ERTMS/ETCS functions triggered by driver input.

4.2.13. GSM-R DMI (Driver Machine Interface)

This Basic Parameter describes the information provided from GSM-R to the driver and entered into the GSM-R on-board by the driver. See Annex A, 4.2.13a.

It includes:

1. ergonomics (including visibility),
2. GSM-R functions to be displayed,
3. call related information outgoing,
4. call related information incoming.

4.2.14. Interface to Data Recording for Regulatory Purposes

This Basic Parameter describes:

1. data exchange between the ERTMS/ETCS on-board and the rolling stock recording device,
2. communication protocols,
3. physical interface.

See Annex A 4.2.14a.

4.2.15. Visibility of track-side Control-Command and Signalling objects

This Basic Parameter describes:

1. the characteristics of retro-reflecting signs to ensure correct visibility,
2. the characteristics of interoperable marker boards.

See Annex A 4.2.15a.

In addition, the installation of track-side Control-Command and Signalling objects shall be compatible with the driver's field of view and the infrastructure requirements.

4.2.16. Environmental conditions

The environmental conditions mandated in the specifications referenced in this TSI shall be respected.

4.3. FUNCTIONAL AND TECHNICAL SPECIFICATIONS OF THE INTERFACES TO OTHER SUBSYSTEMS

4.3.1. Interface to the Subsystem Traffic Operation and Management

Interface with Traffic Operation and Management TSI

Reference CCS TSI		Reference Traffic Operation and Management TSI	
Parameter	Clause	Parameter	Clause
Operating rules (normal and degraded conditions)	4.4	Rule book Operating rules	4.2.1.2.1 4.4
Visibility of track-side Control-Command and Signalling objects	4.2.15	Signal and line-side marker sighting	4.2.2.8
Train braking performance and characteristics	4.2.2	Braking performance	4.2.2.6
Use of sanding equipment On-board flange lubrication Use of composite brake blocks	4.2.10	Rule book	4.2.1.2.1
Interface to Data Recording for Regulatory Purposes	4.2.14	Data recording onboard	4.2.3.5
ETCS DMI	4.2.12	Train running number	4.2.3.2.1
GSM-R DMI	4.2.13	Train running number	4.2.3.2.1

4.3.2. Interface to the Subsystem Rolling Stock

Interface with Rolling Stock TSIs				
Reference CCS TSI		Reference Rolling Stock TSIs		
Parameter	Clause	Parameter		Clause
Compatibility with trackside train detection systems: vehicle design	4.2.10	Rolling stock characteristics to be compatible with train detection systems based on track circuits	HS RS TSI wheelset location axle load sanding electrical resistance between wheels	4.2.7.9.2 4.2.3.2 4.2.3.10 4.2.3.3.1
			LOC & PAS TSI	4.2.3.3.1.1
		Rolling stock characteristics to be compatible with train detection systems based on axle counters	Wagon TSI	4.2.3.2
			HS RS TSI wheelset geometry wheels	4.2.7.9.2 4.2.7.9.3
Electromagnetic compatibility between rolling stock and Control-Command and Signalling track-side equipment	4.2.11	Rolling stock characteristics to be compatible with train detection systems based on track circuits	LOC & PAS TSI	4.2.3.3.1.2
			Wagon TSI	4.2.3.3.1
		Rolling stock characteristics to be compatible with train detection systems based on axle counters	HS RS TSI	None
			LOC & PAS TSI	4.2.3.3.1.3
Train braking performance and characteristics	4.2.2	Emergency braking performance	Wagon TSI	None
			HS RS TSI Emergency braking Service braking	4.2.6.6.1
			LOC & PAS TSI Emergency braking Service braking	4.2.3.3.1
			Wagon TSI	None
Position of Control-Command and Signalling on-board antennas	4.2.2	Kinematic gauge	HS RS TSI	4.2.4.1 4.2.4.4
			LOC & PAS TSI	4.2.4.5.2 4.2.4.5.3
			Wagon TSI	4.2.4.1.2
			HS RS TSI	4.2.3.1
			LOC & PAS TSI	4.2.3.1
			Wagon TSI	none

Interface with Rolling Stock TSIs				
Reference CCS TSI		Reference Rolling Stock TSIs		
Parameter	Clause	Parameter	Clause	
Isolation of on-board ERTMS/ETCS functionality	4.2.2	Operating rules	HS RS TSI	4.2.7.9.1
			LOC & PAS TSI	4.2.12.3
			Wagon TSI	none
Data interfaces	4.2.2	Monitoring and diagnostic concepts	HS RS TSI	4.2.7.10
			LOC & PAS TSI	4.2.1.1
			Wagon TSI	None
Visibility of track-side Control-Command and Signalling objects	4.2.15	External visibility Head lights	HS RS TSI	4.2.7.4.1.1
			LOC & PAS TSI	4.2.7.1.1
			Wagon TSI	None
		Driver's external field of view	HS RS TSI line of sight windscreen LOC & PAS TSI line of sight windscreen Wagon TSI	4.2.2.6 b 4.2.2.7 4.2.9.1.3.1 4.2.9.2 None
Interface to data recording for regulatory purposes	4.2.14	Recording device	HS RS TSI	4.2.7.10
			LOC & PAS TSI	4.2.9.6
			Wagon TSI	none
Commands to rolling stock equipment	4.2.2 4.2.3	Phase separation	HS RS TSI	4.2.8.3.6.7
			LOC & PAS TSI	4.2.8.2.9.8
			Wagon TSI	none
Emergency braking command	4.2.2	Emergency braking command	HS RS TSI	none
			LOC & PAS TSI	4.2.4.4.1
			Wagon TSI	none

4.3.3. Interfaces to Subsystem Infrastructure

Interface with Infrastructure TSI				
Reference CCS TSI		Reference Infrastructure TSI		
Parameter	Clause	Parameter	Clause	
Train detection systems (space for installation)	4.2.10	Minimum infrastructure gauge	HS	4.2.3
		Structure gauge	CR	4.2.4.1
Eurobalise communication (space for installation)	4.2.5.2	Minimum infrastructure gauge	HS	4.2.3
		Structure gauge	CR	4.2.4.1
Euroloop communication (space for installation)	4.2.5.3	Minimum infrastructure gauge	HS	4.2.3
		Structure gauge	CR	4.2.4.1
Visibility of track-side Control-Command and Signalling objects	4.2.15	Minimum infrastructure gauge	HS	4.2.3
		Structure gauge	CR	4.2.4.1

4.3.4. Interfaces to Subsystem Energy

Interface with Energy TSI				
Reference CCS TSI		Reference Energy TSI		
Parameter	Clause	Parameter		Clause
Commands to rolling stock equipment	4.2.2 4.2.3	Phase separation sections	HS ENE TSI	4.2.21
		System separation sections		4.2.22
		Phase separation sections	CR ENE TSI	4.2.19
		System separation sections		4.2.20

4.4. OPERATING RULES

The operating rules specific to the Control-Command and Signalling Subsystem (ERTMS/ETCS and GSM-R) are detailed in the TSI Traffic Operation and Management.

4.5. MAINTENANCE RULES

The maintenance rules of the subsystem covered by this TSI shall ensure that the values quoted in the Basic Parameters indicated in Chapter 4 are maintained within the required limits throughout the lifetime of the assemblies. However, during preventative or corrective maintenance, the subsystem may not be able to respect the values quoted in the Basic Parameters; the maintenance rules shall ensure that safety is not prejudiced during these activities.

The entity in charge of the Control-Command and Signalling Subsystem shall set up maintenance rules to achieve the above objectives. To assist with the preparation of these rules, the following requirements shall be respected.

4.5.1. Responsibility of the manufacturer of equipment

The manufacturer of equipment incorporated in the subsystem shall specify:

1. all maintenance requirements and procedures (including supervision of well functioning, diagnosis, test methods and tools and also the required professional competence) necessary for the achievement of essential requirements and values quoted in the mandatory requirements of this TSI during the whole equipment life-cycle (transport and storage before installation, normal operation, failures, repair actions, verifications and maintenance interventions, decommissioning etc.),
2. the risks for health and safety that may affect the public and the maintenance staff,
3. the conditions for first line maintenance, i.e., the definition of Line Replaceable Units (LRUs), the definition of approved compatible versions of Hardware and Software, the procedures for substitution of failed LRUs, the conditions for storage of LRUs and for the repair of failed LRUs,
4. the verifications to be performed in case equipment is subject to exceptional stress (e.g., adverse environmental conditions or abnormal shocks),
5. the verifications to be performed in case non Control-Command and Signalling equipment with influence on the Control-Command and Signalling subsystem is subject to maintenance action (e.g., wheel diameter change...).

4.5.2. Responsibility of the applicant for subsystem verification

The applicant shall:

1. ensure that the maintenance requirements as described in section 4.5.1 (Responsibility of the Manufacturer of Equipment) are defined for all components within the scope of this TSI (regardless of whether they are interoperability constituents or not),
2. complete the requirements above taking into account the risks due to interactions of different equipment inside the subsystem and interfaces to other subsystems.

4.6. PROFESSIONAL COMPETENCES

The manufacturers of the equipment and of the subsystem shall provide information sufficient to define the professional competences required for the installation, the final inspection and the maintenance of the Control-Command and Signalling Subsystem. See section 4.5 (Maintenance rules).

4.7. HEALTH AND SAFETY CONDITIONS

Precautions shall be taken to ensure health and safety for maintenance and operations staff, in accordance with the European regulations and the National regulations that are compatible with the European legislation.

Manufacturers shall indicate the risks for health and safety deriving from the use and maintenance of their equipment and of subsystems. See section 4.4 (Operating rules) and section 4.5 (Maintenance rules).

4.8. INFRASTRUCTURE AND ROLLING STOCK REGISTERS

The Control-Command and Signalling Subsystem is treated as two Assemblies:

1. the On-board Assembly,
2. the Track-side Assembly.

The requirements for the infrastructure and rolling stock register content with regard to these Assemblies are specified in Annex C (line specific and train specific characteristics).

5. INTEROPERABILITY CONSTITUENTS

5.1. DEFINITION

According to Article 2(f) of Directive 2008/57/EC, interoperability constituents are "any elementary component, group of components, subassembly or complete assembly of equipment incorporated or intended to be incorporated into a subsystem, upon which the interoperability of the rail system depends either directly or indirectly. The concept of a constituent covers both tangible objects and intangible objects such as software."

5.2. LIST OF INTEROPERABILITY CONSTITUENTS

5.2.1. Basic interoperability constituents

The basic interoperability constituents in the Control-Command and Signalling Subsystem are defined in:

1. Table 5.1.a for the On-board Assembly,
2. Table 5.2.a for the Track-side Assembly.

The interoperability constituent 'safety platform' is defined as a building block (generic product, independent of the application) made of hardware and base software (firmware and/or operating system and/or support tools), which can be used for building more complex systems (generic applications, i.e. classes of applications).

5.2.2. Grouping of interoperability constituents

The functions of basic interoperability constituents may be combined to form a group. This group is then defined by those functions and the remaining interfaces to the outside of the group. If a group is formed this way, it shall be considered as an interoperability constituent.

1. Table 5.1.b lists the groups of interoperability constituents of the On-board Assembly
2. Table 5.2.b lists the groups of interoperability constituents of the Track-side Assembly

5.3. CONSTITUENTS' PERFORMANCE AND SPECIFICATIONS

For each basic interoperability constituent or group of interoperability constituents, the tables in Chapter 5 describe:

1. in column 3, the functions and interfaces. Note that some interoperability constituents have functions and/or interfaces that are optional,
2. in column 4, the mandatory specifications for the conformity assessment of each function or interface, as far as relevant, by reference to the relevant section of Chapter 4.

Table 5.1.a Basic interoperability constituents in the On-board Control-Command and Signalling Assembly

ERA ERTMS UNIT

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1	2	3	4
N	Interoperability constituent IC	Characteristics	Specific requirements to be assessed by reference to Chapter 4
1	ERTMS/ETCS on-board	Reliability, Availability, Maintainability, Safety (RAMS)	4.2.1 4.5.1
		On-board ETCS functionality (Excluding Odometry)	4.2.2
		ERTMS/ETCS and GSM-R air gap interfaces <ul style="list-style-type: none"> RBC (level 2 and 3) Radio in-fill unit (optional level 1) Eurobalise airgap Euroloop airgap (optional level 1) 	4.2.5 4.2.5.1 4.2.5.1 4.2.5.2 4.2.5.3
		Interfaces <ul style="list-style-type: none"> STM (implementation of interface K optional) ERTMS/ETCS GSM-R on-board Odometry Key management system ETCS ID Management ERTMS/ETCS Driver Machine Interface Train interface On-board recording device 	4.2.6.1 4.2.6.2 4.2.6.3 4.2.8 4.2.9 4.2.12 4.2.2 4.2.14
		Physical environmental conditions	4.2.16
2	Safety Platform on-board	Safety	4.2.1
3	Odometry	Reliability, Availability, Maintainability, Safety (RAMS)	4.2.1 4.5.1
		On-board ERTMS/ETCS functionality: only Odometry	4.2.2
		Interfaces <ul style="list-style-type: none"> ERTMS/ETCS on-board 	4.2.6.3
		Environmental conditions	4.2.16
4	Interface of External STM	Interfaces <ul style="list-style-type: none"> ERTMS/ETCS on-board 	4.2.6.1
5	GSM-R voice cab radio Note: SIM card, antenna, connecting cables and filters	Reliability, Availability, Maintainability, Safety (RAMS) Note: no requirement for safety	4.2.1 4.5.1

1	2	3	4
N	Interoperability constituent IC	Characteristics	Specific requirements to be assessed by reference to Chapter 4
	are not part of this interoperability constituent	Basic communication functions	4.2.4.1
		Voice and operational communication applications	4.2.4.2
		Interfaces <ul style="list-style-type: none"> GSM-R air gap GSM-R Driver Machine Interface 	4.2.5.1 4.2.13
		Environmental conditions	4.2.16
6	GSM-R ETCS Data only Radio Note: SIM card, antenna, connecting cables and filters are not part of this interoperability constituent	Reliability, Availability, Maintainability, Safety (RAMS) Note: no requirement for safety	4.2.1 4.5.1
		Basic communication functions	4.2.4.1
		ETCS data communication applications	4.2.4.3
		Interfaces <ul style="list-style-type: none"> ERTMS/ETCS on-board GSM-R air gap 	4.2.6.2 4.2.5.1
		Environmental conditions	4.2.16
7	GSM-R SIM card	Basic communication functions	4.2.4.1
		Environmental conditions	4.2.16

Table 5.1.b Groups of interoperability constituents in the On-board Control-Command and Signalling Assembly

This table is an example to show the structure. Other groups are allowed

1	2	3	4
N	Group of Interoperability constituents	Characteristics	Specific requirements to be assessed by reference to Chapter 4

ERA ERTMS UNIT

CCS TSI

1	2	3	4
N	Group of Interoperability constituents	Characteristics	Specific requirements to be assessed by reference to Chapter 4
1	Safety Platform on-board ERTMS/ETCS on-board Odometry	Reliability, Availability, Maintainability, Safety (RAMS)	4.2.1 4.5.1
		On-board ERTMS/ETCS functionality	4.2.2
		ERTMS/ETCS and GSM-R air gap interfaces <ul style="list-style-type: none"> RBC (level 2 and 3) Radio in-fill unit (optional level 1) Eurobalise airgap Euroloop airgap (optional level 1) 	4.2.5 4.2.5.1 4.2.5.1 4.2.5.2 4.2.5.3
		Interfaces <ul style="list-style-type: none"> STM (implementation of interface K optional) ERTMS/ETCS - GSM-R on-board Key management system ETCS-ID Management ERTMS/ETCS Driver Machine Interface Train interface On-board recording device 	4.2.6.1 4.2.6.2 4.2.8 4.2.9 4.2.12 4.2.2 4.2.14
		Physical environmental conditions	4.2.16

Table 5.2.a Basic interoperability constituents in the Track-side Control-Command and Signalling Assembly

ERA ERTMS UNIT

CCS TSI

1	2	3	4
N	Interoperability constituent IC	Characteristics	Specific requirements to be assessed by reference to Chapter 4
1	RBC	Reliability, Availability, Maintainability, Safety (RAMS)	4.2.1 4.5.1
		Track-side ERTMS/ETCS functionality, excluded communication via Eurobalises, radio in-fill and Euroloop	4.2.3
		ERTMS/ETCS and GSM-R air gap interfaces: only radio communication with train	4.2.5.1
		Interfaces <ul style="list-style-type: none"> • Neighbouring RBC • ERTMS/ETCS GSM-R track-side • Key management system • ETCS-ID Management 	4.2.7.1, 4.2.7.2 4.2.7.3 4.2.8 4.2.9
		Environmental conditions	4.2.16
2	Radio in-fill unit	Reliability, Availability, Maintainability, Safety (RAMS)	4.2.1 4.5.1
		Track-side ERTMS/ETCS functionality, excluded communication via Eurobalises, Euroloop and level 2/3 functionality	4.2.3
		ERTMS/ETCS and GSM-R air gap interfaces: only radio communication with train	4.2.5.1
		Interfaces <ul style="list-style-type: none"> • ERTMS/ETCS - GSM-R track-side • Key management system • ETCS-ID Management • Interlocking and LEU 	4.2.7.3 4.2.8 4.2.9 4.2.3
		Environmental conditions	4.2.16
3	Eurobalise	Reliability, Availability, Maintainability, Safety (RAMS)	4.2.1 4.5.1

ERA ERTMS UNIT

CCS TSI

1	2	3	4
N	Interoperability constituent IC	Characteristics	Specific requirements to be assessed by reference to Chapter 4
		ERTMS/ETCS and GSM-R air gap interfaces: only Eurobalise communication with train	4.2.5.2
		Interfaces <ul style="list-style-type: none"> • LEU - Eurobalise 	4.2.7.4
		Environmental conditions	4.2.16
4	Euroloop	Reliability, Availability, Maintainability, Safety (RAMS)	4.2.1 4.5.1
		ERTMS/ETCS and GSM-R air gap interfaces: only Euroloop communication with train	4.2.5.3
		Interfaces <ul style="list-style-type: none"> • LEU - Euroloop 	4.2.7.5
		Environmental conditions	4.2.16
5	LEU Eurobalise	Reliability, Availability, Maintainability, Safety (RAMS)	4.2.1 4.5.1
		Track-side ERTMS/ETCS functionality, excluded communication via radio in-fill, Euroloop and level 2 and level 3 functionality	4.2.3
		Interfaces <ul style="list-style-type: none"> • LEU - Eurobalise 	4.2.7.4
		Environmental conditions	4.2.16
6	LEU Euroloop	Reliability, Availability, Maintainability, Safety (RAMS)	4.2.1 4.5.1

1	2	3	4
N	Interoperability constituent IC	Characteristics	Specific requirements to be assessed by reference to Chapter 4
		Track-side ERTMS/ETCS functionality, excluded communication via radio in-fill, Eurobalise and level 2 and level 3 functionality	4.2.3
		Interfaces <ul style="list-style-type: none"> • LEU - Euroloop 	4.2.7.5
		Environmental conditions	4.2.16

Table 5.2.b Groups of interoperability constituents in the Track-side Control-Command and Signalling Assembly

This table is an example to show the structure. Other groups are allowed

1	2	3	4
N	Group of interoperability constituents	Characteristics	Specific requirements to be assessed by reference to Chapter 4
1	Eurobalise LEU Eurobalise	Reliability, Availability, Maintainability, Safety (RAMS)	4.2.1 4.5.1
		Track-side ERTMS/ETCS functionality, excluded communication via Euroloop and level 2 and level 3 functionality	4.2.3
		ERTMS/ETCS and GSM-R air gap interfaces: only Eurobalise communication with train	4.2.5.2
		Environmental conditions	4.2.16

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1	2	3	4
N	Group of interoperability constituents	Characteristics	Specific requirements to be assessed by reference to Chapter 4
2	Euroloop LEU Euroloop	Reliability, Availability, Maintainability, Safety (RAMS)	4.2.1 4.5.1
		Track-side ERTMS/ETCS functionality, excluded communication via Eurobalise and level 2 and level 3 functionality	4.2.3
		ERTMS/ETCS and GSM-R air gap interfaces: only Euroloop communication with train	4.2.5.3
		Environmental conditions	4.2.16

6. ASSESSMENT OF CONFORMITY AND/OR SUITABILITY FOR USE OF THE CONSTITUENTS AND VERIFICATION OF THE SUBSYSTEM

6.1. INTRODUCTION

6.1.1. General principles

The fulfilment of the essential requirements quoted in Chapter 3 of this TSI is ensured through compliance with the Basic Parameters specified in Chapter 4. This compliance is demonstrated by:

1. the assessment of conformity of interoperability constituents specified in Chapter 5 (see section 6.2),
2. the verification of Assemblies (see section 6.3).

Nevertheless, where part of the essential requirements are satisfied by National Rules, because of:

1. use of Class B systems,
2. open points in the TSI,
3. derogations under article 9 of Directive 2008/57/EC,
4. specific cases described in section 7.2.9,

then the assessment of conformity with such rules shall be carried out under the responsibility of the Member States concerned according to notified procedures.

6.1.2. Principles for testing of ERTMS/ETCS and GSM-R

An on-board assembly with EC Declaration of verification shall be able to run on every track-side assembly with EC Declaration of verification, under the conditions specified in this TSI, with no additional verifications.

The achievement of this goal is facilitated by:

1. rules for the design and installation of the on-board and the track-side assembly,
2. test specifications to prove compliance with the requirements of this TSI and the compatibility of on-board and track-side assemblies.

In order to strengthen the effectiveness of the conformity assessment of ERTMS/ETCS and GSM-R equipment to achieve the goal mentioned above, each Member State shall ensure that the operational test scenarios, related to the verification of the ERTMS/ETCS and GSM-R part of the track-side assembly interacting with the corresponding part of the on-board assemblies, are made available to the European Commission:

1. The test scenarios shall be consistent with the specifications referenced in this TSI and provide a technical description of functions and performances (e.g., reaction times) as far as relevant for the interaction between on-board and track-side.
2. The test scenarios shall be submitted in a standard format. See Annex A 4.2.2c

The European Railway Agency shall:

1. make a preliminary publication of the operational test scenarios, allowing all interested parties to comment about the consistency of the test scenarios with the specifications referenced in this TSI and their impact on other implementations or developments. The period for comments shall be defined with each publication and not exceed 6 months,
2. in the case of negative impact, support and co-ordinate the involved parties, in order to find an agreement, e.g. a modification of the operational test scenarios,
3. progressively build and make publicly available a database of test scenarios that have successfully passed the step described above and representing the situations occurring in different implementations,
4. use the data base of test scenarios to evaluate the opportunity to complete the mandatory test specifications and to define additional engineering rules for the on-board and the track-side assembly.

6.2. INTEROPERABILITY CONSTITUENTS

6.2.1. Assessment procedures for Control-Command and Signalling Interoperability Constituents

The manufacturer of an interoperability constituent (and/or groups of interoperability constituents) or his authorised representative established within the Community shall draw up an EC declaration of conformity in accordance with Article 13.1 and Annex IV of the Directive 2008/57/EC before placing them on the market.

The assessment procedure shall be carried out by application of modules as specified in section 6.2.2 (Modules for Control-Command and Signalling Interoperability Constituents).

An EC declaration of suitability for use is not required for Control-Command and Signalling interoperability constituents, because they have to fully comply with all the relevant Basic Parameters, which is demonstrated by the EC Declaration of conformity and is sufficient for placing them on the market².

6.2.2. Modules for Control-Command and Signalling Interoperability Constituents

For the assessment of interoperability constituents within the Control-Command and Signalling subsystem, the manufacturer, or his authorised representative established within the Community, may choose:

1. either the type-examination procedure (Module CB) for the design and development phase in combination with the production quality management system procedure (Module CD) for the production phase, or
2. the type-examination procedure (Module CB) for the design and development phase in combination with the product verification procedure (Module CF), or

² The check that an Interoperability Constituent is used appropriately is part of the EC verification of on-board and track-side assemblies, as explained in 6.3.3 and 6.3.4

- the full quality management system with design examination procedure (Module CH1).

In addition and only for the SIM card Interoperability Constituent, the selection of module CA is allowed.

The description of the modules is in XXXX.

The following clarifications apply to the use of some of the modules:

- with reference to Chapter 2 of the 'Module CB', EC-type examination shall be carried out through a combination of production type and design type,
- with reference to Chapter 3 of the 'Module CF' (product verification) statistical verification is not allowed, i.e. all interoperability constituents shall be individually examined.

6.2.3. Assessment requirements

Independently of the selected module:

- the requirements stated in section 6.2.4.1 of this TSI shall be respected for the interoperability constituent "ERTMS/ETCS on-board",
- the activities shown in table 6.1 shall be done for the conformity assessment of an interoperability constituent or a group of interoperability constituents as defined in Chapter 5 of this TSI. All verifications shall be done by reference to the applicable table in Chapter 5 and the basic parameters indicated there.

Table 6.1

Aspect	What to assess	supporting evidence
functions, interfaces and performances	that all mandatory functions, interfaces and performances as described in the basic parameters referenced in the relevant table of Chapter 5 are implemented and that they comply with the requirements of this TSI	design documentation and running of test cases and test scenarios, as described in the Basic Parameters referenced in the relevant table of Chapter 5
	which optional functions and interfaces as described in the basic parameters referenced in the relevant table of Chapter 5 are implemented and that they comply with the requirements of this TSI	design documentation and running of test cases and test scenarios, as described in the Basic Parameters referenced in the relevant table of Chapter 5
	which additional functions and interfaces (not specified in this TSI) are implemented and that they do not lead to conflicts with implemented functions specified in this TSI	impact analysis
environment	the compliance with mandatory environmental conditions, where specified in the basic parameters referenced in the relevant table of Chapter 5	tests, to ensure that the requirements of the Basic Parameters referenced in the relevant table of Chapter 5 are satisfied

Aspect	What to assess	supporting evidence
	in addition, the correct functioning in environmental conditions for which the interoperability constituent is designed	tests according to applicant's specifications
Reliability, Availability, Maintainability, Safety (RAMS)	the compliance with safety requirements, as described in the basic parameters referenced in the relevant table of Chapter 5	documentation of: <ol style="list-style-type: none"> 1. the manufacturer quality and safety management throughout design, manufacturing and testing. 2. the safety verification and validation process. 3. the functional and technical safety (correct operation under fault-free conditions, effects of faults and of external influences).
	that the quantitative reliability target indicated by the applicant is met	calculations
	the compliance with requirements about maintenance	document check

6.2.4. Special issues

6.2.4.1. The ERTMS/ETCS on-board

Attention shall be given to the conformity assessment of the ERTMS/ETCS on-board interoperability constituent, because of its complexity and high relevance for the achievement of interoperability.

Independently of the selection of module CB or CH1, the Notified Body shall check that a specimen of the interoperability constituent has passed, in a laboratory accredited for this type of tests, the full set of mandatory test sequences referenced in section 4.2.2 (ETCS on-board functionality).

In addition, to increase confidence on the correct operation of the ERTMS/ETCS on-board with different track-side applications, it is recommended to test the ERTMS/ETCS on-board with scenarios from the data base managed by the Agency and not part of the mandatory test specifications; see section 6.1.2 (Principles for testing of ERTMS/ETCS and GSM-R). The documentation accompanying the certificate shall indicate against which scenarios from the data base the interoperability constituent has been verified.

6.2.4.2. The Specific Transmission Module (STM)

The verification of conformity with national requirements for an STM is the responsibility of the appropriate Member State as stated in Annex B.

The verification of the STM interface to the ERTMS/ETCS on-board requires a conformity assessment carried out by a Notified Body.

6.2.4.3. Content of EC Declaration of conformity

With reference to the content of the EC Declaration of conformity specified in Annex IV of 2008/57/EC, the descriptions met by the interoperability constituent shall include:

1. which optional and additional functions are implemented,
2. the applicable environmental conditions.

6.3. CONTROL-COMMAND AND SIGNALLING SUBSYSTEM

6.3.1. Assessment procedures for Control-Command and Signalling Subsystem

This Chapter deals with EC declaration of verification of Control-Command and Signalling Subsystem.

As stated in Chapter 2, the Track-side and the On-board Assemblies are treated as two separate subsystems.

For each Assembly, an EC declaration of verification is required.

At the request of the applicant the Notified Body carries out EC verification of an On-board or Track-side Assembly in accordance with Annex VI to Directive 2008/57/EC.

The applicant shall draw up the EC declaration of verification for the Control-Command and Signalling Assembly in accordance with Article 18(1) and Annex V of Directive 2008/57EC.

The content of the EC declaration of verification shall conform to Annex V to Directive 2008/57/EC.

The assessment procedure shall be carried out by application of modules as specified in section 6.3.2 (Modules for Control-Command and Signalling Assemblies).

The EC declaration of verification of On-board and Track-side Assemblies, together with the Certificates of Conformity, is sufficient to ensure that an On-board Assembly will be compatible with a Track-side Assembly under the conditions specified in this TSI and without an additional EC Declaration of subsystem verification.

6.3.2. Modules for Control-Command and Signalling Assemblies

For each On-board and Track-side Assembly the modules for EC subsystem verification are applicable.

All modules indicated below are specified in **XXXX**.

6.3.2.1. On-board Assembly

For the verification procedure of the On-board Assembly, the applicant may choose either:

1. the type-examination procedure (Module SB) for the design and development phase in combination with the production quality management system procedure (Module SD) for the production phase, or

2. the type-examination procedure (Module SB) for the design and development phase in combination with the product verification procedure (Module SF), or
3. the full quality management system with design examination procedure (Module SH1).

6.3.2.2. Track-side Assembly

For the verification procedure of the track-side assembly, the applicant may choose either:

1. the unit verification procedure (Module SG), or
2. the type-examination procedure (Module SB) for the design and development phase in combination with the production quality management system procedure (Module SD)) for the production phase, or
3. the type-examination procedure (Module SB) for the design and development phase in combination with the product verification procedure (Module SF), or
4. the full quality management system with design examination procedure (Module SH1).

6.3.2.3. Conditions for use of Modules for On-board and Track-side Assemblies

With reference to section 4.2 of the Module SB (type-examination), design review is requested.

With reference to section 4.2 of the Module SH1 (full quality management system with design examination), a type test is required.

6.3.3. Assessment requirements for an On-board Assembly

The table 6-2 shows the checks that shall be done for the verification of an on-board assembly and the Basic Parameters that shall be respected.

Independently of the selected module:

1. the verification shall demonstrate the compliance with Basic Parameters when the on-board assembly is integrated in the vehicle,
2. functionality and performances already checked at the level of interoperability constituents do not require additional verifications,
3. it shall be ensured that information on the specific implementation of the On-board assembly is provided for the Register of Rolling Stock in accordance with Annex C.

Table 6.2

Aspect	What to assess	supporting evidence
Use of interoperability constituents	the existence of EC Declaration of conformity and corresponding certificate for all interoperability constituents to be integrated in the assembly	existence and content of documents

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Aspect	What to assess	supporting evidence
	restrictions for use of Interoperability Constituents against the characteristics of the assembly and of the environment	analysis by documents check
	in case of interoperability constituents certified against older versions of the CCS TSI, that the certificate still ensures compliance with the requirements in the TSI in force.	impact analysis by documents checks
Integration of interoperability constituents in the assembly	that the correct installation and functioning of the internal interfaces of the assembly - Basic Parameters 4.2.6	checks according to specifications
	that additional functions (not specified in this TSI) do not impact the mandatory ones	impact analysis
	that the values of ETCS IDs are within the allowed range – Basic Parameter 4.2.9	check of design specifications
Integration with rolling stock	the correct installation of equipment - Basic Parameters 4.2.2, 4.2.4, 4.2.14 and conditions for installation of equipment, as specified by the manufacturer	results of checks (according to specifications referenced in the Basic Parameters and installation rules of the manufacturer)
	the compatibility of the equipment of the Control-Command and Signalling assembly with the rolling stock environment	documents check (certificates of interoperability constituents and possible integration solutions against characteristics of rolling stock)
	the correct configuration of parameters (e.g., braking parameters) and that they are within the allowed range	documents check (values of parameters against characteristics of rolling stock)
Integration with Class B	that the external STM is connected to ERTMS/ETCS on-board with TSI compliant interfaces	nothing to test: there is a standard interface already tested at interoperability constituent level – functioning already tested at the level of integration of interoperability constituents in the assembly
	that Class B functions implemented in the ERTMS/ETCS on-board – Basic Parameter 4.2.6.1 - create no additional requirements for track-side assembly due to transitions	nothing to test: all already tested at interoperability constituent level
	that separate Class B equipment not connected to ERTMS/ETCS on-board – Basic Parameter 4.2.6.1 - creates no additional requirements for track-side assembly due to transitions	nothing to test: no interface ³

³ In this case, the assessment of the management of transitions shall be according to national specifications.

Aspect	What to assess	supporting evidence
	that separate Class B equipment connected to ERTMS/ETCS on-board with (partly) non TSI compliant interfaces – basic parameter 4.2.6.1 - creates no additional requirements for track-side assembly due to transitions and that ERTMS/ETCS functions are not affected	impact analysis
Integration with track-side Control-Command and Signalling assemblies	the ability to read Eurobalise telegrams (the scope of this test is limited to checking appropriate installation of the antenna and not repeating the tests already done at the level of Interoperability Constituent) – Basic Parameter 4.2.5	test with a certified Eurobalise the ability to read correctly the telegram
	the ability to read Euroloop telegrams (if applicable) – Basic Parameter 4.2.5	test with a certified Euroloop the ability to read correctly the telegram
	the ability of managing a GSM-R call for voice and data (if applicable) – Basic Parameter 4.2.5	test with a certified GSM-R network the ability to set up, maintain and disconnect a connection
Reliability, Availability, Maintainability, Safety (RAMS)	the compliance with safety requirements - Basic Parameter 4.2.1	Application of procedures specified in the Commission Decision 2009/352/EC
	that the quantitative reliability target is met - Basic Parameter 4.2.1	calculations
	the compliance with requirements about maintenance – section 4.5.2	documents check
Integration with CCS trackside assembly and other subsystems: tests under operational conditions	<p>the behaviour of the assembly in different operational conditions (like line gradient, train speed, vibrations, traction power, climatic conditions, design of CCS track-side functionality) as reasonably feasible. The test shall allow</p> <ol style="list-style-type: none"> 1. the verification of performance of odometry functions - basic parameter 4.2.2 2. the verification of compatibility of Control-Command and Signalling assembly with rolling stock environment – basic parameter 4.2.16 <p>These tests will also increase confidence in the absence of systematic failures.</p> <p>The scope of these tests excludes tests already done in previous steps: tests performed at the level of interoperability constituents and tests performed on the assembly in a simulated environment shall be taken into account.</p> <p>Tests under operational conditions are not necessary for on-board GSM-R voice equipment.</p>	<p>Reports of test runs.</p> <p>Note: Indicate in the certificate which conditions have been tested, which standards have been applied and the criteria to consider the tests terminated</p>

6.3.4. Assessment requirements for a track-side assembly

The assessments to be performed in the scope of this TSI are limited to the compliance with the requirements stated in Chapter 4.

However, for the design of the ERTMS/ETCS part of the Control-Command and Signalling Track-side Assembly, application specific information is necessary, e.g.,

1. the description of the line characteristics such as gradients, distances, positions of route elements and Eurobalises/Euroloops, locations to be protected, etc.,
2. the signalling data and rules required to be handled by the ERTMS/ETCS system.

The assessment of the correctness of application specific information is not in the scope of this TSI.

Independently of the selected module:

1. the tables 6-3 show the checks that shall be done for the verification of a track-side assembly and the Basic Parameters that shall be respected.
2. functionality and performances already checked at the level of interoperability constituents do not require additional verifications.
3. it shall be ensured that information on the specific implementation of the Track-side assembly is provided for the Register of Infrastructure in accordance with Annex C.

Table 6.3

Aspect	What to assess	supporting evidence
Use of interoperability constituents	the existence of EC Declaration of conformity and corresponding certificate for all interoperability constituents to be integrated in the assembly	existence and content of documents
	restrictions for use of interoperability constituents against the characteristics of the assembly and of the environment	impact analysis by documents check
	in case of interoperability constituents certified against older versions of the Control-Command and Signalling TSI, that the certificate still ensures compliance with the requirements in the TSI in force	impact analysis by comparison of specifications referenced in the TSI and certificates of the interoperability constituents
Use of train detection systems	that the selected types comply with Control-Command and Signalling TSI requirements - Basic Parameters 4.2.10, 4.2.11	document check
Integration of interoperability constituents in the assembly	the correct installation and functioning of the internal interfaces of the assembly - Basic Parameters 4.2.5, 4.2.7	checks according to specifications
	that additional functions (not specified in this TSI) do not impact the mandatory ones	impact analysis

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Aspect	What to assess	supporting evidence
	that the values of ETCS IDs are within the allowed range – Basic Parameter 4.2.9	check of design specifications
Integration with infrastructure	the correct installation of equipment - basic parameters 4.2.3, 4.2.4 and conditions for installation specified by the manufacturer	results of checks (according to specifications referenced in the Basic Parameters and installation rules of the manufacturer)
	the compatibility of the equipment of the Control-Command and Signalling assembly with track-side environment	document check (certificates of interoperability constituents and possible integration solutions against characteristics of track-side)
Integration with track-side signalling	that all functions required by the application are implemented in accordance with specifications referenced in this TSI - basic parameter 4.2.3	document check (design specification of the applicant and certificates of interoperability constituents)
	the correct configuration of parameters (Eurobalise telegrams, RBC messages, marker boards positions, etc.)	document check (values of parameters against characteristic of track-side and of signalling)
	the correct installation and functioning of the interfaces	design verification and tests according to information by the applicant
	the correctness of operation of the Control-Command and Signalling assembly according to information at the interfaces with track-side signalling (e.g., appropriate generation of Eurobalise telegrams by a LEU or of message by RBC)	design verification and tests according to information by the applicant
Integration with on-board CCS assemblies and with rolling stock	the GSM-R coverage - Basic Parameter 4.2.4	on site measurements
	the compliance of the train detection systems with the requirements of this TSI - Basic Parameter 4.2.10	on site measurements
	the compliance of the train detection systems with the compatibility requirements stated in this TSI - Basic Parameters 4.2.10 and 4.2.11	check evidence from existing installations (for systems already in use); perform tests according to standards for new types
Reliability, Availability, Maintainability, Safety (RAMS)	the compliance with safety requirements - Basic Parameter 4.2.1	Application of procedures specified in the Commission Regulation 352/2009/EC
	that quantitative reliability targets are respected - Basic Parameter 4.2.1	calculations
	the compliance with requirements about maintenance – section 4.5.2	document check

Aspect	What to assess	supporting evidence
Integration with on-board CCS assemblies and rolling stock: tests under operational conditions	<p>the behaviour of the assembly in such different operational conditions (like train speed, number of trains on the line, climatic conditions) as reasonably feasible. The test shall allow</p> <ol style="list-style-type: none"> 1. the verification of performance of train detection systems - Basic Parameters 4.2.10, 4.2.11, 2. the verification of compatibility of Control-Command and Signalling assembly with track-side environment – Basic Parameter 4.2.16 <p>These tests will also increase confidence in the absence of systematic failures.</p> <p>The scope of these tests excludes tests already done in previous steps: tests performed at the level of interoperability constituents and tests performed on the assembly in a simulated environment shall be taken into account.</p>	<p>Reports of test runs.</p> <p>Note: Indicate in the certificate which conditions have been tested, which standards have been applied and the criteria to consider the tests terminated.</p>

6.4. PROVISIONS FOR PARTIAL CONFORMITY

6.4.1. Introduction

With reference to article 18(4) of the Directive 2008/57/EC, “the Notified Body may issue Intermediate Statement Verifications (ISVs) to cover certain stages of the verification procedure or certain parts of the subsystem”.

According to section 2.2 (Scope) of this TSI, the Control-Command and Signalling subsystem includes three parts, which are specified in section 4.1 (Introduction).

Section 6.4.2 refers to verification of these parts of the Control-Command and Signalling subsystem.

Section 6.4.3 refers to the verification of partial conformity of an interoperability constituent with the requirements of this TSI.

6.4.2. Assessment of parts of Control-Command and Signalling subsystem

Assessment of compliance with the requirements of this TSI for a track-side or on-board Control-Command and Signalling Assembly may be performed in successive steps for the different parts.

In each step only compliance with the TSI requirements for the relevant part is assessed, while other requirements related to the remaining parts are not.

Independently of the modules chosen, the Notified Body shall verify that:

1. the TSI requirements relevant for the part are respected,
2. the TSI requirements already assessed are not prejudiced.

Functions already assessed and unchanged and not affected by this step do not need to be checked again.

6.4.3. Partial conformity of Control-Command and Signalling assemblies

A certificate of conformity for an interoperability constituent can be issued in case some function, interface or performance is not implemented, if:

1. the non implemented function, interface or performance is not required for the integration of the interoperability constituent into an assembly because of specific conditions of use, for example⁴,
 - a) ERTMS/ETCS on-board interface to STM in case the interoperability constituent is intended for installation on vehicles where no external STM is necessary,
 - b) RBC interface to other RBCs, in case the RBC is intended for use in application where no neighbouring RBCs are foreseen,
2. the certificate indicates which functions, interfaces, performance are not implemented and the corresponding restrictions for the use of the interoperability constituent. This information will allow identifying the conditions under which the interoperability constituent can be used and the restrictions that will apply for the interoperability of a subsystem incorporating it.

In any case, the conditions to issue such certificates with restrictions shall be coordinated between the Notified Bodies and the Agency, according to article 21a/5 of 881/2004 as modified by 1335/2008.

When the interoperability constituent is integrated into an assembly, in case the missing functions, interfaces, performances do not allow the assessment of full compliance with the requirements of this TSI, only an Intermediate Statement of Verification indicating which requirements have been assessed can be issued, including the corresponding restrictions for the use of the assembly and its compatibility with other assemblies or railway subsystems.

⁴ *The procedures described in this chapter do not prejudice the possibility of grouping of constituents.*

7. IMPLEMENTATION OF THE TSI CONTROL-COMMAND AND SIGNALLING

7.1. INTRODUCTION

This chapter outlines the strategy and the associated technical solutions for implementation of the TSI, notably the conditions underpinning the migration to Class A systems.

Account must be taken of the fact that the implementation of a TSI occasionally has to be co-ordinated with the implementation of other TSIs.

7.2. GENERALLY APPLICABLE RULES

7.2.1. Upgrading or renewal of the Control-Command Track-side Assembly or parts of it

Upgrading or renewal of the track-side assembly may concern separately:

1. Train protection
2. Radio communication
3. Train detection

Therefore different parts of the Control-Command Track-side Assembly may be upgraded or renewed separately (if interoperability is not jeopardised) and concern:

1. GSM-R functions and interfaces
2. ERTMS/ETCS functions and interfaces
3. Train detection system compatibility with rolling stock

See chapter 4.1 (Introduction) for the definition of the basic parameters relevant for each part.

7.2.2. Legacy systems

Member States shall ensure that the functionality of the legacy systems as well as their interfaces is to remain as currently specified, excluding those modifications that might be deemed necessary in order to mitigate safety-related flaws of these systems.

7.2.3. Availability of Specific Transmission Modules

In case lines under the scope of the present TSI will not be equipped with Class A train protection systems, the Member State shall make every effort for the availability of an external Specific Transmission Module (STM) for its legacy Class B train protection system or systems.

In this context, due regard is to be given to the assurance of an open market for STM at fair commercial conditions. In those cases that due to technical or commercial reasons⁵ the availability of an STM cannot be ensured within the appropriate time frame⁶ the relevant Member State is deemed to inform the Committee of the reasons

⁵ e. g. the feasibility of the external STM concept cannot be technically guaranteed or potential issues relating to the ownership of the intellectual property rights of the Class B systems prevent a timely development of an STM product.

⁶ 31 December 2007.

underpinning such a problem and the mitigation measures that it intends to put into place in order to allow access — notably of foreign operators — to its infrastructure.

7.2.4. Additional Class B equipment on a line equipped with Class A

On a line equipped with ETCS and/or GSM-R, additional Class B equipment is possible in order to allow the operation of rolling stock not compatible with Class A during the migration phase. It is allowed to use existing Class B equipment on-board as a fallback arrangement to Class A system: this does not allow an infrastructure manager to require Class B systems onboard the interoperable trains for running on such a line.

Where dual fitment and operation of Class A and B systems occurs, then both systems may be active simultaneously onboard, provided that national technical requirements and operating rules support this manner and that interoperability is not compromised.

The national technical requirements and operating rules will be provided by the Member State.

7.2.5. Rolling stock with train protection Class A and Class B equipment

Rolling stock may be equipped with both Class A and Class B systems to enable operations on several lines. The Class B systems may be implemented

1. using an STM that may be plugged into the ERTMS equipment ('external STM'), or
2. integrated within the ERTMS/ETCS equipment.

Also, the Class B system could be implemented independently (or, in case of upgrade or renewal, be left 'as is'), in case of Class B systems for which an STM is not an economically viable alternative, from the rolling stock owner's point of view.

However, if a STM is not used, the Railway Undertaking must ensure that the absence of a 'handshake' (i.e., handling, by ETCS, of transitions between Class A and Class B on track-side) nevertheless is properly managed. The Member State may put requirements on this.

When running on a line which is equipped with both Class A and Class B systems, the Class B systems may act as fallback arrangement for the Class A system if the train is equipped with both Class A and Class B systems. This cannot be a requirement for interoperability and is not valid for GSM-R.

7.2.6. Conditions for mandatory and optional functions

According to the characteristics of the track-side Control-Command and Signalling Assembly and its interfaces with other sub-systems, some track-side functionalities not classified as mandatory, may have necessarily to be implemented in certain applications to comply with the essential requirements.

The trackside implementation of National or Optional-functions must not prevent the entry onto that infrastructure of a train that complies only with the mandatory requirements of Onboard Class A system and equipped with ETCS and GSM-R versions equal or higher than the versions implemented trackside, except as required for certain on-board optional functions, under the conditions specified in chapter 4 of this TSI.

7.2.7. GSM-R specific implementation rules**7.2.7.1. *Trackside installations:***

The fitting of GSM-R is mandatory in the case of:

1. New installations of the radio part of a CCS trackside assembly;
2. An upgrade of the radio part of a CCS trackside assembly already in service that changes the functions or the performance of the subsystem, with the exception of those modifications that might be deemed necessary to mitigate safety-related defects in the legacy installation.

It is recommended to install GSM-R whenever the infrastructure or energy sub-system of a section of line already in service is to be upgraded, renewed or maintained when this entails an investment higher than at least ten times those associated with the installation of GSM-R facilities on that section of line.

7.2.7.2. *On-board installations:*

The fitting of GSM-R in rolling stock intended for use on a line including at least a section equipped with Class A interfaces (even if superimposed to a Class B system), is mandatory in the case of:

1. New installations of the radio part of a CCS on-board assembly;
2. An upgrade of the radio part of a CCS on-board assembly already in service that changes the functions or the performance of the subsystem, with the exception of those modifications that might be deemed necessary to mitigate safety-related defects in the legacy installation.

7.2.8. Train detection systems specific implementation rules

In the context of this TSI, train detection system means the equipment installed on the line, which provides the physical detection of presence or absence of vehicles and to which the requirements of mechanical and electromagnetic compatibility set out in this TSI apply.

Trackside systems (e.g., interlocking or level crossing control systems) using information from such equipment are not considered parts of the train detection system.

The implementation of train detection systems compliant with the requirements of this TSI can be done independently of the installation of ETCS or GSM-R, but can be dependent on the Class B signalling systems which are listed in Annex B or on special requirements, e.g., for level crossing equipment.

The requirements of this TSI related to train detection systems shall be respected in each of the following cases:

1. upgrade of the train detection system of a line or of isolated train detection systems (e.g., to operate level crossing equipment)
2. renewal of the train detection system of a line or of isolated train detection systems (e.g., to operate level crossing equipment)
3. removal of Class B train protection systems (in case the train detection system is integrated with the train protection)

7.2.9. Specific Cases

7.2.9.1. Introduction

The following special provisions are permitted in the specific cases below.

These specific cases belong to two categories: the provisions apply either permanently (case 'P'), or temporarily (case 'T').

In temporary cases, it is recommended that the Member States concerned should conform with the relevant subsystem either by 2010 (case 'T1'), an objective set out in Decision No 1692/96/EC of the European Parliament and of the Council of 23 July 1996 on Community guidelines for the development of the trans-European transport network, or by 2020 (case 'T2').

In this TSI temporary case 'T3' is defined as temporary cases which will still exist after 2020.

7.2.9.2. List of specific cases

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7.3. RULES FOR ERTMS

7.3.1. The ERTMS European Deployment Plan

This section outlines the strategy for the implementation (ERTMS European Deployment Plan) of the TSI and specifies the stages to be completed in order to make a gradual transition from the existing situation to the final situation in which compliance with the TSIs shall be the norm.

The ERTMS European Deployment Plan does not apply to lines located in the territory of a Member State when its rail network is separated or isolated by the sea or separated as a result of special geographical conditions from the rail network of the rest of the Community. This strategy does not apply to locomotives running exclusively on such lines.

7.3.2. ERTMS Trackside Implementation

The objective of the ERTMS European Deployment Plan is to ensure that, gradually, locomotives, railcars and other railway vehicles equipped with ERTMS can have access to an increased number of lines, ports, terminals and marshalling yards without needing national equipment in addition to ERTMS.

To that purpose, the deployment plan does not request the removal of the existing Class B systems on the lines included in the plan. However, by the date specified in the implementation plan, equipment with a Class B system shall not be a track access condition to lines included in the deployment plan for locomotives, railcars and other railway vehicles equipped with ERTMS.

When terminal areas, such as ports or specific lines in a port for example, are not equipped with any Class B system, the requirements related to the "connection" of

these terminal areas does not necessarily mean that these terminals or lines need to be equipped with ERTMS, as long as equipment with a Class B system is not requested as a track access condition.

For lines consisting of a double track or more, the line is considered to be equipped as soon as a double track is equipped. When there is more than one line on a corridor section, at least one line has to be equipped on the section and the whole corridor is considered to be equipped as soon as at least one line is equipped on the whole length of the corridor.

7.3.2.1. *Corridors*

The six corridors described in 7.3.4 shall be equipped with ERTMS according to the timetable indicated in that section⁷.

7.3.2.2. *Connection to the main European ports, marshalling yards, freight terminals and freight transport areas.*

The ports, marshalling yards, freight terminals and freight transport areas listed in 7.3.5 shall be linked to at least one of the six corridors specified in 7.3.4 at the date and under the conditions specified in 7.3.5.

7.3.2.3. *High speed network*

It is mandatory to fit an ERTMS/ETCS track-side assembly when:

1. New installations of the train protection part of a Control-Command and Signalling track-side assembly (with or without a Class B system), or
2. the existing train protection part of a Control-Command and Signalling track-side assembly is upgraded, where this would change the functions, performance and/or interoperability-relevant interfaces (air-gaps) of the existing legacy system, with the exception of those modifications that might be deemed necessary to mitigate safety-related defects in the legacy installation.

It is recommended to install ERTMS/ETCS whenever the infrastructure or energy sub-system of a section of line already in service is to be upgraded, renewed or maintained when this entails an investment higher than at least ten times those associated with the installation of ETCS facilities on that section of line.

7.3.2.4. *EU-funded projects*

Without prejudice to sections 7.3.2.1, 7.3.2.2 and 7.3.2.3, the fitting of ERTMS/ETCS is mandatory in the case of:

1. New installations of the train protection part of a CCS assembly or
2. An upgrade of the train protection part of a CCS assembly already in service that changes the functions or the performance of the subsystem

for railway infrastructure projects receiving financial support from European Regional Development Funds and/or Cohesion Funds (EC Regulation 1083/2006⁸) and/or the TEN-T funds (Decision 1692/96/EC of the European Parliament and of the Council⁹).

⁷ Section 7.3.4 indicates the latest date for equipment, with a view to build a consistent ERTMS network on a step by step basis. In a number of cases, voluntary agreements as regards an earlier equipment date exist.

⁸ OJ L 210, 31.7.2006, p. 25

⁹ OJ L 228, 9.9.1996, p. 1

However, when signalling is renewed on short (less than 150 km) and discontinuous sections of a line, the Commission may grant derogation to this rule, provided ERTMS is installed before the earliest of these two dates:

1. 5 years after the end of the project
2. the time by which the section of the line is connected to another ERTMS equipped line.

In this section, the earliest of these two dates is called "later date for equipment".

The Member State concerned shall forward a file to the Commission. This file shall contain an economical analysis showing that there is a substantial economical and/or technical advantage in putting ERTMS into service at the later date for equipment rather than during the course of the EU-funded project.

Such clause can only be advocated by a Member State when the tender covering the renewal or upgrade of the train protection system contains a clear option for the ERTMS equipment of the line, either in the course of the project or at the "later date for equipment".

The Commission shall analyse the file submitted and the measures proposed by the Member State and shall inform the committee referred to in Article 29 of Directive 2008/57/EC of the European Parliament and of the Council¹⁰ of the result of its analysis. When a derogation is granted, the Member State shall ensure that ERTMS is installed before the "later date for equipment".

7.3.2.5. *Notification*

For each corridor section described in 7.3.4, Member States shall either notify to the Commission a detailed timeline for the equipment with ERTMS of the corridor section or confirm that the corridor section is already equipped. The information shall be notified to the Commission at the latest three years before the latest equipment date of the corridor section specified in 7.3.4.

For each port, marshalling yard, freight terminal or freight transport area listed in 7.3.5, Member States shall notify the specific lines to be used to ensure its connection with one of the corridors listed in 7.3.4. This information shall be notified to the Commission at the latest three years before the date specified in 7.3.5 and shall indicate the latest equipment date for this port, marshalling yard, freight terminal or freight transport area. As necessary, the European Commission may request adjustments, in particular in order to ensure consistency between equipped lines at the borders. Member States shall either notify to the Commission a detailed timeline for the equipment with ERTMS of these specific lines or confirm that these specific lines are already equipped with ERTMS. This information shall be notified to the Commission at the latest three years before the date specified in 7.3.5 and shall indicate the latest equipment date for this port, marshalling yard, freight terminal or freight transport area.

The detailed timelines shall in particular indicate the date by which the tender for the equipment of the line will be concluded, the procedures put in place in order to ensure interoperability with the neighbouring countries on the corridor as well as the main milestones related to the project. Member States shall notify the Commission

¹⁰ OJ L 191, 18.7.2008, p. 1

every twelve months on the progress made with the implementation on these lines by sending an updated timeline.

7.3.2.6. *Delays*

When a Member State reasonably expects delays in fulfilling the deadlines laid down in the present Decision, it shall immediately inform the Commission. It shall communicate to the Commission a file containing a technical description of the project and an up to date planning. The file shall also explain the reasons for the delay and shall indicate the corrective measures put in place by the Member State.

An additional delay of no more than three years can be granted to a Member State when the delay is caused by causes beyond Member State's reasonable control such as failure of suppliers or problems regarding the authorisation process due to the absence of appropriate test vehicles. Such clause can only be advocated by a Member State when the following conditions are fulfilled:

1. The notifications referred in section 7.3.2.5 were received in time and were comprehensive.
2. The file referred to in section 7.3.2.6, first paragraph, contains clear evidence that the causes for the delay were beyond Member State's control.
3. A competent authority is responsible for the coordination, of on-board and trackside suppliers and integration and testing of products.
4. Appropriate use of existing laboratories has been made.
5. Evidence is given that appropriate measures have been implemented to minimise the additional delay.

The Commission shall analyse the file submitted and the measures proposed by the Member State and shall inform the committee referred to in Article 29 of Directive 2008/57/EC of the result of its analysis.

7.3.3. **ERTMS - On-board implementation**

New locomotives, new railcars and other new railway vehicles able to run without traction equipped with a driving cab, ordered after 1 January 2012 or put into service after 1 January 2015, shall be equipped with ERTMS.

This requirement does not apply to new shunting locomotives and to other new locomotives, new railcars and other new railway vehicles equipped with a driving cab, if they are designed exclusively for national service or regional border crossing service. Member States may however introduce additional requirements at national level, in particular with a view to:

1. restrict the access to ERTMS equipped lines to ERTMS equipped locomotives, so that existing national systems can be decommissioned;
2. request that new shunting locomotives and/or other new railway vehicles equipped with a driving cab, even designed exclusively for national service or regional border crossing service, are equipped with ERTMS.

7.3.3.1. *High speed network*

It is mandatory to fit an ETCS onboard assembly when:

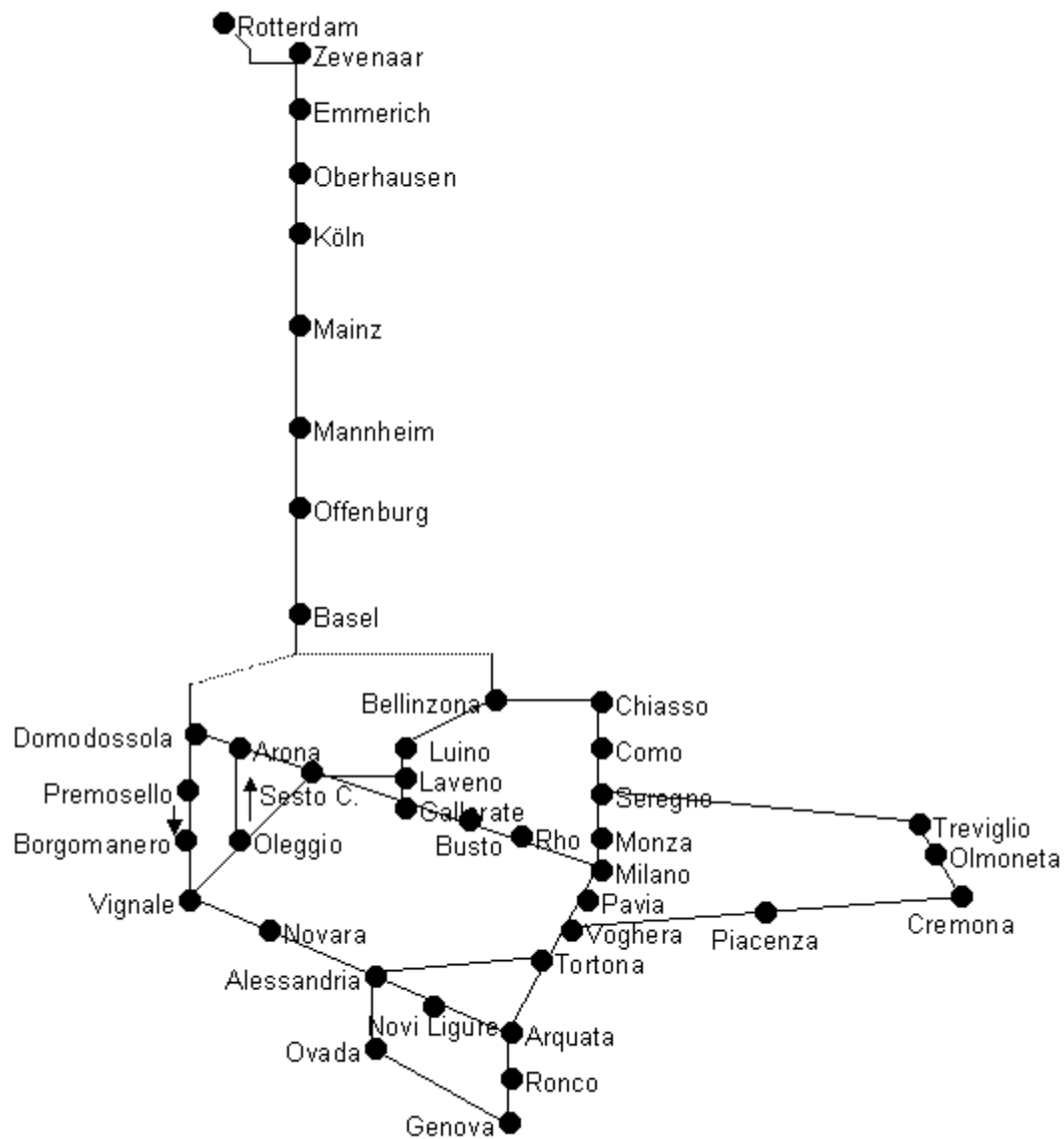
1. any new train protection part of a CCS onboard assembly is installed, or
2. any existing train protection part of a CCS onboard assembly is upgraded, where this would change the functions, performances and/or interoperability-

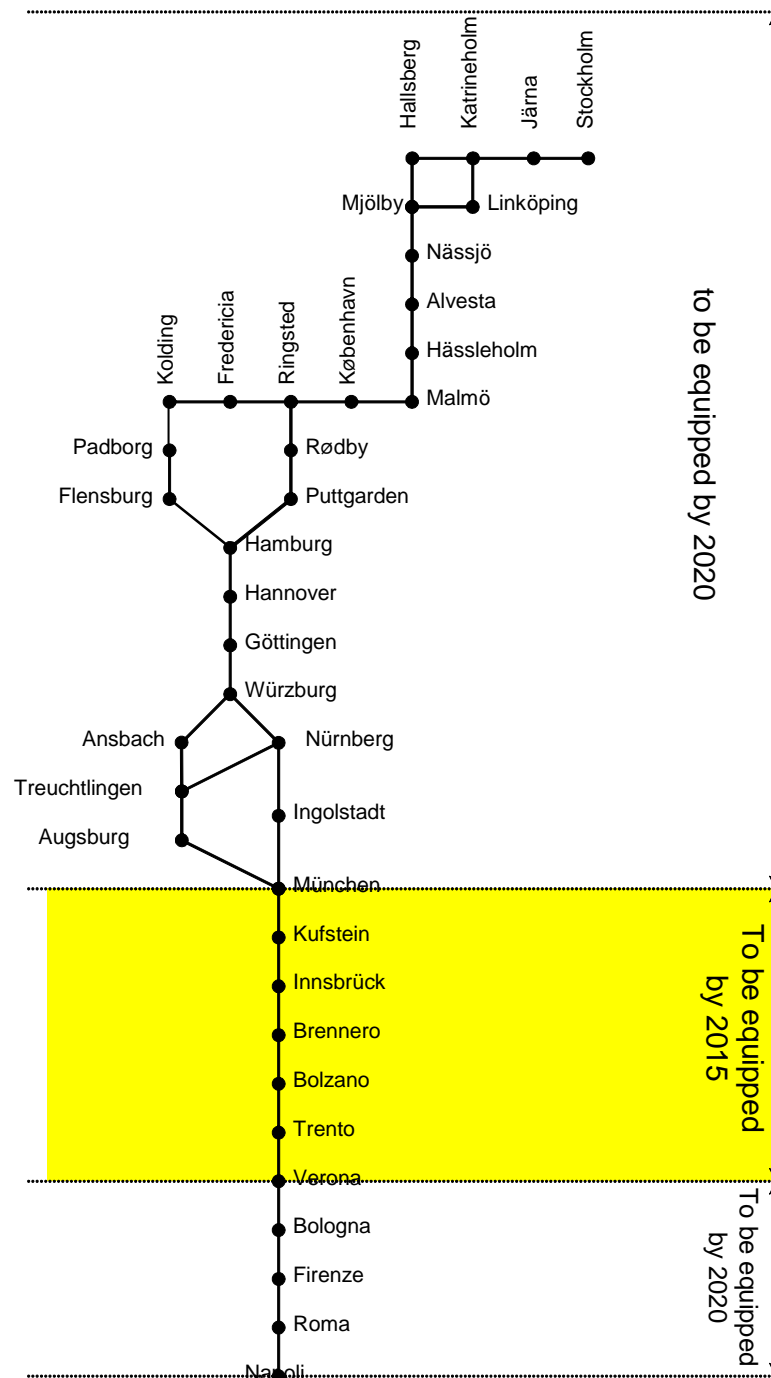
relevant interfaces of the existing legacy system, with the exception of those modifications that might be deemed necessary to mitigate safety related defects in the legacy system.

It is recommended to install ETCS whenever a rolling stock already in service is upgraded when this entails an investment higher than at least ten times those associated with the installation of ETCS on that specific type of rolling stock.

7.3.4. Specific lines constituting the corridors

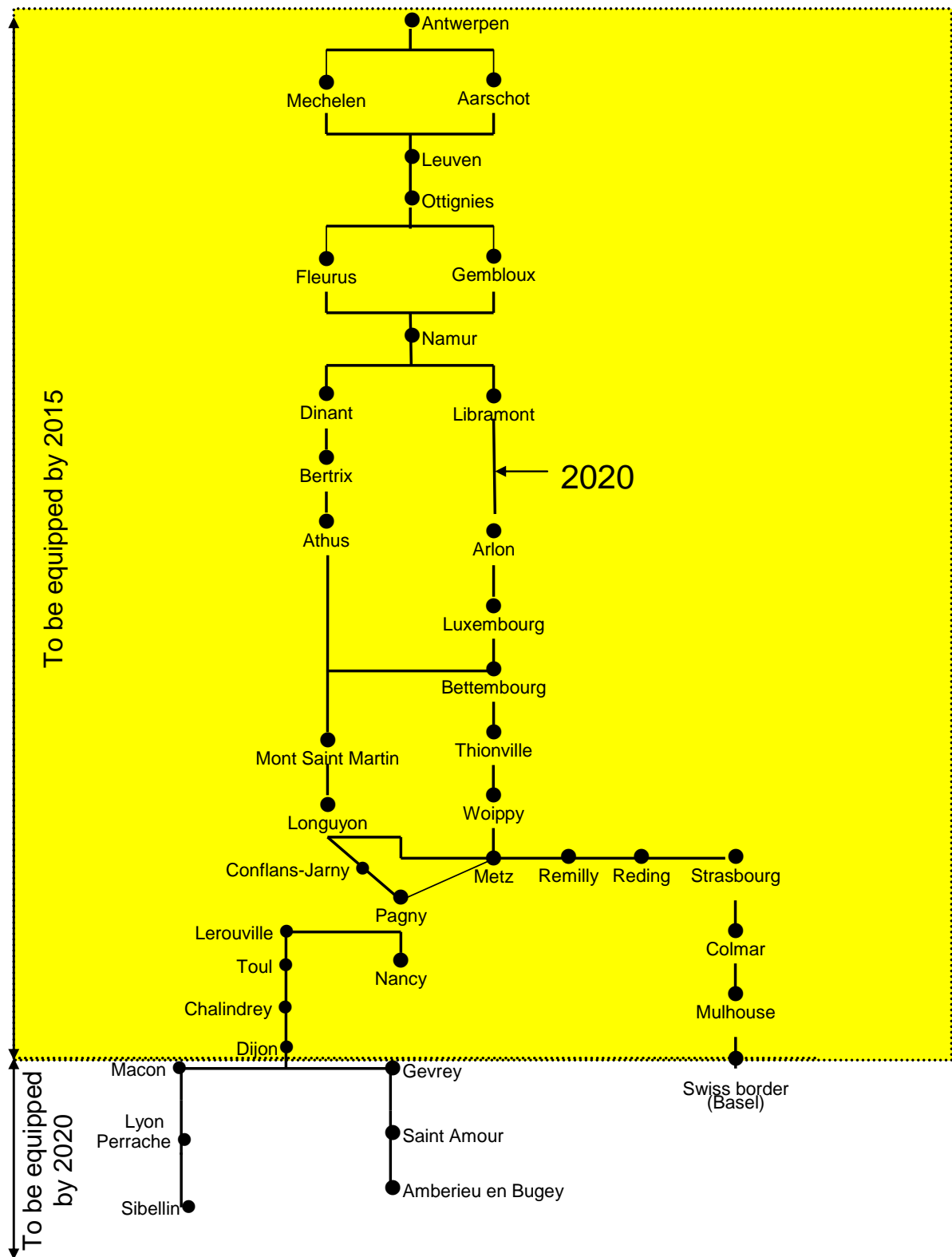
Corridor A – to be equipped by 2015

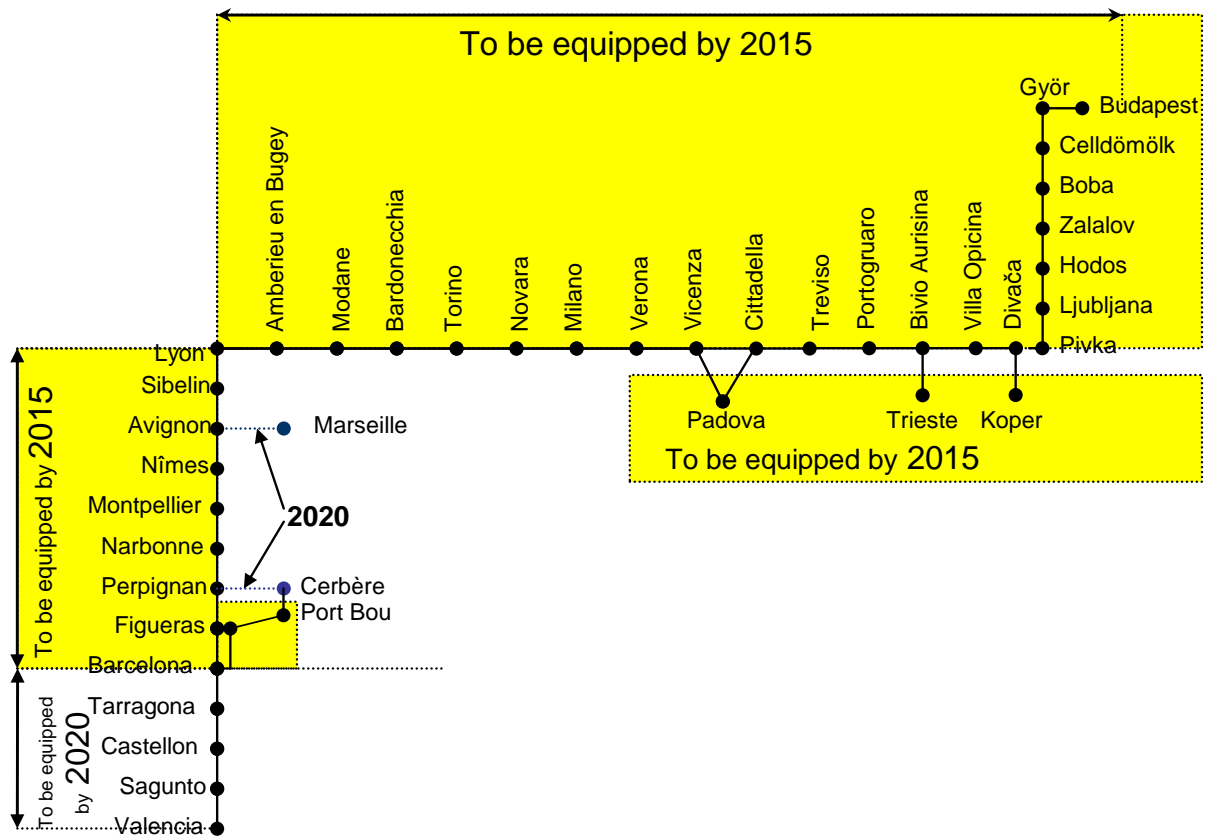


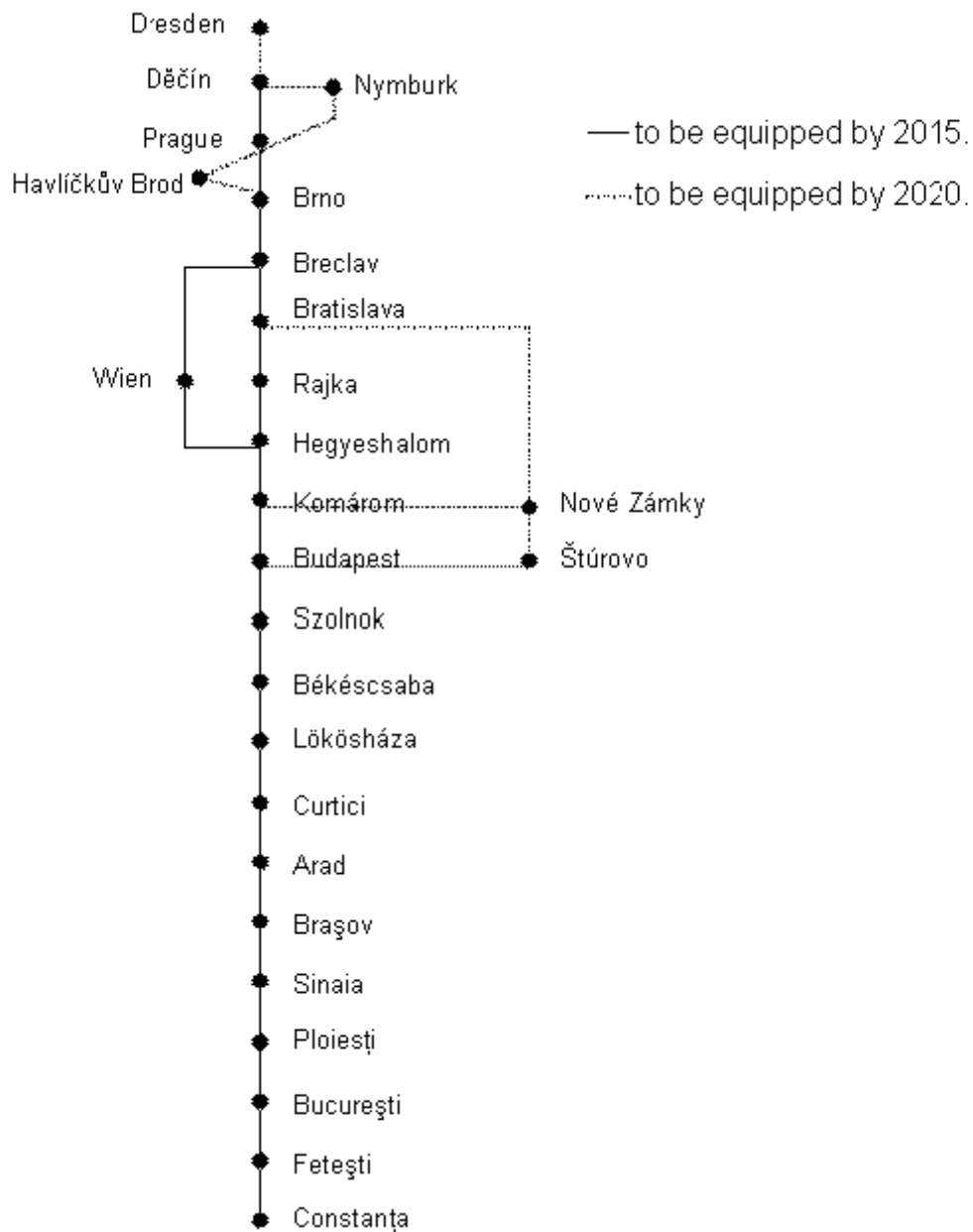
Corridor B¹¹

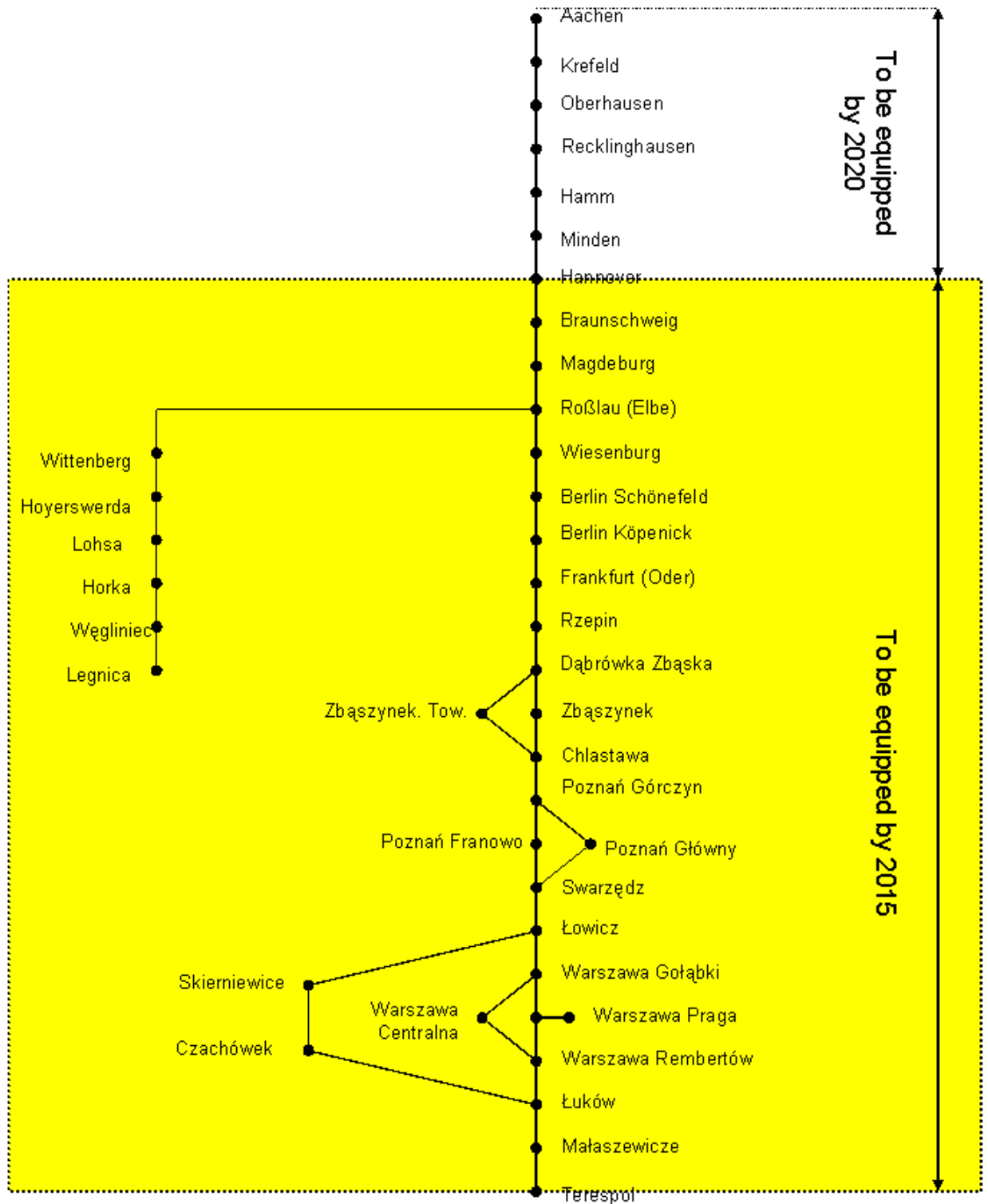
11

Without prejudice of the legislation applicable to the Trans European high speed network, links can be provided through stretches of high speed lines, provided paths are allocated to freight trains. At least one ERTMS equipped link will be provided by 2020 between Denmark and Germany (Flensburg-Hamburg or Rødby – Puttgarden) but not necessarily two. The Brenner base tunnel will be equipped with ERTMS once the infrastructure work completed (target date 2020).

Corridor C¹²

Corridor D¹³

Corridor E

Corridor F

7.3.5. Main European ports, marshalling yards, freight terminals and freight transport areas¹⁴

Country	Freight transport area	Date	Remark
Belgium	Antwerpen	31.12.2015	A link to Rotterdam shall also be provided by 2020.
	Gent	31.12.2020	
	Zeebrugge	31.12.2020	
Bulgaria	Burgas	31.12.2020	The connection to corridor E implies the equipment of the section Bourgas-Sofia and Sofia-Vidin-Calafat and Calafat-Curtici in Romania (PP22).
Czech Republic	Praha	31.12.2015	
	Lovosice	31.12.2020	
Denmark	Taulov	31.12.2020	Connecting this terminal implies that the Flensburg-Padborg line is chosen to be an ERTMS equipped link – see corridor B footnote.
Germany	Dresden ¹⁵	31.12.2020	By 2020, a direct link between corridor E and corridor F (from Dresden to Hannover) shall also be ensured.
	Lübeck	31.12.2020	
	Duisburg	31.12.2015	
	Hamburg ¹⁶	31.12.2020	
	Köln	31.12.2015	
	München	31.12.2015	
	Hannover	31.12.2015	
	Rostock	31.12.2015	
	Ludwigshafen/ Mannheim	31.12.2015	
	Nürnberg	31.12.2020	
Greece	Pireás	31.12.2020	The connection to Corridor E implies equipment of the section Kulata-Sofia in Bulgaria.
Spain	Algeciras	31.12.2020	
	Madrid	31.12.2020	
	Pamplona	31.12.2020	Three connections are requested. A connection to Paris via Hendaye, a connection from Pamplona to Madrid and a connection from Pamplona to corridor D via Zaragoza.
	Zaragoza	31.12.2020	
	Tarragona	31.12.2020	
	Barcelona	31.12.2015	
	Valencia	31.12.2020	
France	Marseille	31.12.2020	
	Perpignan	31.12.2015	
	Avignon	31.12.2015	
	Lyon	31.12.2015	
	Le Havre	31.12.2020	
	Lille	31.12.2020	
	Dunkerque	31.12.2020	
	Paris	31.12.2020	By 2020 the following connections will be provided: i) Hendaye ii) Channel Tunnel iii) Dijon iv) Metz via Epernay and Châlons-en-Champagne.
Italy	La Spezia	31.12.2020	
	Genova	31.12.2015	
	Gioia Tauro	31.12.2020	

¹⁴ The list of hubs included in this Appendix may be revised, as long as any revisions do not reduce freight traffic or significantly impact projects in other Member States.

¹⁵ Germany will do its best to equip the corridor E section, Dresden -Czech border at an earlier date.

¹⁶ Germany will ensure the equipment of a rail link to Hamburg but the harbour area may only be partly equipped by 2020.

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Country	Freight transport area	Date	Remark
	Verona	31.12.2015	
	Milano	31.12.2015	
	Taranto	31.12.2020	
	Bari	31.12.2020	
	Padova	31.12.2015	
	Trieste	31.12.2015	
	Novara	31.12.2015	
	Bologna	31.12.2020	
	Roma	31.12.2020	
Luxembourg	Bettembourg	31.12.2015	
Hungary	Budapest	31.12.2015	
Netherlands	Amsterdam	31.12.2020	
	Rotterdam	31.12.2015	A link to Antwerp shall also be provided by 2020.
Austria	Graz	31.12.2020	
	Wien	31.12.2020	
Poland	Gdynia	31.12.2015	
	Katowice	31.12.2020	
	Wrocław	31.12.2015	By 2020 the line Wrocław-Legnica, shall be equipped in order to ensure a direct link to the German border (Gorlitz).
	Gliwice	31.12.2015	
	Poznań	31.12.2015	
	Warszawa	31.12.2015	
Portugal	Sines	31.12.2020	
	Lisboa	31.12.2020	
Romania	Constanța	31.12.2015	
Slovenia	Koper	31.12.2015	
	Ljubljana	31.12.2015	
Slovakia	Bratislava	31.12.2015	
UK	Bristol		This terminal will be connected as corridor C is extended to the Channel Tunnel

8. ANNEX A

8.1. REFERENCES

The following table A-1 indicates for each reference made in the basic parameters (Chapter 4 of this TSI) the corresponding mandatory specifications, via the Index of the table 2.

Table A 1

Reference in Chapter 4	Index of table A 2
4.1	
4.1a	1
4.1b	32
4.1c	3
4.2.1	
4.2.1 a	27
4.2.1 b	28
4.2.2	
4.2.2.a	14
4.2.2.b	1, 4, 13, 15
4.2.2.c	31, 37
4.2.2.d	18, 20
4.2.2.e	6,
4.2.2.f	7
4.2.3	
4.2.3 a	14
4.2.3 b	1, 4, 13, 15
4.2.3 c	31, 37 b, c, d
4.2.3 d	18, 21
4.2.4	
4.2.4 a	64, 65
4.2.4 b	66
4.2.4 c	67
4.2.4 d	68
4.2.4 e	32, 33
4.2.4 f	48
4.2.4 g	69, 70
4.2.4 h	71, 72
4.2.4 j	73, 74
4.2.4 m	75, 76
4.2.5	
4.2.5 a	35, 64, 65
4.2.5 b	10, 39, 40
4.2.5c	19, 20
4.2.5 d	9, 43
4.2.5 e	16, 50
4.2.6	
4.2.6 a	8, 25, 26, 49
4.2.6 b	45
4.2.6 c	46
4.2.6 d	34

Reference in Chapter 4	Index of table A 2
4.2.6 e	20
4.2.6 f	44
4.2.7	
4.2.7 a	12
4.2.7 b	58, 62, 63
4.2.7 c	34
4.2.7 d	9
4.2.7 e	16
4.2.8	
4.2.8 a	11, 56
4.2.9	
4.2.9 a	23
4.2.9 b	53
4.2.10	
4.2.10 a	77 (sections xx)
4.2.11	
4.2.11 a	77 (sections yy)
4.2.12	
4.2.12 a	51
4.2.13	
4.2.13 a	32, 33, 51
4.2.14	
4.2.14 a	5, 41
4.2.15	
4.2.15 a	38

8.2. SPECIFICATIONS

All specifications in the table A-2 below, and only they, are legally binding. Documents mentioned inside a specification listed in the table A-2 shall be considered informative, unless they are explicitly listed in the table A-2.

In case a specification listed in the table A-2 makes references to another specification listed in the table A-2, the applicable version is the one indicated in the table A-2.

These principles take precedence on any different statement possibly made in the specifications themselves.

Table A 2 - List of mandatory specifications

Index N	Reference	Document Name	Version	Notes
1	ERA/ERTMS/003204	ERTMS/ETCS Functional requirement specification	5.0	
2	Intentionally deleted			
3	UNISIG SUBSET-023	Glossary of terms and abbreviations	2.0.0	
4	UNISIG SUBSET-026	System requirement specification	2.3.0	
5	UNISIG SUBSET-027	FFFIS Juridical recorder-downloading tool	2.3.0	
6	UNISIG SUBSET-033	FIS for man-machine interface	2.0.0	

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Index N	Reference	Document Name	Version	Notes
7	UNISIG SUBSET-034	FIS for the train interface	2.0.0	
8	UNISIG SUBSET-035	Specific transmission module FFFIS	2.1.1	
9	UNISIG SUBSET-036	FFFIS for Eurobalise	2.4.1	
10	UNISIG SUBSET-037	EuroRadio FIS	2.3.0	
11	Reserved 05E537	Offline key management FIS		
12	UNISIG SUBSET-039	FIS for the RBC/RBC handover	2.3.0	
13	UNISIG SUBSET-040	Dimensioning and engineering rules	2.3.0	
14	UNISIG SUBSET-041	Performance requirements for interoperability	2.1.0	
15	ERA SUBSET-108	Interoperability related consolidation on TSI annex A documents	1.2.0	
16	UNISIG SUBSET-044	FFFIS for Euroloop subsystem	2.3.0	
17	Intentionally deleted			
18	UNISIG SUBSET-046	Radio infill FFFS	2.0.0	
19	UNISIG SUBSET-047	Track-side-trainborne FIS for radio infill	2.0.0	
20	UNISIG SUBSET-048	Trainborne FFFIS for radio infill	2.0.0	
21	UNISIG SUBSET-049	Radio infill FIS with LEU/interlocking	2.0.0	
22	Intentionally deleted			
23	UNISIG SUBSET-054	Assignment of values to ETCS variables	2.0.0	
24	Intentionally deleted			
25	UNISIG SUBSET-056	STM FFFIS Safe time layer	2.2.0	
26	UNISIG SUBSET-057	STM FFFIS Safe link layer	2.2.0	
27	UNISIG SUBSET-091	Safety requirements for the technical interoperability of ETCS in levels 1 and 2	2.5.0	
28	Reserved	Reliability — availability requirements		
29	UNISIG SUBSET-102	Test specification for interface “k”	1.0.0	
30	Intentionally deleted			
31	UNISIG SUBSET-094	UNISIG Functional requirements for an onboard reference test facility	2.0.2	
32	EIRENE FRS	GSM-R Functional requirements specification	7	
33	EIRENE SRS	GSM-R System requirements specification	15	
34	A11T6001 12	(MORANE) Radio transmission FFFIS for EuroRadio	12	
35	ECC/DC(02)05	ECC Decision of 5 July 2002 on the designation and availability of frequency bands for railway purposes in the 876-880 and 921-925 MHz bands		
36 a	Intentionally deleted			
36 b	Intentionally deleted			
36 c	UNISIG SUBSET-074-2	FFFIS STM Test cases document	1.0.0	
37 a	Intentionally deleted			
37 b	UNISIG SUBSET-076-5-2	Test cases related to features	2.3.1	
37 c	UNISIG SUBSET-076-6-3	Test sequences	2.3.1	
37 d	UNISIG SUBSET-076-7	Scope of the test specifications	1.0.2	
37 e	Intentionally deleted			
38	06E068	ETCS Marker-board definition	1.0	
39	UNISIG SUBSET-092-1	ERTMS EuroRadio conformance requirements	2.3.0	
40	UNISIG SUBSET-092-2	ERTMS EuroRadio test cases safety layer	2.3.0	
41	Reserved UNISIG SUBSET 028	JRU Test specification		
42	Intentionally deleted			
43	UNISIG SUBSET 085	Test specification for Eurobalise FFFIS	2.2.2	
44	Reserved	Odometry FIS		
45	UNISIG SUBSET-101	Interface “K” specification	1.0.0	
46	UNISIG SUBSET-100	Interface “G” specification	1.0.1	
47	Intentionally deleted			
48	Reserved	Test specification for mobile equipment GSM-R		
49	UNISIG SUBSET-059	Performance requirements for STM	2.1.1	
50	UNISIG SUBSET-103	Test specification for Euroloop	1.0.0	
51	Reserved	Ergonomic aspects of the DMI		
52	UNISIG SUBSET-058	FFFIS STM Application layer	2.1.1	
53	Reserved	AEIF-ETCS Variables manual		
54	Intentionally deleted			
55	Reserved	Juridical recorder baseline requirements		
56	Reserved 05E538	ERTMS Key management conformance requirements		
57	Intentionally deleted			
58	UNISIG SUBSET-097	Requirements for RBC-RBC safe communication interface	1.1.0	
59	Intentionally deleted			

Index N	Reference	Document Name	Version	Notes
60	Reserved UNISIG SUBSET-104	ETCS Version management		
61	Reserved	GSM-R Version management		
62	Reserved UNISIG SUBSET-099	RBC-RBC Test specification for safe communication interface		
63	UNISIG SUBSET-098	RBC-RBC Safe communication interface	1.0.0'	
64	EN 301 515	Global System for Mobile Communication (GSM); Requirements for GSM operation on railways	2.3.0	Note 1
65	TR 102 281	Detailed requirements for GSM operation on railways	1.0.0	Note 2
66	(MORANE) A 01 T 0004 1	ASCI Options for Interoperability	1	
67	(MORANE) P 38 T 9001 3	FFFS for GSM-R SIM Cards	3	
68	(MORANE) H 22 T 0001 2	Specification on Usage of the UUIE in the GSM-R environment	2	
69	(MORANE) F 10 T 6002 3	FFFS for Confirmation of High Priority Calls'	3	
70	(MORANE) F 12 T 6002 3	FIS for Confirmation of High Priority Calls	3	
71	(MORANE) E 10 T 6001 3	FFFS for Functional Addressing	3	
72	(MORANE) E 12 T 6001 4	FIS for Functional Addressing	4	
73	(MORANE) F 10 T 6001 3	FFFS for Location Dependent Addressing	3	
74	(MORANE) F 12 T 6001 2	FIS for Location Dependent Addressing	2	
75	(MORANE) F 10 T 6003 3	FFFS for Presentation of Functional Numbers to Called and Calling Parties	3	
76	(MORANE) F 12 T 6003 3	FIS for Presentation of Functional Numbers to Called and Calling Parties	3	
77	Reserved	Interfaces between CCS track-side and other subsystems		

Note 1: as an exception to the general rule stated above, the specifications listed in Indexes [1] to [36] inclusive of this standard are mandatory.

Note 2: as an exception to the general rule stated above, the change requests (CRs) listed in table 1 and 2 of this standard are mandatory.

9. ANNEX B

Intentionally deleted

10. ANNEX C**LINE SPECIFIC CHARACTERISTICS AND TRAIN SPECIFIC CHARACTERISTICS TO BE PUT IN THE REGISTERS ACCORDING TO ART. 22.A OF THE DIRECTIVE 2008/57/EC**

As stated in section 4.8 of this TSI, this Annex indicates which information concerning the Control-Command and Signalling subsystem shall be included in the Register of Infrastructure and in the European Register of Authorised Types of Vehicles (ERATV) respectively.

List of specific technical characteristics and the requirements associated with an interoperable line and with an interoperable train

Nº	Register of Infrastructure	ERATV
1	ETCS Level(s)	ETCS Level(s)
2	ETCS baseline version	ETCS baseline version
3	ETCS infill necessary for line access	ETCS onboard equipment for reception of infill function information
4	ETCS infill installed line side	
5	ETCS national application implemented (NID_XUSER of packet 44)	ETCS national application implemented (NID_XUSER of packet 44)
6	Existence of operating restrictions or conditions	Existence of operating restrictions or conditions
7	Class B train protection systems installed (system and if applicable version)	Class B train protection systems installed (system and if applicable version)
8	Need for more than one class B train protection system required onboard	
9	Existence of switch over between different protection, control and warning systems	Special conditions implemented onboard to switch over between different train protection, control and warning systems
10	GSM-R version	GSM-R version
11	Minimum number of active GSM-R mobiles onboard for data transmission	Number of GSM-R mobile sets for data transmission
12	Class B radio systems installed (system and if applicable version)	Class B radio systems installed (system and if applicable version)
13	Existence of switch over between different radio systems	Special conditions implemented onboard to switch over between different radio systems
14	Types of train detection systems	

№	Register of Infrastructure	ERATV
15	Maximum permitted distance between two consecutive axles	Maximum distance between two consecutive axles
16	Minimum permitted distance between two consecutive axles	Minimum distance between two consecutive axles
17	Minimum permitted distance between first and last axle	Minimum distance between first and last axle
18	Maximum permitted length of the vehicle nose	Maximum length of the vehicle nose
19	Minimum permitted width of the rim	Minimum width of the rim
20	Minimum permitted wheel diameter	Minimum wheel diameter
21	Minimum permitted thickness of the flange	Minimum thickness of the flange
22	Minimum permitted height of the flange	Minimum height of the flange
23	Maximum permitted height of the flange	Maximum height of the flange
24	Minimum permitted axle load	Minimum axle load
25	Metal-free space around wheels	Metal-free space around wheels
26	Metal-mass of vehicle	Metal-mass of the vehicle
27	Ferromagnetic characteristics of wheel material required	Wheel material is ferromagnetic
28	Maximum permitted impedance between opposite wheels of a wheel set	Impedance between opposite wheels of a wheel set
29	Minimum permitted impedance between pantograph and wheels	Impedance between pantograph and wheels
30	Maximum sanding output	Maximum sanding output
31	Sanding override by driver required	Possibility of sanding override by driver
32	Return current in the rails	Return current
33	Electric, magnetic, electromagnetic fields	Electromagnetic emission of the train

11. ANNEX D

Intentionally deleted

12. ANNEX E

Intentionally deleted

13. ANNEX F

Intentionally deleted

14. ANNEX G**OPEN POINTS**

Priority of an open point:

1. Priority 1 (P1): the most urgent part
2. Priority 2 (P2): the least urgent part

Open Point	Priority	Notes
Level crossing functionality	P1	ERTMS/ETCS baseline 3
Braking safety margins	P1	ERTMS/ETCS baseline 3
Index 28 availability	P1	
Index 44 odometry FIS	P2	
safety requirements for ETCS DMI functions	P1	
Index 48 GSM-R mobile tests	P1	
Index 51 Ergonomic aspects of the DMI	P1	
Index 53 Manual of ETCS variables	P1	
Index 56 KM conformance requirements	P1	
Index 62 RBC RBC test specification for safe communication interface	P1	
relation between axle distance and wheel diameter (speed greater than 350 km/h)	P1	
relation between axle distance and line speed	P1	
metal free space between wheels	P1	
inductive components between wheels	P1	
metal mass of a vehicle	P1	
Electromagnetic interferences (traction current)	P1	
Electromagnetic interferences (electromagnetic fields)	P1	