COMMISSION IMPLEMENTING REGULATION (EU) 2023/1695

of 10 August 2023

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

(Text with EEA relevance)

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Directive (EU) 2016/797 of the European Parliament and of the Council of 11 May 2016 on the interoperability of the rail system within the European Union ([1]), and in particular Article 5(11) thereof,

Whereas:

(1) Commission Regulation (EU) 2016/919 ([2]) lays down the technical specification for interoperability (TSI) relating to the 'control-command and signalling' (CCS) subsystems.

(2) Pursuant to Article 3(5), points (b) and (f) of Commission Delegated Decision (EU) 2017/1474 ([3]), TSIs are to be reviewed in order to take into account the developments of the Union railway system and related research and innovation activities, and update references to standards.

(3) On 24 January 2020, in accordance with Article 19(1) of Regulation (EU) 2016/796 of the European Parliament and of the Council ([4]), the Commission asked the European Union Agency for Railways (the 'Agency') to prepare recommendations implementing a selection of the specific objectives set out in Articles 3 and 7 of Delegated Decision (EU) 2017/1474.

(4) On 30 June 2022, the Agency issued a recommendation relating to the CCS subsystems (ERA-REC-1175-1218-2022/REC). This Regulation is based on that recommendation.

(5) The existing regulatory framework should be modernised in order to enable new functionalities associated with the digitalisation of railway networks. The efficiency and sustainability of rail freight should be improved through further harmonisation of the European Rail Traffic Management System (ERTMS) and a broader and more systematic deployment of the ERTMS across the Union, notably on trans-European transport network.

(6) The new functionalities associated with digitalisation of railway networks and identified in the ERTMS Longer Term Perspective Report of the Agency required the update of the TSI on CCS subsystems. These new technologies requested by the railway sector, as well, were the Future Railway Mobile Communication System (FRMCS), automated train operations, advanced train positioning, and digital automatic couplers.

(7) Therefore, this revision delivers both full specifications for automated train operations (Grade of Automation 2) and the interface to FRMCS, which were available. Full FRMCS, advanced train positioning, and digital automatic coupler specifications were not yet available due to the need for further development.

([1]) OJ L 138, 26.5.2016, p. 44.

([2]) Commission Regulation (EU) 2016/919 of 27 May 2016 on the technical specification for interoperability relating to the 'control-command and signalling' subsystems of the rail system in the European Union (OJ L 158, 15.6.2016, p. 1).

([3]) Commission Delegated Decision (EU) 2017/1474 of 8 June 2017 supplementing Directive (EU) 2016/797 of the European Parliament and of the Council with regard to specific objectives for the drafting, adoption and review of technical specifications for interoperability (OJ L 210, 15.8.2017, p. 5).

([4]) Regulation (EU) 2016/796 of the European Parliament and of the Council of 11 May 2016 on the European Union Agency for Railways and repealing Regulation (EC) No 881/2004 (OJ L 138, 26.5.2016, p. 1).

(8) In order to keep pace with technological progress, innovative solutions may be required, which do not comply with the specifications set out in the Annex I or for which the assessment methods set out in the Annex I cannot be applied. Such innovative solutions, especially those coming from the Europe's Rail Joint Undertaking (ERJU), should be promoted and their voluntary implementation should, under certain conditions, be allowed. For this purpose it is appropriate to provide a process harmonised for all Member States to validate such innovative solutions for voluntary implementation.

(9) Commission Implementing Decision (EU) 2021/1730 ([5]) establishes the harmonised conditions for the availability and efficient use of radio spectrum for the Railway Mobile Radio (RMR). Member States are required to use these frequencies in order to plan the deployment of FRMCS.

(10) The European Train Control System (ETCS) is the main signalling and control-command system used as part of the ERTMS. To adapt it to the updated needs of the rail sector, two new system versions of the ETCS (system version 2.2 and system version 3.0) are introduced in the latest update of ETCS, i.e. Baseline 4 and included in this revision. System version 2.2 is fully backwards compatible. System version 3.0 is not compatible because it includes functionalities, which are required on-board when implemented track-side.

(11) In order to achieve further harmonisation of the ERTMS, this revision provides a new coherent transition and migration regime, ensures a robust procedure for correcting errors in specifications, reduces the scope for partial fulfilment, and phases out the need for compatibility checks.

(12) The new transition and migration regime has been developed to provide a consistent framework for the deployment of new functionalities in relation to the CCS TSI on the rail network. The aim of this regime is to ensure a balance between the interests of railway stakeholders, in particular infrastructure managers and railway undertakings.

(13) Considering the fact that the ERTMS is a complex software-based system requiring active specification maintenance, the Agency in its capacity of system authority for the ERTMS should support the correction of errors in ERTMS specifications. To ensure safety and interoperability, the procedure to implement these error corrections into the interoperability constituents and CCS subsystems should be specified.

(14) Full TSI compliance ensures the achievement of the Single European Rail Area from a technical point of view. It ensures interoperable vehicles and increases their potential reuse value. Partial fulfilment was initially perceived as necessary to take into account some national constraints, but should be reduced significantly in scope in this regulation to reach the goal above.

(15) Even a successful certification process cannot always prevent one of the subsystems repeatedly failing to function or perform as intended under certain conditions when an on-board CCS subsystem interacts with a trackside CCS subsystem. Therefore, checks should be carried out to demonstrate the technical compatibility of the CCS subsystems in the area of use for a vehicle.

(16) These checks should be considered a temporary measure to increase confidence in the technical compatibility between the subsystems. The principles applicable to those checks should be transparent and prepare the ground for further harmonisation. The possibility of conducting those checks in a laboratory representing the trackside configuration to be made available by the infrastructure manager should be prioritised. To reduce the checks to a minimum, each Member State should promote harmonisation within its infrastructure.

([5]) Commission Implementing Decision (EU) 2021/1730 of 28 September 2021 on the harmonised use of the paired frequency bands 874,4-880,0 MHz and 919,4-925,0 MHz and of the unpaired frequency band 1 900-1 910 MHz for Railway Mobile Radio (OJ L 346, 30.9.2021, p. 1).

(17) Consideration should be given to the steps required to increase, in the shortest possible time, confidence in the technical compatibility of on-board units with different trackside implementations of ERTMS and to reduce and eliminate the tests or checks needed to prove the technical compatibility of on-board units with different trackside implementations of ERTMS. Therefore, the Agency should assess the underlying technical divergences and decide on the necessary steps to eliminate the need for tests or checks to prove the technical compatibility of on-board units with different trackside implementations.

(18) Analysing train detection systems aims at improving the interoperability and harmonisation of the European railway system, where economically feasible. Part of this analysis is the transparent identification of non TSI compliant train detection systems.

(19) Regulation (EU) 2016/919 should therefore be repealed.

(20) The measures provided for in this Regulation are in accordance with the opinion of the Committee established in accordance with Article 51(1) of Directive (EU) 2016/797,

HAS ADOPTED THIS REGULATION:

Article 1

Subject matter

This Regulation establishes the technical specification for interoperability (TSI) relating to the control-command and signalling (CCS) subsystems of the rail system in the Union.

Article 2

Scope

1. The TSI shall apply to new trackside CCS and on-board CCS subsystems of the rail system as defined in points 2.3 and 2.4 of Annex II to Directive (EU) 2016/797. Point 7.2.2 of Annex I to this Regulation shall apply to all changes to an existing on-board CCS subsystem.

2. The TSI shall not apply to existing trackside CCS and on-board CCS subsystems of the rail system already placed in service on all or part of any Member State's railway network by 28 September 2023.

3. However, the TSI shall apply to existing trackside and on-board CCS subsystems that have one of the following characteristics:

(a) the subsystem is subject to renewal or upgrading in accordance with Chapter 7 of Annex I to this Regulation;

(b) the area of use of a vehicle is extended in accordance with Article 54(3) of Directive (EU) 2016/797, in which case point 7.4.2.3 of the Annex I to this Regulation shall apply, unless no installation of ETCS is indicated in RINF for the subsequent five years in the new area of use and the area of use is limited to two Member States;

(c) the subsystem is subject to the specification maintenance requirements set out in point 7.2.10 of Annex I to this Regulation.

4. The technical and geographical scope of the TSI is set out in points 1.1 and 1.2 of Annex I.

Article 3

Open points

1. With regard to the aspects listed as 'open points' in Appendix F of Annex I to this Regulation, the conditions to be complied with for verifying the essential requirements set out in Annex III to Directive (EU) 2016/797 may be laid down by national rules in force in a Member State.

2. By 28 March 2024, each Member State shall submit to the Agency in accordance with the procedure under Article 25 of Regulation (EU) 2016/796 the following information, unless such information has already been communicated to either the Agency or Commission pursuant to previous version of this Regulation:

(a) the national rules referred to in paragraph 1;

(b) the conformity assessment and verification procedures to be carried out to apply the national rules referred to in paragraph 1;

(c) the bodies designated to carry out the conformity assessment and verification procedures with respect to the open points.

Article 4

Specific cases

1. With regard to specific cases listed in point 7.7.2 of Annex I to this Regulation, the conditions to be met for the verification of the essential requirements set out in Annex III to Directive (EU) 2016/797 shall be those laid down in point 7.7.2 of Annex I or if justified, may be laid down by national rules in force in a Member State.

2. By 28 March 2024, each Member State shall submit to the Agency in accordance with the procedure under Article 25 of Regulation (EU) 2016/796 the following information, unless such information has already been communicated to either the Agency or Commission pursuant to previous version of this Regulation:

(a) the national rules referred to in paragraph 1;

(b) the conformity assessment and verification procedures to be carried out to apply the national rules referred to in paragraph 1;

(c) the bodies designated to carry out the conformity assessment and verification procedures with respect to the specific cases.

Article 5

Implementation

1. Manufacturers and applicants for authorisation for placing in service of infrastructure or for placing on the market of vehicles shall ensure that subsystems referred to in Article 2 of this Regulation and intended to be used on the networks referred to in Article 2(1) of Directive (EU) 2016/797 comply with the TSI set out in Annex I of this Regulation.

2. Manufacturers and infrastructure managers, railway undertakings, or any other entity responsible for the rail vehicle or infrastructure, shall ensure that subsystems referred to in Article 2 comply with the specification maintenance requirements set out in point 7.2.10 of Annex I.

3. Notified bodies shall ensure that certificates based on Chapter 6 of Annex I of this Regulation are issued within their responsibilities for interoperability constituents or subsystems in accordance with Articles 10 or 15 of Directive (EU) 2016/797, respectively.

4. Member States shall notify their national implementation plan drawn up in accordance with point 7.4.4 of the Annex I to the Commission and the Agency by 15 June 2024.

Article 6

Availability of ETCS, ATO and FRMCS on-board products

1. The Agency shall prepare by 1 January 2025 a report to the Commission on

(a) the availability of ETCS on-board products compliant with ETCS Baseline 4 specifications;

(b) the availability of ATO on-board products compliant with ATO Baseline 1 specifications;

(c) the availability of FRMCS on-board prototypes based on draft release specifications.

2. The Commission shall present its report to the Committee referred to in Article 51 of Directive (EU) 2016/797 and take appropriate measures.

Article 7

Class-B systems

1. Member States shall ensure that the functionality, performance, and interfaces of the Class-B systems remain as specified in Annex II to this regulation, unless modifications are needed to mitigate safety-critical errors in those systems.

2. Member States shall notify the Commission and the Agency about the modifications referred to in paragraph 1 and request a technical opinion of compliance from the Agency based on Article 10(1) and (3) of the Regulation (EU) 2016/796.

Article 8

Union funded projects

1. Financial support from Union funds for CCS related expenditure is limited to eligible costs directly related to the installation or upgrade of track-side and on-board ERTMS or related to the preparation of a future implementation of ERTMS, including train detection systems compliant with this regulation and interlockings.

Financial support from Union funds may also cover on-going and future projects implementing the Recovery and Resilience Plans and ERTMS National Implementation Plans available at the entry into force of this regulation.

2. Vehicles subject to paragraph 1 that require Class B on-board systems to circulate on routes only equipped with Class-B systems may be granted Union funds, if using options indicated in the Annex I point 4.2.6.1 (1), (2), and (3).

Article 9

Error corrections

1. Pursuant to its role as system authority for ERTMS under Article 28 of Regulation (EU) 2016/796, the Agency shall analyse all requests made to it for changes to the system. It shall prioritise change requests that it categorises as errors that potentially prevent the normal service of the rail system.

2. The Agency shall regularly provide a maintenance release of the specifications at the request of the Commission according to the specification maintenance procedure set out in Annex I to this Regulation.

Article 10

Future Railway Mobile Communication System

Where the Agency has issued an opinion with the draft release specifications relating to the Future Railway Mobile Communication System (FRMCS), manufacturers and early implementers shall use those specifications in their pilots and shall inform the Commission and the Agency about each pilot at its beginning, and keep them informed of the subsequent progress of those pilots.

Article 11

Innovative solutions

1. For innovative solutions that technological progress requires and have been approved by the System Pillar of the Europe's Rail Joint Undertaking (ERJU), the ERJU shall submit innovative solutions to the Commission together with information on how these solutions deviate from or supplement the relevant provisions of this TSI.

2. The Commission shall request an opinion of the Agency on the innovative solution pursuant to Article 6 of Directive (EU) 2016/797.

3. The Agency, as system authority, shall deliver an opinion on the innovative solution. The Commission shall analyse the Agency's opinion and may ask the ERJU to provide the appropriate functional and interface specifications and the assessment method, all of which need to be included in the TSI in order to make possible the use of the innovative solution.

4. The Commission may ask the Agency to integrate the specifications and assessment methods in an ERA recommendation pursuant to Article 5 of Directive (EU) 2016/797. Pending the review of the TSI, the Commission may ask the Agency to issue an opinion with the draft release specifications and the assessment method of the innovative solution.

Article 12

ERTMS compatibility and future revision

By 28 March 2024, infrastructure managers shall submit to the Agency the definition of the checks for the compatibility of vehicles with the infrastructure regarding the ETCS system and the radio system for the existing lines equipped with ERTMS or GSM-R in operation. Member States shall repeal the related national rules by the same date. By 1 June 2024, the Agency shall provide the Commission with its analysis on how to phase out the checks to prove the technical compatibility of on-board units with different ERTMS trackside implementations and to achieve harmonisation of engineering and operational rules for the Single European Rail Area.

Article 13

Train-detection compatibility

1. By 31 December 2024, Member States whose infrastructure managers operate train-detection systems not compliant with this regulation must request a specific case and shall notify the Agency of these systems by informing it about:

(a) the interference current limits for track circuits including the evaluation methods and vehicle impedance in accordance with clause 3.2.2 of ERA/ERTMS/033281 rev 5.0;

(b) field limits for axle counters in X, Y, Z axis including the evaluation methods in accordance with clause 3.2.1 of ERA/ERTMS/033281 rev 5.0;

(c) the specific cases for train detection systems not compliant with this regulation using the template referred in Annex B.1 of ERA/ERTMS 033281 rev 5.0.

2. By 31 December 2024, Infrastructure Managers shall inform the Agency about the required interference current limits/ frequencies from the frequency management for TSI-compliant train-detection systems as specified in sections 3.2.2.1 to 3.2.2.6 ERA/ERTMS/033281 rev 5.0 for their relevant networks. These limits/ frequencies shall be published on the Agency's website.

3. Infrastructure Managers shall update accordingly the values of the relevant parameters of the Register of Infrastructure.

4. With the publication of Specific Cases under Article 13(1), latest by 31 December 2025, Member States shall repeal all national rules concerning compatibility with train-detection systems, except for cases covered by Article 13(2)(f) of Directive (EU) 2016/797.

5. By 31 December 2027, the train detection systems specific cases and the corresponding end dates shall be re-examined, with the aim to improve the interoperability and harmonisation of the European railway system, with respect to the economic feasibility.

Article 14

Repeal and transitional provisions

Regulation (EU) 2016/919 is repealed.

It shall however continue to apply to subsystems authorised in accordance with that Regulation that do not fall under the scope of this Regulation pursuant to Article 2.

The respective chapters/tables/documents of the repealed Regulation shall continue to apply to subsystems and interoperability constituents to the extent and for as long as a transition regime is provided for these chapters/tables/documents in accordance with Appendix B of Annex I.

Infrastructure Managers continue to be bound by the obligation to notify the definition of the checks for the compatibility of vehicles with the infrastructure regarding the ETCS system and the radio system for the existing lines with ERTMS or GSM-R in operation pursuant to point 6.1.2.4 of the Annex to Regulation (EU) 2016/919 by 16 January 2020. In respect to projects started after 16 January 2020 and before the entry into force of this regulation, infrastructure managers shall notify this information within 6 months after the entry into force of this regulation.

Article 15

Entry into force

This Regulation shall enter into force on the twentieth day following that of its publication in the *Official Journal of the European Union*.

This Regulation shall be binding in its entirety and directly applicable in all Member States.

Done at Brussels, 10 August 2023.

For the Commission
The President
Ursula VON DER LEYEN

ANNEX I

Table of contents

Page

1. INTRODUCTION ... 391
   1.1. **Technical scope** ... 391
   1.2. **Geographical Scope** ... 391
   1.3. **Content of this TSI** ... 391
2. SUBSYSTEM DEFINITION AND SCOPE ... 392
   2.1. **Introduction** ... 392
   2.2. **Scope** ... 392
   2.3. **Trackside Application Levels (ETCS)** ... 393
3. THE ESSENTIAL REQUIREMENTS FOR THE CONTROL-COMMAND AND SIGNALLING SUBSYSTEMS ... 393
   3.1. **General** ... 393
   3.2. **Specific Aspects of the Control-Command and Signalling Subsystems** ... 395
      3.2.1. *Safety* ... 395
      3.2.2. *Reliability and Availability* ... 395
      3.2.3. *Technical Compatibility* ... 395
   3.3. **Essential requirements not directly covered by this TSI** ... 396
      3.3.1. *Safety* ... 396
      3.3.2. *Health* ... 396
      3.3.3. *Environmental Protection* ... 396
      3.3.4. *Technical Compatibility* ... 396
      3.3.5. *Accessibility* ... 396
4. CHARACTERISATION OF THE SUBSYSTEMS ... 397
   4.1. **Introduction** ... 397
      4.1.1. *Basic parameters* ... 397
      4.1.2. *Overview of the requirements* ... 397
      4.1.3. *Parts of Control-command and Signalling Subsystems* ... 398
   4.2. **Functional and technical specifications of the Subsystems** ... 398
      4.2.1. *Control-Command and Signalling reliability, availability and safety characteristics relevant to interoperability* ... 398
      4.2.2. *On-Board ETCS functionality* ... 400
      4.2.3. *Trackside ETCS functionality* ... 401
      4.2.4. *Mobile communication functions for railways RMR* ... 402
      4.2.5. *RMR, ETCS and ATO air gap interfaces* ... 403
      4.2.6. *On-Board Interfaces Internal to Control-Command and Signalling* ... 404
      4.2.7. *Trackside Interfaces Internal to Control-Command and Signalling* ... 406
      4.2.8. *Key Management* ... 407

4.2.9. *ETCS-ID Management* ... 407
4.2.10. *Trackside Train Detection Systems* ... 407
4.2.11. *Electromagnetic Compatibility between Rolling Stock and Control-Command and Signalling trackside equipment* ... 407
4.2.12. *ETCS DMI (Driver-Machine Interface)* ... 407
4.2.13. *RMR DMI (Driver-Machine Interface)* ... 407
4.2.14. *Interface to Data Recording for Regulatory Purposes* ... 408
4.2.15. *Trackside Control-Command and Signalling objects* ... 408
4.2.16. *Construction of equipment used in CCS subsystems* ... 408
4.2.17. *ETCS and Radio System Compatibility* ... 408
4.2.18. *On-Board ATO functionality* ... 412
4.2.19. *Trackside ATO functionality* ... 413
4.2.20. *Technical documentation for Maintenance* ... 413
4.3. **Functional and technical specifications of the interfaces to other Subsystems** ... 414
4.3.1. *Interface to the Operation and Traffic Management Subsystem* ... 414
4.3.2. *Interface to the Rolling Stock Subsystem* ... 415
4.3.3. *Interfaces to Infrastructure Subsystem* ... 418
4.3.4. *Interfaces to Energy Subsystem* ... 418
4.4. **Operating rules** ... 418
4.5. **Maintenance rules** ... 418
4.6. **Professional competences** ... 418
4.7. **Health and safety conditions** ... 419
4.8. **Registers** ... 419
4.9. **Route compatibility checks before the use of authorised vehicles** ... 419
5. INTEROPERABILITY CONSTITUENTS ... 419
5.1. **Definition** ... 419
5.2. **List of interoperability constituents** ... 419
5.2.1. *Basic interoperability constituents* ... 419
5.2.2. *Grouping of interoperability constituents* ... 419
5.3. **Constituents' performance and specifications** ... 420
6. ASSESSING THE CONFORMITY AND/OR SUITABILITY FOR USE OF THE CONSTITUENTS AND VERIFYING THE SUBSYSTEMS ... 426
6.1. **Introduction** ... 426
6.1.1. *General principles* ... 426
6.1.2. *Principles for testing ETCS, ATO and RMR* ... 427
6.2. **Interoperability constituents** ... 427
6.2.1. *Assessment procedures for Control-Command and Signalling Interoperability Constituents* ... 427
6.2.2. *Modules for Control-Command and Signalling Interoperability Constituents* ... 428
6.2.3. *Assessment requirements* ... 428
6.2.4. *Special issues* ... 431

6.3. **Control-Command and Signalling Subsystems** ... 432
6.3.1. *Assessment procedures for Control-Command and Signalling Subsystems* ... 432
6.3.2. *Modules for Control-Command and Signalling Subsystems* ... 433
6.3.3. *Assessment requirements for an On-board Subsystem* ... 433
6.3.4. *Assessment requirements for a Trackside Subsystem* ... 438
6.4. **Provisions in case of the partial assessment of TSI requirements** ... 443
6.4.1. *Assessment of parts of control-command and signalling subsystems* ... 443
6.4.2. *Intermediate Statement of Verification* ... 444
6.5. **Management of errors** ... 444
6.5.1. *Content of EC certificates* ... 444
6.5.2. *Content of EC declarations* ... 445
7. IMPLEMENTING THE TSI CONTROL-COMMAND AND SIGNALLING ... 445
7.1. **Introduction** ... 445
7.2. **Generally applicable rules** ... 445
7.2.1. *Upgrading or renewing the Control-Command Subsystems or parts of them* ... 445
7.2.2. *Changes to an existing On-Board subsystem* ... 445
7.2.3. *Upgrade or renewal of existing trackside subsystem* ... 451
7.2.4. *EC type or design examination certificates* ... 454
7.2.5. *Legacy systems* ... 455
7.2.6. *Availability of Specific Transmission Modules and interfaces to Class B on-board* ... 455
7.2.7. *Additional Class B equipment on a line equipped with Class A* ... 456
7.2.8. *Vehicle with Class A and Class B equipment* ... 456
7.2.9. *Conditions for mandatory and optional functions* ... 456
7.2.10. *Specifications maintenance (error corrections)* ... 458
7.3. **RMR specific implementation rules** ... 459
7.3.1. *Trackside installations* ... 459
7.3.2. *On-board installations* ... 460
7.4. **ETCS specific implementation rules** ... 461
7.4.1. *Trackside installations* ... 461
7.4.2. *On-board installations* ... 462
7.4.3. *National requirements* ... 464
7.4.4. *National Implementation Plans* ... 464
7.5. **ETCS and radio system compatibility checks implementation rules** ... 466
7.6. **Train detection systems specific implementation rules** ... 466
7.7. **Specific cases** ... 466
7.7.1. *Introduction* ... 466
7.7.2. *List of specific cases* ... 467

Appendix A 478
Table A 1 – **References between basic parameters and mandatory specifications** 478
Table A 2 – **List of mandatory specifications** 481
Table A 3 – **List of standards** 486
Table A 4 – **List of mandatory standards for accredited laboratories** 486
Appendix B 487
B1. **Changes of requirements and transition regimes for On-Board Subsystems** 487
B2. **Changes of requirements and transition regimes for CCS Trackside Subsystem** 499
B3. **Changes of Interoperability Constituent requirements and transition regimes for CCS Subsystem** 501
Appendix C 503
Appendix C.1: ESC Statement template 504
Appendix C.2: ESC Interoperability Constituent Statement template 505
Appendix C.3: RSC Statement template 506
Appendix C.4: RSC Interoperability Constituent Statement template 507
Appendix C.5: Combined ESC/RSC Statement template 508
Appendix C.6: Combined ESC/RSC Interoperability Constituent Statement template 509
Appendix D 510
Appendix E 511
Appendix F 515
Appendix G 516
Appendix H 518

1. INTRODUCTION

1.1. Technical scope

This TSI concerns the Control Command and Signalling On-Board Subsystem and the Control-Command and Signalling Trackside Subsystem.

This TSI is applicable to control-command and signalling trackside Subsystems of the rail network defined in the point 1.2 (Geographical Scope) of this TSI and to the control-command and signalling on-board subsystems of vehicles which are (or are intended to be) operated on it. These vehicles are of one of the following types (as defined in point 2 of Annex I to Directive (EU) 2016/797):

(1) locomotives and passenger rolling stock, including thermal or electric traction units, self-propelling thermal or electric passenger trains, and passenger coach, if equipped with a driving cab;

(2) special vehicles, such as on-track machines, if equipped with a driving cab and intended to be used in running mode on its own wheels.

This list of vehicles shall include those which are specially designed to operate on the different types of high-speed lines described in point 1.2 (Geographical Scope).

1.2. Geographical Scope

The geographical scope of this TSI is the network of the whole rail system, as described in point 1 of Annex I to Directive (EU) 2016/797 and excludes the infrastructure cases referred to in Article 1(3) and (4) of Directive (EU) 2016/797.

The TSI shall apply to networks with 1 435 mm, 1 520 mm, 1 524 mm, 1 600 mm and 1 668 mm track gauges. However, it shall not apply to short border crossing lines with 1 520 mm track gauges that are connected to the network of third countries.

1.3. Content of this TSI

In accordance with Article 4(3) of Directive (EU) 2016/797, this TSI:

(1) indicates its intended scope – Chapter 2 (Subsystem definition and scope);

(2) lays down essential requirements for the Control-Command and Signalling Subsystems and their interfaces vis-à-vis other subsystems – Chapter 3 (The Essential Requirements for the Control-command and signalling Subsystems);

(3) lays down the functional and technical specifications to be met by the Subsystems and their interfaces vis-à-vis other subsystems – Chapter 4 (Characterisation of the Subsystems);

(4) determines the interoperability constituents and interfaces which must be covered by European specifications, including European standards, and which are necessary to achieve interoperability within the Union rail system – Chapter 5 (Interoperability Constituents);

(5) states, in each case under consideration, which procedures are to be used to assess the conformity or the suitability for use of the interoperability constituents and for the 'EC' verification of the subsystems – Chapter 6 (Assessing the conformity and/or suitability for use of the constituents and verifying the subsystems);

(6) indicates the strategy for implementing this TSI – Chapter 7 (Implementing the TSI Control-Command and Signalling);

(7) indicates the professional competences and health and safety conditions at work required for the staff operating and maintaining these subsystems and implementing the TSI – Chapter 4 (Characterisation of the Subsystems);

(8) indicates the provisions applicable to the existing subsystems, in particular in the event of upgrading and renewal and, in such cases, the modification work which requires an application for a new authorisation for the vehicle or trackside subsystem – Chapter 7 (Implementing the TSI Control-Command and Signalling);

(9) indicates the parameters of the subsystems to be checked by the railway undertaking and the procedures to be applied to check those parameters after the delivery of the vehicle authorisation for placing on the market and before the first use of the vehicle to ensure compatibility between vehicles and the routes on which they are to be operated – Chapter 4 (Characterisation of the Subsystems).

In accordance with Article 4(5) of Directive (EU) 2016/797, provisions for specific cases are indicated in Chapter 7 (Implementing the TSI Control-Command and Signalling).

This TSI also sets out, in Chapter 4 (Characterisation of the Subsystems), the operating and maintenance rules which specifically apply 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 Subsystems are defined in Annex II to Directive (EU) 2016/797 as:

(1) Trackside control-command and signalling as: 'all the trackside equipment required to ensure safety and to command and control movements of trains authorised to travel on the network.';

(2) On-board control-command and signalling as 'all the on-board equipment required to ensure safety and to command and control movements of trains authorised to travel on the network'.

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

(1) the functions that are essential for the safe control of railway traffic, and that are essential for its operation, including those required for degraded modes ([1]);

(2) the interfaces;

(3) the level of performance required to meet the essential requirements.

2.2. **Scope**

The Control-Command and Signalling Subsystem TSI specifies only those requirements which are necessary to assure the interoperability of the Union rail system and the compliance with the essential requirements ([2]).

The Control-Command and Signalling Subsystems include the following parts:

(1) train protection;

(2) voice radio communication;

(3) data radio communication;

(4) train detection;

(5) automated train operation ([3]).

ERTMS (European Rail Traffic Management System) is composed of train protection (ETCS), radio communication (RMR) and automated train operation (ATO).

The Class A train protection system is ETCS (European Train Control System) ([4]) whilst the Class A radio system is RMR (Railway Mobile Radio system). In this TSI, RMR comprises two radio class A systems: GSM-R and FRMCS (Future Railway Mobile Communication System) that may be implemented both at the same time or each of them independently ([5]).

([1]) Degraded modes are modes of operation designed to deal with faults. They have been taken into account when designing the Control-Command and Signalling Subsystems.

([2]) Currently the CCS TSI does not specify any interoperability requirement for the interlockings, level crossings and certain other elements of the CCS.

([3]) In this document the term ATO is referring to the ERTMS/ATO specifications which is the Class A automated train operation.

([4]) In some documents referenced in this TSI the term 'ERTMS' (European Rail Traffic Management System) is used to indicate a system including ETCS, RMR and ATO and 'ETCS' is indicated as 'ERTMS/ETCS'.

([5]) When referring to both Class A systems, the term RMR system is used. When referring to specific one of these Class A systems, the terms GSM-R or FRMCS are used.

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

The list of Class B systems is established in the Annex II to this Regulation.

The requirements for the Control-Command and Signalling On-board Subsystem are specified in relation to Class A radio mobiles, train protection and automated train operation.

The requirements for the Control-Command and Signalling Trackside Subsystem are specified in relation to:

(1) the Class A radio network;

(2) the Class A train protection;

(3) the Class A automated train operation;

(4) the interface requirements for train detection systems, to ensure their compatibility with rolling stock.

All Control-Command and Signalling Subsystems, even where not specified in this TSI, shall be assessed according with Commission Implementing Regulation (EU) No 402/2013 ([6]).

2.3. **Trackside Application Levels (ETCS)**

The interfaces specified by this TSI define the means of data transmission to, and (where appropriate) from trains. The ETCS specifications referenced by this TSI provide 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. For the technical definition of the ETCS application levels see Appendix A, Table A.1, 4.1 c.

3. THE ESSENTIAL REQUIREMENTS FOR THE CONTROL-COMMAND AND SIGNALLING SUBSYSTEMS

3.1. **General**

Directive (EU) 2016/797 requires that the subsystems and the interoperability constituents including interfaces meet the essential requirements set out in general terms in Annex III to that Directive.

The essential requirements are:

(1) Safety;

(2) Reliability and Availability;

(3) Health;

(4) Environmental Protection;

(5) Technical compatibility;

(6) Accessibility.

The essential requirements for Class A systems are described in Table 3.1.

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

The following table indicates the essential requirements, as set out and numbered in Annex III to Directive (EU) 2016/797, taken into account by the basic parameters defined in Chapter 4 of this TSI.

([6]) Commission Implementing Regulation (EU) No 402/2013 of 30 April 2013 on the common safety method for risk evaluation and assessment and repealing Regulation (EC) No 352/2009 (OJ L 121, 3.5.2013, p. 8).

Table 3.1.

Relation between Essential Requirements and Basic Parameters

Basic Parameter Point	Basic Parameter Title	Safety	Reliability-Availability	Health	Environmental protection	Technical compatibility
4.2.1	Control-Command and Signalling reliability, availability and safety characteristics relevant to interoperability	1.1.1 1.1.3 2.3.1	1.2			
4.2.2	On-Board ETCS functionality	1.1.1				1.5 2.3.2
4.2.3	Trackside ETCS functionality	1.1.1				1.5 2.3.2
4.2.4	Mobile communication functions for railways RMR				1.4.3	1.5 2.3.2
4.2.5	RMR, ETCS and ATO air gap interfaces					1.5 2.3.2
4.2.6	On-Board Interfaces Internal to Control-Command and Signalling					1.5 2.3.2
4.2.7	Trackside Interfaces Internal to Control-Command and Signalling					1.5 2.3.2
4.2.8	Key Management					1.5 2.3.2
4.2.9	ETCS-ID Management					1.5 2.3.2
4.2.10	Trackside Train Detection Systems					1.5 2.3.2
4.2.11	Electromagnetic Compatibility between Rolling Stock and Control-Command and Signalling trackside equipment				1.4.3	1.5 2.3.2
4.2.12	ETCS DMI (Driver-Machine Interface)					1.5 2.3.2
4.2.13	RMR DMI (Driver-Machine Interface)					1.5 2.3.2
4.2.14	Interface to Data Recording for Regulatory Purposes	1.1.1				1.5 2.3.2
4.2.15	Trackside Control-Command and Signalling objects					1.5 2.3.2
4.2.16	Construction of equipment used in CCS subsystems	1.1.3 1.1.4		1.3.2	1.4.2	
4.2.17	ETCS and Radio System Compatibility					1.5 2.3.2
4.2.18	On-Board ATO functionality					1.5 2.3.2

4.2.19	Trackside ATO functionality					1.5 2.3.2
4.2.20	Technical documentation for Maintenance	1.1.5 1.1.1				

3.2. **Specific Aspects of the Control-Command and Signalling Subsystems**

3.2.1. *Safety*

Every Control-Command and Signalling Subsystems project shall take the measures necessary to ensure that the level of risk of an error occurring within the scope of the Control-Command and Signalling Subsystems, is not higher than the objective for the service.

To ensure that the measures taken to achieve safety do not jeopardise interoperability, the requirements of the basic parameter defined in point 4.2.1 (Control-Command and Signalling reliability, availability and safety characteristics relevant to interoperability) shall be respected.

For the ETCS Class A system the safety objective is apportioned between the Control-Command and Signalling On-board and Trackside Subsystems. The detailed requirements are specified in the basic parameter defined in point 4.2.1 (Control-Command and Signalling reliability, availability and safety characteristics relevant to interoperability). This safety requirement shall be met together with the availability requirements as defined in point 3.2.2 (Reliability and Availability).

3.2.2. *Reliability and Availability*

For the Class A system, the reliability and availability objectives are apportioned between the Control-Command and Signalling On-board and Trackside Subsystems. The detailed requirements are specified in the basic parameter defined in point 4.2.1 (Control-Command and Signalling reliability, availability and safety characteristics relevant to interoperability).

The level of risk caused by age and wear of constituents used within the subsystem shall be monitored. The requirements for maintenance stated in point 4.5 shall be respected.

3.2.3. *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 Subsystems have to be applied technically and what functions they have to perform to ensure interoperability. This category is defined in Chapter 4.

(3) The third category describes how the Control Command and Signalling Subsystems are interfaced with the Operation and Traffic Management Subsystem in order that operational interoperability is achieved. This category is described in Chapter 4.

3.2.3.1. Engineering Compatibility

3.2.3.1.1. *Physical environmental conditions*

Control Command and Signalling equipment shall be capable of operating under the climatic and physical conditions which characterise the area in which the relevant part of the Union rail system is located.

The requirements of basic parameter 4.2.16 (Construction of equipment used in CCS subsystems) shall be respected.

3.2.3.1.2. *Railway Internal Electromagnetic Compatibility*

The basic parameter related to electromagnetic compatibility between Rolling Stock and Control-Command and Signalling trackside equipment is described in point 4.2.11 (Electromagnetic Compatibility between Rolling Stock and Control-Command and Signalling trackside equipment).

3.3. Essential requirements not directly covered by this TSI

3.3.1. *Safety*

The essential requirement 1.1.2 in Annex III to Directive (EU) 2016/797 is not within the scope of this TSI.

The essential requirement 1.1.4 in Annex III to Directive (EU) 2016/797 for the Control-Command Signalling trackside subsystems is covered by the applicable European and national provisions in force.

3.3.2. *Health*

In accordance with Union legislation and with national legislation that is compatible with the Union legislation, care shall be taken to ensure that the materials used and the design of the Control-Command and Signalling Subsystems do not constitute a health hazard to persons having access to them. This is in relation with the essential requirement 1.3.1 in Annex III to Directive (EU) 2016/797. The essential requirement 1.3.2 in Annex III to Directive (EU) 2016/797 for the Control-Command Signalling trackside subsystems is covered by the applicable European and national provisions in force.

3.3.3. *Environmental Protection*

In accordance with Union legislation and with national legislation that is compatible with Union 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. This is in relation with the essential requirement 1.4.2 in Annex III to Directive (EU) 2016/797;

(2) the Control-Command and Signalling equipment shall not contain substances which may abnormally contaminate the environment during their normal use. This is in relation with the essential requirement 1.4.1 in Annex III to Directive (EU) 2016/797;

(3) the Control-Command and Signalling equipment shall be subject to the Union legislation in force controlling the limits to the emission of and the susceptibility to electromagnetic interference along the boundaries of railway property. This is in relation with the essential requirement 1.4.3 in Annex III to Directive (EU) 2016/797;

(4) the Control-Command and Signalling equipment shall comply with existing regulations on noise pollution. This is in relation with the essential requirement 1.4.4 in Annex III to Directive (EU) 2016/797;

(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). This is in relation with the essential requirement 1.4.5 in Annex III to Directive (EU) 2016/797.

3.3.4. *Technical Compatibility*

3.3.4.1. Railway Internal Electromagnetic Compatibility

In accordance with Union legislation and with national legislation that is compatible with the Union legislation, the Control Command and Signalling equipment shall neither interfere with nor be interfered with by other control-command and signalling equipment or other subsystems.

3.3.5. *Accessibility*

The essential requirement 1.6 in Annex III to Directive (EU) 2016/797 is not within the scope of this TSI.

4. CHARACTERISATION OF THE SUBSYSTEMS

4.1. Introduction

4.1.1. *Basic parameters*

In accordance with the relevant essential requirements, the Control-Command and Signalling Subsystems are characterised by the following basic parameters:

(1) Control-Command and Signalling reliability, availability and safety characteristics relevant to interoperability (point 4.2.1);

(2) On-Board ETCS functionality (point 4.2.2);

(3) Trackside ETCS functionality (point 4.2.3);

(4) Mobile communication functions for railways RMR (point 4.2.4);

(5) RMR, ETCS and ATO air gap interfaces (point 4.2.5);

(6) On-Board Interfaces Internal to Control-Command and Signalling (point 4.2.6);

(7) Trackside Interfaces Internal to Control-Command and Signalling (point 4.2.7);

(8) Key Management (point 4.2.8);

(9) ETCS-ID Management (point 4.2.9);

(10) Trackside Train Detection Systems (point 4.2.10);

(11) Electromagnetic Compatibility between Rolling Stock and Control-Command and Signalling trackside equipment (point 4.2.11);

(12) ETCS DMI (Driver-Machine Interface) (point 4.2.12);

(13) RMR DMI (Driver-Machine Interface) (point 4.2.13);

(14) Interface to Data Recording for Regulatory Purposes (point 4.2.14);

(15) Trackside Control-Command and Signalling objects (point 4.2.15);

(16) Construction of equipment used in CCS subsystems (point 4.2.16);

(17) ETCS and Radio System Compatibility (point 4.2.17);

(18) On-Board ATO functionality (point 4.2.18);

(19) Trackside ATO functionality (point 4.2.19);

(20) Technical documentation for Maintenance (point 4.2.20).

4.1.2. *Overview of the requirements*

All requirements in point 4.2 (Functional and technical specifications of the Subsystems) related to these basic parameters shall be applied to the Class A system.

Requirements for Class B systems and for STMs (which enable the Class A On-board system to operate on Class B infrastructure) are the responsibility of the relevant Member State.

This TSI is based on the principles of enabling the Control-Command and Signalling Trackside Subsystem to be compatible with TSI-compliant Control-Command and Signalling On-board Subsystems. To achieve this goal:

(1) functions, interfaces and performance of the Control-Command and Signalling On-board Subsystem are standardised, ensuring that every train will react in a predictable way to data received from trackside;

(2) for the Control-Command and Signalling Trackside Subsystem, track-to-train and train-to-track communication are fully standardised in this TSI. The specifications referenced in the points below allow Control-Command and Signalling trackside functionality to be applied in a flexible way, so that it can be optimally integrated into the railway system. This flexibility shall be exploited without limiting the movement of vehicles with TSI-compliant on-board subsystems.

The Control-Command and Signalling functions are classified in categories indicating whether they are optional or mandatory. The categories are defined in point 7.2.9 of this TSI and in specifications referred to in Appendix A and these texts also state how the functions are classified.

Appendix A, Table A.1, 4.1 c provides the Glossary of ETCS and ATO terms and definitions, which are used in the specifications referred to in Appendix A.

4.1.3. *Parts of Control-command and Signalling Subsystems*

According to point 2.2 (Scope) the Control-Command and Signalling Subsystems can be subdivided in parts.

The following table indicates which basic parameters are relevant for each subsystem and for each part.

Table 4.1.

Parts of Control Command and Signalling Subsystems

Subsystem	Part	Basic parameters
Control-Command and Signalling 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, 4.2.17, 4.2.20
	Voice radio communication	4.2.1.2, 4.2.4.1, 4.2.4.2, 4.2.5.1, 4.2.13, 4.2.16, 4.2.17, 4.2.20
	Data radio communication	4.2.1.2, 4.2.4.1, 4.2.4.3, 4.2.5.1, 4.2.6.2, 4.2.16, 4.2.17, 4.2.20
	Automated Train Operation	4.2.1.2, 4.2.5.1, 4.2.6, 4.2.12, 4.2.16, 4.2.18, 4.2.20
Control-Command and Signalling Trackside	Train protection	4.2.1, 4.2.3, 4.2.5, 4.2.7, 4.2.8, 4.2.9, 4.2.15, 4.2.16, 4.2.17, 4.2.20
	Voice radio communication	4.2.1.2, 4.2.4, 4.2.5.1, 4.2.7, 4.2.16, 4.2.17, 4.2.20
	Data radio communication	4.2.1.2, 4.2.4, 4.2.5.1, 4.2.7, 4.2.16, 4.2.17, 4.2.20
	Train detection	4.2.10, 4.2.11
	Automated Train Operation	4.2.1.2, 4.2.5.1, 4.2.7, 4.2.16, 4.2.19, 4.2.20

4.2. Functional and technical specifications of the Subsystems

4.2.1. *Control-Command and Signalling reliability, availability and safety characteristics relevant to interoperability*

This basic parameter describes the requirements for the Control-Command and Signalling On-board Subsystem and Trackside subsystem with reference to point 3.2.1 (Safety) and point 3.2.2 (Reliability and Availability).

In order to achieve interoperability, when implementing Control-Command and Signalling On-board and Trackside subsystems the following provisions shall be respected:

(1) The design, implementation and use of a Control-Command and Signalling On-board or Trackside subsystem shall not export any requirements:

(a) across the interface between Control-Command and Signalling On-board and Trackside subsystems in addition to the requirements specified in this TSI;

(b) to any other subsystem in addition to the requirements specified in the corresponding TSIs.

(2) The requirements set out in points 4.2.1.1 and 4.2.1.2 below shall be respected.

4.2.1.1. Safety

The Control-Command and Signalling On-board and Trackside subsystems shall respect the requirements for ETCS equipment and installations stated in this TSI.

For the hazard 'exceeding speed and/or distance limits advised to ETCS' the tolerable hazard rate (THR) shall be 10^{-9} h^{-1} for random failures of the on-board ETCS and 10^{-9} h^{-1} for random failures of the trackside ETCS. See Appendix A, Table A 1, 4.2.1 a.

To achieve interoperability, the on-board ETCS shall fully respect all requirements specified in Appendix A, Table A 1, 4.2.1. Nevertheless, less stringent safety requirements are acceptable for trackside ETCS provided that, in combination with TSI-compliant Control-Command and Signalling On-board subsystems, the safety level for the service is met.

For the ETCS Class A system:

(1) the changes made by railway undertakings and infrastructure managers to implement preventive or corrective maintenance actions shall be managed in compliance with the processes and procedures of their safety management system according to Article 9 of Directive (EU) 2016/798 of the European Parliament and of the Council (Safety Directive) ([7]);

(2) other types of changes made by railway undertaking and infrastructure managers (e.g. changes of the design or implementation of ETCS), as well as the changes made by other actors (e.g. manufacturers or other suppliers) shall be managed according to the risk management process set out in Annex I to the Implementing Regulation (EU) No 402/2013, as referred to in Article 6(1)(a) of Directive (EU) 2016/798.

Additionally, the correct application of the risk management process as set out in Annex I to Implementing Regulation (EU) No 402/2013, as well as the appropriateness of the results from this application, shall be independently assessed by a CSM assessment body according to Article 6 of that Regulation. There shall not be restrictions with respect to the type A, B or C of independence of the CSM assessment body permitted by Implementing Regulation (EU) No 402/2013. The appointed CSM assessment body shall be accredited or recognised according to the requirements in Annex II to Implementing Regulation (EU) No 402/2013 in the field of 'Control-Command and Signalling' sub-system, as listed in item 5 'classification' of ERADIS database entry for Assessment Bodies.

The accreditation, or recognition, in the field of 'Control-Command and Signalling' sub-system, covers the CSM assessment body competence to independently assess the 'safe integration' at the level of an ETCS subsystem, or an ETCS Interoperability Constituent. This includes the competence for:

(1) the assessment of safe integration of all internal components and interfaces that form the architecture of the ETCS subsystem or ETCS Interoperability Constituent;

(2) the assessment of safe integration of all external interfaces of the ETCS subsystem, or ETCS Interoperability Constituent, within its direct physical, functional, environmental, operational and maintenance context.

The application of the standards as referred to in Appendix A, Table A 3 is an appropriate means to fully comply to the risk management process as set out in Annex I to the Implementing Regulation (EU) No 402/2013 for design, implementation, production, installation and validation (incl. Safety acceptance) of interoperability constituents and subsystems. When different standards from the ones referred to in Appendix A, Table A 3 are applied, at least equivalence shall be proven.

Whenever for an ETCS subsystem or an ETCS Interoperability Constituent the specifications as referred to in Appendix A, Table A 3 are used as an appropriate means to fully comply to the risk management process as set out in Annex I to the Implementing Regulation (EU) No 402/2013, in order to avoid unnecessary duplication of independent assessment work, the independent safety assessment activities that are required by the specifications referred to in Appendix A, Table A 3 shall be carried out by a CSM assessment body accredited or recognized as specified in the point above instead of a CENELEC independent safety assessor.

4.2.1.2. Availability/Reliability

This point refers to the occurrence of failure modes not causing safety hazards but creating degraded situations, the management of which could decrease the overall safety of the system.

In the context of this parameter, 'failure' means the termination of the ability of an item to perform a required function with the required performance and 'failure mode' means the effect by which the failure is observed.

([7]) Directive (EU) 2016/798 of the European Parliament and of the Council of 11 May 2016 on railway safety (OJ L 138, 26.5.2016, p. 102).

To ensure that the relevant infrastructure managers and railway undertaking are given all the information they need to define appropriate procedures for managing degraded situations, the technical file accompanying the EC declaration of verification for an on-board or trackside CCS subsystem shall contain the calculated availability/reliability values related to failure modes having an impact on the capability of the CCS subsystem to supervise the safe movement of one or more vehicles or to establish radio voice communication between traffic control and the train drivers.

Compliance with the following calculated values shall be ensured:

(1) Mean time of hours of operation between failures of a CCS on-board subsystem requiring the isolation of the train protection functions: (open point);

(2) Mean time of hours of operation between failures of a CCS on-board subsystem preventing radio voice communication between traffic control and the train driver: (open point).

To allow the infrastructure managers and railway undertakings to monitor, during the life of the subsystems, the level of risk and the respect of the reliability/availability values used for the definition of procedures to manage degraded situations, the requirements for maintenance stated in point 4.2.20 (Technical documentation for Maintenance) shall be respected.

4.2.2. *On-Board ETCS functionality*

The basic parameter for ETCS on-board functionality describes all the functions needed 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 trackside;

(3) performing odometry functions;

(4) locating the train in a coordinate system based on Eurobalise locations;

(5) calculating the dynamic speed profile for its mission on the basis of train characteristics and of information from trackside;

(6) supervising the dynamic speed profile during the mission;

(7) providing the intervention function.

These functions shall be implemented in accordance with Appendix A, Table A 1, 4.2.2 b and their performance shall conform to Appendix A, Table A 1, 4.2.2 a.

The requirements for tests are specified in Appendix A, Table A 1, 4.2.2 c.

The main functionality is supported by other functions, to which Appendix A, Table A 1, 4.2.2 a and 4.2.2 b also apply, together with the additional specifications indicated below:

(1) Communication with the Control-Command and Signalling Trackside Subsystem.

   (a) Eurobalise data transmission. See point 4.2.5.2 (Eurobalise communication with the train for ERTMS applications).

   (b) Euroloop data transmission. See point 4.2.5.3 (Euroloop communication with the train for ERTMS applications). This functionality is optional on-board unless required by specific cases in point 7.7, which shall only refer to the Appendix A specifications.

   (c) Radio data transmission for radio infill. See Appendix A, Table A 1, 4.2.2 d, point 4.2.5.1 (RMR air gap interface), point 4.2.6.2 (Interface between RMR Data Communication and ETCS/ATO-applications) and point 4.2.8 (Key Management). This functionality is optional on-board unless required by specific cases in point 7.7. The implementation of this functionality, including for specific cases, shall be compliant to Appendix A specifications.

   (d) Radio data transmission. See point 4.2.5.1 (RMR air gap interface), point 4.2.6.2 (Interface between RMR Data Communication and ETCS/ATO-applications) and point 4.2.8 (Key Management). This radio data transmission is optional unless operating on an ETCS level 2 (formerly ETCS level 2 or level 3) line.

(2) Communicating with the driver. See Appendix A, Table A 1, 4.2.2 e, point 4.2.12 (ETCS DMI (Driver-Machine Interface)).

(3) Communicating with the STM. See point 4.2.6.1 (ETCS and Class B train protection). 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:

(a) completeness of the train – Supplying the train integrity and safe consist length information to the on-board subsystem, is optional unless it is required by trackside.

(b) cold movement detection – The ETCS on-board equipment shall be fitted with a Cold Movement Detection.

(5) Equipment health monitoring and degraded mode support. This function includes:

(a) initialising the on-board ETCS functionality;

(b) providing degraded mode support;

(c) isolating the on-board ETCS functionality.

(6) Support data recording for regulatory purposes. See point 4.2.14 (Interface to Data Recording for Regulatory Purposes).

(7) Forwarding information/orders and receiving state information from rolling stock:

to/from the train interface unit. See Appendix A, Table A 1, 4.2.2 f.

Note: The ETCS on-board shall be compliant with the train FFFIS only on newly developed vehicle designs requiring a first authorisation as defined in Article 14 (1), point (a) of Commission Implementing Regulation (EU) 2018/545 ([8]).

(8) Forwarding information/orders and receiving state information from ATO on-board. See Appendix A, Table A 1, 4.2.2 h.

4.2.3. *Trackside ETCS functionality*

This Basic parameter describes the ETCS trackside functionality. It contains all ETCS functionality to provide a safe path to a specific train.

The main functionalities are:

(1) locating a specific train in a coordinate system based on Eurobalise locations (ETCS level 2);

(2) translating the information from trackside signalling equipment into a standard format for the Control-Command and Signalling On-board Subsystem;

(3) sending movement authorities including track description and orders assigned to a specific train.

These functions shall be implemented in accordance with Appendix A, Table A 1, 4.2.3 band their performance shall conform to Appendix A, Table A 1, 4.2.3 a.

The main functionality is supported by other functions, to which Appendix A, Table A 1, 4.2.3 a and 4.2.3 b also apply, together with the additional specifications indicated below:

(1) communicating with the Control-Command and Signalling On-board Subsystem. This includes:

(a) Eurobalise data transmission. See point 4.2.5.2 (Eurobalise communication with the train for ERTMS applications) and point 4.2.7.4 (Eurobalise/LEU;

([8]) Commission Implementing Regulation (EU) 2018/545 of 4 April 2018 establishing practical arrangements for the railway vehicle authorisation and railway vehicle type authorisation process pursuant to Directive (EU) 2016/797 of the European Parliament and of the Council (OJ L 90, 6.4.2018, p. 66).

(b) Euroloop data transmission. See point 4.2.5.3 (Euroloop communication with the train for ERTMS applicationsand point 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 point 4.2.5.1.2.1 (GSM-R air gap interface for the ETCS application), point 4.2.7.3.1.1 (GSM-R/trackside ETCS) and point 4.2.8 (Key Management). Radio infill is only relevant in level 1, in which it is optional;

(d) Radio data transmission. See point 4.2.5.1 (RMR air gap interface), point 4.2.7.3 (RMR/trackside ETCS and RMR/trackside ATO) and point 4.2.8 (Key Management). Radio data transmission is only relevant to ETCS level 2;

(2) generating information/orders to the on-board 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 trackside; it can however be required by other applicable TSIs or national rules or the application of risk evaluation and assessment to ensure safe integration of subsystems;

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

4.2.4. *Mobile communication functions for railways RMR*

This basic parameter describes the radio communication functions. Such functions shall be implemented in the Control-Command and Signalling On-board and Trackside subsystems, according to the specifications indicated below.

4.2.4.1. Basic communication function

4.2.4.1.1. *GSM-R Basic communication function*

The general requirements are specified in Appendix A, Table A 1, 4.2.4 a.

In addition, the following specifications shall be respected:

(1) ASCI features; Appendix A, Table A 1, 4.2.4 b;

(2) SIM card; Appendix A, Table A 1, 4.2.4 c;

(3) location-dependent addressing; Appendix A, Table A 1, 4.2.4 e.

4.2.4.1.2. *FRMCS Basic communication function*

The general requirements are specified in Appendix A, Table A 1, 4.2.4 l

In addition, the following specifications shall be respected:

(1) FRMCS Profile; Appendix A, Table A 1, 4.2.4 n;

4.2.4.2. Voice and operational communication applications

4.2.4.2.1. *GSM-R Voice and operational communication applications*

The general requirements are defined in Appendix A, Table A 1, 4.2.4 f.

The requirements for tests are specified in Appendix A, Table A 1, 4.2.4 g.

In addition, the following specifications shall be respected:

(1) confirmation of high priority calls; Appendix A, Table A 1, 4.2.4 h;

(2) functional addressing; Appendix A, Table A 1, 4.2.4 j;

(3) presentation of functional numbers; Appendix A, Table A 1, 4.2.4 k;

(4) User-to-User Signalling; Appendix A, Table A 1, 4.2.4 d.

4.2.4.2.2. *FRMCS Voice and operational communication applications*

The general requirements are defined in Appendix A, Table A 1, 4.2.4 m.

The requirements for tests are specified in Appendix A, Table A 1, 4.2.4 o.

4.2.4.3. Data communication applications for ETCS and ATO

4.2.4.3.1. *Data communication for ETCS*

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

4.2.4.3.1.1. GSM-R data communication for ETCS

The general requirements are defined in Appendix A, Table A 1, 4.2.4 f.

The requirements for tests are specified in Appendix A, Table A 1, 4.2.4 g.

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

4.2.4.3.1.2. FRMCS data communication for ETCS

The general requirements are defined in Appendix A, Table A 1, 4.2.4 m.

The requirements for tests are specified in Appendix A, Table A 1, 4.2.4 o.

This functionality is mandatory in the case of ETCS level 2 applications.

4.2.4.3.2. *Data communication for ATO*

4.2.4.3.2.1. GSM-R data communication for ATO

The general requirements are defined in Appendix A, Table A 1, 4.2.4 f.

The requirements for tests are specified in Appendix A, Table A 1, 4.2.4 g.

4.2.4.3.2.2. FRMCS data communication for ATO

The general requirements are defined in Appendix A, Table A 1, 4.2.4 m.

The requirements for tests are specified in Appendix A, Table A 1, 4.2.4 o.

4.2.5. *RMR, ETCS and ATO air gap interfaces*

This basic parameter specifies the requirements for the air gap between Control-Command and Signalling Trackside and On-board subsystems and has to be taken into account in conjunction with the requirements for the interfaces between ETCS, ATO and RMR equipment, as specified in point 4.2.6 (On-Board Interfaces Internal to Control-Command and Signalling) and point 4.2.7 (Trackside 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. RMR air gap interface

4.2.5.1.1. *RMR general air gap interface*

4.2.5.1.1.1. GSM-R air gap interface

The air gap interface shall comply with the requirements specified in Appendix A, Table A 1, 4.2.5 a and 4.2.4 f.

Note 1: GSM-R radio communication interfaces shall operate in the frequency band specified in Appendix A, Table A 1, 4.2.5 a and 4.2.4 f.

Note 2: On-Board Control-command and Signalling Subsystems shall be protected against interference, fulfilling the requirements specified in Appendix A, Table A 1, 4.2.4 f.

4.2.5.1.1.2. FRMCS air gap interface

The air gap interface shall comply with the requirements specified in Appendix A, Table A 1, 4.2.5 f.

4.2.5.1.2. *RMR air gap interface for ETCS application*

4.2.5.1.2.1. GSM-R air gap interface for the ETCS application

The data communication protocols shall comply with Appendix A, Table A 1, 4.2.5 b.

Where radio infill is implemented, the requirements stated in Appendix A, Table A 1, 4.2.5 c shall be respected in addition.

4.2.5.1.2.2. FRMCS air gap interface for the ETCS application

The data communication protocols shall comply with Appendix A, Table A 1, 4.2.5 j.

4.2.5.1.3. *RMR air gap interface for ATO application*

4.2.5.1.3.1. GSM-R air gap interface for ATO application

Packet switch communication shall be used and the data communication protocols shall comply with the relevant requirements in Appendix A, Table A 1, 4.2.5 h.

The use of other wireless communication networks, e.g. operated by a public or private Mobile Network Operator, is allowed for the ATO application, however it is considered out of scope of this TSI.

The use of these networks shall not interfere with GSM-R voice and data communications.

4.2.5.1.3.2. FRMCS air gap interface for ATO application

The data communication protocols shall comply with Appendix A, Table A 1, 4.2.5 i.

4.2.5.2. Eurobalise communication with the train for ERTMS applications

Eurobalise communication interfaces shall comply with Appendix A, Table A 1, 4.2.5 d.

4.2.5.3. Euroloop communication with the train for ERTMS applications

Euroloop communication interfaces shall comply with Appendix A, Table A 1, 4.2.5 e.

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

This Basic Parameter consists of the following parts:

4.2.6.1. ETCS and Class B train protection

Where ETCS and Class B train protection functions are installed on-board, the integration and transitions between them shall be managed with one of the following:

(1) a standardised interface (STM); or

(2) a non-standardised interface; or

(3) Class B and Class A integrated within the same equipment (e.g. 'bi-standards'); or

(4) no direct interface between both equipment.

Where the integration of, and transitions between, ETCS and Class B systems are managed with the standardised interface (STM), it shall comply with requirements as specified in Appendix A, Table A 1, 4.2.6 a.

Appendix A, Table A 1, 4.2.6 b specifies the K interface (to allow certain STMs to read information from Class B balises through the ETCS on-board antenna) and Appendix A, Table A 1, 4.2.6 c the G interface (air gap between ETCS on-board antenna and Class B balises).

Implementation of Interface 'K' is optional, but if done it must be in accordance with Appendix A, Table A 1, 4.2.6 b.

Furthermore, if Interface 'K' is implemented, the on-board transmission channel functionality must be able to handle the properties of Appendix A, Table A 1, 4.2.6 c.

If the integration and transitions between ETCS and Class B train protection on-board are not managed using the standardised interface specified in Appendix A, Table A 1, 4.2.6 a, the method shall not impose any additional requirements on the Control-Command and Signalling Trackside Subsystem.

4.2.6.2. Interface between RMR Data Communication and ETCS/ATO-applications

4.2.6.2.1. *Interface between RMR Data Communication and ETCS*

4.2.6.2.1.1. Interface between GSM-R Data Communication and ETCS

The requirements for the interface between the on-board GSM-R and the on-board ETCS functionality are specified in Appendix A, Table A 1, 4.2.6 d.

Where radio infill is implemented, the requirements stated in Appendix A, Table A 1, 4.2.6 e shall be respected.

4.2.6.2.1.2. Interface between FRMCS Data Communication and ETCS

The requirements for the interface between on-board FRMCS and the on-board ETCS functionality are specified in Appendix A, Table A 1, 4.2.6 g.

4.2.6.2.2. *Interface between RMR Data Communication and ATO*

4.2.6.2.2.1. Interface between GSM-R Data Communication and ATO

The requirements for the interface between the on-board GSM-R and the on-board ATO functionality are specified in Appendix A, Table A 1, 4.2.6 j.

4.2.6.2.2.2. Interface between FRMCS Data Communication and ATO

The requirements for the interface between on-board FRMCS and the on-board ATO functionality are specified in Appendix A, Table A 1, 4.2.6 k.

4.2.6.2.3. *Interface between FRMCS on-board voice application and on-board FRMCS*

The requirements for the interface between FRMCS on-board voice application and on-board FRMCS are specified in Appendix A, Table A 1, 4.2.6 l.

4.2.6.3. Odometry

There are no specific requirements for the odometry interface.

4.2.6.4. Interface between ATO and ETCS

The requirements for the interface between the on-board ATO functionality and the on-board ETCS functionality are specified in Appendix A, Table A 1, 4.2.6 h.

4.2.6.5. Additional CCS On-Board Internal Interfaces

4.2.6.5.1. *CCS Consist network communication layers*

The interface between the end devices (e.g. ETCS on-board, ATO on-board and FRMCS on-board) and the Ethernet Consist Network shall comply with Appendix A, Table A 1, 4.2.6 i unless otherwise specified. This interface is only applicable on newly developed vehicle designs requiring a first authorisation as defined in Article 14 (1), point (a), of Implementing Regulation (EU) 2018/545.

4.2.7. *Trackside 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.

(3) The requirements are specified in Appendix A, Table A 1, 4.2.7 a.

4.2.7.2. RBC/RBC

This is the technical interface between two RBCs. The requirements are specified in Appendix A, Table A 1, 4.2.7 b.

4.2.7.3. RMR/trackside ETCS and RMR/trackside ATO

4.2.7.3.1. *RMR/trackside ETCS*

4.2.7.3.1.1. GSM-R/trackside ETCS

The requirements for the interface between GSM-R and the trackside ETCS functionality are specified in Appendix A, Table A 1, 4.2.7 c.

4.2.7.3.1.2. FRMCS/trackside ETCS

The requirements for the interface between FRMCS and the trackside ETCS functionality are specified in Appendix A, Table A 1, 4.2.7 f.

4.2.7.3.2. *RMR/trackside ATO*

4.2.7.3.2.1. GSM-R/trackside ATO

The requirements for the interface between GSM-R and the trackside ATO functionality are specified in Appendix A, Table A 1, 4.2.7 g.

4.2.7.3.2.2. FRMCS/trackside ATO

The requirements for the interface between FRMCS and the trackside ATO functionality are specified in Appendix A, Table A 1, 4.2.7 h

4.2.7.4. Eurobalise/LEU

This is the interface between Eurobalise and the LEU. The requirements are specified in Appendix A, Table A 1, 4.2.7 d.

This interface contributes to this basic parameter only when Eurobalise and LEU are supplied as separate interoperability constituents (see point 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 Appendix A, Table A 1, 4.2.7 e.

This interface contributes to this Basic Parameter only when Euroloop and LEU are supplied as separate interoperability constituents (see point 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.

The requirements are specified in Appendix A, Table A 1, 4.2.8 a. Only requirements related to the interfaces of Control-Command and Signalling equipment fall within the scope of this TSI.

4.2.9. *ETCS-ID Management*

This basic parameter concerns the ETCS-identities (ETCS-IDs) for equipment in Control-Command and Signalling Trackside and On-board Subsystems.

The requirements are specified in Appendix A 4.2.9 a.

4.2.10. *Trackside Train Detection Systems*

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

The interface requirements to be respected by the train detection systems are specified in Appendix A, Table A 1, 4.2.10 a.

4.2.11. *Electromagnetic Compatibility between Rolling Stock and Control-Command and Signalling trackside equipment*

This basic parameter specifies the interface requirements for electromagnetic compatibility between rolling stock and trackside Control-Command and Signalling train detection equipment.

The interface requirements to be respected by the train detection system are specified in Appendix A, Table A 1, 4.2.11 a.

4.2.12. *ETCS DMI (Driver-Machine Interface)*

This basic parameter describes the information provided from ETCS and ATO to the driver and entered into the on-board by the driver. See Appendix A, Table A 1, 4.2.12 a.

It includes:

(1) ergonomics (including visibility);

(2) ETCS and ATO functions to be displayed;

(3) ETCS and ATO functions triggered by driver input.

4.2.13. *RMR DMI (Driver-Machine Interface)*

This basic parameter describes the information provided from RMR to the driver and entered into the RMR on-board by the driver.

It includes:

(1) ergonomics (including visibility);

(2) RMR functions to be displayed;

(3) call-related information outgoing;

(4) call-related information incoming.

4.2.13.1. GSM-R DMI (Driver Machine Interface)

See Appendix A, Table A 1, 4.2.13 a for GSM-R.

4.2.13.2. FRMCS DMI (Driver Machine Interface)

See Appendix A, Table A 1, 4.2.13 b for FRMCS.

4.2.14. *Interface to Data Recording for Regulatory Purposes*

This basic parameter describes the data exchange between the on-board ETCS and the rolling stock recording device.

See Appendix A, Table A 1, 4.2.14 a.

4.2.15. *Trackside 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;

(3) the positioning of interoperable marker boards to meet their intended operational purpose.

For (1) and (2) see Appendix A, Table A 1, 4.2.15 a.

For (3) see Appendix A, Table A 1, 4.2.15 b.

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

4.2.16. *Construction of equipment used in CCS subsystems*

The environmental conditions specified in the documents listed in Appendix A, Table A 2 of this TSI shall be respected.

Requirements for materials referred to in Commission Regulation (EU) No 1302/2014 ([9]) (LOC&PAS TSI) (e.g. related to fire protection) shall be respected by Control-command and signalling On-board Interoperability Constituents and Subsystems.

4.2.17. *ETCS and Radio System Compatibility*

Due to the different possible implementations and the status of the migration to fully compliant CCS Subsystems, checks shall be performed in order to demonstrate the technical compatibility between the on-board and trackside CCS Subsystems. The necessity of these checks shall be considered as a measure to increase the confidence on the technical compatibility between the CCS subsystems. It is expected that these checks will be reduced until the principle stated in 6.1.2.1 is achieved.

4.2.17.1. ETCS System Compatibility

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

Each ESC Type identifies the set of ESC checks (e.g. document check, lab or track test, …) applicable for a section or group of sections within an area of use. It is possible to use the same ESC type for cross border infrastructure and for different national infrastructures.

The results of the ESC checks for an on-board unit on the Interoperability Constituent level or subsystem level, including findings and conditions arising, are recorded in the ESC Check Report.

([9]) Commission Regulation (EU) No 1302/2014 of 18 November 2014 concerning a technical specification for interoperability relating to the rolling stock — locomotives and passenger rolling stock subsystem of the rail system in the European Union (OJ L 356, 12.12.2014, p. 228).

'Representative configuration' means a configuration on the basis of which test results can be achieved, which are valid for various configurations of the same certified ETCS on-board interoperability constituent or of a certified on-board subsystem. These results shall also be equivalent for various configurations of a certified ETCS trackside subsystem.

For ESC checks at ETCS on-board Interoperability Constituent level the following is to be observed:

(1) The ESC Interoperability Constituent Statement records the ESC results of the ETCS On-board Interoperability Constituent to the ESC Type(s) that is valid regardless of the specific configuration of the ETCS on-board Interoperability Constituent. This document shall be produced by the on-board supplier. The template provided in Appendix C.2 or C.6 shall be used.

(2) The ESC Interoperability Constituent Statement shall include the summary of the findings and conditions of the ESC Check Report(s) on the results of the ESC checks passed (defined in one or more ESC Type), which are valid independently from the specific configuration parameters of the on-board Interoperability Constituent and can therefore be used in every applicable specific on-board CCS subsystem level.

(3) The ESC Interoperability Constituent Statement shall include the list of ESC checks performed for the ESC Type(s).

(4) The ESC Interoperability Constituent Statement shall include the reference to the NoBo assessment Report according to 6.2.4.3 (ETCS and radio system compatibility checks for Interoperability Constituent).

The ESC of the specific on-board CCS subsystem with respect to one or more ESC Type(s) is laid down in the ESC Statement. The template provided in Appendix C.1 or C.5 shall be used.

At subsystem level, the ESC Statement shall also include the summary of the ESC Check Report and shall demonstrate the fulfilment of the required ESC checks (for each ESC Type included in the Statement) published in the Agency ESC/RSC technical document in addition to already provided ESC interoperability constituent statements.

The ESC Statement shall also include the full list of ESC Interoperability Constituent statements taken into account in the assessment (if any), the conditions (if any) with respect to the different ESC Types and the NoBo Assessment Report according to 6.3.3.1 (ETCS and radio system compatibility checks).

4.2.17.2. Requirements for ETCS System Compatibility

The Infrastructure Manager is responsible for defining the ESC type(s). All sections of the Union network which require the same set of checks for the demonstration of ESC shall have the same ESC type.

The list of ESC Types is published and maintained by the European Union Agency for Railways in the technical document 'ESC/RSC technical document, TD/011REC1028'. See Appendix A, Table A 1, 4.2.17 a. The Agency shall assess the checks unless they have been assessed by a NoBo as required in Table 6.3 row 10. The assessment by the Agency shall be done within 2 months of receipt thereof, unless a longer period is agreed between the Agency and the Infrastructure Manager but not exceeding 4 months in total. The technical document will be updated within 10 working days after positive assessment.

The ESC Types shall only be used when published with status 'Valid' in the Agency Technical document referred above.

Infrastructure Managers, with the support of the ETCS suppliers for their network, shall submit to the Agency the definition of the necessary checks for each ESC type on their network. The minimum information that shall be included:

(1) Definition of each check to be performed.

(2) Criteria to pass each check.

(3) If a check is only required for trains compatible with a specific M_VERSION functionality and a given TSI release.

(4) If checks are to be performed in laboratories or on the track. In case of track, it shall be indicated if a specific location is required.

(5) Contact details in order to request the performance of each check.

(6) Description of the representative configuration of a check whenever defined by the relevant IM to be performed in a laboratory.

(7) Proposal of the transition period between the new version of ESC Types definition and prior version, or the national procedure. It shall also be indicated the validity of the previous ESC Types. The final transition period shall be agreed with the Agency. In the absence of agreement it will be 6 months.

Infrastructure Managers shall classify the ETCS lines according to ESC Types and register the ESC Types in RINF. If no ESC definition is published in the ESC/RSC Technical Document or received by the Agency for existing lines equipped with ETCS, it shall be considered that no ESC checks are required for the concerned lines.

Infrastructure Manager shall provide the necessary means, laboratory or access to the infrastructure, to perform the checks, as required by Article 6 of Implementing Regulation (EU) 2018/545.

Infrastructure Managers shall submit to the Agency any changes on the referred checks for their network.

The ESC types are valid indefinitely unless modified or withdrawn by the Infrastructure Manager. In case of changes, the provisions on 7.2.3.4 (Impact on the technical compatibility between on-board and trackside parts of the CCS subsystems) shall be respected. If an on-board needs to be rechecked, only the new/updated ESC checks need to be done, applying the principle that already passed checks remain valid, if the vehicle is not modified.

When ESC checks are published or updated by the Agency in the technical document 'ESC/RSC technical document, TD/011REC1028', the corresponding existing National Rules for ETCS compatibility testing shall be withdrawn and only ESC checks shall be performed to demonstrate technical compatibility between subsystems. The IM shall indicate the equivalence (none, partial or complete) of the ESC with the previous national procedure, if existing. In such a case, Interoperability Constituent or subsystems which have demonstrated technical compatibility with the previous national procedure, may reuse that as evidence for the demonstration of compliance with the equivalent part of the new ESC without the need to execute the checks again. If not fully equivalent, the IM shall indicate a transition period as mentioned in point (7) above.

The Entity in charge of ESC demonstration shall define a representative configuration of the ETCS on-board subsystem.

The ESC Statement shall be produced by the Entity applying for ESC Demonstration.

The Entity applying for ESC Demonstration shall have the ESC check report for the Interoperability Constituent or Subsystem assessed by a Notified Body according with points 6.2.4.3 (ETCS and radio system compatibility checks for Interoperability Constituent) or 6.3.3.1 (ETCS and radio system compatibility checks).

If a Check Report or an ESC Interoperability Constituent Statement referred to in the ESC Statement contains Conditions, all Conditions shall be recorded, reflecting the status and if agreed how they are managed by the affected party (e.g. RU willing to demonstrate the compatibility with a route), and this responsibility shall be recorded in the ESC Statement.

4.2.17.3. Radio System Compatibility

Radio System Compatibility (RSC) is the recording of technical compatibility between voice or data radio on-board and the trackside parts of RMR of the CCS subsystems within an area of use.

Each RSC Type identifies the set of RSC checks (e.g. document check, lab or track test) applicable for a section or group of sections within an area of use. It is possible to use the same RSC type for cross border infrastructure and for different national infrastructures.

The results of the RSC checks for an on-board voice or data radio part on the Interoperability Constituent level or subsystem level, including findings and conditions arising, are recorded in the RSC Check Report.

Representative Configuration means a configuration on the basis of which test results can be achieved, which are valid for various configurations of the same certified Interoperability Constituent or of a certified on-board subsystem. These results shall also be equivalent for various configurations of a certified RMR trackside subsystem.

For RSC checks at Interoperability Constituent level the following is to be observed:

(1) The RSC Interoperability Constituent Statement records the RSC results of the Interoperability Constituent (e.g. Cab Radio or EDOR) to the RSC Type(s) that is valid regardless of the specific configuration of the Interoperability Constituents. This document shall be produced by the supplier. The template provided in Appendix C.4 or C.6 shall be used.

(2) The RSC Interoperability Constituent Statement shall include the summary of the findings and conditions of RSC Check Report(s) on the results of the RSC checks passed (defined in one or more RSC Type), which are valid independently from the specific configuration parameters of the on-board Interoperability Constituent and can therefore be used in every applicable on-board CCS subsystem level.

(3) The RSC Interoperability Constituent Statement shall include the list of RSC checks performed for the RSC Type(s).

(4) The RSC Interoperability Constituent Statement shall include the reference to the NoBo assessment Report according to 6.2.4.3 (ETCS and radio system compatibility checks for Interoperability Constituent).

The RSC of the specific on-board CCS subsystem with respect to one or more RSC Type(s) is laid down in the RSC Statement. The template provided in Appendix C.3 or C.5 shall be used.

At subsystem level, the RSC Statement shall also include the summary of the Check Report and shall demonstrate the fulfilment of the required RSC checks (for each RSC Type included in the Statement) published in the Agency ESC/RSC technical document in addition to already provided RSC interoperability constituent statements.

The RSC Statement shall also include the full list of RSC Interoperability Constituent statements taken into account in the assessment (if any), the conditions (if any) with respect to the different RSC Types and the NoBo Assessment Report according to 6.3.3.1 (ETCS and radio system compatibility checks).

4.2.17.4. Requirements for Radio System Compatibility

The Infrastructure Manager is responsible for defining the RSC type(s). All sections of the Union network which require the same set of checks for the demonstration of RSC shall have the same RSC type.

The list of RSC Types is published and maintained by the European Union Agency for Railways in the technical document 'ESC/RSC technical document, TD/011REC1028'. See Appendix A, Table A 1, 4.2.17 a. The Agency shall assess the checks unless they have been assessed by a NoBo as required in Table 6.3 row 10. The assessment by the Agency shall be done within 2 months of receipt thereof, unless a longer period is agreed between the Agency and the Infrastructure Manager but not exceeding 4 months in total. The technical document will be updated within 10 working days after positive assessment.

The RSC Types shall only be used when published with status 'Valid' in the Agency Technical document referred above.

Infrastructure Managers, with the support of the RMR suppliers for their network, shall submit to the Agency the definition of the necessary checks for each RSC type on their network. The minimum information that shall be included:

(1) Definition of each check to be performed

(2) Criteria to pass each check

(3) If a check is only required for trains equipped with a specific RMR GSM-R/FRMCS baseline and a given TSI release.

(4) If checks are to be performed in laboratories or on the track. In case of track, it shall be indicated if a specific location is required.

(5) Contact details in order to request the performance of each check

(6) Description of the representative configuration of a check whenever defined by the relevant IM to be performed in a laboratory

(7) Proposal of the transition period between the new version of RSC Types definition and prior version, or the national procedure. It shall also be indicated the validity of the previous RSC Types. The final transition period shall be agreed with the Agency. In the absence of agreement it will be 6 months.

Infrastructure Managers shall classify their lines according to RSC Types for voice and, if applicable, ETCS data. This RSC type classification shall be registered in RINF. If no RSC definition is published in the ESC/RSC Technical Document or received by the Agency for existing lines equipped with RMR GSM-R, it shall be considered that no RSC checks are required for the concerned lines.

Infrastructure Manager shall provide the necessary means, laboratory or access to the infrastructure, to perform the checks, as required by Article 6 of the Implementing Regulation (EU) 2018/545.

Infrastructure Managers shall submit to the Agency any changes on the referred checks for their network.

The RSC types are valid indefinitely unless modified or withdrawn by the Infrastructure Manager. In case of changes, the provisions on 7.2.3.4 (Impact on the technical compatibility between on-board and trackside parts of the CCS subsystems) shall be respected. If an on-board needs to be rechecked, only the new/updated RSC checks need to be done, applying the principle that already passed checks remain valid, if the vehicle is not modified.

When RSC checks are published or updated by the Agency in the technical document 'ESC/RSC technical document, TD/011REC1028', the corresponding existing National Rules for Radio compatibility testing shall be withdrawn and only RSC checks shall be performed to demonstrate technical compatibility between subsystems. The IM shall indicate the equivalence (none, partial or complete) of the RSC with the previous national procedure, if existing. In such a case, Interoperability Constituent or subsystems which have demonstrated technical compatibility with the previous national procedure, may reuse that as evidence for the RSC without the need to execute the checks again.

Entity in charge of RSC demonstration shall define a representative configuration of the Radio on-board subsystem.

The RSC Statement shall be produced by the Entity applying for RSC Demonstration.

The Entity applying for RSC Demonstration shall have the check report for the Interoperability Constituent or Subsystem assessed by a Notified Body according with points 6.2.4.3 (ETCS and radio system compatibility checks for Interoperability Constituent) or 6.3.3.1 (ETCS and radio system compatibility checks).

If a Check Report or an RSC Interoperability Constituent Statement referred to in the RSC Statement contains Conditions, all Conditions shall be recorded, reflecting the status and if agreed how they are managed by the affected party (e.g. RU willing to demonstrate the compatibility with a route), and this responsibility shall be recorded in the RSC Statement.

4.2.18. *On-Board ATO functionality*

This basic parameter describes the ATO on-board functionality needed to operate a train up to Grade of Automation 2 with ETCS providing the automatic train protection functionality to enable it. The functions shall be implemented according to Appendix A, Table A 1, 4.2.18 a in addition to those required in point 4.2.2 (On-Board ETCS functionality).

The ATO functionality is supported by the additional specifications indicated below:

(1) Communication with the Control-Command and Signalling Trackside Subsystem for radio data transmission. See point 4.2.5.1 (RMR air gap interface), point 4.2.6.2 (Interface between RMR Data Communication and ETCS/ATO-applications).

(2) Communicating with the driver. See Appendix A, Table A 1, 4.2.2 e and 4.2.12 a (ETCS DMI).

(3) Forwarding information/orders and receiving state information from rolling stock. See Appendix A, Table A 1, 4.2.18 c.

(4) Forwarding information/orders and receiving state information from on-board ETCS. See Appendix A, Table A 1, 4.2.18 d.

The requirements for tests are specified in Appendix A, Table A 1, 4.2.18 b.

4.2.19. *Trackside ATO functionality*

This basic parameter describes the ATO trackside functionality needed to operate a train up to Grade of Automation 2 with ETCS providing the automatic train protection functionality to enable it.

In addition to those required in point 4.2.3 (Trackside ETCS functionality), the functions shall be implemented according to Appendix A, Table A 1, 4.2.19 a.

The ATO functionality is supported with the additional specifications for communicating with the Control-Command and Signalling On-board Subsystem based on radio data transmission. See Appendix A, point 4.2.5.1 (RMR air gap interface) and point 4.2.7.3 (RMR/trackside ETCS and RMR/trackside ATO).

The requirements for tests are specified in Appendix A, Table A 1, 4.2.19 b.

4.2.20. *Technical documentation for Maintenance*

This basic parameter describes the necessary requirements in relation to the technical documentation for maintenance to be fulfilled by the manufacturers of equipment and the applicant for subsystem verification.

4.2.20.1. Responsibility of the manufacturer of equipment

The manufacturer of equipment incorporated in the subsystem shall specify:

(1) all maintenance requirements and procedures (including health monitoring, diagnosis of events, test methods and tools and also the required professional competence) necessary for achieving essential requirements and values quoted in the mandatory requirements of this TSI throughout the equipment life-cycle (transport and storage before installation, normal operation, failures and effects of failures, repair work, checking and maintenance, decommissioning, etc.). For further details on error corrections see points 6.5 (Management of errors) and 7.2.10 (Specifications maintenance (error corrections));

(2) all requirements and procedures (test methods and tools, the required professional competence and the evaluation of the impact of the updated Interoperability Constituent on the subsystem) necessary to implement updated Interoperability Constituents due to specification error corrections throughout the equipment life-cycle (specifications maintenance). This includes the definition of the necessary procedures for updates of approved system modules and processes, during all life cycle phases, when there are error corrections according to Article 9 of this Regulation applicable to the subsystems;

(3) the health and safety risks that may affect the public and the maintenance staff;

(4) 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 replacing failed LRUs, the conditions for storing LRUs and for repairing failed LRUs;

(5) the checks to be carried out if equipment is subject to exceptional stress (e.g. adverse environmental conditions or abnormal shocks);

(6) the checks to be carried out when maintaining equipment other than Control-Command and Signalling equipment and which influences the Control-Command and Signalling Subsystems (e.g. changing the wheel diameter).

4.2.20.2. Responsibility of the applicant for subsystem verification

The applicant shall:

(1) ensure that the maintenance requirements as described in point 4.2.20.1 (Responsibility of the manufacturer of equipment) are defined for all components within the scope of this TSI regardless of whether or not they are interoperability constituents;

(2) complete the above requirements in point 4.2.20.1 taking into account the risks arising from interactions between different components of the subsystem and interfaces to other subsystems.

(3) define procedures for the roll-out of updated interoperability constituents due to specification error corrections (specifications maintenance) according to the relevant documentation of the interoperability constituent, where applicable. The applicant shall provide a configuration management system to identify the impact on the subsystem. The applicant shall ensure the availability of the documentation regarding the version of the interoperability constituents included in its subsystems.

4.2.20.3. System identifier

The ERTMS (ETCS, RMR, ATO) functionality of an Interoperability Constituent or a subsystem shall be described with a 'system identifier', which is a numbering scheme to identify the system version and distinguish between a functional and a realisation identifier. The 'functional identifier' is part of the system identifier and means a figure or a number of figures defined by the individual configuration management, which represents a reference of the functionality for CCS implemented in a CCS subsystem or Interoperability Constituent. The 'Realisation identifier' is part of the system identifier and means a figure or a number of figures defined by the individual configuration management of a supplier, which represents a specific configuration (e.g. HW and SW) of a CCS subsystem or Interoperability Constituent. The 'system identifier', 'functional identifier' and 'realisation identifier' shall be defined by each supplier.

4.3. Functional and technical specifications of the interfaces to other Subsystems

4.3.1. *Interface to the Operation and Traffic Management Subsystem*

Interface with Operation and Traffic Management TSI			
Reference CCS TSI		Reference Operation and Traffic Management TSI [1]	
Parameter	Point	Parameter	Point
Operating rules List of harmonised text indications and messages displayed on the ETCS Driver Machine Interface	4.4 Appendix E	Driver's Rule book Operating rules ERTMS trackside engineering information relevant to operation	4.2.1.2.1 4.4 Appendix D3
Trackside Control-Command and Signalling objects	4.2.15	Requirements for signal and line-side marker sighting	4.2.2.8
Train braking performance and characteristics	4.2.2	Train braking	4.2.2.6
Use of sanding equipment On-board flange lubrication Use of composite brake blocks	4.2.10	Driver's Rule book	4.2.1.2.1
Interface to Data Recording for Regulatory Purposes	4.2.14	Data recording	4.2.3.5
ETCS DMI (Driver-Machine Interface)	4.2.12	Format of train running number	4.2.3.2.1
RMR DMI (Driver-Machine Interface)	4.2.13	Format of train running number	4.2.3.2.1

Key Management	4.2.8	Ensuring that the train is in running order	4.2.2.7
Route compatibility checks before the use of authorised vehicles	4.9	Parameters for the vehicle and train compatibility over the route intended for operation	Appendix D1

([1]) In accordance with Commission Implementing Regulation (EU) 2019/773 of 16 May 2019 on the technical specification for interoperability relating to the operation and traffic management subsystem of the rail system within the European Union and repealing Decision 2012/757/EU (OJ L 139 I, 27.5.2019, p. 5).

4.3.2. *Interface to the Rolling Stock Subsystem*

Interface with Rolling Stock TSIs				
Reference CCS TSI		Reference Rolling Stock TSIs		
Parameter	Point	Parameter		Point
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	LOC & PAS TSI	4.2.3.3.1.1
			Wagon TSI ([1])	4.2.3.2
		Rolling stock characteristics to be compatible with train detection systems based on axle counters	LOC & PAS TSI	4.2.3.3.1.2
			Wagon TSI	4.2.3.3
		Rolling stock characteristics to be compatible with loop equipment	LOC & PAS TSI	4.2.3.3.1.3
			Wagon TSI	4.2.3.3
Electromagnetic Compatibility between Rolling Stock and Control-Command and Signalling trackside equipment	4.2.11	Rolling stock characteristics to be compatible with train detection systems based on track circuits	LOC & PAS TSI	4.2.3.3.1.1
			Wagon TSI	4.2.3.3
		Rolling stock characteristics to be compatible with train detection systems based on axle counters	LOC & PAS TSI	4.2.3.3.1.2
			Wagon TSI	4.2.3.3
Train braking performance and characteristics	4.2.2 4.2.18	Braking performance	LOC & PAS TSI Emergency braking	4.2.4.5.2
			LOC & PAS TSI Service braking	4.2.4.5.3
			Wagon TSI	4.2.4.1.2
Position of Control-Command and Signalling on-board antennas	4.2.2	Kinematic gauge	LOC & PAS TSI	4.2.3.1
			Wagon TSI	None

Isolation of on-board ETCS functionality	4.2.2	Operating rules	LOC & PAS TSI	4.2.12.3
			Wagon TSI	None
Trackside Control-Command and Signalling objects	4.2.15	External visibility Head lights	LOC & PAS TSI	4.2.7.1.1
			Wagon TSI	None
		Driver's external field of view	LOC & PAS TSI Line of sight	4.2.9.1.3.1
			LOC & PAS TSI Windscreen	4.2.9.2
			Wagon TSI	None
Interface to Data Recording for Regulatory Purposes	4.2.14	Recording device	LOC & PAS TSI	4.2.9.6
			Wagon TSI	None
ETCS on-board: Forwarding information/orders and receiving state information from rolling stock	4.2.2	Separation sections	LOC & PAS TSI	4.2.8.2.9.8
			Wagon TSI	None
		Dynamic braking command	LOC&PAS TSI	4.2.4.4.4
			Wagon TSI	None
		Magnetic track brake	LOC&PAS TSI	4.2.4.8.2
			Wagon TSI	None
		Eddy current track brake	LOC&PAS TSI	4.2.4.8.3
			Wagon TSI	None
		Maximum power and current from the overhead contact line	LOC&PAS TSI	4.2.8.2.4
			Wagon TSI	None
		Door opening	LOC&PAS TSI	4.2.5.5.6
			Wagon TSI	None
		Requirements on performance	LOC&PAS TSI	4.2.8.1.2
			Wagon TSI	None
		Smoke control	LOC&PAS TSI	4.2.10.4.2
			Wagon TSI	None

		Radio Remote control function by staff for shunting operation	LOC&PAS TSI	4.2.9.3.6
			Wagon TSI	None
		Driver's desk – Ergonomics	LOC&PAS TSI	4.2.9.1.6
			Wagon TSI	None
		Requirements for management of ETCS modes: sleeping mode	LOC&PAS TSI	4.2.9.3.7.1
			Wagon TSI	None
		Requirements for management of ETCS modes: passive shunting	LOC&PAS TSI	4.2.9.3.7.2
			Wagon TSI	None
		Requirements for management of ETCS modes: non leading	LOC&PAS TSI	4.2.9.3.7.3
			Wagon TSI	None
		Type of brake system	LOC&PAS TSI	4.2.4.3
			Wagon TSI	None
		Traction Status	LOC&PAS TSI	4.2.9.3.8
			Wagon TSI	None
		Running dynamic behaviour	LOC&PAS TSI	4.2.3.4.2
			Wagon TSI	None
ATO on-board: Forwarding information/orders and receiving state information from rolling stock	4.2.18	Interface requirements with Automated Train Operation onboard	LOC & PAS TSI	4.2.13
			Wagon TSI	None
Emergency braking command	4.2.2	Emergency braking command	LOC & PAS TSI	4.2.4.4.1
			Wagon TSI	None
Construction of equipment used in CCS subsystems	4.2.16	Material requirements	LOC&PAS TSI	4.2.10.2.1
			Wagon TSI	None
Service braking command	4.2.2	Service braking command	LOC & PAS TSI	4.2.4.4.2
			Wagon TSI	None

([1]) In accordance with Commission Regulation (EU) No 321/2013 of 13 March 2013 concerning the technical specification for interoperability relating to the subsystem rolling stock — freight wagons of the rail system in the European Union and repealing Decision 2006/861/EC (OJ L 104 12.4.2013, p. 1).

4.3.3. *Interfaces to Infrastructure Subsystem*

Interface with Infrastructure TSI				
Reference CCS TSI		Reference Infrastructure TSI		
Parameter	Point	Parameter		Point
Eurobalise communication (space for installation)	4.2.5.2	Structure gauge	INF TSI ([1])	4.2.3.1
Euroloop communication (space for installation)	4.2.5.3	Structure gauge	INF TSI	4.2.3.1
Trackside Control-Command and Signalling objects	4.2.15	Structure gauge	INF TSI	4.2.3.1

([1]) INF TSI is Commission Regulation (EU) No 1299/2014 of 18 November 2014 on the technical specifications for interoperability relating to the 'infrastructure' subsystem of the rail system in the European Union (OJ L 356, 12.12.2014, p. 1).

4.3.4. *Interfaces to Energy Subsystem*

Interface with Energy TSI				
Reference CCS TSI		Reference Energy TSI		
Parameter	Point	Parameter		Point
Commands to rolling stock equipment	4.2.2 4.2.3	Phase separation sections System separation sections	ENE TSI ([1])	4.2.15 4.2.16

([1]) ENE TSI is Commission Regulation (EU) No 1301/2014 of 18 November 2014 on the technical specifications for interoperability relating to the 'energy' subsystem of the rail system in the Union (OJ L 356, 12.12.2014, p. 179).

4.4. **Operating rules**

The rules for operating a railway service with ETCS, ATO and RMR are specified in the Operation and Traffic Management TSI.

The harmonised text indications and messages displayed on the ETCS Driver Machine Interface are listed under Appendix E.

4.5. **Maintenance rules**

The maintenance rules of the subsystems 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 subsystems. 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 Subsystems shall set up maintenance rules to achieve the above objectives. The preparation of these rules shall be done with the assistance of the requirements in 4.2.20 (Technical documentation for Maintenance).

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, final inspection and maintenance of the Control-Command and Signalling Subsystems. See point 4.5 (Maintenance rules).

4.7. **Health and safety conditions**

Care shall be taken to ensure health and safety for maintenance and operations staff, in accordance with Union legislation and the national legislation that is compatible with the Union legislation.

Manufacturers shall indicate the risks for health and safety that arise from using and maintaining their equipment and subsystems. See point 4.4 (Operating rules) and point 4.5 (Maintenance rules).

4.8. **Registers**

The data to be provided for the registers provided for in Articles 48 and 49 of Directive (EU) 2016/797 are those indicated in Commission Implementing Decision 2011/665/EU ([10]) and Commission Implementing Regulation (EU) 2019/777 ([11]).

4.9. **Route compatibility checks before the use of authorised vehicles**

The parameters of the on-board CCS subsystem to be used by the railway undertaking, for the purpose of route compatibility check, are described in Appendix D1 of Implementing Regulation (EU) 2019/773.

5. INTEROPERABILITY CONSTITUENTS

5.1. **Definition**

In accordance with Article 2(7) of Directive (EU) 2016/797, interoperability constituents means 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 directly or indirectly, including both tangible objects and intangible objects.

5.2. **List of interoperability constituents**

5.2.1. *Basic interoperability constituents*

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

(1) Table 5.1. for the Control-Command and Signalling On-board Subsystem;

(2) Table 5.2. for the Control-Command and Signalling Trackside Subsystem.

5.2.2. *Grouping of interoperability constituents*

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

Compliance of interfaces internal to the group of Interoperability Constituents to basic parameters of Chapter 4 does not have to be verified. Compliance of interfaces external to the group of Interoperability Constituents has to be verified to demonstrate conformity with the basic parameters related to the requirements of these external interfaces.

5.2.2.2. When interoperability constituents are grouped, the grouped functions and their addressing must be configurable in such a way that the grouped functions of the ATO, ETCS and the radio ICs can be replaced during the life cycle of the CCS subsystem by an external ATO, ETCS or Radio ICs. Therefore, the following interfaces in a grouped Interoperability Constituent shall be made externally accessible on the CCS Consist network communication layers as specified in Appendix A, Table A 1, 4.2.6 i:

([10]) Commission Implementing Decision 2011/665/EU of 4 October 2011 on the European register of authorised types of railway vehicles (OJ L 264, 8.10.2011, p. 32).

([11]) Commission Implementing Regulation (EU) 2019/777 of 16 May 2019 on the common specifications for the register of railway infrastructure and repealing Decision 2014/880/EU (OJ L 139 I, 27.5.2019, p. 312).

(1) Interface between ATO On-Board and ETCS On-Board as specified in Appendix A, Table A 1, 4.2.6 h;

(2) Interface between ATO On-Board and GSM-R data radio On-Board as specified in Appendix A, Table A 1, 4.2.6 j;

(3) Interface between On-board FRMCS and the CCS applications (ETCS in Appendix A, Table A 1, 4.2.6 g and ATO in Appendix A, Table A 1, 4.2.6 k);

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 (where applicable) by reference to the relevant section of Chapter 4.

Table 5.1.

Basic interoperability constituents in the Control-Command and Signalling On-board Subsystem

No	Interoperability constituent (IC)	Characteristics	Specific requirements to be assessed by reference to Chapter 4
1	ETCS on-board	Reliability, Availability, Maintainability, Safety (RAMS): Safety Availability/Reliability Maintainability	4.2.1.1 4.2.1.2 4.2.20.1
		On-board ETCS functionality (excluding odometry) System identifier	4.2.2 4.2.20.3
		ETCS air gap interfaces RBC (Radio data transmission optional) Radio infill unit (functionality optional) Eurobalise air gap Euroloop air gap (functionality optional)	4.2.5 4.2.5.1.2 4.2.5.1.2.1 4.2.5.2 4.2.5.3
		Interfaces STM (implementation of interface K optional) GSM-R data radio On-Board FRMCS Key management ETCS-ID Management ETCS Driver-Machine Interface Train interface (see note below) On-board recording device ATO interface	4.2.6.1 4.2.6.2.1.1 4.2.6.2.1.2 4.2.8 4.2.9 4.2.12 4.2.2 4.2.14 4.2.6.4 4.2.6.5.1

		CCS Consist network communication layers. *Note for train interface:* The implementation of all functions described in Appendix A Index 7 document is mandatory at Interoperability Constituent level.	
		Construction of equipment	4.2.16
		ETCS System Compatibility (ESC) (optional)	4.2.17.1 4.2.17.2
2	Odometry equipment	Reliability, Availability, Maintainability, Safety (RAMS): Safety Availability/Reliability Maintainability	4.2.1.1 4.2.1.2 4.2.20.1
		On-board ETCS functionality: only Odometry	4.2.2
		Construction of equipment	4.2.16
3	Standardised interface STM	Interfaces On-board ETCS	4.2.6.1
4	GSM-R voice cab radio *Note:* SIM card, antenna, connecting cables and filters are not part of this interoperability constituent	Reliability, Availability, Maintainability (RAM): Availability/Reliability Maintainability	4.2.1.2 4.2.20.1
		Basic communication functions	4.2.4.1.1
		Voice and operational communication applications System identifier	4.2.4.2.1 4.2.20.3
		Interfaces GSM-R air gap GSM-R Driver-Machine Interface	4.2.5.1.1.1 4.2.13.1
		Construction of equipment	4.2.16
		Radio System Compatibility (RSC) (optional)	4.2.17.3 4.2.17.4
5	GSM-R data radio *Note:* SIM card, antenna, connecting cables and filters are not part of this interoperability constituent	Reliability, Availability, Maintainability (RAM): Availability/Reliability Maintainability	4.2.1.2 4.2.20.1
		Basic communication functions	4.2.4.1.1

		ETCS data communication applications System identifier	4.2.4.3.1.1 4.2.20.3
		Interfaces On-board ETCS On-board ATO GSM-R air gap GSM-R air gap for ETCS GSM-R air gap for ATO	4.2.6.2.1.1 4.2.6.2.2.1 4.2.5.1.1.1 4.2.5.1.2.1 4.2.5.1.3.1
		Construction of equipment	4.2.16
		Radio System Compatibility (RSC) (optional)	4.2.17.3 4.2.17.4
6	GSM-R SIM card *Note:* It is the responsibility of the GSM-R network operator to deliver to railway undertakings the SIM cards to be inserted in GSM-R terminal equipment.	Basic communication functions System identifier	4.2.4.1.1 4.2.20.3
		Construction of equipment	4.2.16
		Radio System Compatibility (RSC) (optional)	4.2.17.3 4.2.17.4
7	ATO On-Board	Reliability, Availability, Maintainability (RAM): Availability/Reliability Maintainability	4.2.1.2 4.2.20.1
		On-board ATO functionality (excluding communication) System identifier	4.2.18 4.2.20.3
		ATO air gap interfaces	4.2.5.1.3
		Interfaces GSM-R data radio On-Board FRMCS Train interface ETCS interface CCS Consist network communication layers	4.2.6.2.2.1 4.2.6.2.2.2 4.2.18 4.2.6.4 4.2.6.5.1
		Construction of equipment	4.2.16
8	FRMCS On-Board voice application	Reliability, Availability, Maintainability (RAM): Availability/Reliability Maintainability	4.2.1.2 4.2.20.1
		Basic communication functions	4.2.4.1.2
		Voice and operational communication applications System identifier	4.2.4.2.2 4.2.20.3

		Interfaces On-board FRMCS FRMCS Driver-Machine Interface	4.2.6.2.3 4.2.13.2
		Construction of equipment	4.2.16
		Radio System Compatibility (RSC) (optional)	4.2.17.3 4.2.17.4
9	On-board FRMCS	Reliability, Availability, Maintainability (RAM): Availability/Reliability Maintainability	4.2.1.2 4.2.20.1
		Basic communication functions System identifier	4.2.4.1.2 4.2.20.3
		Interfaces FRMCS on-board voice application FRMCS air gap FRMCS air gap for ETCS application FRMCS air gap for ATO application On-board ETCS On-board ATO CCS Consist network communication layers	4.2.6.2.3 4.2.5.1.1.2 4.2.5.1.2.2 4.2.5.1.3.2 4.2.6.2.1.2 4.2.6.2.2.2 4.2.6.5.1
		Construction of equipment	4.2.16
		Radio System Compatibility (RSC) (optional)	4.2.17.3 4.2.17.4
10	FRMCS Profile *Note:* It is the responsibility of the FRMCS network operator to ensure that the FRMCS profile is made available to the subscribers.	Basic communication functions System identifier	4.2.4.1.2 4.2.20.3
		Construction of equipment	4.2.16
		Radio System Compatibility (RSC) (optional)	4.2.17.3 4.2.17.4

Table 5.2.

Basic interoperability constituents in the Control-Command and Signalling Trackside Subsystem

1	2	3	4
No	Interoperability Constituent (IC)	Characteristics	Specific requirements to be assessed by reference to Chapter 4
1	RBC	Reliability, Availability, Maintainability, Safety (RAMS): Safety Availability/Reliability Maintainability	4.2.1.1 4.2.1.2 4.2.20.1

		Trackside ETCS functionality (excluding communication via Eurobalises, radio infill and Euroloop) System identifier	4.2.3 4.2.20.3
		RMR, ETCS and ATO air gap interfaces: only radio communication with train GSM-R air gap interface for ETCS FRMCS air gap interface for ETCS	4.2.5.1.2.1 4.2.5.1.2.2
		Interfaces Neighbouring RBC GSM-R Data radio communication FRMCS Trackside Key management ETCS-ID Management	4.2.7.1, 4.2.7.2 4.2.7.3.1.1 4.2.7.3.1.2 4.2.8 4.2.9
		Construction of equipment	4.2.16
2	Radio infill unit	Reliability, Availability, Maintainability, Safety (RAMS): Safety Availability/Reliability Maintainability	4.2.1.1 4.2.1.2 4.2.20.1
		Trackside ETCS functionality (excluding communication via Eurobalises, Euroloop and level 2 functionality) System identifier	4.2.3 4.2.20.3
		RMR, ETCS and ATO air gap interfaces: only radio communication with train GSM-R air gap interface for ETCS	4.2.5.1.2.1
		Interfaces GSM-R Data radio communication Key management ETCS-ID Management Interlocking and LEU	4.2.7.3 4.2.8 4.2.9 4.2.3
		Construction of equipment	4.2.16
3	Eurobalise	Reliability, Availability, Maintainability, Safety (RAMS): Safety Availability/Reliability Maintainability	4.2.1.1 4.2.1.2 4.2.20.1
		ETCS and RMR air gap interfaces: only Eurobalise communication with train System identifier	4.2.5.2 4.2.20.3

		Interfaces LEU – Eurobalise	4.2.7.4
		Construction of equipment	4.2.16
4	Euroloop	Reliability, Availability, Maintainability, Safety (RAMS): Safety Availability/Reliability Maintainability	4.2.1.1 4.2.1.2 4.2.20.1
		ETCS and RMR air gap interfaces: only Euroloop communication with train System identifier	4.2.5.3 4.2.20.3
		Interfaces LEU – Euroloop	4.2.7.5
		Construction of equipment	4.2.16
5	LEU Eurobalise	Reliability, Availability, Maintainability, Safety (RAMS): Safety Availability/Reliability Maintainability	4.2.1.1 4.2.1.2 4.2.20.1
		Trackside ETCS functionality (excluding communication via radio infill, Euroloop and level 2 functionality) System identifier	4.2.3 4.2.20.3
		Interfaces LEU – Eurobalise	4.2.7.4
		Construction of equipment	4.2.16
6	LEU Euroloop	Reliability, Availability, Maintainability, Safety (RAMS): Safety Availability/Reliability Maintainability	4.2.1.1 4.2.1.2 4.2.20.1
		Trackside ETCS functionality (excluding communication via radio infill, Eurobalise and level 2 functionality) System identifier	4.2.3 4.2.20.3
		Interfaces LEU – Euroloop	4.2.7.5
		Construction of equipment	4.2.16
7	Axle Counter	Trackside train detection systems (only parameters relevant for axle counters)	4.2.10
		Electromagnetic compatibility (only parameters relevant for axle counters)	4.2.11

8	Marker Board	Trackside Control-Command and Signalling objects (only points 1 and 2)	4.2.15
		Construction of equipment	4.2.16
9	ATO Trackside	Reliability, Availability, Maintainability (RAM): Availability/Reliability Maintainability	4.2.1.2 4.2.20.1
		Trackside ATO functionality System identifier	4.2.19 4.2.20.3
		RMR, ETCS and ATO air gap interfaces: only radio communication with train GSM-R air gap interface for ATO FRMCS air gap interface for ATO	4.2.5.1.3.1 4.2.5.1.3.2
		Interfaces: GSM-R Data radio communication FRMCS Trackside	4.2.7.3.2.1 4.2.7.3.2.2
		Construction of equipment	4.2.16

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

6.1. **Introduction**

6.1.1. *General principles*

6.1.1.1. Compliance with basic parameters

Fulfilment of the essential requirements set out in Chapter 3 of this TSI shall be ensured through compliance with the basic parameters specified in Chapter 4.

This compliance shall be demonstrated by:

(1) assessing the conformity of the interoperability constituents specified in Chapter 5 (see points 6.2.1, 6.2.2, 6.2.3, 6.2.4);

(2) verifying the subsystems (see point 6.3 and point 6.4).

In case of changes to existing subsystems, the requirements in 7.2.2 for on-board subsystems and 7.2.3 for trackside subsystems shall be considered in the assessment.

6.1.1.2. Partial fulfilment of TSI requirements

An on-board subsystem may, if fulfilling both conditions below, not implement all mandatory functionalities specified in this TSI:

(1) the functionalities are listed in Appendix G;

(2) the Infrastructure Manager (with the support of the Member State) has indicated in RINF that the partial fulfilment of the listed requirement does not prevent an optimal and safe operation on its network.

Where a control-command and signalling interoperability constituent or subsystem does not implement all functionalities specified in this TSI, the relevant conditions for use shall reflect it in accordance with provisions of points 6.5.1 and 6.5.2.

6.1.2. *Principles for testing ETCS, ATO and RMR*

6.1.2.1. Principle

The principle is that a Control-Command and Signalling On-board Subsystem covered by an 'EC' declaration of verification is able to run on every Control-Command and Signalling Trackside Subsystem covered by an 'EC' Declaration of verification, under the conditions specified in this TSI, with no additional verifications.

Achievement of this principle is facilitated by:

(1) rules for the design and installation of the Control-Command and Signalling On-board and the Trackside subsystems;

(2) test specifications to prove that the Control-Command and Signalling On-board and Trackside Subsystems comply with the requirements of this TSI and are mutually compatible.

6.1.2.2. Operational test scenarios

For the purpose of this TSI, an 'operational test scenario' means a sequence of trackside and on-board events related to or influencing the Control-command and Signalling subsystems (e.g. sending/receiving messages, exceeding a speed limit, actions of operators) and the specified timing between them in order to test the intended railway system operation in situations relevant for ETCS, ATO and RMR (e.g. entry of a train into an equipped area, awakening of a train, overriding a signal at stop).

The operational tests scenarios are based on the engineering rules adopted for the project.

Check of compliance of a real implementation with an operational test scenario shall be possible gathering information through easily accessible interfaces (preferably the standard interfaces specified in this TSI).

6.1.2.3. Requirements for Operational test scenarios

The set of engineering rules for the trackside parts of ETCS, ATO and RMR and related operational test scenarios for the Trackside Control-command and Signalling Subsystem shall be sufficient to describe all intended system operations relevant for the Trackside Control-command and Signalling Subsystem in normal and identified degraded situations, and:

(1) shall be consistent with the specifications referenced in this TSI;

(2) shall assume that functions, interfaces and performance of the Control-command and Signalling On-board Subsystems interacting with the Trackside Subsystem are compliant with the requirements of this TSI;

(3) shall be the ones used in the EC Verification of the Trackside Control-command and Signalling Subsystem, to check that the implemented functions, interfaces and performance are able to ensure that the intended system operation in combination with the relevant modes and transitions between levels and modes of the Control-command and Signalling On-board Subsystems are respected.

6.2. **Interoperability constituents**

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

Before placing on the market an interoperability constituent and/or groups of interoperability constituents the manufacturer or his authorised representative established within the European Union shall draw up an 'EC' declaration of conformity in accordance with Article 9(2) and Article 10(1) of Directive (EU) 2016/797.

The assessment procedure shall be carried out using one of the modules specified in point 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. Compliance with relevant basic parameters, as demonstrated by the 'EC' Declaration of conformity, is sufficient for placing the interoperability constituents on the market ([12]).

6.2.2. *Modules for Control-Command and Signalling Interoperability Constituents*

For assessing interoperability constituents within the Control-Command and Signalling Subsystems, the manufacturer or his authorised representative established within the European Union, 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

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

In addition, for checking the SIM card and Marker Board Interoperability Constituent, the manufacturer or his representative may choose Module CA.

The modules are described in detail in the Commission Decision 2010/713/EU ([13]).

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

(1) 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;

(2) 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:

(1) the requirements stated in point 6.2.4.1 of this TSI shall be respected for the 'On-board ETCS' interoperability constituent;

(2) the activities shown in Table 6.1.1 shall be carried out when assessing the conformity of an interoperability constituent or a group of interoperability constituents as defined in Chapter 5 of this TSI. All verifications shall be carried out by reference to the applicable table in Chapter 5 and the basic parameters indicated there.

(3) The manufacturer of the equipment shall inform a Notified Body about all changes affecting the conformity of the Interoperability Constituent due to the requirements of the applicable TSI release. The manufacturer shall also demonstrate if these specifications of error corrections require new checks, in accordance with Table 6.1.1 and by application of modules for the EC Conformity according to 6.2.2. This information shall be provided by the manufacturer with corresponding references to the technical documentation relating to the existing EC certificate. The manufacturer shall justify and document that applicable requirements are met at interoperability constituent level, which shall be assessed by a Notified Body.

The manufacturer shall inform the impacted entities about changes, e.g. regarding operation and maintenance, if they affect existing and already implemented products/components.

([12]) Checking that an Interoperability Constituent is used appropriately is part of the overall EC verification of Control-Command and Signalling On-board and Track-side Subsystems, as explained in 6.3.3 and 6.3.4.

([13]) Commission Decision 2010/713/EU of 9 November 2010 on modules for the procedures for assessment of conformity, suitability for use and 'EC' verification to be used in the technical specifications for interoperability adopted under Directive 2008/57/EC of the European Parliament and of the Council (OJ L 319, 4.12.2010, p. 1).

Table 6.1.1.

Conformity assessment requirements of an interoperability constituent or a group of interoperability constituents

No	Aspect	What to assess	Supporting evidence
1a	Functions, interfaces and performances	Check 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 sequences, as described in the basic parameters referenced in the relevant table of Chapter 5.
1b		Check 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 sequences, as described in the basic parameters referenced in the relevant table of Chapter 5.
1c		Check 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.
2a	Construction of equipment	Check compliance with mandatory conditions, where specified in the basic parameters referenced in the relevant table of Chapter 5.	Documentation on material used and, where necessary, tests to ensure that the requirements of the basic parameters referenced in the relevant table of Chapter 5 are satisfied.
2b		In addition, check that the interoperability constituent functions correctly in the environmental conditions for which it is designed.	Tests according to the applicant's specifications.
3	Reliability, Availability, Maintainability, Safety (RAMS)	Check compliance with the safety requirements where specified in the basic parameters referenced in the relevant table of Chapter 5, i.e. 1. respect for quantitative Tolerable Hazard Rates (THRs) caused by random failures; 2. the development process is able to detect and eliminate systematic failures.	1. Calculations for the THRs caused by random failures, supported by reliability data. 2.1. The manufacturer's quality and safety management throughout design, manufacturing and testing conforms to a recognised standard (see Note).

			2.2. The software development life-cycle, the hardware development life-cycle and the integration of hardware and software have each been undertaken in accordance with a recognised standard (see Note). 2.3. The safety verification and validation process has been undertaken in accordance with a recognised standard (see Note) and respects the safety requirements described in the basic parameters referenced in the relevant table of Chapter 5. 2.4. The functional and technical safety requirements (correct operation under fault-free conditions, effects of faults and of external influences) are verified in accordance with a recognised standard (see Note). *Note:* The standard shall satisfy at least the following requirements: (1) be compliant with the requirements for code of practice, as stated in Annex I, point 2.3.2, of Regulation (EU) No 402/2013; (2) be widely acknowledged in the railway domain. If this is not the case, the standard will have to be justified and be acceptable to the Notified Body; (3) be relevant for the control of the considered hazards in the system under assessment; (4) be publicly available for all actors who want to use it.
4		Check that the quantitative reliability target (related to random failures) indicated by the applicant is met.	Calculations

5		Elimination of systematic failures.	Tests of equipment (full Interoperability Constituent or separately for subassemblies) in operational conditions, with repair when defects are detected. Documentation accompanying the certificate which indicates which kind of verifications have been performed, which standards have been applied and criteria adopted to consider these tests completed (according to decisions of the applicant).
6	Technical documentation for maintenance	Check compliance with maintenance requirements – point 4.2.20.1.	Document check

6.2.4. *Special issues*

6.2.4.1. Mandatory tests for the on-board ETCS

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

Regardless of whether module CB or CH1 is chosen, the Notified Body shall check that:

(1) a representative specimen of the interoperability constituent has been submitted to a full set of test sequences including all test cases necessary to check the functions referenced in point 4.2.2 (On-Board ETCS functionality). The applicant is responsible to define the test cases and their organisation in sequences, if this is not included in specifications referenced in this TSI;

(2) these tests were carried out in a laboratory accredited in accordance with Regulation (EC) No 765/2008 of the European Parliament and of the Council ([14]) and the standards referred to in Appendix A, Table A 4 to carry out tests with the use of the test architecture and the procedures specified in Appendix A, Table A 1:

(a) For on-board ETCS supporting up to system version 2.1: 4.2.2 c.

(b) For on-board ETCS supporting up to system version 2.2 and 3.0: not included, see previous point (1).

The laboratory shall provide a full report clearly indicating the results of the tests cases and sequences used. The Notified Body is responsible to assess the suitability of test cases and sequences to check compliance with all relevant requirements and to evaluate the results of tests in view of the certification of the Interoperability Constituent.

6.2.4.2. Class B interfaces

Each Member State shall be responsible for verifying that Class B systems and their interfaces to the ETCS on-board Interoperability Constituent conform to its national requirements.

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

([14]) Regulation (EC) No 765/2008 of the European Parliament and of the Council of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products and repealing Regulation (EEC) No 339/93 (OJ L 218, 13.8.2008, p. 30).

6.2.4.3. ETCS and radio system compatibility checks for Interoperability Constituent

Since the ESC/RSC checks are not required in Table 6.1.1, they are not required for issuing an interoperability constituent certificate.

If ESC/RSC checks are executed at Interoperability Constituent level, the task of the NoBo with regards to the ESC/RSC Interoperability Constituent statement(s) and associated report is to verify the correctness and completeness of the ESC/RSC check report for the Interoperability Constituent, according to the requirements in this point.

In line with the Directive (EU) 2016/797 the Notified Body performing this assessment may be a different one from the Notified Body performing the EC conformity or suitability procedure for the interoperability constituent.

Table 6.1.2.

NoBo assessment of the ETCS or Radio System Compatibility Check for Interoperability Constituents

No	Aspect	What to assess	Supporting evidence
1	Availability of the results	Assess that the check report gives reference to the checks according to the definition of the ESC/RSC types in the technical document published by ERA ([1]). Assess that the Interoperability Constituent check report clearly indicates which checks have been verified for the ESC/RSC Type.	Evaluation of the ESC/RSC Check Report.
2	Availability of the results	Assess that ESC/RSC results indicate for every ESC/RSC Check whether the ESC/RSC Check was passed as specified or not.	Evaluation of the ESC/RSC Check Report.
3	Incompatibilities and errors reported	Assess that for every ESC/RSC Check which was not passed as specified, the incompatibilities and errors reported during ESC/RSC Checks are stated.	Evaluation of the ESC/RSC Check Report.
4	Impact analysis	Assess that for every ESC/RSC Check which was not passed as specified, an impact analysis of the effects on ESC/RSC has been performed and recorded using the template provided in the Appendix D.	Evaluation of the ESC/RSC Check Report.

([1]) This includes the documents referred to in the Agency ESC/RSC Technical Document.

6.3. Control-Command and Signalling Subsystems

6.3.1. *Assessment procedures for Control-Command and Signalling Subsystems*

This Chapter deals with the 'EC' declaration of verification for the Control-Command and Signalling On-board Subsystem and the 'EC' declaration of verification for the Control-Command and Signalling Trackside Subsystem.

At the request of the applicant the Notified Body shall carry out an 'EC' verification of a Control-Command and Signalling On-board or Trackside Subsystem in accordance with Annex IV to Directive (EU) 2016/797.

The applicant shall draw up the 'EC' declaration of verification for the Control-Command and Signalling On-board or Trackside Subsystem in accordance with Article 15(1) and (9) of Directive (EU) 2016/797.

The content of the 'EC' declaration of verification shall conform to Article 15(9) of Directive (EU) 2016/797.

The assessment procedure shall be carried out using the modules specified in point 6.3.2 (Modules for Control-Command and Signalling Subsystems).

The 'EC' declarations of verification for a Control-Command and Signalling On-board Subsystem and of a Control-Command and Signalling Trackside Subsystem, together with the certificates of conformity, shall be deemed sufficient to ensure that the subsystems are compatible under the conditions specified in this TSI.

6.3.2. *Modules for Control-Command and Signalling Subsystems*

All modules indicated below are specified in the Decision 2010/713/EU.

6.3.2.1. On-board Subsystem

For verifying the Control-Command and Signalling On-board Subsystem, 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. Trackside Subsystem

For verifying the Control-Command and Signalling Trackside Subsystem, 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 using modules for On-board and Trackside Subsystems

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

With reference to point 4.2 of Module SH1 (full quality management system with design examination), an additional type test is required.

6.3.3. *Assessment requirements for an On-board Subsystem*

Table 6.2.1 shows the checks that must be carried out when verifying a Control-Command and Signalling On-board Subsystem and the basic parameters that must be respected.

Independently of the module chosen:

(1) verification shall demonstrate that the Control-Command and Signalling On-board Subsystem complies with basic parameters when it is integrated into the vehicle;

(2) the functionality and performances of interoperability constituents already covered by their EC Declaration of conformity do not require additional verifications;

(3) the update due to specifications maintenance of an already integrated Interoperability Constituent will not require additional verification by a subsystem Notified Body if the Interoperability Constituent Notified Body confirms that the impact of the update to be assessed is limited to the Interoperability Constituent and if no impact at subsystem level is identified by the CSM assessment body assessing the subsystem integration of the update.

Table 6.2.1.

Conformity assessment requirements for an On-board Subsystem or for groups of Parts

No	Aspect	What to assess	Supporting evidence
1a	Use of interoperability constituents	Check whether the interoperability constituents to be integrated into the subsystem are all covered by an 'EC' Declaration of conformity and a corresponding certificate. The Subsystem needs to be checked with a SIM card compliant with the requirements of this TSI. Changing the SIM card with another one compliant with the TSI is not a modification of the Subsystem.	Existence and content of documents.
1b		Check conditions and limits of use on the use of Interoperability Constituents against the characteristics of the subsystem and of the environment	Analysis by document check.
1c		For interoperability constituents that have been certified against a version of the CCS TSI, which is different from the version applied for the 'EC' Verification of the subsystem and/or against a set of specifications which is different from the set of specifications applied for the 'EC' Verification of the subsystem, check that the certificate still ensures subsystem compliance with the requirements of the TSI currently in force.	Impact analysis by document checks.
2a	Integration of interoperability constituents in the subsystem	Check the correct installation and functioning of the internal interfaces of the subsystem – Basic parameter 4.2.6.	Checks according to specifications.
2b		Check that additional functions (not specified in this TSI) do not impact the mandatory ones.	Impact analysis.
2c		Check that the values of ETCS IDs are within the allowed range and, if required by this TSI, have unique values – Basic parameter 4.2.9.	Check of design specifications.

2d		Check that there is a system identifier for ETCS part of the subsystem. In case of modification of the functional or realisation part of the system identifier, that the modification corresponds to the definition – Basic Parameter 4.2.20.3.	Document check.
3	Integration of parts in the subsystem	Check the interfaces and integration between the different parts of the subsystem – Table 4.1 and Basic parameter 4.2.6.	Impact analysis by document checks.
4a	Integration with rolling stock	Check the correct installation of equipment – Basic Parameters 4.2.2, 4.2.4, 4.2.14, 4.2.18 and conditions for installation of equipment, as specified by the manufacturer.	Results of checks (according to specifications referenced in the Basic Parameters and the manufacturer's installation rules).
4b		Check that the Control-Command and Signalling On-board Subsystem is compatible with the rolling stock environment – Basic parameter 4.2.16.	Document check (certificates of interoperability constituents and possible integration methods checked against characteristics of rolling stock).
4c		Check that parameters (e.g. braking parameters) are correctly configured and that they are within the allowed range.	Document check (values of parameters checked against characteristics of rolling stock).
5a	Integration with Class B, depending on ETCS on-board and Class B interface	Check that the standardised interface STM is connected to on-board ETCS with TSI-compliant interfaces.	Nothing to test: there is a standard interface already tested at interoperability constituent level. Its functioning has already been tested when checking the integration of interoperability constituents in the subsystem.
5b		Check that Class B functions implemented in the on-board ETCS– Basic parameter 4.2.6.1 – create no additional requirements for the Control-Command and Signalling Trackside Subsystem due to transitions.	Nothing to test: everything has already been tested at interoperability constituent level.

5c		Check that separate Class B equipment which is not connected to the on-board ETCS– Basic Parameter 4.2.6.1 – creates no additional requirements for Control-Command and Signalling Trackside Subsystem due to transitions.	Nothing to test: no interface ([1]).
5d		Check that separate Class B equipment connected on-board ETCS using (partly) non TSI compliant interfaces – basic parameter 4.2.6.1 – creates no additional requirements for the Control-Command and Signalling Trackside Subsystem due to transitions. Also check that ETCS functions are not affected.	Impact analysis by document check and integration tests report.
6a	Integration with Control-Command and Signalling Trackside Subsystems	Check that Eurobalise telegrams can be read (scope of this test is limited to checking that the antenna has been appropriately installed. The tests already carried out at Interoperability Constituent level shall not be repeated) – Basic Parameter 4.2.5.	Test using a certified Eurobalise: the ability to read correctly the telegram is the supporting evidence.
6b		Check that Euroloop telegrams (if applicable) can be read – Basic Parameter 4.2.5.	Test using a certified Euroloop: the ability to read correctly the telegram is the supporting evidence.
6c		Check that the equipment can handle a RMR call for voice and data (if applicable) – Basic Parameter 4.2.5.	Test with a certified RMR network. The ability to set up, maintain and disconnect a connection is the supporting evidence.
7a	Reliability, Availability, Maintainability, Safety (RAMS)	Check that the equipment complies with safety requirements – Basic Parameter 4.2.1.	Application of procedures specified in the Common Safety Method for Risk Evaluation and Assessment.
7b		Check that the quantitative reliability target is met – Basic Parameter 4.2.1.	Calculations.
7c		Check the compliance with requirements about maintenance – point 4.2.20.2.	Documents check.

8	Integration with Control-Command and Signalling Trackside Subsystems and other subsystems: tests under conditions representing the intended operation.	Test the behaviour of the subsystem under as many different conditions as reasonably possible representing the intended operation (e.g. line gradient, train speed, vibrations, traction power, weather conditions, design of Control-Command and Signalling trackside functionality). The test must be able to verify: (1) that odometry functions are correctly performed – basic parameter 4.2.2; (2) that the on-board Control-Command and Signalling Subsystem is compatible with the rolling stock environment – basic parameter 4.2.16. These tests must also be such as to increase confidence that there will be no systematic failures. The scope of these tests excludes tests already carried out at different stages: tests performed on the interoperability constituents and tests performed on the subsystem in a simulated environment shall be taken into account. Tests under environmental conditions are not necessary for on-board RMR voice equipment. *Note:* Indicate in the certificate which conditions have been tested and which standards have been applied.	Reports of test runs.

([1]) In this case, the assessment of the management of transitions shall be according to national specifications.

6.3.3.1. ETCS and radio system compatibility checks

The task of the NoBo with regards to the ESC/RSC check report is to verify the correctness and completeness of the ESC/RSC check report for the subsystem, according to the requirements in this point.

Since the ESC/RSC checks are not required in Table 6.2.1, they are not needed for issuing an on-board subsystem certificate. Such an on-board subsystem therefore will only be considered compatible with Class A infrastructures where no specific ESC/RSC check is required to demonstrate technical compatibility (i.e. identified by the IM as ESC-EU-0 or RSC-EU-0 in RINF).

Table 6.2.2.

NoBo assessment of the ETCS or Radio System Compatibility Check for On-Board Subsystems

No	Aspect	What to assess	Supporting evidence
1	Availability of the results	Assess that the check report gives reference to the checks according to the definition of the ESC/RSC types in the technical document published by ERA ([1]). Assess that all required ESC/RSC checks of that ESC/RSC type have been evaluated.	Evaluation of the ESC/RSC Check Report.
2	Availability of the results	Assess that ESC/RSC results indicate for every ESC/RSC Check whether the ESC/RSC Check was passed as specified or not.	Evaluation of the ESC/RSC Check Report.
3	Incompatibilities and errors reported	Assess that for every ESC/RSC Check which was not passed as specified, the incompatibilities and errors reported during ESC/RSC Checks are stated.	Evaluation of the ESC/RSC Check Report.
4	Impact analysis	Assess that for every ESC/RSC Check which was not passed as specified, an impact analysis of the effects on ESC/RSC has been performed and recorded using the template provided in the Appendix D.	Evaluation of the ESC/RSC Check Report.
5	Conditions	Assess that all conditions are referred to in the check report.	Evaluation of the ESC/RSC Check Report.
6	Integration of ESC/RSC Interoperability Constituent Statements	Assess that if the ESC/RSC statement is based on ESC/RSC Interoperability Constituent statements, the results from ESC/RSC Interoperability Constituent Statement are applicable to the concerned subsystem.	Evaluation of the ESC/RSC Check Report.

([1]) This includes the documents referred to in the Agency ESC/RSC Technical Document.

The Notified Body shall not check again any aspect covered during the already performed EC Verification procedure for the on-board subsystem or already covered in the ESC/RSC Interoperability Constituent Statement.

In line with the Directive (EU) 2016/797, the Notified Body performing this assessment may be a different one from the Notified Body performing the EC Verification procedure for the on-board subsystem or from the Notified Body performing the assessment on the ESC/RSC Interoperability Constituents check report.

6.3.4. *Assessment requirements for a Trackside Subsystem*

The purpose of assessments carried out within the scope of this TSI is to verify that the equipment complies with the requirements stated in Chapter 4.

However, for the design of the ETCS part of the Control-Command and Signalling Trackside Subsystem, application-specific information is needed. This shall include:

(1) line characteristics such as gradients, distances, positions of route elements and Eurobalises/Euroloops, locations to be protected, etc.;

(2) the signalling data and rules to be handled by the ETCS system.

This TSI does not cover checks to assess whether the application-specific information is correct.

Regardless of the module chosen:

(1) Table 6.3 shows the checks that shall be carried out to verify a Control-Command and Signalling Trackside Subsystem and the basic parameters that shall be respected;

(2) functionality and performance that have already been checked at the level of the interoperability constituents do not require additional verification;

(3) the update due to specifications maintenance of an already integrated Interoperability Constituent will not require additional verification by a subsystem Notified Body if the Interoperability Constituent Notified Body confirms that the impact of the update to be assessed is limited to the Interoperability Constituent and if no impact at subsystem level is identified by the CSM assessment body assessing the subsystem integration of the update.

Table 6.3.

Conformity assessment requirements for a Trackside Subsystem

No	Aspect	What to assess	Supporting evidence
1a	Use of interoperability constituents	Check that all interoperability constituents to be integrated into the subsystem are covered by an EC declaration of conformity and the corresponding certificate.	Existence and content of documents.
1b		Check conditions and limits of use on the use of interoperability constituents against the characteristics of the subsystem and of the environment.	Impact analysis by documents check.
1c		For interoperability constituents that have been certified against a version of the Control-Command and Signalling TSI, which is different from the version applied for the 'EC' Verification of the subsystem and/or against a set of specifications which is different from the set of specifications applied for the 'EC' Verification of the subsystem, check that the certificate still ensures compliance with the requirements of the TSI currently in force.	Impact analysis by comparison of specifications referenced in the TSI and certificates of the interoperability constituents.
2a	Integration of interoperability constituents in the subsystem *Note:* Only those with a specific assessment at subsystem level.	Check that the internal interfaces of the subsystem have been installed properly and function properly – Basic parameters 4.2.5, 4.2.7 and conditions specified by the manufacturer. (N/A for Interoperability Constituent axle counter and Marker Boards)	Checks according to specifications.

2b		Check that additional functions (not specified in this TSI) do not impact the mandatory ones. (N/A for Interoperability Constituent axle counter and Marker Boards)	Impact analysis.
2c		Check that the values of ETCS IDs are within the allowed range and, if required by this TSI, have unique values – Basic Parameter 4.2.9. (N/A for Interoperability Constituent axle counter and Marker Boards)	Check of design specifications.
2d		For Interoperability Constituent axle counters (only): The integration of the Interoperability Constituent in the subsystem has to be verified: Check index 77 document Chapter 4, table 16 'conformity assessment'. Check the correct installation of equipment and conditions specified by the manufacturer and/or the infrastructure manager.	Document check.
2e		Check that there is a system identifier for the ETCS part of the subsystem. In case of modification of the functional or realisation part of the system identifier, that the modification corresponds to the definition – Basic Parameter 4.2.20.3.	Document check.
3	Trackside Control-Command objects	Check that requirements for marker boards specified in this TSI are fulfilled (characteristics, compatibility with the infrastructure requirements (gauge, …), compatibility with the driver's field of view, the positioning of interoperable marker boards to meet their intended operational purpose) – Basic parameter 4.2.15.	Design documentation, results of tests or test runs with TSI compliant rolling stock.

4a	Integration with infrastructure	Check that the ETCS, RMR and ATO equipment has been properly installed – Basic parameters 4.2.3, 4.2.4, 4.2.19 and conditions for installation specified by the manufacturer.	Results of checks (according to specifications referenced in the basic parameters and manufacturer's installation rules).
4b		Check that the Control-Command and Signalling Trackside subsystem equipment is compatible with the trackside environment – Basic parameter 4.2.16.	Document check (certificates of interoperability constituents and possible methods of integration checked against trackside characteristics).
5a	Integration with trackside signalling (not applicable for train detection part)	Check that all functions required by the application are implemented in accordance with specifications referenced in this TSI – Basic parameter 4.2.3.	Document check (applicant's design specification and certificates of interoperability constituents).
5b		Check the correct configuration of parameters (Eurobalise telegrams, RBC messages, marker boards positions, etc.).	Document check (values of parameters checked against characteristics of trackside and of signalling).
5c		Check that the interfaces are correctly installed and function properly.	Design verification and tests according to information supplied by the applicant.
5d		Check that the Control-Command and Signalling Trackside subsystem operates correctly according to information at the interfaces with trackside signalling (e.g. appropriate generation of Eurobalise telegrams by a LEU or of message by RBC).	Design verification and tests according to the information supplied by the applicant.
6a	Integration with Control-Command and Signalling On-board Subsystems	Check the RMR coverage – Basic Parameter 4.2.4.	On site measurements.
6b		Check that all functions required by the application are implemented in accordance with specifications referenced in this TSI – basic parameters 4.2.3, 4.2.4 and 4.2.5.	Reports of the operational test scenarios specified in point 6.1.2 with at least two certified Control-Command and Signalling On-board Subsystems from different suppliers. The report shall indicate which operational test scenarios have been tested, which on-board equipment has been used and whether tests have been performed in laboratories, test lines or real implementation.

7	Compatibility of train detection systems (Excluding axle counters)	Check that the train detection systems comply with the requirements of this TSI – Basic parameters 4.2.10 and 4.2.11. Check index 77 document Chapter 4. Check the correct installation of equipment and conditions specified by the manufacturer and/or the infrastructure manager.	Evidence of compatibility of equipment from existing installations (for systems already in use); perform tests according to standards for new types. On-site measurements to prove correctness of installation. Document check of correct installation of equipment.
8a	Reliability, Availability, Maintainability, Safety (RAMS) (excluding train detection)	Check compliance with safety requirements – Basic Parameter 4.2.1.1.	Application of procedures specified in the Common Safety Method for Risk Evaluation and Assessment.
8b		Check that quantitative reliability targets are respected – Basic Parameter 4.2.1.2.	Calculations.
8c		Check the compliance with requirements about maintenance – point 4.2.20.2.	Document check.
9	Integration with Control-Command and Signalling On-board Subsystems and rolling stock: tests under conditions representing the intended operation.	Test the behaviour of the subsystem under many different conditions as reasonably feasible representing the intended operation (e.g. train speed, number of trains on the line, weather conditions). The test must be able to verify: (1) the performance of train detection systems – Basic parameters 4.2.10, 4.2.11; (2) that the Control-Command and Signalling Trackside subsystem is compatible with trackside environment – Basic parameter 4.2.16. These tests will also increase confidence in the absence of systematic failures. The scope of these tests excludes tests already done in different steps: tests performed at the level of interoperability constituents and tests performed on the subsystem in a simulated environment shall be taken into account. *Note:* Indicate in the certificate which conditions have been tested and which standards have been applied.	Reports of test runs.

10	ETCS and radio System Compatibility	The proposed ESC and RSC checks are only covering TSI requirements and are in line with the specifications – Basic Parameter 4.2.17.	Document check of the envisaged ESC/RSC types in case they are new or modified. OR The technical compatibility checks for ESC and RSC Type(s) are published as 'Valid' in the Agency ESC/RSC technical document, if they remain unchanged.

6.4. **Provisions in case of the partial assessment of TSI requirements**

6.4.1. *Assessment of parts of control-command and signalling subsystems*

Pursuant to Article 15(7) of Directive (EU) 2016/797, the Notified Body may issue EC certificates of verification for certain parts of a subsystem, if allowed to do so under the relevant TSI.

As pointed out in point 2.2 (Scope) of this TSI, the trackside and on-board control-command and signalling subsystems contain parts, as specified in point 4.1 (Introduction), and this section only relates to those defined parts.

An EC certificate of verification may be issued for each part or for a combination of parts specified in this TSI.

Regardless of which module is chosen, the Notified Body shall check that the requirements (all relevant requirements as specified in Table 6.2.1) are fulfilled for:

(1) the part in question; and

(2) its interfaces to the unchanged parts of the subsystem; and

(3) the integration with the unchanged parts of the subsystem.

For the CCS on-board subsystem: In any case of assessment of parts the EC certificate(s) of verification issued by the Notified Body(ies) shall consider one of the following options:

(1) An EC certificate of verification of the CCS on-board subsystem covering all parts; or

(2) An EC certificate of verification for each of the following groups of parts:

   (a) Train protection, data radio communication and automated train operation parts; and

   (b) Voice radio communication part.

The EC certificate of verification shall state and provide evidence on the fulfilment of all requirements in Table 6.2.1, and on possible interfaces between parts or absence thereof, in one of the following ways:

(1) the absence of interfaces with the other part/group of parts; or

(2) in case of interfaces with the other part/group of parts, the absence of the conditions and limits of use of the other part/group of parts.

   In case of interfaces that require conditions and limits of use in line with the requirements specified in the Table 6.2.1 of this TSI and that export constraints to the other part/group of parts, there shall be an EC subsystem certificate; or

(3) in case the subsystem consists of only one part/group of parts, no additional assessment on subsystem level is necessary if the assessment of the part/group of parts covers all TSI requirements for that part/group of parts. In this case the EC certificate of verification for the part replaces the subsystem EC certificate of verification.

6.4.2. *Intermediate Statement of Verification*

If conformity is assessed for subsystems specified by the applicant and different from the parts allowed in Table 4.1, and the assessment process is different from the process described in point 6.4.1 (Assessment of parts of control-command and signalling subsystems) of this TSI, or if only certain stages of the verification procedure have been performed, only an intermediate statement of verification may be issued.

6.5. **Management of errors**

Where deviations from intended functions and/or performance are detected during the tests or during the operational life of a subsystem, the applicants and/or operators shall inform without delay the Agency and the authorising entity that issued the authorisations for the concerned trackside subsystems or vehicles, to initiate the procedures set out in Article 16 of Directive (EU) 2016/797. As a result of the application of Article 16(3) of that Directive:

(1) if the deviation is due to incorrect application of this TSI or to errors in design or installation of equipment, the applicant for the relevant certificates shall take the necessary corrective actions and the certificates affected and/or the corresponding technical files (for interoperability constituents and/or subsystems), together with the corresponding EC Declarations, shall be updated;

(2) if the deviation is due to errors in this TSI or in specifications referenced therein, the procedure set out in Article 6 of the Directive (EU) 2016/797 shall be initiated.

The applicants and/or suppliers may be applying their own solution to the identified error once the error related change request has been validated by the Change Control Management (CCM) procedure according to Article 28(2) of Regulation (EU) 2016/796. This validation shall be done within 3 months after the complete information has been submitted.

Any such temporary solution to the identified error, that does not export constraints to the other subsystem, may be applied until the agreed error correction is adopted in a new version of CCS TSI. Once a solution to the identified error is adopted in a new TSI version the applicants and/or suppliers shall apply the adopted solution to the existing vehicles according to the earlier of the following conditions:

(a) if implementation of error correction does not require authorization: at the next occasion when error correction is mandatory by virtue of table B1.1 row 1 and in any case not before 1.1.2026;

(b) if implementation of error correction requires authorization: at the next reauthorisation resulting from another change to the vehicle train protection (ETCS) system;

(c) at the next upgrade to a higher system version of the vehicle train protection part.

Note: For Interoperability constituents for which the result of the information to be provided as described in point 7.2.10.1 indicates that there is no impact regarding safety, operation and interoperability, an update is not required.

Error corrections might impact the CCS trackside and CCS on-board subsystems. The Agency shall organise an efficient processing of all the information received in order to facilitate the Change Control Management process for improvement and further development of the specifications, including the test specifications.

6.5.1. *Content of EC certificates*

As per Commission Implementing Regulation (EU) 2019/250 ([15]) the notified bodies shall describe the restrictions and conditions for use of interoperability constituents and subsystems in the relevant EC certificates.

Notified bodies shall coordinate with the Agency the way in which errors, restrictions and conditions for use of interoperability constituents and subsystems are managed in the relevant EC certificates for verification and their accompanying technical files in the working group set up under Article 29 of Regulation (EU) 2016/796.

([15]) Commission Implementing Regulation (EU) 2019/250 of 12 February 2019 on the templates for 'EC' declarations and certificates for railway interoperability constituents and subsystems, on the model of declaration of conformity to an authorised railway vehicle type and on the 'EC' verification procedures for subsystems in accordance with Directive (EU) 2016/797 of the European Parliament and of the Council and repealing Commission Regulation (EU) No 201/2011 (OJ L 42, 13.2.2019, p. 9).

In the accompanying technical file issued by the NoBo the template of Appendix D shall be used.

6.5.2. *Content of EC declarations*

As per Implementing Regulation (EU) 2019/250 the interoperability constituent's manufacturer or the subsystem applicant shall describe in the EC declaration of conformity or verification the restrictions and conditions for use.

In the accompanying technical files the template of Appendix D shall be used.

7. IMPLEMENTING THE TSI CONTROL-COMMAND AND SIGNALLING

7.1. Introduction

This Chapter outlines the technical measures for implementing the TSI, and in particular the conditions for migrating to Class A systems.

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

7.2. Generally applicable rules

7.2.1. *Upgrading or renewing the Control-Command Subsystems or parts of them*

Upgrading or renewing the Control-Command and Signalling Subsystems may concern any or all of the parts constituting them, as specified in point 2.2 (Scope).

The different parts of the Control-Command and Signalling Subsystems may therefore be upgraded or renewed separately, if interoperability is not jeopardised.

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

7.2.2. *Changes to an existing On-Board subsystem*

This point defines the principles to be applied by the entities managing the change and authorising entities in line with the EC verification procedure described in Articles 15(9) and 21(12) and Annex IV of Directive (EU) 2016/797. This procedure is further developed in Articles 13, 15 and 16 of Implementing Regulation (EU) 2018/545 and in Decision 2010/713/EU.

This point applies in case of any change(s) to an existing on-board subsystem or on-board subsystem type, including renewal or upgrade. It does not apply in case of changes covered by Article 15(1), point (a) of Implementing Regulation (EU) 2018/545.

7.2.2.1. Rules to manage changes in on-board CCS subsystems

(1) Parts, as defined in Table 4.1 of this TSI, and basic parameters of the on-board subsystem that are not affected by the change(s) are exempt from conformity assessment against the provisions in this TSI. The list of parts and basic parameters affected by the change is to be provided by the entity managing the change.

(2) The entity managing the change shall inform a Notified Body of all changes affecting the conformity of the subsystem with the requirements of the relevant TSI(s) requiring new checks, in accordance with Articles 15 and 16 of Implementing Regulation (EU) 2018/545 and Decision 2010/713/EU and by application of modules SB, SD/SF or SH1 for the EC verification, and if relevant Article 15(5) of Directive (EU) 2016/797. This information shall be provided by the entity managing the change with corresponding references to the technical documentation relating to the existing EC certificate.

(3) The entity managing the change has to justify and document that applicable requirements remain consistent at subsystem level, and this has to be assessed by a Notified Body.

(4) The changes impacting the Basic Design Characteristics of the on-board subsystem are defined in Table 7.1 (Basic Design Characteristics) and shall be classified as Article 15(1), points (c) or (d) of Implementing Regulation (EU) 2018/545, and in accordance with Table 7.1 (Basic Design Characteristics) changes not impacting but related to the Basic Design Characteristics shall be classified by the entity managing the change as Article 15(1), point (b) of Implementing Regulation (EU) 2018/545.

(5) Changes not covered by point 7.2.2.1(4) above are deemed not to have any impact on the basic design characteristics. They will be classified by the entity managing the change as Article 15(1), points (a) or (b) of Implementing Regulation (EU) 2018/545.

Note: The classification of the changes set out in points 7.2.2.1(4) and this point above is performed by the entity managing the change without prejudice of the safety judgement mandated in Article 21(12), point (b) of Directive (EU) 2016/797.

(6) All changes shall remain compliant with the applicable TSIs ([16]) regardless its classification.

Table 7.1.

Basic Design Characteristics

1. TSI Point	2. Related basic design characteristic(s)	3. Changes not impacting the basic design characteristics according to 15(1)(b) of Implementing Regulation (EU) 2018/545	4. Changes impacting the basic design characteristic but inside the acceptable range of parameters therefore to be classified as Art 15.1(c) of Implementing Regulation (EU) 2018/545	5. Changes impacting the basic design characteristic and outside the acceptable range of parameters therefore to be classified as Art 15.1 (d) of Implementing Regulation (EU) 2018/545
4.2.2 On-Board ETCS functionality	ETCS equipment on-board and the set of specification of CCS TSI Appendix A	Not applicable	Not applicable	Use another Appendix A set of specifications.
	Envelope of legally operated ETCS system versions	Not applicable	Not applicable	Installation or start the operational use of ETCS; Modification of the envelope of legally operated ETCS system versions from set of specifications in Appendix A.

([16]) According to Agency's Advice 2017/3, if after a modification there is no need for new authorisation the applicable TSI corresponds to the one used for the original certification. In case there is a need for new authorisation, applicable TSI corresponds to the latest TSI.

	ETCS On-board implementation	Fulfilling all the conditions in point 7.2.2.2 (change of realisation identifier)	Not applicable	Not fulfilling all the conditions in point 7.2.2.2 (change of functional identifier)
	Managing information about the completeness of the train (not from driver)	Not applicable	Adding or removing train integrity supervision	Not applicable
	Safe consist length information from on-board necessary to access the line and SIL	Not applicable	Adding or removing safe consist length information	Not applicable
4.2.17.1 ETCS System Compatibility	ETCS System Compatibility	Not applicable	Adding or removing an ESC statement fulfilling all the conditions in point 7.2.2.4.	Adding or removing an ESC statement not fulfilling all the conditions in point 7.2.2.4.
4.2.4 Mobile communication functions for railways RMR 4.2.4.2.1 GSM-R Voice and operational communication applications	GSM-R Radio voice on board and its Baseline	Usage of another Baseline fulfilling all the conditions in point 7.2.2.3	Not applicable	Installation or start the operational use of GSM-R cab radio; Usage of another Baseline not fulfilling all the conditions in point 7.2.2.3.
	GSM-R Voice and operational communication implementation	Fulfilling all the conditions in point 7.2.2.3 (change of realisation identifier)	Not applicable	Not fulfilling all the conditions in point 7.2.2.3 (change of functional identifier)
	GSM-R Voice SIM Card support of Group ID 555	Not applicable	Change the SIM Card support of Group ID 555	Not applicable
4.2.17.3 ETCS and Radio System Compatibility	Radio Voice System Compatibility	Not applicable	Adding or removing an RSC statement fulfilling all the conditions in point 7.2.2.4.	Adding or removing an RSC statement not fulfilling all the conditions in point 7.2.2.4.

4.2.4 Mobile communication functions for railways RMR 4.2.4.3.1.1 GSM-R data communication for ETCS	GSM-R Radio Data communication on board and its Baseline	Usage of another Baseline fulfilling all the conditions in point 7.2.2.3.	Not applicable	Installation or start the operational use of GSM-R EDOR; Usage another Baseline not fulfilling all the conditions in point 7.2.2.3.
4.2.4.3.2.1 GSM-R data communication for ATO	GSM-R Data communication for ETCS and ATO implementation	Fulfilling all the conditions in point 7.2.2.3 (change of realisation identifier)	Not applicable	Not fulfilling all the conditions in point 7.2.2.3 (change of functional identifier)
4.2.17.3 ETCS and Radio System Compatibility	Radio Data System Compatibility	Not applicable	Adding or removing an RSC statement fulfilling all the conditions in point 7.2.2.4.	Adding or removing an RSC statement not fulfilling all the conditions in point 7.2.2.4.
4.2.4 Mobile communication functions for railways RMR 4.2.4.1.1 GSM-R Basic communication function	Voice SIM Card GSM-R Home Network	Not applicable	Replacement of a TSI compliant GSM-R SIM Card by another TSI compliant GSM-R SIM Card with a different GSM-R Home Network	Not applicable
	Data SIM Card GSM-R Home Network	Not applicable	Replacement of a TSI compliant GSM-R SIM Card by another TSI compliant GSM-R SIM Card with a different GSM-R Home Network	Not applicable
4.2.18 On-Board ATO functionality	On-board ATO system version	Not applicable	Change of the ATO system version fulfilling all the conditions in point 7.2.2.3.	Add or remove the ATO part of the CCS on-board subsystem; Start the operational use of ATO. Or change of the ATO system version not fulfilling all the conditions in point 7.2.2.3.

	On-board ATO implementation	Fulfilling all the conditions in point 7.2.2.3 (change of realisation identifier)	Not applicable	Not fulfilling all the conditions in point 7.2.2.3 (change of functional identifier)
7.2.5 Legacy systems	Class B or other train protection, control and warning legacy systems installed (system and, if applicable, version)	The requirements for Class B system are the responsibility of the relevant Member State.	The requirements for Class B system are the responsibility of the relevant Member State.	Add or remove Class B train protection systems. The requirements for Class B system are the responsibility of the relevant Member State.
	Class B or other radio legacy systems installed (system and, if applicable, version)	The requirements for Class B system are the responsibility of the relevant Member State.	The requirements for Class B system are the responsibility of the relevant Member State.	Add or remove Class B radio legacy systems. The requirements for Class B system are the responsibility of the relevant Member State.

(7) In order to establish the EC certificate of verification, the Notified Body may refer to:

(a) the original EC certificate of verification for parts of the design that are unchanged or those that are changed but do not affect the conformity of the subsystem, as far as it is still valid;

(b) amendments to the original EC certificate of verification for modified parts of the design that affect the conformity of the subsystem with the applicable TSI version used for the EC verification.

(8) In any case, the entity managing the change shall ensure that the technical documentation which is relating to the EC certificate is updated accordingly.

(9) The updated technical documentation, related to the EC certificate is referred to in the technical file accompanying the EC declaration of verification issued by the entity managing the change for on-board subsystem declared as conformant to the modified type.

7.2.2.2. Conditions for a change in the On-board ETCS functionality that does not impact the basic design characteristics

(1) The target functionality ([17]) remains unchanged or is set to the state already expected during the original certification or authorisation. Target functionality is considered unchanged when applying the specification maintenance (error correction) process described in point 7.2.10 which includes the implementation of error corrections or the implementation of mitigation measures.

([17]) Target functionality refers to the ETCS functionality that has been evaluated in the subsystem EC certificate. The Technical Opinions published by the Agency that correct errors in the TSI are considered to define the functionality state already expected during the original certification or authorisation.

(2) The interfaces relevant for safety & technical compatibility remain unchanged or are set to the state already expected during the original certification or authorisation.

(3) The result of the safety judgement (e.g. safety case according to EN 50126) remains unchanged.

(4) No new safety related application conditions (SRAC) or interoperability constraints have been added due to the change.

(5) A CSM assessment body (CSM RA) as specified in point 4.2.1 has independently assessed the applicant's risk assessment and within it the demonstration that the change does not adversely affect safety. The applicant's demonstration shall include the evidence that the change actually corrects the causes of the initial deviation of the functionality.

(6) Depending on the type of change:

(a) in the case where the change is made due to a product error: The change is performed under a quality management system approved by a notified body. For other modules it shall be justified that the verification performed remains valid ([18]);

(b) in the case where the change is made due to the specification maintenance process (there are updated specifications in Appendix A Table A 2 with the descriptions of the error correction): an updated EC design examination or EC type examination certificate for the Interoperability Constituents or Subsystem with the implementation of error corrections is needed. In this case the provisions of point 6.3.3 (3) apply.

(7) The individual configuration management defines a 'system identifier' (as defined in 4.2.20.3) and the 'functional identifier' of the 'system identifier' has not been changed after the change.

(8) The change shall be part of the configuration management required by Article 5 of Implementing Regulation (EU) 2018/545.

7.2.2.3. Conditions for a change in the on-board mobile communication functions for railways or in the ATO on-board functionality that does not impact the basic design characteristics

(1) The target functionality ([19]) remains unchanged or is set to the state already expected during the original certification or authorisation. Target functionality is considered unchanged when applying the specification maintenance (error correction) process described in point 7.2.10, which includes either the implementation of error corrections or the implementation of mitigation measures.

(2) The interfaces relevant for technical compatibility remain unchanged or are set to the state already expected during the original certification or authorisation.

(3) Depending on the type of change:

(a) in the case where the change is made due to a product error: The change is performed under a quality management system approved by a notified body. For other modules it shall be justified that the verification performed remains valid ([20]);

([18]) All activities required for a modification which are performed outside a quality management system approved by a notified body might require additional examinations or tests by the notified body.

([19]) Target functionality refers to the mobile communication functionality that has been evaluated in the subsystem EC certificate. The Technical Opinions published by the Agency and error corrections inside specification releases that correct errors in the TSI are considered to define the functionality state already expected during the original certification or authorisation.

([20]) All activities required for a modification which are performed outside a quality management system approved by a notified body might require additional examinations or tests by the notified body.

(b) in the case where the change is made due to the specification maintenance process (there are updated specifications in Appendix A Table A 2 with the descriptions of the error correction): an updated EC design examination or EC type examination certificate for the Interoperability Constituents or Subsystem with the implementation of error corrections is needed. In this case the provisions of point 6.3.3(3) apply.

(4) The change shall be part of the configuration management required by Article 5 of Implementing Regulation (EU) 2018/545.

7.2.2.4. Conditions for a change in the on-board subsystem regarding ETCS or Radio system compatibility that does not impact the basic design characteristics

(1) No safety related application conditions (SRAC) or interoperability constraints related to the technical compatibility with the network have been added or removed due to the addition or removal of an ESC or RSC statement.

(2) No interoperability constraints (restrictions or conditions for use) related to the technical compatibility with the network have been added or removed due to the ESC or RSC statement.

7.2.3. *Upgrade or renewal of existing trackside subsystem*

This point defines the principles to be applied by the entities managing the change and authorising entities in line with the EC verification procedure described in Articles 15(9) and 18(6) of Directive (EU) 2016/797 and in Decision 2010/713/EU.

7.2.3.1. Rules to manage upgrade or renewal of existing trackside CCS subsystems

In the event of upgrading or renewing the Control-Command and Signalling Subsystems bearing EC certificate of verification the following rules apply:

(1) The changes require new authorisation if they impact basic parameters as defined in Table 7.2.

Table 7.2.

Trackside basic parameters modifications which requires a new authorisation

Basic Parameter		Modification which requires a new authorisation
4.2.3	Trackside ETCS functionality	Not fulfilling all the conditions in point 7.2.3.2
4.2.4 4.2.4.2	Mobile communication functions for railways RMR Voice and operational communication applications	Not fulfilling all the conditions in point 7.2.3.3
4.2.4 4.2.4.3	Mobile communication functions for railways RMR Data communication applications for ETCS and ATO	Not fulfilling all the conditions in point 7.2.3.3
4.2.19	Trackside ATO functionality	Not fulfilling all the conditions in point 7.2.3.3

(2) The changes are permitted to be dealt with by only re-assessing those modifications that affect the conformity of the subsystem with the applicable TSIs version used for the EC verification. The entity managing the change has to justify and document that applicable requirements remain consistent at subsystem level, and this has to be assessed by a Notified Body.

(3) The entity managing the change shall inform the Notified Body of all changes that may affect the conformity of the subsystem with the requirements of the relevant TSI(s) or the conditions for validity of the certificate.

This information shall be provided by the entity managing the change with corresponding references to the technical documentation relating to the existing EC certificate.

(4) An EC-Certificate reflecting the changes that affect the conformity to the TSI shall be established by a NoBo. In order to establish the EC certificate, the Notified Body may to refer to:

(a) the original EC certificate for parts of the design that are unchanged or those that are changed but do not affect the conformity of the subsystem, as far as it is still valid;

(b) additional EC certificate (amending the original certificate) for modified parts of the design that affect the conformity of the subsystem with the applicable TSI version used for the EC verification.

(5) In any case, the entity managing the change shall ensure that the technical documentation which is relating to the EC certificate is updated accordingly.

(6) 'Configuration management' means a systematic organisational, technical and administrative process put in place throughout the lifecycle of a CCS subsystem to ensure that the consistency of the documentation and the traceability of the changes are established and maintained so that:

(a) requirements from relevant Union law and national rules are met;

(b) changes are controlled and documented either in the technical files or in the file accompanying the issued authorisation;

(c) information and data is kept current and accurate;

(d) relevant parties are informed of changes, as required.

7.2.3.2. Conditions for an upgrade or renewal in the trackside ETCS functionality that, if not fulfilled, requires new authorisation for placing in service

(1) The target functionality ([21]) of the basic parameter 4.2.3 remains unchanged or is set to the state already expected during the original certification or authorisation. Target functionality is considered unchanged when applying the specification maintenance (error correction) process described in point 7.2.10, which includes the implementation of error corrections or the implementation of mitigation measures.

(2) The interfaces of the basic parameter 4.2.3 relevant for safety & technical compatibility remain unchanged or are set to the state already expected during the original certification or authorisation.

(3) The result of the safety judgement (e.g. safety case according to EN 50126) remains unchanged.

(4) No new safety related application conditions (SRAC) or interoperability constraints have been added due to the change.

(5) When required in point 4.2.1, a CSM assessment body (CSM RA) has independently assessed the applicant's risk assessment and within it the demonstration that the change does not adversely affect safety. In the case where the change is due to product error, the applicant's demonstration shall include the evidence that the change actually corrects the causes of the product error.

([21]) Target functionality refers to the ETCS functionality that has been evaluated in the subsystem EC certificate. The Technical Opinions published by the Agency and error corrections inside specification releases that correct errors in the TSI are considered to define the functionality state already expected during the original certification or authorisation.

(6) Depending on the type of change:

(a) in the case where the change is made due to a product error: The change is performed under a quality management system approved by a notified body. For other modules it shall be justified that the verification performed remains valid ([22]);

(b) in the case where the change is made due to the specification maintenance process (there are updated specifications in Appendix A Table A 2 with the descriptions of the error correction solution): an updated EC certificate for the Interoperability Constituents or Subsystem with the implementation of error corrections is needed. In this case the provisions of point 6.3.4 (3) apply.

(7) The individual configuration management defines a 'system identifier' (as defined in 4.2.20.3) and the 'functional identifier' of the 'system identifier' has not been changed after the change.

(8) The change shall be part of the configuration management as defined in 7.2.1b.1.7.

7.2.3.3. Conditions for an upgrade or renewal in the trackside mobile communication for railways or trackside ATO functionality that, if not fulfilled, requires a new authorisation for placing in service

(1) The target functionality ([23]) of basic parameters 4.2.4.2, 4.2.4.3 and 4.2.19 remain unchanged or is set to the state already expected during the original certification or authorisation. Target functionality is considered unchanged when applying the specification maintenance (error correction) process described in point 7.2.10, which includes either the implementation of error corrections or the implementation of mitigation measures.

(2) The interfaces of basic parameters 4.2.4.2, 4.2.4.3 and 4.2.19 relevant for technical compatibility remain unchanged or are set to the state already expected during the original certification or authorisation.

(3) Depending on the type of change:

(a) in the case where the change is made due to a product error: The change is performed under a quality management system approved by a notified body (e.g. according to modules CH1, SH1, CD, SD). For other modules (e.g. CF, SF, SG) it shall be justified that the verification performed remains valid ([24]);

(b) in the case where the change is made due to the specification maintenance process (there are updated specifications in Appendix A Table A 2 with the descriptions of the error correction solution): an updated EC certificate for the Interoperability Constituents or Subsystem with the implementation of error corrections is needed. In this case the provisions of point 6.3.4 (3) apply.

(4) The change shall be part of the configuration management as defined in 7.2.3.1 (6)

7.2.3.4. Impact on the technical compatibility between on-board and trackside parts of the CCS subsystems

Infrastructure managers shall ensure that changes to an existing trackside subsystem allow the continuation of the operation of TSI compliant ([25]) on-board subsystems in operation on the lines concerned by the changes.

([22]) All activities required for a modification which are performed outside a quality management system approved by a notified body might require additional examinations or tests by the notified body, as described in Decision 2010/713/EU.

([23]) Target functionality refers to the mobile communication functionality that has been evaluated in the subsystem EC certificate. The Technical Opinions published by the Agency that correct errors in the TSI are considered to define the functionality state already expected during the original certification or authorisation.

([24]) All activities required for a modification which are performed outside a quality management system approved by a notified body might require additional examinations or tests by the notified body.

([25]) On-Board subsystems with conditions and restrictions of use or non-detected deficiencies are not considered compliant regarding this clause.

This requirement is not applicable when the changes are due to the implementation of a new level application trackside, by requirements defined in 7.2.9.1 (1) and (4), or by requirements of an incompatible application (e.g. change to a new X of M_VERSION as defined in 7.4.2.4).

7.2.4. *EC type or design examination certificates*

7.2.4.1. CCS On-Board Subsystem

7.2.4.1.1. *Definitions*

(1) Initial assessment framework for CCS On-Board Subsystem

The initial assessment framework is the CCS TSI applicable at the beginning of the design phase when the notified body for the CCS on-board Subsystem is contracted by the applicant.

(2) Certification framework for CCS On-Board Subsystem

The certification framework is the CCS TSI applicable at the time of issuing the EC type or design examination certificate. It is the initial assessment framework amended with the revisions of TSIs that came into force during the design phase, and applicable as per the transition regime described in Appendix B.

(3) Design phase for CCS On-Board Subsystem

The design phase for the CCS subsystem is the period starting once a notified body, which is responsible for EC verification, is contracted by the applicant and ending when the EC type or design examination certificate is issued.

A design phase covers the CCS subsystem integrated in a vehicle type and one or several type variant(s) and type version(s). For all type variant(s) and type version(s), the design phase is considered as starting at the same time as for the main type.

(4) Production phase for CCS On-Board Subsystem

The production phase is the period during which the CCS on-board subsystem may be placed on the market on the basis of an EC declaration of verification referring to a valid EC type or design examination certificate.

(5) Vehicle in operation

The vehicle is in operation when it is registered with 'Valid' registration code '00', in the National Vehicle Register in accordance with Commission Decision 2007/756/EC ([26]) or in the European Vehicle Register in accordance with Commission Implementing Decision (EU) 2018/1614 ([27]) and maintained in a safe state of running in accordance with Commission Implementing Regulation (EU) 2019/779 ([28]).

7.2.4.1.2. *Rules related to the EC type or design examination certificate*

(1) The notified body shall issue the EC type or design examination certificate referring to the certification framework.

(2) When a revision of this TSI comes into force during the design phase, the notified body shall issue the EC type or design examination certificate according to the following rules:

([26]) Commission Decision 2007/756/EC of 9 November 2007 adopting a common specification of the national vehicle register provided for under Articles 14(4) and (5) of Directives 96/48/EC and 2001/16/EC (OJ L 305, 23.11.2007, p. 30).

([27]) Commission Implementing Decision (EU) 2018/1614 of 25 October 2018 laying down specifications for the vehicle registers referred to in Article 47 of Directive (EU) 2016/797 of the European Parliament and of the Council and amending and repealing Commission Decision 2007/756/EC (OJ L 268, 26.10.2018, p. 53).

([28]) Commission Implementing Regulation (EU) 2019/779 of 16 May 2019 laying down detailed provisions on a system of certification of entities in charge of maintenance of vehicles pursuant to Directive (EU) 2016/798 of the European Parliament and of the Council and repealing Commission Regulation (EU) No 445/2011 (OJ L 139 I, 27.5.2019, p. 360).

For changes in the TSIs that are not referenced in Appendix B, conformity with the initial assessment framework leads to conformity to the certification framework. The Notified Body shall issue the EC type or design examination certificate referring to the certification framework without additional assessment.

For changes in the TSIs that are referenced in Appendix B, their application is mandatory according to the transition regime defined in this Appendix B. During the defined transition period, the Notified Body may issue the EC type or design examination certificate referring to the certification framework without additional assessment. The Notified Body shall list in the EC type or design examination certificate all the points (from Table B1.1) assessed according to the initial assessment framework.

(3) When several revisions of this TSI come into force during the design phase, the paragraph (2) above shall apply to all revisions successively.

(4) It is always permissible (but not mandatory) to use a most recent version of any TSI, either totally or for particular points, unless explicitly otherwise specified in the revision of these TSIs; in case of application limited to particular points, the applicant has to justify and document that applicable requirements remain consistent, and this has to be approved by the notified body.

7.2.4.1.3. *Validity of the EC type or design examination certificate*

When a revision of this TSI comes into force, the EC type or design examination certificate for the subsystem remains valid unless it is required to be revised according to the specific transition regime of a TSI change as defined in Appendix B of this TSI.

7.2.4.2. CCS Trackside Subsystem

According to Article 4, point (2) of Directive (EU) 2016/797, the CCS Trackside Subsystem shall comply with the TSI in force at the time of the request for authorisation of placing in service.

When a revision of this TSI comes into force, the EC type or design examination certificate for the subsystem remains valid unless it is required to be revised according to the transition regime of a TSI change as defined in Appendix B (Table B2) of this TSI.

7.2.4.3. Interoperability constituents

EC design or type certificates of interoperability constituents already placed on the market based on a previous version of this TSI remain valid even if a revision of this TSI comes into force, unless a requirement is applicable at CCS subsystem level which impacts the interoperability constituent (as specified in Table B1.1 or Table B2 of Appendix B) or unless explicitly otherwise specified in the revision of this TSI within Table B3 of Appendix B.

During this time, these interoperability constituents are permitted to be placed on the market without a new design or type examination.

7.2.5. *Legacy systems*

Member States shall ensure that the functionality of the legacy systems and their interfaces remains unchanged, except where modifications are needed to mitigate safety-related flaws in these systems ([29]).

7.2.6. *Availability of Specific Transmission Modules and interfaces to Class B on-board*

If trackside that fall within the scope of this TSI are not equipped with the Class A train protection system, the Member State shall ensure the availability of a Specific Transmission Module (STM) or products and/or specifications that would allow the integration of its legacy Class B train protection system with the Class A on-board system. For lines equipped with more than one Class B system, the requirement applies to at least one of these Class B systems.

([29]) Extension of functionality is not recognised as a mitigation for a safety related flaw.

The Member State shall notify within one year of the entry into force of the TSI, the Class B system (s) for which the requirement is met.

The Class B on-board and its interface, for existing products that have already demonstrated integration with Class A TSI compliant products, shall correspond to any of the technical possibilities defined in point 4.2.6.1. In the case where there is no system available that has already demonstrated integration with Class A TSI compliant on-board system, the solution made available shall be with standardised interface (STM).

The Member State shall notify the specifications of the interfaces between class A and class B on-board train protection systems within 1 year after entry into force of the TSI.

If for a particular class B system, the only solution available in the market is Class B and Class A integrated within the same equipment, the holders of the Class B specifications (e.g. supplier, railway undertaking, infrastructure manager) shall provide the specifications, for the parts they hold, necessary for integration of this Class B system with a compliant ETCS on-board. Any relevant intellectual property they hold shall be made available on a FRAND (fair, reasonable and non-discriminatory) terms basis. The holders of the specifications shall ensure the information provided is sufficient to allow other manufacturers to integrate class B with any ETCS on-board in existing rolling stock.

In this context, due regard is to be given to ensuring an open market for Class B and STM under fair commercial conditions. If, for technical or economic reasons, including applicable intellectual property rights, the availability of an STM or a Class B with its complete interface specifications to a class A system cannot be ensured, the Member States concerned shall inform the Committee referred to in Article 51(1) of Directive (EU) 2016/797 of the underlying reasons for the problem and of the mitigation measures that it intends to put into place in order to allow operators – and in particular foreign operators – access to its infrastructure.

7.2.7. *Additional Class B equipment on a line equipped with Class A*

On a line equipped with ETCS and/or RMR, additional Class B trackside equipment may be installed in order to allow the operation of rolling stock not compatible yet with Class A during the on-board Class A deployment phase.

Each Infrastructure Manager shall be responsible for verifying that the trackside design supports transitions between Class A and Class B and does not impose any additional requirements to the CCS Class A on-board, thus the Control-Command and Signalling Trackside Subsystem shall be designed as if Control-Command and Signalling Class A on-board is using standardised interface (STM) between Class A and Class B systems.

7.2.8. *Vehicle with Class A and Class B equipment*

Vehicle may be equipped with both Class A and Class B systems to enable operation on several lines.

The Member State concerned may restrict the use of an on-board Class B system on lines where the Class B system is not installed trackside.

A vehicle equipped with both class A and class B shall demonstrate technical compatibility with trackside Class A on lines double equipped with Class A in parallel with Class B. Being equipped with a Class B system in addition to Class A shall not be a requirement for the compatibility of a vehicle with lines where Class B is installed in parallel with Class A.

For vehicle equipped with class A, class B train protection systems may be implemented according to requirements defined in point 4.2.6.1 and following the requirements in point 7.2.6.

7.2.9. *Conditions for mandatory and optional functions*

The applicant for EC verification of a Control-command and Signalling Trackside subsystem shall check whether Control-command and Signalling Trackside functions, which are defined 'optional' in this TSI, are required by other TSIs, national rules or by the application of risk evaluation and assessment to ensure safe integration of subsystems.

The trackside implementation of national or optional functions shall be technically compatible and not prevent the use of that infrastructure by a train that complies only with the mandatory requirements of the On-board Class A system except as required for the following on-board optional functions in point 7.2.9.1 and 7.2.9.3. The trackside implementation of one of these optional functions which leads to a new mandatory on-board requirement on specific lines shall be notified minimum 5 years before the function can become a mandatory on-board requirement. The notification of a new mandatory on-board requirement shall be done within the RINF and these changes in RINF shall be listed in the Network Statement according to Article 27 of the Directive 2012/34/EU of the European Parliament and of the Council ([30]). A notification period shorter than 5 years is only allowed if this is agreed between the IM and RU's who run services or intent to run services (at the time of establishing the agreement) on these lines. This agreement on shortening the notification period shall be notified to the European Commission.

An on-board subsystem which incorporates a KER STM, may make it necessary to implement the K-interface.

7.2.9.1. ETCS

(1) An ETCS Level 2 Trackside application with no or reduced train detection (formerly ETCS level 3) relies on on-board information to determine track occupation and requires that the on-board is able to fulfil the requirements for confirmed train length information as specified in Appendix A, Table A 2, index 27.

(2) An ETCS Level 1 Trackside application with infill requires that the on-board is equipped with the corresponding in-fill data transmission (Euroloop or radio) if the release speed is set to zero for safety reasons (e.g. protection of danger points).

(3) When ETCS needs data transmission by radio, the data radio communication part as specified in this TSI is required.

(4) When ETCS trackside needs a specific ETCS system version, the on-board shall be equipped according to the implementation requirements listed in 7.4.2.4.2.

7.2.9.2. ATO

(1) ATO Trackside: the trackside implementation of ATO is an optional function for interoperability which does technically not prevent the use of that infrastructure by a train that is not equipped with ATO on-board. Where ATO GoA1/2 functionality is implemented over ETCS trackside, the specifications of ATO in Appendix A of this TSI shall be applied.

Note: Where ATO GoA1/2 functionality is implemented over Class B trackside, the specifications of ATO trackside in Appendix A of this TSI should be applied in order to facilitate the future migration to ATO on lines to be equipped with ETCS.

(2) ATO on-board: the fitting of ATO in a CCS on-board Subsystem is mandatory ([31]) when implementing ETCS for the first time into the vehicle and the vehicle is also intended for use on a line including at least one section equipped with ATO where the IM has notified in RINF the services requiring mandatory ATO on-board implementation.

([30]) Directive 2012/34/EU of the European Parliament and of the Council of 21 November 2012 establishing a single European railway area (recast) (OJ L 343, 14.12.2012, p. 32).

([31]) The mandatory ATO on-board implementation requirement is not linked to technical compatibility, however linked to the regulatory need that no specific incentive mechanism for ATO on-board implementation shall be developed by Member States or Infrastructure Manager for vehicles implementing ETCS for the first time.

Note: Where ATO GoA1/2 functionality is implemented over Class B trackside, the ATO on-board implementation is based on contractual agreements between the IM and RUs and as such there are no mandatory ATO GoA1/2 implementation requirements until ATO trackside and Class B trackside lines are migrated to a fully compliant ETCS including ATO trackside specifications in Appendix A of this TSI.

7.2.9.3. RMR

GSM-R and/or FRMCS shall be implemented according to the implementation requirements listed in point 7.3.2.

7.2.10. *Specifications maintenance (error corrections)*

7.2.10.1. Responsibilities during the Change Control Management process

During the Change Control Management (CCM) process of the ERTMS specifications and before the entry into force of the next legal release of this TSI, errors are classified as preventing normal service or as not preventing normal service.

For the errors preventing normal service, on-board manufacturers, operators, e.g. providing input on the occurrence of the error during normal service, and infrastructure managers with the necessary input from the trackside manufacturers shall describe their products and system implementations with respect to the situation identified by answering to the ERA questionnaires (which include the resolutions of the errors and the mitigation measures).

The answers on these ERA questionnaires shall be provided within 3 months after publication of the questionnaires, in particular the Infrastructure Manager shall evaluate within the ERA questionnaire if:

(1) the impact of the error is acceptable, as regards safety and network operation;

(2) the impact of the error is acceptable for interoperability, this either means that:

(a) the non-implementation of the trackside error correction would allow any ERTMS vehicle complying with the latest TSI release to provide normal service in the network;

or

(b) the non-implementation of the on-board error correction would allow that ERTMS vehicle to provide normal service in the TSI compliant network.

The Agency shall publish the results of the ERA questionnaires in a transparent manner.

7.2.10.2. On-board and Trackside Manufacturer responsibilities

After the publication of the error corrections in a legal release, manufacturers shall update their Interoperability Constituents accordingly and are responsible for maintaining the Interoperability Constituents as requested in point 4.2.20.1 (including maintaining the associated EC Certificates) and according to the transition requirements in Appendix B (Table B3). These updated Interoperability Constituents (including the associated EC Certificates) shall be made available for integration in the concerned subsystems according to Appendix B (Table B3).

Note: For Interoperability constituents for which the information previously provided as described in point 7.2.10.1 indicates that there is no impact regarding safety, operation and interoperability, an update is not required.

7.2.10.3. Infrastructure Manager and Railway Undertaking responsibilities

7.2.10.3.1. *Infrastructure Manager responsibilities*

In case the impact of one of the errors as described in point 7.2.10.1 is identified as unacceptable on the Infrastructure Manager's network, the Infrastructure Manager, based on the information previously provided by on-board manufacturers within the ERA questionnaires, shall identify the ERTMS vehicles authorised to run on its network or being authorised to run on its network that have not implemented a solution which mitigates the interoperability or safety problem caused by the specification error. In case of significant impact on existing vehicles running on its network reported by on-board manufacturers (with the support of operators), the Infrastructure Manager can voluntarily decide to evaluate the implementation of temporary trackside mitigation measures in order to facilitate existing vehicles to continue their services until on-board error corrections are implemented.

The Infrastructure Manager shall register in the related RINF ([32]) parameter which error corrections are applicable (i.e. the errors preventing normal service in the network) for the on-board. This shall be registered at the latest 12 months after the entry into force of the TSI or shall be registered in case of new or upgrade trackside implementation within its network.

For impacted ERTMS trackside subsystems, Infrastructure Managers shall implement the relevant trackside error corrections enabling a TSI compliant CCS on-board (including on-board error correction implementation) to provide a normal service, in accordance with appendix B (Table B2) of this CCS TSI.

This Infrastructure Manager shall update -if applicable- the existing ETCS and radio system compatibility checks type (ESC/RSC) (i.e. this shall not lead to the creation of a new ESC/RSC type).

7.2.10.3.2. *Railway Undertakings responsibilities*

The Railway Undertakings shall compare the error corrections registered in RINF for the area of use of the vehicle with the information previously provided as described in point 7.2.10.1 to identify the necessary error corrections to be implemented in the vehicles.

For impacted ERTMS on-board subsystems, Railway Undertakings with support of the on-board manufacturers shall implement the necessary error corrections in the CCS on-board subsystems in accordance with appendix B (Table B1.1) of this CCS TSI.

7.3. **RMR specific implementation rules**

7.3.1. *Trackside installations*

7.3.1.1. The fitting of GSM-R or FRMCS is mandatory when:

(1) installing for the first time the radio communication part of a Control-Command and Signalling Trackside Subsystem; When FRMCS is the first class A radio system on a line, conditions in 7.3.1.3 shall be respected.

(2) upgrading the radio communication part of a Control-Command and Signalling Trackside Subsystem already in service in such a way that it changes the functions or the performance of the subsystem. This does not include the modifications deemed necessary to mitigate safety-related defects in the legacy installation;

(3) Implementation of ETCS level 2 needs data radio communication.

(4) Implementation of ETCS level 1 with radio infill needs GSM-R data radio communication.

([32]) The Network Statement can be used as tool in case RINF is not upgraded yet to notify this change.

7.3.1.2. GSM-R may only be taken out of operation when the following conditions are fulfilled:

— Condition 1: minimum notification period of 5 years where GSM-R services shall be stopped. This notification shall only be done when FRMCS on-board Interoperability Constituents' specifications, as listed in Table 5.1 and Appendix A, are completed and published with an amendment of this CCS TSI which allows the tendering of the complete FRMCS on-board equipment. This notification shall be done within the RINF and these changes in RINF shall be listed in the Network Statement as part of Article 27 of Directive 2012/34/EU;

and

— Condition 2: FRMCS is in service;

A shorter period is allowed if this is agreed between the IM and the RU's who run services or intent to run services (at the time of establishing the agreement) on these lines. This agreement on shorter notification period shall be notified to the European Commission.

7.3.1.3. The trackside implementation of FRMCS only, without pre-existing GSM-R, is allowed if the following condition is fulfilled:

Minimum notification period of 5 years where FRMCS services shall be in operation. This notification can only be done when FRMCS on-board Interoperability Constituents' specifications, as listed in Table 5.1 and Appendix A, are completed and published with an amendment of this CCS TSI which allows the tendering of the complete FRMCS on-board equipment. This notification shall be done within the RINF and these changes in RINF shall be listed in the Network Statement as part of Article 27 of Directive 2012/34/EU.

A shorter period is allowed if this is agreed between the IM and the RU's who run services or intent to run services (at the time of establishing the agreement) on these lines. This agreement shall be notified to the Commission.

7.3.2. *On-board installations*

7.3.2.1. The fitting of GSM-R in rolling stock intended for use on a line including at least one section equipped with GSM-R and not equipped with FRMCS or on a line including at least one RBC not supporting FRMCS (even if superimposed to a legacy radio communication system), is mandatory when:

(1) installing for the first time the voice radio communication part of a Control-Command and Signalling On-board Subsystem;

(2) upgrading the voice radio communication part of a Control-Command and Signalling On-board Subsystem already on the market (Class B) in such a way that it changes the functions or the performance of the subsystem. This does not apply to modifications deemed necessary to mitigate safety-related defects in the legacy installation;

(3) implementation of ETCS level 2 or level 1 with radio infill need data radio communication.

7.3.2.2. The fitting of FRMCS in rolling stock is mandatory for vehicles intended to operate on a line where the IM has notified the FRMCS trackside implementation:

(1) installing for the first time the voice radio communication part of a Control-Command and Signalling On-board Subsystem;

(2) upgrading the voice radio communication part of a Control-Command and Signalling On-board Subsystem already on the market (Class B or GSM-R) in such a way that it changes the functions or the performance of the subsystem. This does not apply to modifications deemed necessary to mitigate safety-related defects in the legacy installation;

(3) implementation of ETCS level 2 need data radio communication.

7.4. **ETCS specific implementation rules**

7.4.1. *Trackside installations*

Articles 1 and 2 and Annex I to Commission Implementing Regulation (EU) 2017/6 ([33]) shall apply as referred to in Article 47 of Regulation (EU) No 1315/2013 of the European Parliament and of the Council ([34]) and any update to this Regulation.

Euroloop and radio infill data transmission shall not be installed, nor operated, except at lines/trackside areas which are listed as specific case in point 7.7.

The trackside installations shall comply with the harmonised engineering rules referenced under index 13 (subset 40) and shall be operated without restriction under the operating rules set out in the Appendix A of Implementing Regulation (EU) 2019/773. The Agency when issuing trackside approvals in accordance with Article 19 of Directive (EU) 2016/797 and the NSA when authorising the placing in service of fixed installations, shall confirm compliance.

Infrastructure Manager shall communicate through RINF to operators the time and date when authorised ERTMS trackside installations will be put in operation.

7.4.1.1. High-speed network

It is mandatory to fit ETCS trackside when:

(1) installing for the first time the train protection part of a Control-Command and Signalling Trackside Subsystem (with or without a Class B system); or

(2) upgrading the existing train protection part of a Control-Command and Signalling Trackside Subsystem, where this would change the functions, performance and/or interoperability-relevant interfaces (air gaps) of the existing legacy system. This does not apply to modifications deemed necessary to mitigate safety-related defects in the legacy installation.

7.4.1.2. Set of specifications from previous versions of the CCS TSI.

Networks that implement and operate ETCS lines according to former set #1 as in Annex A, Table A2.1 of previous versions of this TSI before the entry into force of this TSI and with more than 1 000 km or 25% in operation or under construction in the Core Network Corridors before 31 December 2020, can exceptionally continue to use those ETCS specifications for the placing into service for 7 year after publication of this TSI for new projects and for 10 years after entry into force of this TSI for upgraded or renewal projects in the network under the following conditions:

(1) Notification of the intention to deploy former set of specifications #1 and the intended scope and plan has been sent to the European Commission within 2 years after the publication date of this TSI.

(2) Infrastructure Manager shall ensure that those lines will include the implementation of all the relevant error correction measures enabling an ETCS On-board compliant with this TSI (including on-board error correction implementation) to provide a normal service.

(3) The Infrastructure Manager shall implement the relevant error corrections and the harmonised or equivalent mitigation measures in Agency Opinions or published releases of the specifications, according to point 7.2.10.

(4) In addition, any modification performed in infrastructure compliant with former set of specifications #1 shall ensure that the previous conditions (2) and (3) are also preserved.

([33]) Commission Implementing Regulation (EU) 2017/6 of 5 January 2017 on the European Rail Traffic Management System European deployment plan (OJ L 3, 6.1.2017, p. 6).

([34]) Regulation (EU) No 1315/2013 of the European Parliament and of the Council of 11 December 2013 on Union guidelines for the development of the trans-European transport network and repealing Decision No 661/2010/EU (OJ L 348, 20.12.2013, p. 1).

Networks that implement and operate ETCS lines according to former set #2 and set #3 as in Annex A, Table A2.2 and Table A2.3 of previous versions of this TSI before the entry into force of this TSI, can exceptionally continue to use those specifications for the placing into service for 7 years after publication of this TSI for new projects and for 10 years after entry into force of this TSI for upgraded or renewal projects in the network under the following conditions:

(1) Infrastructure Manager shall ensure that those lines will include the implementation of all the relevant error correction measures enabling an ETCS On-board compliant with this TSI (including on-board error correction implementation) to provide a normal service.

(2) The Infrastructure Manager shall implement the relevant error corrections and the harmonised or equivalent mitigation measures in Agency Opinions or published releases of the specifications, according to point 7.2.10.

(3) In addition, any modification performed in infrastructure compliant with former set of specifications #2 and #3 shall ensure that the previous conditions (1) and (2) are also preserved.

7.4.1.3. ETCS System Version implementation rules

The trackside implementation can select which ETCS-functions shall be implemented from the set of specifications in Appendix A. The specifications in Appendix A contain functions from the following system versions: 1.0, 1.1, 2.0, 2.1, 2.2, 2.3 and 3.0. In accordance with the process defined in 7.4.4, the IM shall notify which lines make use of which system version. This notification shall be done within the RINF and these changes in RINF shall be listed in the Network Statement as part of Article 27 of Directive 2012/34/EU.

The trackside implementation leading to ETCS on-board system version 3.0 is allowed if the following condition is fulfilled:

Minimum notification period of 5 years for the lines where ETCS system version 3.0 is a mandatory on-board requirement for the vehicles operating on its network. The notification of lines for which ETCS on-board system version 3.0 is required both for vehicles being authorised and for vehicles operating on its network can only become mandatory applicable after an amendment of this CCS TSI ([35]) (see Table B1.1). A shorter period is allowed if this is agreed between the IM and the RU's who run or intent to run (at the time of establishing the agreement) services on these lines. This agreement shall be notified to the Commission.

7.4.2. *On-board installations*

7.4.2.1. Newly built vehicles

In order to be placed on the market in accordance with Article 21 of Directive (EU) 2016/797, newly built vehicles shall be equipped and ready for operation with ETCS in accordance with this TSI.

7.4.2.2. Existing vehicles

When authorising existing vehicles in accordance with Article 21 of Directive (EU) 2016/797, they shall be equipped and ready for operation with ETCS (Class A train protection system) in accordance with this TSI if installing any new Class B train protection system in a control-command and signalling on-board subsystem.

It is mandatory to fulfil points 7.4.2.4.1 and 7.4.2.4.2 if upgrading the existing ETCS on-board part within a vehicle.

It is not needed to fulfil points 7.4.2.4.1 and 7.4.2.4.2 if correcting the existing ETCS on-board functionality within a vehicle.

7.4.2.3. Rules for the extension of the area of use for existing vehicle

The following rules apply to existing vehicles in operation and registered in the National Vehicle Register in accordance with Decision 2007/756/EC, or in the European Vehicle Register in accordance with Implementing Decision (EU) 2018/1614, when requesting an extension of the area of use:

([35]) This amendment includes the publication of FRMCS On-Board specifications or includes trackside engineering and operational rules linked to the supervised manoeuvre functionality.

(1) Vehicles shall comply with relevant special provisions applicable in the specific cases referred to in point 7.7 of this Annex and with relevant national rules referred to in points (a), (c) and (d) of Article 13(2) of Directive (EU) 2016/797 notified in accordance with Article 14 of that Directive.

(2) Vehicles already equipped with ETCS, GSM-R or FRMCS do not need to be upgraded, except where required for technical compatibility with ETCS, GSM-R or FRMCS.

(3) Vehicles that are not equipped with ETCS shall install ETCS and comply with sets of specifications referred to in Table A 2 of Appendix A. It is mandatory to fulfil points 7.4.2.4.1 and 7.4.2.4.2.

(4) When the vehicle is intended for use on a network where at least one section is equipped with Class A RMR, vehicles that are not yet equipped with a Class A RMR voice radio shall install a Class A RMR voice cab radio which is technically compatible with the radio network, except if this network is superimposed to a legacy Class B radio communication system compatible with the class B already installed in the vehicle. In such a case, the Class A RMR voice radio shall comply with the specifications referred to in Table A 2. of Appendix A.

(5) When the vehicle is required to install ETCS in accordance with point (3) and it is intended to operate in a network in the extended area of use that is equipped with ETCS Level 2, vehicles that are not yet equipped with the Class A RMR data communication, shall install at least one of the Class A RMR data radio which is technical compatible with the radio network. In such case, the Class A RMR data radio shall comply with the specifications referred to in Table A 2 of Appendix A.

(6) Where an authorised vehicle benefited from non-application of TSIs or part of them pursuant to Article 9 of Directive 2008/57/EC, the applicant shall seek derogation(s) in the Member States of the extended area of use in accordance with Article 7 of Directive (EU) 2016/797.

(7) When the request for extending the area of use is combined with a request for new authorisation upgrading the existing CCS on-board subsystem train protection part, it is mandatory to fulfil point 7.4.2.4.1 and 7.4.2.4.2.

7.4.2.4. ETCS System Version implementation rules

7.4.2.4.1. The ETCS on-board Interoperability Constituent placed on the market shall implement one of the following envelopes:

(1) envelope of legally operated ETCS system versions from 1.0 to 2.1 inclusive;

(2) envelope of legally operated ETCS system versions from 1.0 to 2.2 inclusive;

(3) envelope of legally operated ETCS system versions from 1.0 to 3.0 inclusive.

7.4.2.4.2. A vehicle type shall integrate the appropriate ETCS on-board Interoperability Constituent with the required envelope of legally operated ETCS system versions as defined in 7.4.2.4.1 ([36]). The required envelope of legally operated ETCS system versions shall be defined based on the notified system versions in RINF ([37]) for the intended area of use of the vehicle type specified in its authorisation. The vehicle type shall implement the ETCS system version which complies as a minimum to the notified ETCS system version which become applicable in the next 5 years according to the timeframe in Appendix B, when:

(1) installing for the first time the ETCS part of a Control-Command and Signalling On-board Subsystem;

or

(2) upgrading the ETCS part of a Control-Command and Signalling On-board Subsystem already on the market in such a way that it changes the functions of the subsystem. This does not apply to modifications deemed necessary to implement error corrections as stated in 7.2.10;

([36]) If set of specification #1 is used based on clause 7.4.2.3 point 3 (b) from Regulation (EU) 2016/919, the requirement remains applicable to enforce compliance with set specifications #2 or #3 within a period of time not exceeding 1 July 2023.

([37]) The changes of the notified system versions in RINF shall be listed in the Network Statement according to Article 27 of Directive 2012/34/EU.

7.4.3. *National requirements*

7.4.3.1. Member States may introduce additional requirements at national level, in particular with a view to allowing only ETCS-equipped vehicles to access ETCS-equipped lines, so that existing national systems can be decommissioned; This shall be notified a minimum 5 years before the decommissioning. A shorter period is allowed if this is agreed between the IM and the RU's who run or intend to run (at the time of establishing the agreement) services on these lines. This notification shall be done within the RINF and these changes in RINF shall be listed in the Network Statement as part of Article 27 of Directive 2012/34/EU ([38]). The 5-years notification period does not apply to those requirements allowing only ETCS-equipped vehicles to access ETCS-equipped lines, which were announced in the Network Statement before the entry into force of this Regulation.

7.4.3.2. Member States may decide to exclude special vehicles as defined in point 2.2.2 (C) of the LOC&PAS TSI, including road-rail vehicles, from the obligation to equip them with ETCS, RMR or ATO on a specific area of use if the operation of these vehicles does not prevent the Class B decommissioning. This shall be notified and shall be listed in the Network Statement as part of Article 27 of Directive 2012/34/EU.

7.4.3.3. Member States may decide to exclude from the obligation to equip with ETCS passenger trains reserved to a strictly local use in accordance with Article 1.4 b) of Directive (EU) 2016/797 and shunting locomotives in service for more than 20 years that operate exclusively on a part of the national network where no ETCS exists and no ETCS deployment is planned for the next 5 years.

7.4.4. *National Implementation Plans*

Member States shall develop a national plan for the implementation of this TSI in coordination with the Infrastructure Managers and Railway Undertakings concerned, considering the coherence of the entire rail system of the European Union taking into account the economic viability, interoperability and safety of the rail system. Member States shall consult the neighbouring countries for a coherent planning of the railway cross-border sections. This plan shall include all lines in scope of the TSI including TEN-T lines and the nodes and last mile connections.

Member States shall coordinate the process between all stakeholders concerned to set up the technical and indicative financial migration strategy required for the overall ERTMS deployment of this national implementation plan.

Member States shall include the assessment of the needs expressed by the railway undertakings and the infrastructure managers for the CCS subsystem related to the conditions for mandatory and optional functions listed in 7.2.9 in the National Implementation Plan.

Member States shall decide on the migration strategy describing the expected overall impact for the railway system (taking a Union perspective) and how the impact is balanced in a non-discriminatory way between the stakeholders concerned based on the above assessment. The output of this coordination process shall be the definition of the technical and the financial migration strategy being implemented.

The national implementation plan shall provide information on all new, renewed and upgraded lines in relation to mandatory and optional functions listed in 7.2.9 ensuring that notifications to RUs are provided at least 5 years in advance in case there will be new mandatory on-board requirements for operating on the network. This shall be notified within the RINF ([39]) and these changes in RINF shall be listed in the Network Statement as part of Article 27 of Directive 2012/34/EU. The 5-years notification period does not apply to any requirements, which were announced in the Network Statement before the entry into force of this CCS TSI.

The national implementation plans shall cover a period of at least 20 years and shall be updated regularly, at least every five years. The plans shall follow the template provided in the Appendix H

([38]) The Network Statement can be used as tool in case RINF is not upgraded yet to notify this change.
([39]) The Network Statement can be used as tool in case RINF is not upgraded yet to notify this change.

for the first five years of the period covered. For the subsequent period of fifteen years, the plan shall follow this template to the extent possible with a less detailed approach.

The Commission shall publish the national implementation plans on its website and inform Member States about them through the Committee referred to in Article 51(1) of Directive (EU) 2016/797.

The Commission shall draw up an analysis of the national implementation plans that shall encompass among others comparison of the plans and identification of needs for additional coordination measures.

The national implementation plan shall at least include the following information ([40]):

(1) General migration strategy as described above, including the assessment of the needs expressed by the railway undertakings and the infrastructure managers.

(2) Context description of the current status, including:

(a) facts and figures on installed train protection, ATO radio and train detection systems, including details on the benefits they provide for capacity, safety, reliability and performance aspects and including the legal references to the CCS on-board requirements;

(b) Class B systems and their remaining economic lifetime including a description of the measures taken to ensure open market conditions for its legacy Class B train protection and radio systems as set out in point 7.2.6;

(c) on-board CCS subsystems, based on the available information.

(3) Definition of the migration strategy (future status).

The technical migration strategy shall include information and planning of:

(1) ETCS part: ETCS Level and System version required per line and per network, with detailed information on cross border sections and nodes. If applicable, information on the baseline and levels update strategy;

(2) Radio part: information on radio systems (e.g. radio circuit switching, packet switching, radio infill options for ETCS);

(3) ATO part: information on the need for deployment of ATO;

(4) Train detection part: information on the migration to the TSI compliant train detection system;

(5) Specific cases: information on the phasing out of specific cases;

(6) On-board CCS subsystems;

(7) Trackside and on-board financial information.

Planning (network maps) providing an overview of changes in the next 20 years related to:

(1) Train protection part:

(a) Network map with dates when ETCS is put into service; detailed information on cross-border lines and nodes;

(b) If applicable, network map with dates when Class B operation is not allowed anymore or when ETCS operation only is mandatory; and if not similar, network map with dates where Class B system is taken out of service;

(2) Radio part:

(a) Network map with dates when GSM-R is put into service; detailed information on cross-border lines and nodes;

(b) If applicable, network map with dates when Class B Radio operation is not allowed anymore; and if not similar, network map with dates where Class B Radio system is taken out of service;

([40]) The complete template for the National Implementation Plan is provided in Appendix H.

(c) Network map with dates when FRMCS is put into service;

(d) If applicable, network map with dates when GSM-R operation is not allowed anymore; and if not similar, network map with dates where GSM-R system is taken out of service;

(3) ATO part:

(a) If applicable, network map with dates when ATO is put into service; detailed information on cross-border lines and nodes.

(4) Train Detection Part:

(a) Network map with dates when TSI compliant train detection system is put into service; detailed information on cross-border lines and nodes;

(5) On-board CCS subsystems, with optional information on cross-border vehicles.

7.5. **ETCS and radio system compatibility checks implementation rules**

Existing vehicles, and their corresponding vehicle type, equipped with ETCS and RMR shall be deemed compatible with the ETCS and radio system compatibility types of the networks on which they are operating with ETCS and RMR by 16 January 2020 without any further checks, maintaining the existing restrictions or conditions for use.

Any subsequent modification of the vehicle, their corresponding vehicle type or the infrastructure regarding the technical or route compatibility shall be managed according to the requirements specified for ETCS and Radio system compatibility in this TSI.

7.6. **Train detection systems specific implementation rules**

In the context of this TSI, train detection system means the equipment installed trackside, which detects the presence or absence of vehicles either on an entire line of route or on a local section of it.

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

This TSI specifies the requirements for the interface with rolling stock only to the extent necessary to ensure compatibility between TSI-compliant rolling stock and the Control-command and Signalling Trackside.

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

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

(1) upgrading the train detection system;

(2) renewing the train detection system, provided that respecting the requirements of this TSI does not imply unwanted modifications or upgrades of other trackside or on-board systems;

(3) renewing the train detection system, where this is required by the upgrade or renewal of trackside systems that use information from the train detection system;

(4) removing Class B train protection systems where the train detection and train protection systems are integrated.

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

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

7.7. **Specific cases**

7.7.1. *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, to be removed before 2040 (case 'T') or a date to be specified after the re-examination process defined in Article 13(5) of this Regulation (case 'T2').

The specific cases set out in points below shall be read in conjunction with the relevant points of Chapter 4 and/or specifications referenced there.

The specific cases replace the corresponding requirements set out in Chapter 4.

Where the requirements set out in the relevant point of Chapter 4 are not subject to a specific case, those requirements have not been duplicated in points below and continue to apply unmodified.

The assessment of the specific cases related to basic parameters 4.2.10 and 4.2.11 where indicated in the Notes column as 'applicable to vehicles' shall be assessed by Rolling Stock subsystem Notified Body.

All specific cases and their relevant dates shall be re-examined in the course of future revisions of the TSI with a view to limiting their technical and geographical scope based on an assessment of their impact on safety, interoperability, cross border services, TEN-T corridors, and the practical and economic impacts of retaining or eliminating them. Special account shall be given to availability of EU funding. The train detection systems and corresponding end dates shall be re-examined following Article 13(5) of this Regulation.

Specific cases shall be limited to the route or network where they are strictly necessary and taken account of through route compatibility procedures.

7.7.2. *List of specific cases*

7.7.2.1. Belgium

Specific case	Category	Notes
4.2.10. Trackside Train Detection Systems Index 77, point 3.1.2.3: The distance between first and last axle L - (b1 + b2) (Fig.1) is at least 16 000 mm.	T	Applicable on HS L1 Applicable on vehicles This Specific Case is linked with the use of TVM.
4.2.10. Trackside Train Detection Systems Index 77, point 3.1.7: The weight of an isolated vehicle or a trainset is at least 40 t. If the weight of an isolated vehicle or a trainset is inferior to 90 t, the vehicle shall have a system ensuring the shunting which has an electrical basis superior or equal to 16 000 mm.	T	Applicable on HS L1, L2, L3, L4 Applicable on vehicles This Specific Case is linked with the use of TVM.

7.7.2.2. UK for Northern Ireland

Specific case	Category	Notes
4.2.10. Trackside Train Detection Systems Index 77, point 3.1.3.1: The minimum wheel rim width (B_R) for 1 600 mm track gauge network is 127 mm.	T	Applicable in Northern Ireland
4.2.10. Trackside Train Detection Systems Index 77, point 3.1.3.3: The minimum flange thickness (S_d) for 1 600 mm track gauge network is 24 mm.	T	Applicable in Northern Ireland

4.2.10. Trackside Train Detection Systems Index 77, point 3.1.4.1: In addition to the requirements in point 3.1.4.1, sanding for traction purposes on multiple units: (a) is not permitted ahead of the leading axle below 40 km/h; and (b) is only permitted where it can be demonstrated that at least a further six axles of the multiple unit are beyond the laying position.	T	
4.2.12. ETCS DMI (Driver-Machine Interface) Index 6: It is permissible to use an alphanumeric keyboard to enter the train running number if support for alphanumeric train running numbers is required by the technical rule notified for this purpose.	T	There is no impact on interoperability.
4.2.12. ETCS DMI (Driver-Machine Interface) Index 6: It is permissible for the ETCS DMI to display dynamic train speed information in miles per hour (and indicate 'mph') when operating on parts of the GB mainline network.	T	There is no impact on interoperability.

7.7.2.3. France

Specific case	Category	Notes
4.2.10. Trackside Train Detection Systems Index 77, point 3.1.2.3: The distance between first and last axle L - (b1 + b2) (Fig.1) is at least 16 000 mm	T2	Applicable on infrastructure Applicable on vehicles This Specific Case is linked with the use of track circuits using electrical joints.
4.2.10. Trackside Train Detection Systems Index 77, point 3.1.9: The electrical resistance between the running surfaces of the opposite wheels of a wheelset does not exceed 0,05 Ohm, measured by a voltage between 1,8 VDC and 2,0 VDC (open circuit). In addition, for non-conventional wheelset ('conventional wheelset' has to be understood as two monobloc wheels set on a metallic axle), the electrical reactance between the running surfaces of the opposite wheels of a wheelset does not exceed f/100 mOhm when f is between 500 Hz and 40 kHz, under a measuring current of at least 10 ARMS and open voltage of 2 VRMS.	T2	Applicable on infrastructure Applicable on vehicles This specific case may be revised when the open point related to the frequency management for track circuits is closed.

4.2.10. Trackside Train Detection Systems Index 77, point 3.1.7: The weight of an isolated vehicle or a trainset is at least 40 t. If the weight of an isolated vehicle or a trainset is inferior to 90 t, this vehicle shall have a system ensuring the shunting which has a distance between following axles, as defined in ERA/ERTMS/033281, superior or equal to 16 000 mm.	T	Applicable on infrastructure Applicable on vehicles This Specific Case is linked with the use of TVM.
4.2.10. Trackside Train Detection Systems Index 77, point 3.1.3.2: Dimension D (figure 2) is not less than: 450 mm independently of the speed.	T	Applicable on infrastructure Applicable on vehicles.
4.2.10. Trackside Train Detection Systems Index 77, point 3.1.4.1. In addition to the TSI requirements, the allowed maximum amount of sand per unit and per rail within 30 s is: 750 g.	T2	This specific case is linked to the use of track circuits with a higher sensitivity regarding the isolation layer between wheels and rails due to sanding on the French Network.

7.7.2.4. Poland

Specific case	Category	Notes
4.2.10. Trackside Train Detection Systems Index 77, point 3.1.9: The electrical resistance between the running surfaces of the opposite wheels of a wheelset does not exceed 0,05 Ohm, measured by a voltage between 1,8 VDC and 2,0 VDC (open circuit). In addition, the electrical reactance between the running surfaces of the opposite wheels of a wheelset does not exceed f/100 mOhm when f is between 500 Hz and 40 kHz, under a measuring current of at least 10 ARMS and open voltage of 2 VRMS.	T	Applicable on infrastructure Applicable on vehicles This specific case may be revised when the open point related to the frequency management for track circuits is closed.

7.7.2.5. Lithuania, Latvia and Estonia

Specific case	Category	Notes
4.2.10. Trackside Train Detection Systems Index 77, point 3.1.3.3: The minimum flange thickness (S_d) for 1 520 mm track gauge network is 20 mm.	T	Applicable on infrastructure Applicable on vehicles This specific case is needed as long as ČME locomotives operate on 1 520 mm network.

<table>
<tr>
<td>4.2.10. Trackside Train Detection Systems
Index 77, point 3.1.3.4:
The minimum flange height (S_h) for 1 520 mm track gauge network is 26,25 mm.</td>
<td>T</td>
<td>Applicable on infrastructure
Applicable on vehicles
This specific case is needed as long as ČME locomotives operate on 1 520 mm network.</td>
</tr>
<tr>
<td>4.2.11. Electromagnetic Compatibility between Rolling Stock and Control-Command and Signalling trackside equipment
Index 77, point 3.2.2.4:
The limits and associated parameters for the evaluation of rolling stock emissions are provided in the following table:
<table>
<tr><th>Frequency range</th><th>Interference current limit [rms value]</th></tr>
<tr><td>15 — 21 Hz</td><td>4,1 A</td></tr>
<tr><td>21 — 29 Hz</td><td>1,0 A</td></tr>
<tr><td>29 — 35 Hz</td><td>4,1 A</td></tr>
<tr><td>65 — 85 Hz</td><td>4,1 A</td></tr>
<tr><td>167 — 184 Hz</td><td>0,4 A</td></tr>
<tr><td>408 — 432 Hz</td><td>0,35 A</td></tr>
<tr><td>468 — 492 Hz</td><td>0,35 A</td></tr>
<tr><td>568 — 592 Hz</td><td>0,35 A</td></tr>
<tr><td>708 — 732 Hz</td><td>0,35 A</td></tr>
<tr><td>768 — 792 Hz</td><td>0,35 A</td></tr>
<tr><td>4 462,5 — 4 537,5 Hz</td><td>0,2 A</td></tr>
<tr><td>4 507,5 — 4 582,5 Hz</td><td>0,2 A</td></tr>
<tr><td>4 962,5 — 5 037,5 Hz</td><td>0,2 A</td></tr>
<tr><td>5 462,5 — 5 537,5 Hz</td><td>0,2 A</td></tr>
<tr><td>5 517,5 — 5 592,5 Hz</td><td>0,2 A</td></tr>
</table>
</td>
<td>T</td>
<td>Applicable on vehicles
This specific case is linked with the use of ALSN on the 1 520 mm network.</td>
</tr>
<tr>
<td>4.2.11. Electromagnetic Compatibility between Rolling Stock and Control-Command and Signalling trackside equipment
Index 77, point 3.2.2.6:
The limits and associated parameters for the evaluation of rolling stock emissions are provided in the following table:
<table>
<tr><th>Frequency range</th><th>Interference current limit [rms value]</th></tr>
<tr><td>19 — 21 Hz</td><td>11,6 A</td></tr>
<tr><td>21 — 29 Hz</td><td>1,0 A</td></tr>
<tr><td>29 — 31 Hz</td><td>11,6 A</td></tr>
<tr><td>40 — 46 Hz</td><td>5,0 A</td></tr>
<tr><td>46 — 54 Hz</td><td>1,3 A</td></tr>
<tr><td>54 — 60 Hz</td><td>5,0 A</td></tr>
<tr><td>167 — 184 Hz</td><td>0,4 A</td></tr>
<tr><td>408 — 432 Hz</td><td>0,35 A</td></tr>
<tr><td>468 — 492 Hz</td><td>0,35 A</td></tr>
<tr><td>568 — 592 Hz</td><td>0,35 A</td></tr>
<tr><td>708 — 732 Hz</td><td>0,35 A</td></tr>
<tr><td>768 — 792 Hz</td><td>0,35 A</td></tr>
<tr><td>4 507,5 — 4 582,5 Hz</td><td>0,2 A</td></tr>
<tr><td>4 962,5 — 5 037,5 Hz</td><td>0,2 A</td></tr>
<tr><td>5 517,5 — 5 592,5 Hz</td><td>0,2 A</td></tr>
</table>
</td>
<td>T</td>
<td>Applicable on vehicles
This specific case is linked with the use of ALSN on the 1 520 mm network</td>
</tr>
</table>

7.7.2.6. Sweden

Specific case	Category	Notes
4.2.4. Mobile communication functions for railways RMR Index 33, point 4.2.3: It is permissible to put on the market on-board Control-Command and Signalling Subsystems including 2 Watt GSM-R voice cab radios. The subsystems shall be able to operate in networks with -82 dBm.	P	No impact on interoperability
4.2.10. Trackside Train Detection Systems Index 77, point 3.1.2.1: Maximum axle distance between two axles ≤ 17,5 m ai in Fig. 1, point 3.1.2.1.	P	Applicable on vehicles
4.2.10. Trackside Train Detection Systems Index 77, point 3.1.2.3: Minimum axle distance between first and last axle ≥ 4,5 m L-b1-b2 in Fig. 1, point 3.1.2.3.	P	Applicable on vehicles
4.2.11. Electromagnetic Compatibility between Rolling Stock and Control-Command and Signalling trackside equipment Index 77, point 3.2.2.5: Frequency range: 0,0-2,0 Hz Interference current limit [rms value]: 25,0 A Evaluation method: Low-Pass filter Evaluation parameters: (Down sampling to 1 kHz, followed by) 2,0 Hz 4th order Butterworth low-pass filter, followed by an ideal rectifier to give the absolute value. The maximum interference current for a rail vehicle must not exceed 25,0 A in the frequency range 0,0-2,0 Hz. Inrush current may exceed 45,0 A for less than 1,5 seconds and 25 A for less than 2,5 seconds.	P	Applicable on infrastructure Applicable on vehicles

7.7.2.7. Luxembourg

Specific case	Category	Notes
4.2.10. Trackside Train Detection Systems Index 77, point 3.1.4.1: (1) The output of the sanding devices fitted to the vehicle shall not exceed 0,3 l per minute per rail. (2) The sanding in the stations identified in the infrastructure register is prohibited.	T	

(3) The Sanding in the area of switches is prohibited. (4) For emergency braking, no restrictions shall apply.		
4.2.11. Electromagnetic Compatibility between Rolling Stock and Control-Command and Signalling trackside equipment Index 77, point 3.2.2.3: The measurement and evaluation of rolling stock with individual track circuits shall be done according to the document GI.II.STC-VF (parameters A1, A4, V2 and D1).	T	Applicable on vehicles This specific case is needed as long as track circuits (operating frequency 83,3 Hz) are used. Document GI.II.STC.VF is available on the website of the NSA LU ([1]).
4.2.11. Electromagnetic Compatibility between Rolling Stock and Control-Command and Signalling trackside equipment Index 77, point 3.2.2.3: The measurement and evaluation of rolling stock with individual track circuits shall be done according to the document GI.II.STC-VF (parameters A5, V2 and D2).	T	Applicable on vehicles This specific case is needed as long as track circuits (operating frequency 125 Hz) are used. Document GI.II.STC.VF is available on the website of the NSA LU.

([1]) 'NSA LU' stands for 'National Safety Authority of Luxembourg': Administration des Chemins de Fer (ACF), www.railinfra.lu (website).

7.7.2.8. Germany

Specific case	Category	Notes
4.2.10. Trackside Train Detection Systems Index 77, point 3.1.7.1: The minimum axle load of vehicles to run on specific lines indicated in the register of infrastructure is 5 t. This specific case only applies to vehicles; it does not modify the technical requirements for train detection systems specified in Index 77 and the provisions of point 7.2.8 related to their implementation.	T	Applicable on vehicles This specific case is needed as long as track circuits type WSSB are used.
4.2.10. Trackside Train Detection Systems Index 77, point 3.1.2.2: For speed not higher than 140 km/h, the distance a_i (Fig 1) between two consecutive axles (concerning the first 5 axles of the consist or the whole set of axles if the total number of axles is lower than 5) is in no case less than 1 000 mm. This specific case only applies to vehicles; it does not modify the technical requirements for train detection systems specified in Index 77 and the provisions of point 7.2.8 related to their implementation.	T	Applicable on vehicles This specific case is needed as long as EBUET 80 type of level crossing protection is used.

4.2.11. Electromagnetic Compatibility between Rolling Stock and Control-Command and Signalling trackside equipment Index 77, point 3.2.2.5: Frequency range: 93 - 110 Hz Interference current limit [rms value]: 2,8 A (for influencing unit) 2 A (for one traction unit) Evaluation method: Band Pass Filters Evaluation parameters: — BP filter characteristics: Centre frequencies: 95, 96, 98, 100, 102, 104, 106 and 108 Hz 3dB-Bandwidth: 4 Hz Butterworth, 6th order — RMS calculation: Integration time: 0,5 s Time overlap: 50 %	T	Applicable on infrastructure Applicable on vehicles This specific case is needed because these track circuits may be modified by shifting the centre frequency from 100 Hz to 106,7 Hz. This would make obsolete a vehicle related National Technical Rule requiring a 100 Hz monitoring system.

7.7.2.9. Italy

Specific case	Category	Notes
4.2.10. Trackside Train Detection Systems Index 77, point 3.1.4.1: In addition to the TSI requirements, following criteria shall be respected. The allowed maximum amount of sand per sanding device within 30 s is: (1) For speed v ≤ 140 km/h; 400 g + 100 g (2) For speed v > 140 km/h; 650 g + 150 g	T	The national values for dispensing sand will remain valid until harmonized test specifications (currently non-existent) are available for demonstrating that different modes for dispensing sand are safety-acceptable for train detection systems operating in Italy.
4.2.10. Trackside Train Detection Systems Index 77, point 3.1.4.2 In addition to the TSI requirements, following criteria shall be respected. *Granulometry* ≥ 85% of the sand mixture, with grains' diameters between 0,1 mm and 0,6 mm; and in particular: 0,07 mm ÷ 0,1 mm ≤ 3 % of the sand mixture; 0,1 mm ÷ 0,15 mm ≤ 5 % of the sand mixture; 0,15 mm ÷ 0,2 mm ≤ 25 % of the sand mixture; 0,2 mm ÷ 0,3 mm till 100 % of the sand mixture; 0,3 mm ÷ 0,4 mm till 100 % of the sand mixture;	T	The national values of sand mixture will remain valid until harmonized test specifications (currently non-existent) are available for demonstrating that different kinds of sand mixture are safety-acceptable for train detection systems operating in Italy.

0,4 mm ÷ 0,6 mm ≤ 65 % of the sand mixture; 0,6 mm ÷ 1,5 mm ≤ 4 % of the sand mixture. Composition Siliceous sand; Percentage of clay in the mixture: ≤ 2 %; Percentage of humidity in the mixture: ≤ 0,5 %.		
4.2.11. Electromagnetic Compatibility between Rolling Stock and Control-Command and Signalling trackside equipment Index 77, point 3.2.2.4 and point 3.2.2.6: Frequency range: 82 - 86 Hz Interference current limit [rms value]: 1 125 mA (per influencing unit) Evaluation method: Fast Fourier Transformation Evaluation parameters: Time window 1s, Hanning window, 50 % overlap, average on 6 consecutive windows	T2	Applicable on infrastructure Applicable on vehicles
4.2.2. On-Board ETCS functionality 4.2.3. Trackside ETCS functionality An ETCS Level 1 Trackside application with infill requires that the on-board is equipped with the corresponding radio infill data transmission if the release speed is set to zero for safety reasons.	P	This is applicable for the projects notified to the European Commission by 30 June 2020.

7.7.2.10. Czech Republic

Specific case	Category	Notes
4.2.11. Electromagnetic Compatibility between Rolling Stock and Control-Command and Signalling trackside equipment Index 77, point 3.2.2.4 and point 3.2.2.6: Frequency range: 70,5 – 79,5 Hz Interference current limit [rms value]: 1 A Evaluation method: Band Pass Filters Evaluation parameters: — BP filter characteristics: Centre frequencies: 73, 75, 77 Hz (continuous band) 3dB-Bandwidth: 5 Hz Butterworth, order 2*4 — RMS calculation: Integration time: 0,5 s Time overlap: min 75 %	T	Applicable on infrastructure Applicable on vehicles This specific case is needed as long as track circuits type EFCP are used.

Frequency range: 271,5 - 278,5 Hz Interference current limit [rms value]: 0,5 A Evaluation method: Band Pass Filters Evaluation parameters: — BP filter characteristics: Centre frequencies: 274, 276 Hz (continuous band) 3dB-Bandwidth: 5 Hz Butterworth, order 2*4 — RMS calculation: Integration time: 0,5 s Time overlap: min 75 %		

7.7.2.11. The Netherlands

Specific case	Category	Notes
4.2.11. Electromagnetic Compatibility between Rolling Stock and Control-Command and Signalling trackside equipment Index 77, point 3.2.2.6: Frequency range: 65-85 Hz (ATBEG limit) Interference current limit [rms value]: 0,5 A Evaluation method: Band Pass Filters Evaluation parameters: — BP filter characteristics: Centre frequency: 75 Hz 3dB-Bandwith: 20 Hz 20dB-Bandwith: 40 Hz — RMS calculation: Integration time: 5 s Time overlap: 80 % Transient shorter than 1s only exceeding the ATBEG limit and not the GRS limit may be ignored. Frequency range: 65-85 Hz (GRS TC limit) Interference current limit [rms value]: 1,7 A Evaluation method: Band Pass Filters Evaluation parameters: — BP filter characteristics Centre frequency: 75 Hz 3dB-Bandwith: 20 Hz 20dB-Bandwith: 40 Hz	P	Applicable on infrastructure Applicable on vehicles This Specific Case is needed in the context of the Class-B system ATBEG. Alternative demonstration, leading to presumption of conformity, is permissible by compliance with the national rules related to rail return current notified for this purpose.

— RMS calculation: Integration time: 1,8 s Time overlap: 80 %		

7.7.2.12. Ireland

Specific case	Category	Notes
4.2.10. Trackside Train Detection Systems Index 77, point 3.1.4: A train's leading axle shall not be sanded.	T	This specific case is linked with the IE Class B system and certain train detection systems that require the first axle of a train having a good electric contact with the track.
4.2.13.1. GSM-R DMI (Driver Machine Interface) Index 32 and 33: The GSM-R user interfaces (including keyboard and display facilities) as well as any other GSM-R functions shall facilitate the employment of alphanumeric train running numbers as defined in the national rule notified for this purpose.	T	This augments but does not replace the other TSI requirements for management of train running numbers, so that all new equipment shall remain also fully compatible with the interoperability requirements. A transition to pure numeric train numbers shall thus become possible and is envisaged as soon as the train management systems in Ireland are all equipped for pure numeric train running numbers.
4.2.12. ETCS DMI (Driver-Machine Interface) Index 6: The ETCS DMI shall be configurable so that it can show the speed in mph in addition to the standard km/h display. The configurable options shall be as follows: — Display the speed dial in both km/h and mph in the figure below, as indicated as an example for the 180km/h configuration:  — Display the speed dial in km/h only.	T	This augments but does not replace the other TSI requirements for management of the driver interface, so that all new equipment shall remain also fully compatible with the interoperability requirements. A transition to the pure km/h speed dial shall thus become possible and is envisaged as soon as the Irish network is fully fitted with ETCS, or all lineside speed restriction signs can be changed to km/h (i.e. all existing trains present a km/h speedometer).

7.7.2.13. Bulgaria

Specific case	Category	Notes
4.2.10. Trackside Train Detection Systems Index 77, point 3.1.2.5: The distance bx (Figure 1) does not exceed 3 000 mm.	T	Applicable on vehicles

7.7.2.14. Austria

Specific case	Category	Notes
4.2.2. On-Board ETCS functionality 4.2.3. Trackside ETCS functionality An ETCS Level 1 Trackside application with infill requires that the on-board is equipped with the corresponding Euroloop infill data transmission if the release speed is set to zero for safety reasons.	T	This is applicable for the projects notified to the European Commission by 30 June 2020.
4.2.10. Trackside Train Detection Systems Index 77, point 3.1.7.1: The minimum permissible axle load for unrestricted use on the network is 2,0 t for lowfloor wagons. This specific case only applies to lowfloor wagons; it does not modify the technical requirements for train detection systems specified in Index 77 and the provisions of point 7.2.8 related to their implementation.	T2	Applicable to lowfloor Wagon

Appendix A [41]

References

For each reference made in the basic parameters (point 4 of this TSI) the following table indicates the corresponding mandatory specifications, via the Index in Table A 2.

Table A 1

References between basic parameters and mandatory specifications

Reference in Chapter 4	Index number (see Table A 2)
4.1	
4.1 a	Intentionally deleted
4.1 b	Intentionally deleted
4.1 c	3, 102
4.2.1	
4.2.1 a	27
4.2.2	
4.2.2 a	14
4.2.2 b	4, 13, 60, 104
4.2.2 c	31, 37 b, 37 c, 37 d
4.2.2 d	20
4.2.2 e	6
4.2.2 f	7, 81, 82
4.2.2 g	Intentionally deleted
4.2.2 h	87
4.2.3	
4.2.3 a	14
4.2.3 b	4, 13, 60
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	73, 74
4.2.4 f	32, 33
4.2.4 g	48
4.2.4 h	69, 70
4.2.4 i	Intentionally deleted
4.2.4 j	71, 72
4.2.4 k	75, 76

[41] In former versions of the TSI this was named Annex A. In some of the documents of Table A–2 the references to CCS TSI Annex A shall be read as CCS TSI Appendix A.

4.2.4 l	93, 94, 95, 99
4.2.4 m	93, 94, 95
4.2.4 n	96
4.2.4 o	97
4.2.5	
4.2.5 a	64, 65
4.2.5 b	10a, 10b, 10d, 34, 39, 40
4.2.5 c	19, 20
4.2.5 d	9, 43
4.2.5 e	16, 50
4.2.5 f	93, 94, 95
4.2.5 g	Intentionally deleted
4.2.5 h	86, 10a, 10d, 33, 34
4.2.5 i	86, 10a, 10c, 10d, 92, 94, 95
4.2.5 j	10a, 10b, 10c, 10d, 39, 40, 92, 94, 95
4.2.6	
4.2.6 a	8, 25, 26, 36 c, 49, 52
4.2.6 b	29, 45
4.2.6 c	46
4.2.6 d	10a,10b, 10d, 34
4.2.6 e	10a, 20
4.2.6 f	Intentionally deleted
4.2.6 g	92, 10a, 10b, 10c, 10d
4.2.6 h	87, 89
4.2.6 i	90
4.2.6 j	10a, 10d, 34
4.2.6 k	92, 10a, 10c, 10d
4.2.6 l	92, 93, 99, 94, 95
4.2.7	
4.2.7 a	12
4.2.7 b	63
4.2.7 c	34, 10a, 10b, 10d
4.2.7 d	9
4.2.7 e	16
4.2.7 f	92, 10a, 10b, 10c, 10d
4.2.7 g	34, 10a, 10d
4.2.7 h	92, 10a, 10c, 10d

4.2.8	
4.2.8 a	10d, 11, 79, 83
4.2.9	
4.2.9 a	23
4.2.10	
4.2.10 a	77 (point 3.1)
4.2.11	
4.2.11 a	77 (point 3.2)
4.2.12	
4.2.12 a	6
4.2.13	
4.2.13 a	32, 33
4.2.13 b	93, 94
4.2.14	
4.2.14 a	5
4.2.15	
4.2.15 a	38
4.2.15 b	101
4.2.17	
4.2.17 a	103
4.2.18	
4.2.18 a	84, 85
4.2.18 b	98
4.2.18 c	88
4.2.18 d	87
4.2.19	
4.2.19 a	84, 85
4.2.19 b	98

Specifications

When a document listed in Table A 2 incorporates, by copying or by reference to, a clearly identified point of another document, this point, and only this, shall be considered a part of the document listed in Table A 2.

For the purposes of this TSI, when a document listed in Table A 2 makes a 'mandatory' or 'normative' reference to a document not listed in Table A 2, the referenced document shall always be understood as an acceptable means of compliance with basic parameters (that can be used for certification of Interoperability Constituents and Subsystems and not requiring future revisions of the TSI) and not as a mandatory specification.

Note: specifications indicated as 'Reserved' in Table A 2 are also listed as open points in Appendix F when there is a need for notification of national rules to close the corresponding open points. Reserved documents not listed as open points are intended as improvements to the system.

Table A 2

List of mandatory specifications

Index No	ETCS Baseline 4 Release 1; RMR: GSM-R Baseline 1 Maintenance Release 1 + FRMCS Baseline 0; ATO Baseline 1 Release 1			
	Reference	Name of Specification	Version	Notes
1	Intentionally deleted			
2	Intentionally deleted			
3	SUBSET-023	Glossary of Terms and Abbreviations	4.0.0	
4	SUBSET-026	System Requirements Specification	4.0.0	
5	SUBSET-027	FIS Juridical Recording	4.0.0	
6	ERA_ERTMS_015560	ETCS Driver Machine interface	4.0.0	
7	SUBSET-034	Train Interface FIS	4.0.0	
8	SUBSET-035	Specific Transmission Module FFFIS	4.0.0	
9	SUBSET-036	FFFIS for Eurobalise	4.0.0	
10a	SUBSET-037-1	EuroRadio FIS GSM-R – Part 1 [Communication layer and coordination function]	4.0.0	
10b	SUBSET-037-2	EuroRadio FIS – Part 2 [Safety layer]	4.0.0	
10c	SUBSET-037-3	EuroRadio FIS – Part 3 [FRMCS interface]	4.0.0	
10d	SUBSET-146	ERTMS End-to-End Security	4.0.0	
11	SUBSET-038	Offline key management FIS	4.0.0	
12	SUBSET-039	FIS for the RBC/RBC handover	4.0.0	
13	SUBSET-040	Dimensioning and Engineering rules	4.0.0	
14	SUBSET-041	Performance Requirements for Interoperability	4.0.0	
15	Intentionally deleted			
16	SUBSET-044	FFFIS for Euroloop	2.4.0	
17	Intentionally deleted			
18	Intentionally deleted			
19	SUBSET-047	Trackside-Trainborne FIS for Radio infill	4.0.0	
20	SUBSET-048	Trainborne FFFIS for Radio infill	3.0.0	

21	Intentionally deleted			
22	Intentionally deleted			
23	SUBSET-054	Responsibilities and rules for the assignment of values to ETCS variables	4.0.0	
24	Intentionally deleted			
25	SUBSET-056	STM FFFIS Safe time layer	3.0.0	
26	SUBSET-057	STM FFFIS Safe link layer	3.1.0	
27	SUBSET-091	Safety Requirements for the Technical Interoperability of ETCS	4.0.0	
28	Intentionally deleted			
29	SUBSET-102	Test specification for interface 'K'	2.0.0	
30	Intentionally deleted			
31	SUBSET-094	Functional requirements for an on-board reference test facility	3.1.0	
32	EIRENE FRS	GSM-R Functional requirements specification	8.1.0	Note 7
33	EIRENE SRS	GSM-R System requirements specification	16.1.0	Note 7
34	A11T6001	(MORANE) Radio Transmission FFFIS for EuroRadio	14.0.0	
35	Intentionally deleted			
36a	Intentionally deleted			
36b	Intentionally deleted			
36c	SUBSET-074-2	FFFIS STM Test cases document	4.0.0	
37a	Intentionally deleted			
37b	SUBSET-076-5-2	Test cases related to features	3.3.0	
37c	SUBSET-076-6-3	Test sequences	3.2.0	
37d	SUBSET-076-7	Scope of the test specifications	3.3.0	
37e	Intentionally deleted			
38	EN 16494	Railway applications. Requirements for ERTMS Trackside Boards	2015	
39	SUBSET-092-1	ERTMS EuroRadio Conformance Requirements	4.0.0	
40	SUBSET-092-2	ERTMS EuroRadio test cases safety layer	4.0.0	

41	Intentionally deleted			
42	Intentionally deleted			
43	SUBSET-085	Test specification for Eurobalise FFFIS	4.0.0	
44	Intentionally deleted			
45	SUBSET-101	Interface 'K' Specification	2.0.0	
46	SUBSET-100	Interface 'G' Specification	2.0.0	
47	Intentionally deleted			
48	Reserved	Test specification for mobile equipment GSM-R		Note 3
49	SUBSET-059	Performance requirements for STM	4.0.0	
50	SUBSET-103	Test specification for Euroloop	1.1.0	
51	Intentionally deleted			
52	SUBSET-058	FFFIS STM Application layer	4.0.0	
53	Intentionally deleted			
54	Intentionally deleted			
55	Intentionally deleted			
56	Intentionally deleted			
57	Intentionally deleted			
58	Intentionally deleted			
59	Intentionally deleted			
60	SUBSET-104	ETCS System Version Management	4.0.0	
61	Intentionally deleted			
62	Intentionally deleted			
63	SUBSET-098	RBC-RBC Safe Communication Interface	4.0.0	
64	EN 301 515	Global System for Mobile Communication (GSM); Requirements for GSM operation on railways	3.0.0	Note 1
65	TS 102 281	Detailed requirements for GSM operation on railways	3.1.1	Note 2
66	TS 103 169	ASCI Options for Interoperability	1.1.1	

67	(MORANE) P 38 T 9001	FFFIS for GSM-R SIM Cards	6.0.0	Note 7
68	ETSI TS 102 610	Railway Telecommunication; GSM; Usage of the UUIE for GSM operation on railways	1.3.0	
69	(MORANE) F 10 T 6002	FFFS for Confirmation of High Priority Calls	5	
70	(MORANE) F 12 T 6002	FIS for Confirmation of High Priority Calls	5	
71	(MORANE) E 10 T 6001	FFFS for Functional Addressing	4.1	
72	(MORANE) E 12 T 6001	FIS for Functional Addressing	5.1	
73	(MORANE) F 10 T6001	FFFS for Location Dependent Addressing	4	
74	(MORANE) F 12 T6001	FIS for Location Dependent Addressing	3	
75	(MORANE) F 10 T 6003	FFFS for Presentation of Functional Numbers to Called and Calling Parties	4	
76	(MORANE) F 12 T 6003	FIS for Presentation of Functional Numbers to Called and Calling Parties	4	
77	ERA/ERTMS/033281	Interfaces between CCS trackside and other subsystems	5.0	Note 6
78	Intentionally deleted			Note 5
79	SUBSET-114	KMC-ETCS Entity Off-line KM FIS	4.0.0	
80	Intentionally deleted			Note 4
81	SUBSET-119	Train Interface FFFIS	4.0.0	
82	SUBSET-120	Train Interface – Safety requirements	4.0.0	
83	SUBSET-137	On-line Key Management FFFIS	4.0.0	
84	SUBSET-125	ERTMS/ATO System Requirement Specification	1.0.0	
85	SUBSET-126	ATO-OB/ATO-TS FFFIS Application Layer	1.0.0	
86	SUBSET-148	ATO-OB/ATO-TS FFFIS Transport and Security Layers	1.0.0	
87	SUBSET-130	ATO-OB/ETCS-OB FFFIS Application Layer	1.0.0	

88	SUBSET-139	ATO OB/Rolling Stock FFFIS Application Layer	1.0.0	
89	SUBSET-143	Interface Specification Communication Layers for On-board Communication	1.0.0	
90	SUBSET-147	CCS Consist network communication Layers FFFIS	1.0.0	
91	Intentionally deleted			
92	FFFIS-7950	FRMCS FFFIS	1.0.0	Note 8
93	FU-7120	FRMCS FRS	1.0.0	Note 9
94	AT-7800	FRMCS SRS	1.0.0	Note 9
95	FIS-7970	FRMCS FIS	1.0.0	Note 8
96	Reserved	[FFFIS for FRMCS profile placeholder]		
97	Reserved	[FRMCS Test specifications placeholder]		
98	SUBSET-151	ATO-OB/ATO-TS Test Specifications	Reserved	
99	TOBA-7510	On-board FRMCS TOBA FRS	1.0.0	Note 9
100	Intentionally deleted			
101	21E089	Engineering rules for harmonised marker boards	1-	
102	13E154	ERTMS/ATO Glossary	2-	
103	TD/011REC1028	ESC/RSC technical document	Version published in ERA website	
104	SUBSET-153	Exceptions for on-board reduced envelopes of system versions	Reserved	

Note 1: The points of the specifications listed in point 2.1 of EN 301 515 which are referenced in Index 32 and Index 33 as 'MI' are mandatory.

Note 2: The change requests (CRs) listed in table 1 and 2 of TS 102 281 which affect points referenced in Index 32 and Index 33 as 'MI' are mandatory.

Note 3: Index 48 refers only to test cases for GSM-R mobile equipment. It is kept 'reserved' for the time being. When agreed in a future revision of the TSI, the catalogue of available harmonised test cases for the assessment of mobile equipment and networks, according to the steps indicated in point 6.1.2 of this TSI, will be introduced in these tables.

Note 4: The products which are on the market are already tailored to the needs of the RU related to GSM-R Driver Machine Interface and fully interoperable so there is no need for a standard in the TSI CCS.

Note 5: Information that was intended for index 78 is now incorporated in Index 27 (SUBSET-091).

Note 6: This document is ETCS, RMR and ATO baseline independent.

Note 7: Only the (MI) requirements are mandated by TSI CCS.

Note 8: These specifications, as regards to ETCS and ATO on board equipment, shall be fully implemented.

Note 9: These specifications, in their current version, as regards to FRMCS on-board equipment, are not considered complete for the purpose of tendering the on-board equipment.

Table A 3

List of standards

The application of the version of the standards listed in the table below, and their subsequent amendments when published as harmonised standard in the certification process is an appropriate means to fully comply to the risk management process as set out in Annex I to the Implementing Regulation (EU) No 402/2013, without prejudice to the points 4 and 6 of this TSI.

No	Reference	Document name and comments	Version	Note
A1	EN 50126-1	Railway applications – The specification and demonstration of reliability, availability, maintainability and safety (RAMS) – Part 1: Generic RAMS Process	2017	1
A2	EN 50128	Railway applications – Communication, signalling and processing systems – Software for railway control and protection systems	2011 +A2:2020	
A3	EN 50129	Railway applications – Communication, signalling and processing systems – Safety related electronic systems for signalling	2018 +AC:2019	1
A4	EN 50159	Railway applications – Communication, signalling and processing systems	2010 +A1:2020	1
A5	EN 50126-2	Railway Applications – The specification and demonstration of reliability, availability, maintainability and safety (RAMS) – Part 2: Systems Approach to Safety	2017	1, 2

Note 1: This standard is harmonised, see 'Commission Communication in the framework of the implementation of Directive 2008/57/EC of the European Parliament and of the Council of 17 June 2008 on the interoperability of the rail system within the Community (recast)' ([42]) and 'Commission Implementing Decision (EU) 2020/453 of 27 March 2020 on the harmonised standards for railway products drafted in support of Directive 2008/57/EC of the European Parliament and of the Council on the interoperability of the rail system within the Community' ([43]), where also published editorial corrigenda are indicated.

Note 2: To be used in combination with EN 50126-1:2017.

Table A 4

List of mandatory standards for accredited laboratories

No	Reference	Document name and comments	Version	Note
A6	ISO/IEC 17025	General requirements for the competence of testing and calibration laboratories	2017	

([42]) OJ C 282, 10.8.2018, p. 6.
([43]) OJ L 95, 30.3.2020, p. 1.

Appendix B

B1. **Changes of requirements and transition regimes for On-Board Subsystems**

Table B1.1

Transition Regime ([44]) **for CCS On-Board Subsystem**

No	TSI point(s)	TSI point(s) in previous version	Explanation on TSI change	Transition regime			
				Design phase started after TSI enters into force	Design phase started before TSI enters into force	Production phase	Vehicle in operation
CCS On-Board Error corrections							
1	Appendix A + point 7.2.10.3	No mandatory implementation of error corrections published in technical opinions	CCS Subsystems with mandatory implementation of registered error corrections for functionality ETCS up to system version 2.1 and GSM-R.	For legal releases (with maintenance of specifications) published before 1 January 2026: If one or more registered errors are identified for the area of use for which a new authorisation is required: the CCS subsystem integrated into a vehicle type shall implement the necessary error corrections at the latest 6 months after the update of the concerned interoperability constituents. *Note:* If one or more registered errors are identified for the area of use for which no new authorisation is required, the CCS subsystem integrated into a vehicle type is considered compliant with the update of the concerned interoperability constituents (as defined in Table B3).		For legal releases (with maintenance of specifications) published before 1 January 2026: If one or more registered errors are identified for the area of use: the CCS subsystem integrated into a vehicle shall implement the necessary error corrections the latest — 1 year after the update of the concerned interoperability constituents (as defined in Table B3) in the case no new authorisation is required; or — 1 year after the update of the vehicle type in the case a new authorisation is required;	

([44]) Definition of phases provided in point 7.2.4.1.1.

				For legal releases (with maintenance of specifications) published after 1 January 2026: If one or more registered errors are identified for the area of use for which a new authorisation is required: the CCS subsystem integrated into a vehicle type shall implement the full maintenance package of error corrections at the latest 6 months after the update of the concerned interoperability constituents. *Note:* If one or more registered errors are identified for the area of use for which no new authorisation is required, the CCS subsystem integrated into a vehicle type is considered compliant with the update of the concerned interoperability constituents (as defined in Table B3).		For legal releases (with maintenance of specifications) published after 1 January 2026: If one or more registered errors are identified for the area of use: the CCS subsystem integrated into a vehicle shall implement the full maintenance package of error corrections the latest — 1 year after the update of the concerned interoperability constituents (as defined in Table B3) in the case no new authorisation is required; or — 1 year after the update of the vehicle type in the case a new authorisation is required;	
ETCS On-Board implementation							
2	Points 7.4.2.1, and 7.4.3	7.4.2.1.2. and 7.4.3(2) grants exemptions for new vehicles to be equipped with ETCS	7.4.2.1.2. and point 7.4.3(2) deleted. All newly built vehicles shall be equipped with ETCS.	Directly applicable *Note:* Design phase started after TSI enters into force here relates to 'RST design phase' for vehicles without ETCS. For special vehicles applicable from 1 January 2026 with respect to 7.4.3.2.	Applicable from 1 January 2028 *Note:* Design phase started before TSI enters into force here relates to 'RST design phase' for vehicles without ETCS. For special vehicles applicable from 1 January 2030 with respect to 7.4.3.2.	Applicable from 1 January 2030 *Note:* Production phase here relates to 'RST production phase' for vehicles without ETCS.	Not applicable

3	Point 7.4.2.2	7.4.2.2 only applicable to upgrade of existing high-speed vehicles	7.4.2.2 applicable to vehicle type and/or vehicles requiring a new authorisation	Directly applicable For special vehicles applicable from 1 January 2026.	Applicable from 1 January 2028 *Note:* Remains directly applicable to high-speed vehicles according to previous CCS TSI. For special vehicles applicable from 1 January 2030.	Not applicable	Not applicable
4	Point 7.4.2.3 (3)	7.4.2.4 extension area of use: exemptions to install ETCS in point (3)	7.4.2.4 extension area of use: exemptions deleted in point (3)	Not applicable	Not applicable	Not applicable	Applicable from 1 January 2030
ETCS system versions							
5	Appendix A – 7.4.2.4.1 and 7.4.2.4.2 for envelope of legally operated ETCS system versions from 1.0 up to 2.1 inclusive.	The minimum reduced on-board envelope is the envelope up to ETCS system version 2.0.	The minimum reduced on-board envelope is the envelope up to ETCS system version 2.1.	Applicable 3 years after entry into force of the TSI	Applicable from 1 January 2030	Applicable on newly built vehicles from 1 January 2030	Not applicable

6	Appendix A – 7.4.2.4.1 and 7.4.2.4.2 for envelope of legally operated ETCS system versions from 1.0 up to 2.2 inclusive.	Not applicable	On-board implementation of notified ETCS functions from system version 2.2.	Design phase started after notification from IM and notification is done after 1 January 2025: the ETCS system version 2.2 is directly applicable.	The ETCS system version 2.2 is applicable if the design phase is not ended within the latest date between following dates: — 1 January 2030; — 5 years after the notification date from the IM.	Not applicable	Not applicable
				Design phase started before notification from IM or notification is done before 1 January 2025: the ETCS system version 2.2 is applicable if the design phase is not ended within the latest date between following dates: — 1 January 2030; — 5 years after the notification date from the IM.			

7	Appendix A – 7.4.2.4.1, 7.4.2.4.2 and 7.4.1.3 for envelope of legally operated ETCS system versions from 1.0 up to 3.0 inclusive.	Not applicable	On-board implementation of notified ETCS functions from system version 3.0 ([1]).	Not applicable. *Note:* Transition regime after entry into force of amendment ([2]): Design phase started after notification from IM and notification is done after 2 years of the CCS TSI amendment: the ETCS system version 3.0 is directly applicable.	Not applicable. *Note:* Transition regime after entry into force of CCS TSI amendment ([1]): The ETCS system version 3.0 is applicable if the design phase has not ended within the latest date between following dates: — 5 years after the CCS TSI amendment; — 5 years after the notification date from the IM	Not applicable. *Note:* Transition regime after entry into force of CCS TSI amendment ([1]): the notified ETCS system version 3.0 is mandatory when required for compatibility with the ETCS trackside implementation of ETCS TS 3.0	Not applicable. *Note:* Transition regime after entry into force of CCS TSI amendment ([2]): the notified ETCS system version 3.0 is mandatory when required for compatibility with the ETCS trackside implementation of ETCS TS 3.0
				Design phase started before notification from IM or notification is done before entry into force of CCS TSI amendment: see transition regime in column 'Design phase started before TSI set into force'.			

8	Appendix A – 7.4.2.3 (7)	Mandatory use of system version 2.0 or higher in case of extension of area of use	Legal enforcement to mandate usage of system version 2.1 or higher in case of extension of area of use only when the extending area of use is combined with a request for new authorisation	Directly applicable	Directly applicable	Not applicable	Not applicable
Former sets of specifications #2 and #3							
9	Appendix A – Table A 2	Appendix A – Table A 2 2 – Set of specification #2	The specifications in Appendix A – Table A 2 does not include ETCS system version 2.0, since the minimum reduced on-board envelope is the envelope up to ETCS system version 2.1.	Applicable 3 years after entry into force of the TSI In any case the error correction provisions in point 7.2.10 shall be respected with its corresponding transition period. No constraint shall be exported to the other subsystem.	Applicable from 1 January 2030 In any case the error correction provisions in point 7.2.10 shall be respected with its corresponding transition period. No constraint shall be exported to the other subsystem.	Applicable on newly built vehicles from 1 January 2030 In any case the error correction provisions in point 7.2.10 shall be respected with its corresponding transition period. No constraint shall be exported to the other subsystem.	Not applicable In any case the error correction provisions in point 7.2.10 shall be respected with its corresponding transition period. No constraint shall be exported to the other subsystem.

10	Appendix A – Table A 2	Appendix A – Table A 2 3 – Set of specification #3	The specifications in Appendix A – Table A 2 have the agreed error corrected version of former set #3	Applicable 3 years after entry into force of the TSI In any case the error correction provisions in point 7.2.10 shall be respected with its corresponding transition period. No constraint shall be exported to the other subsystem.	Applicable from 1 January 2030 In any case the error correction provisions in point 7.2.10 shall be respected with its corresponding transition period. No constraint shall be exported to the other subsystem.	Applicable on newly built vehicles from 1 January 2032 In any case the error correction provisions in point 7.2.10 shall be respected with its corresponding transition period. No constraint shall be exported to the other subsystem.	Not applicable In any case the error correction provisions in point 7.2.10 shall be respected with its corresponding transition period. No constraint shall be exported to the other subsystem.
CMD							
11	4.2.2 (b) – Cold Movement Detection	CMD Optional	CMD Mandatory	Directly applicable when ETCS is installed for the first time into a vehicle design.	Applicable from 1 January 2028 when ETCS is installed for the first time into a vehicle design.	Applicable on newly built vehicles placed on the market from 1 January 2030.	Not applicable
ATO On-Board Implementation							

12	4.2.18 + Point 7.2.9.2	Not applicable	ATO on-board specification and implementation requirements	Design phase started after notification from IM and notification is done after 1 January 2025: ATO on-board requirements are directly applicable. Design phase started before notification from IM or notification is done before 1 January 2025: ATO On-board requirements are applicable if the design phase is not ended within the latest date between following dates: — 1 January 2030; — 5 years after the notification date from the IM.	ATO on-board requirements are applicable if the design phase is not ended within the latest date between following dates: — 1 January 2030; — 5 years after the notification date from the IM.	Not applicable	Not applicable

CCS On-Board Modularity							
13	Index 90 + point 5.2.2.2	Not applicable	Mandatory implementation of Ethernet based platform New requirement in case of grouping of Interoperability Constituents defined in table 5.1	Applicable 2 years after entry into force of the TSI on newly developed vehicle designs requiring first authorisation	Applicable 7 years after entry into force of the TSI on newly developed vehicle designs requiring first authorisation	Not applicable	Not applicable
14	Appendix A – CCS and RST interfaces Indexes 81, 82, 88, 90	Not applicable	Mandatory implementation of on-board interfaces between CCS subsystem and RST subsystem	Applicable 2 years after entry into force of the TSI on newly developed vehicle designs requiring first authorisation	Applicable 7 years after entry into force of the TSI on newly developed vehicle designs requiring first authorisation	Not applicable	Not applicable
FRMCS On-Board implementation							

15	Point 7.3.2.2	Not applicable	FRMCS on-board implementation ([3])	Not applicable. *Note:* Transition regime after TSI amendment: Design phase started after notification from IM and notification is done after 2 years of the entry into force of CCS TSI amendment: FRMCS on-board implementation is directly applicable.	Not applicable. *Note:* Transition regime after TSI amendment: FRMCS on-board is applicable if the design phase is not ended within the latest date between following dates: — 5 years after the CCS TSI amendment; — 5 years after the notification date from the IM.	Not applicable. *Note:* The FRMCS on-board implementation is mandatory when required for compatibility with FRMCS only trackside implementation	Not applicable. *Note:* The FRMCS on-board implementation is mandatory when required for compatibility with FRMCS only trackside implementation
				Design phase started before notification from IM: see transition regime in column 'Design phase started before TSI set into force'.			

Partial fulfilment

16	Point 6.1.1.2	Points 6.1.1.3 and 6.4.3 are deleted.	With respect to 6.1.1.2 it is no longer possible to exclude mandatory functionalities, interfaces or performance except if listed in Appendix G.	3 years after the entry into force of the TSI. If partial fulfilment is used, a condition for use shall be included in their authorisation for placing on the market enforcing compliance at the next upgrade of the vehicle train protection part.	7 years after the entry into force of the TSI.	Not applicable	Not applicable
DMI indication translation							
17	Appendix E	No mandatory harmonised translation of DMI indications	Harmonised translation of DMI indications.	Directly applicable	7 years after the entry into force of the TSI.	Not applicable	Not applicable

(1) *Note:* If the Member State has agreed with the stakeholders to implement the new ETCS system version 3.0 (see clause 7.4.4), the IM shall notify the dates when the ETCS on-board system version 3.0 shall be a mandatory on-board requirement according to clause 7.4.1.3. All vehicles using these lines shall need to implement the ETCS on-board system version 3.0.

(2) This concerns CCS TSI new legal release with full FRMCS and DAC readiness specifications.

(3) *Note:* If the Member State has agreed with the stakeholders to implement FRMCS (see clause 7.4.4), the IM shall notify the dates when the FRMCS on-board system shall be a mandatory on-board requirement according to clause 7.3.1. All vehicles using these lines shall need to implement the FRMCS on-board system.

Table B1.2

Transition Regime ([45]) for RST Subsystem

No	TSI point(s)	TSI point(s) in previous version	Explanation on TSI change	Transition regime			
				Design phase started after TSI enters into force	Design phase started before TSI enters into force	Production phase	Vehicle in operation
1	Index 77	V4 – Frequency management not fully defined for the vehicle	V5 – Frequency management fully defined for the vehicle	Directly applicable with the exception of point 3.2.2. This point is applicable 2 years after the entry into force of the TSI on newly developed vehicle designs requiring a first authorisation as defined in Article 14 point 1(a) of Commission Implementing Regulation (EU) 2018/545; Applicable 7 years after the entry into force of the TSI on modified vehicles designs requiring a new authorisation as defined in Article 14 point 1(d) of Commission Implementing Regulation (EU) 2018/545;	Applicable 7 years after the entry into force of the TSI	Not applicable	Not applicable

([45]) Definition of phases provided in point 7.2.4.1.1.

B2. **Changes of requirements and transition regimes for CCS Trackside Subsystem**

Table B2

Transition regime for CCS Trackside Subsystem

No	TSI point(s)	TSI point(s) in previous version	Explanation on TSI change	Transition Regime
CCS Trackside Error Corrections				
1	Appendix A + Points 7.4.1.2 and 7.2.10.3	Set 1, 2 and 3 of specifications without error corrections	Table A2 includes the maintenance of the functions into 1 set of specifications.	CCS Trackside Subsystems, which are in advanced stage of development or in operation, shall implement the identified set of corrections for the unacceptable errors as described in point 7.2.10.1 within: — 2 years after the publication of the IM decision in the case no new authorisation is required; — 2 years and 6 months after the publication of the IM decision in the case a new authorisation is required. CCS Trackside Subsystems placed into service after the entry into force of this TSI, which are not in advanced stage of development, shall directly comply with the maintained set of specifications of this TSI.
CCS Trackside Enhancements				
2	ETCS: Appendix A; + point 7.4.1.3	Not applicable	New ETCS functions from system version 2.2 to 3.0	If implemented (optional trackside function), directly applicable for ETCS equipped lines
3	ETCS: Appendix A; Table A.2 – Index 38, 101	Marker-board definition based on 06E068	EN 16494 and engineering rules for harmonised marker boards	Directly applicable if: — Marker Boards are installed for the first time in a line being equipped with ERTMS (which are not in advanced stage of development), even when a Class B system is also installed at the same time; or — Marker Boards are installed during renewal or upgrading (which are not in advanced stage of development) of the infrastructure subsystem in a line equipped with ERTMS. Detailed provisions for applicable requirements for fitting the harmonised Marker Boards are stated in the Appendix A – Table A.2 – Index 101 document.

4	4.2.19	No specifications	ATO Trackside Implementation	If implemented (optional trackside function), directly applicable for ATO GoA1/2 implementation on ETCS equipped lines.
5	FRMCS radio system	No specifications	New set of FRMCS specifications	If implemented (optional trackside function), directly applicable for FRMCS projects when FRMCS specifications are completed and published with an amendment of this CCS TSI.
			Partial fulfilment	
6	Not applicable	Points 6.1.1.3 and 6.4.3 are deleted.	When implemented, all functions, performance and interfaces or performance shall comply with the Chapter 4 (including the specifications referred to in Appendix A).	7 years after the entry into force of the TSI.
Former set of specifications set #1, #2 and #3				
7	Appendix A — Table A 2	Appendix A – Table A 2 1 – Set of specification #1, Table A 2 2 – Set of specification #2 Table A 2 3 – Set of specification #3	Table A 2 includes the maintenance of the functions into 1 set of specifications.	Requirements and deadlines defined in point 7.4.1.2.

B3. **Changes of Interoperability Constituent requirements and transition regimes for CCS Subsystem**

Table B3

Transition regime for CCS Interoperability Constituents

According to point 7.2.4.3 Interoperability constituents transition periods defined for CCS Subsystems are applicable for the Interoperability Constituents unless specified in this table.

No	TSI point(s)	TSI point(s) in previous version	Explanation on TSI change	Transition Regime
1	Appendix A + point 4.2.20.1 + point 7.2.10.2	Technical opinions on Art. 10 errors are not legally binding	Implementation of error corrections into ERTMS on-board Interoperability Constituents for existing CCS subsystems for functionality ETCS up to system version 2.1 and GSM-R.	If one or more registered errors are identified for the area of use specified in the authorisation of the vehicle: (a) for legal releases (with error correction specifications) published before 1 January 2026: ERTMS on-board Interoperability Constituents integrated into a vehicle shall implement the necessary error corrections within the area of use specified in the authorisation, the latest 18 months after the publication of the IM-decision; (b) for legal releases (with error correction specifications) published after 1 January 2026 onwards: ERTMS on-board Interoperability Constituents integrated into a vehicle shall comply with the maintained set of specifications of this TSI 18 months after the publication of the IM-decision. This transition regime can be handled flexibly in agreement with the applicant for the EC verification of the on-board subsystem and the railway undertaking as long as the overall transition regime (as per Table B1.1 plus as per Table B3) is met. *Note:* If no errors are registered for the concerned area of use, error corrections will be mandatory implemented according to the transition regime linked to the point of partial fulfilment.

2	Appendix A + point 4.2.20.1 + point 7.2.10.2	Technical opinions on Art. 10 errors are not legally binding	Implementation of error corrections into ERTMS Trackside Interoperability Constituents for new CCS trackside projects for functionality, ETCS up to system version 2.1 and GSM-R.	ERTMS Trackside Interoperability Constituents, integrated into a CCS Trackside Subsystem for which the project is not in advanced stage of development, shall directly comply with the maintained set of specifications of this TSI.
3	Appendix A + point 4.2.20.1 + point 7.2.10.2	Technical opinions on Art. 10 errors are not legally binding	Implementation of error corrections into ERTMS Trackside Interoperability Constituents for existing CCS trackside projects (i.e. trackside subsystem in advanced stage of deployment or in operations)	ERTMS Trackside Interoperability Constituents, integrated into a CCS Trackside Subsystem for which the project is in advanced stage of development or being integrated in a CCS Trackside Subsystem in operation, shall implement the identified set of corrections for the unacceptable trackside errors for the area of use specified in the authorisation within 18 months year after the publication of the IM-decision.
4	Appendix A, Table A.2 Index 90, 92 + 5.2.2.2	N/A	Implementation of Ethernet based communication for integration with ATO On-Board IC and FRMCS On-Board IC	New ETCS On-Board Interoperability Constituents placed on the market within 2 years after entry into force of the TSI shall implement the Ethernet based connections required for ATO and FRMCS interfacing as specified in Index 90 (points 3.1.1.2 and 3.1.1.3) and as specified in Index 92 (point 7.2)

Appendix C

In this appendix the templates for the different ESC/RSC (Interoperability Constituent) Statement are provided.

Appendix C.1: ESC Statement template

TEMPLATE FOR ETCS SYSTEM COMPATIBILITY STATEMENT

ETCS SYSTEM COMPATIBILITY STATEMENT

ETCS System Compatibility Statement document *[Document number]* ([46])

We, Applicant:

[Business name]

[Complete postal Address]

Declare under our sole responsibility that the following subsystem ([47]):

[Name/short description of the subsystem, relevant configuration, unique identification of the subsystem]

to which this statement refers has been subject to the relevant verifications that corresponds to the following ESC Type(s):

[Reference to: ESC Type Identifiers as published in the Agency Technical Document]

has been assessed by the following Notified body:

[Business name]

[Registration number]

[Full address]

In accordance with the following report(s):

[Report(s) number(s), date(s) of issue]

The following conditions of use and other restrictions apply ([48]) ([49]):

[Reference to document with the list of conditions of use and other restrictions]

The following ESC Interoperability Constituent Statements has been considered:

[Indicate use of ESC Interoperability Constituent Statements]

Reference to former ETCS System Compatibility Statement (where applicable)

[Yes/No]

Done on:

[date DD/MM/YYYY]

Signature of Applicant:

[First Name, Surname]

([46]) The information in square brackets [ ] is provided to support the user in correctly and exhaustively compiling the template.
([47]) The description of the subsystem shall enable unique identification and allow for traceability.
([48]) When a reference to a list of conditions of use and other restrictions is made, such list shall be accessible to the authorising entity.
([49]) Template for restrictions and added functionality in the CCS TSI Appendix D shall be used.

Appendix C.2: ESC Interoperability Constituent Statement template

TEMPLATE FOR ESC STATEMENT FOR INTEROPERABILITY CONSTITUENT

ESC STATEMENT FOR INTEROPERABILITY CONSTITUENT

ETCS System Compatibility Statement document for the Interoperability Constituent *[Document number]* ([50])

We, Applicant:

[Business name]

[Complete postal Address]

Declare under our sole responsibility that the following Interoperability Constituent ([51]):

[Name/short description of the interoperability constituent, relevant configuration, unique identification of the interoperability constituent]

to which this statement refers has been subject to the relevant verifications that corresponds to the following ESC Type(s):

[Reference to: ESC Type Identifiers as published in the Agency Technical Document]

has been assessed by the following Notified body:

[Business name]

[Registration number]

[Full address]

In accordance with the following report(s):

[Report(s) number(s), date(s) of issue]

The following conditions of use and other restrictions apply ([52]) ([53]):

[Reference to document with the list of conditions of use and other restrictions]

Reference to former ETCS Interoperability Constituent System Compatibility Statement (where applicable)

[Yes/No]

Done on:

[date DD/MM/YYYY]

Signature of Applicant:

[First Name, Surname]

([50]) The information in square brackets [ ] is provided to support the user in correctly and exhaustively compiling the template.
([51]) The description of the interoperability constituent shall enable unique identification and allow for traceability.
([52]) When a reference to a list of conditions of use and other restrictions is made, such list shall be accessible to the authorising entity.
([53]) Template for restrictions and added functionality in the CCS TSI Appendix D shall be used.

Appendix C.3: RSC Statement template

TEMPLATE FOR RADIO SYSTEM COMPATIBILITY STATEMENT

RADIO SYSTEM COMPATIBILITY STATEMENT

Radio System Compatibility Statement document *[Document number]* ([54])

We, Applicant:

[Business name]

[Complete postal Address]

Declare under our sole responsibility that the following subsystem ([55]):

[Name/short description of the subsystem, relevant configuration, unique identification of the subsystem]

to which this statement refers has been subject to the relevant verifications that corresponds to the following RSC Type(s):

[Reference to: RSC Type Identifiers as published in the Agency Technical Document]

has been assessed by the following Notified body:

[Business name]

[Registration number]

[Full address]

In accordance with the following report(s):

[Report(s) number(s), date(s) of issue]

The following conditions of use and other restrictions apply ([56]) ([57]):

[Reference to document with the list of conditions of use and other restrictions]

The following RSC Interoperability Constituent Statements has been considered:

[Indicate use of RSC Interoperability Constituent Statements]

Reference to former Radio System Compatibility Statement (where applicable)

[Yes/No]

Done on:

[date DD/MM/YYYY]

Signature of Applicant:

[First Name, Surname]

([54]) The information in square brackets [ ] is provided to support the user in correctly and exhaustively compiling the template.
([55]) The description of the subsystem shall enable unique identification and allow for traceability.
([56]) When a reference to a list of conditions of use and other restrictions is made, such list shall be accessible to the authorising entity.
([57]) Template for restrictions and added functionality in the CCS TSI Appendix D shall be used.

Appendix C.4: RSC Statement for Interoperability Constituent template

TEMPLATE FOR RSC STATEMENT FOR INTEROPERABILITY CONSTITUENT

RSC STATEMENT FOR INTEROPERABILITY CONSTITUENT

Radio System Compatibility Statement document for the Interoperability Constituent *[Document number]* ([58])

We, Applicant:

[Business name]

[Complete postal Address]

Declare under our sole responsibility that the following Interoperability Constituent ([59]):

[Name/short description of the interoperability constituent, relevant configuration, unique identification of the interoperability constituent]

to which this statement refers has been subject to the relevant verifications that corresponds to the following RSC Type(s):

[Reference to: RSC Type Identifiers as published in the Agency Technical Document]

has been assessed by the following Notified body:

[Business name]

[Registration number]

[Full address]

In accordance with the following report(s):

[Report(s) number(s), date(s) of issue]

The following conditions of use and other restrictions apply ([60]) ([61]):

[Reference to document with the list of conditions of use and other restrictions]

Reference to former Radio Interoperability Constituent System Compatibility Statement (where applicable)

[Yes/No]

Done on:

[date DD/MM/YYYY]

Signature of Applicant:

[First Name, Surname]

([58]) The information in square brackets [ ] is provided to support the user in correctly and exhaustively compiling the template.
([59]) The description of the interoperability constituent shall enable unique identification and allow for traceability.
([60]) When a reference to a list of conditions of use and other restrictions is made, such list shall be accessible to the authorising entity.
([61]) Template for restrictions and added functionality in the CCS TSI Appendix D shall be used.

Appendix C.5: Combined ESC/RSC Statement template

TEMPLATE FOR ETCS AND RADIO SYSTEM COMPATIBILITY STATEMENT

ETCS AND RADIO SYSTEM COMPATIBILITY STATEMENT

ETCS and RSC System Compatibility Statement document *[Document number]* ([62])

We, Applicant:

[Business name]

[Complete postal Address]

Declare under our sole responsibility that the following subsystem ([2]) ([63]):

[Name/short description of the subsystem, relevant configuration, unique identification of the subsystem]

to which this statement refers has been subject to the relevant verifications that corresponds to the following ESC and RSC Types:

[Reference to: ESC Type and RSC Type identifiers as published in the Agency Technical Document]

has been assessed by the following Notified body:

[Business name]

[Registration number]

[Full address]

In accordance with the following report(s):

[Report(s) number(s), date(s) of issue]

The following conditions of use and other restrictions apply ([64]) ([65]):

[Reference to document with the list of conditions of use and other restrictions]

The following ESC and RSC Interoperability Constituent Statements has been considered:

[Indicate use of ESC and RSC Interoperability Constituent Statements]

Reference to former ETCS and RSC System Compatibility Statement (where applicable)

[Yes/No]

Done on:

[date DD/MM/YYYY]

Signature of Applicant:

[First Name, Surname]

([62]) The information in square brackets [ ] is provided to support the user in correctly and exhaustively compiling the template.
([63]) The description of the subsystem shall enable unique identification and allow for traceability.
([64]) When a reference to a list of conditions of use and other restrictions is made, such list shall be accessible to the authorising entity.
([65]) Template for restrictions and added functionality in the CCS TSI Appendix D shall be used.

Appendix C.6: Combined ESC/RSC Interoperability Constituent Statement template

TEMPLATE FOR COMBINED ESC AND RSC STATEMENT FOR INTEROPERABILITY CONSTITUENT

COMBINED ESC AND RSC STATEMENT FOR INTEROPERABILITY CONSTITUENT

ETCS and Radio System Compatibility Statement document for Interoperability Constituent *[Document number]* ([66])

We, Applicant:

[Business name]

[Complete postal Address]

Declare under our sole responsibility that the following Interoperability Constituent ([67]):

[Name/short description of the interoperability constituent, relevant configuration, unique identification of the interoperability constituent]

to which this statement refers has been subject to the relevant verifications that corresponds to the following ESC and RSC Type:

[Reference to: ESC Type and RSC Type Identifiers as published in the Agency Technical Document]

has been assessed by the following Notified body:

[Business name]

[Registration number]

[Full address]

In accordance with the following report(s):

[Report(s) number(s), date(s) of issue]

The following conditions of use and other restrictions apply ([68]) ([69]):

[Reference to document with the list of conditions of use and other restrictions]

Reference to former ESC and Radio Interoperability Constituent System Compatibility Statement (where applicable)

[Yes/No]

Done on:

[date DD/MM/YYYY]

Signature of Applicant:

[First Name, Surname]

([66]) The information in square brackets [ ] is provided to support the user in correctly and exhaustively compiling the template.
([67]) The description of the interoperability constituent shall enable unique identification and allow for traceability.
([68]) When a reference to a list of conditions of use and other restrictions is made, such list shall be accessible to the authorising entity.
([69]) Template for restrictions and added functionality in the CCS TSI Appendix D shall be used.

Appendix D

In this appendix the template for description of conditions, restrictions and added functions is provided.

The document describing the template and its use is in the Agency Web page in the ERTMS section.

Appendix E

List of harmonised text indications and messages displayed on the ETCS Driver Machine Interface

Table E1

List of harmonised text indications and messages displayed on the ETCS Driver Machine Interface

Id. Number	Text indication/message
1	Ack(nowledgement)
2	Adhesion
3	Airtight
4	ATO data
5	ATO data entry complete?
6	ATO data view
7	ATO needs data
8	ATO selector
9	Axle load category
10	Balise read error
11	BMM reaction inhibition
12	Brake percentage
13	Brightness
14	Communication error
15	Contact last RBC
16	Continue in SM
17	Data
18	Data view
19	Del(ete)
20	Driver ID
21	Emergency stop
22	End of data entry
23	Enter data
24	Enter RBC data
25	Entering FS
26	Entering OS
27	Entering SM
28	Exit Shunting
29	Exit SM

30	Initiate SM
31	Language
32	Length (m)
33	Level
34	Level crossing not protected
35	Loading gauge
36	Main
37	Maintain Shunting
38	Max(imum) speed
39	NL no longer permitted
40	No
41	No MA received at level transition
42	No track description
43	Non slippery rail
44	Non-Leading
45	Odometer impaired
46	On
47	Operated system version
48	Out of GC
49	Override
50	PT distance exceeded
51	Radio data
52	Radio network ID
53	Radio network registration failed
54	RBC data
55	RBC data entry complete?
56	RBC ID
57	RBC phone number
58	Revoke BMM reaction inhibition
59	Remove VBC
60	Remove VBC entry complete?
61	Route unsuitable – axle load category
62	Route unsuitable – loading gauge
63	Route unsuitable – traction system
64	Runaway movement

65	RV distance exceeded
66	Safe consist length no longer available
67	Select type
68	Set VBC
69	Set VBC entry complete?
70	Settings
71	SH refused
72	SH request failed
73	SH stop order
74	Shunting
75	Slippery rail
76	SM refused
77	SM request failed
78	Spec(ial)
79	Specific data entry selection
80	SR distance exceeded
81	SR speed/distance
82	SR speed/distance entry complete?
83	SR stop order
84	Stand-by
85	Start
86	System version
87	Trackside malfunction
88	Trackside not compatible
89	Train category
90	Train data
91	Train data changed
92	Train data entry complete?
93	Train integrity
94	Train is rejected
95	Train running number
96	Train type
97	Unauthorized passing of EOA/LOA
98	Use short number

99	Validate ATO data
100	Validate [name of NTC] data
101	Validate remove VBC
102	Validate set VBC
103	Validate train data
104	VBC[n] set code
105	VBC code
106	Volume
107	Yes
108	[name of NTC] brake demand
109	[name of NTC] data entry complete?
110	[name of NTC] failed
111	[name of NTC] is not available
112	[name of NTC] needs data

Appendix F ([70])

Open Points

Open Point	Notes
Reliability/availability requirements	Frequent occurrences of degraded situations caused by failures of control-command and signalling equipment will decrease the system safety. See point 4.2.1.2

([70]) In former versions of the TSI this was named Annex G. References to CCS TSI Annex G shall be read as CCS TSI Appendix F.

Appendix G

Partial Fulfilment

Notwithstanding the options allowed in this TSI, e.g. under point 7.3.2 or in subset 34, it is possible to deviate from this TSI provided that compliance with provisions of point 6.1.1.2 and the deviation fulfils one of the categories below and limited to the defined cases in the table underneath:

(1) Functions requiring upgrades of existing installations which would compromise the economic viability of a project regarding upgrades of already authorized hardware installed in the vehicles.

(2) Functions included in system version 2.2 and 3.0 temporarily not implemented as long as the missing functions are not required for the intended area of use – provided such functions would be implemented at the earlier of the following conditions:

(a) If implementation of the missing function does not require authorization: at the next occasion when error correction is mandatory by virtue of table B1.1 row 1 and in any case not before 1.1.2026.

(b) If implementation of the missing function requires authorization: at the next reauthorisation resulting from another change to the vehicle train protection (ETCS) system.

(c) At the next upgrade to a higher system version of the ETCS train protection part.

Until the implementation of full functionalities of system versions 2.2 and 3.0 these vehicles shall be declared as system version 2.1 and 2.2 respectively.

(3) Subset 34 options at interoperability constituent level: if functionally relevant to exclude certain signals or functions

Partial fulfilment of TSI Requirement	Conditions and mitigation measures	Scope of application of partial fulfilment
SUBSET-091: safety requirements leading to DMI SIL 2 may not be implemented.	The associated hazards linked to the safety requirements leading to DMI SIL 2 shall be mitigated by appropriate measures.	Only allowed in case of upgrading an existing ETCS part (with DMI SIL 0).
Some new functionalities included in this TSI are excluded from the on-board envelopes up to 2.1 and 2.2. These reduced envelopes will be specified in SUBSET-153.	*Note:* Individual CR solutions which are excluded are published on the ERA website to temporarily develop the on-board envelopes up to 2.1 and up to 2.2. After the publication of the SUBSET-153, the vehicle shall update its products if not compliant to the consolidated specifications according to the transition clause on partial fulfilment listed in Table B.1.	The following on-board functionalities impacting the ETCS on-board system version are excluded in the reduced on-board envelope up to 2.1: CR968;CR988; CR1238;CR1244; CR1302; CR1344;CR1346;CR1350; CR1359;CR1363;CR1367; CR1374; CR1375;CR1379; CR1397. The following on-board functionalities impacting the ETCS on-board system version are excluded in the reduced on-board envelope up to 2.2: CR968;CR988; CR1244;CR1302; CR1344; CR1346;CR1350;CR1359; CR1363;CR1367;CR1374; CR1375; CR1379;CR1397.

Subset 34: options available at subsystem level are also available at interoperability constituent level.	The functionality will not be required for the fully interoperable operations of the vehicle.	Interoperability constituents are not required to include functionalities related to electrical traction if these interoperability constituents are designed for vehicles equipped with catenary independent engines.

Appendix H

In this appendix the template for the National Implementation Plan is provided.

ISSUANCE YEAR

NATIONAL IMPLEMENTATION PLAN

[MEMBER STATE]

Table of contents

Page

1. GENERAL MIGRATION STRATEGY INTRODUCTION ... 522
2. GENERAL CONTEXT DESCRIPTION OF THE CURRENT STATUS ... 522
   2.1. **Context description of the Class A systems, ATO and train detection part** ... 522
      2.1.1. *Current status of deployment for Class A systems, ATO and train detection part* ... 522
      2.1.2. *Benefit for capacity, safety, reliability and performance aspects* ... 531
      2.1.3. *Current mandatory onboard requirements* ... 531
      2.1.4. *Current status of deployment for on-board CCS subsystems.* ... 532
      2.1.4. *information on the ESC/RSC Type linked with lines and activities for trackside/on-board integration.* ... 532
      2.1.6. *Information on cross-border lines* ... 532
      2.1.7. *Information on nodes* ... 532
   2.2. **Context description of Class B systems** ... 532
      2.2.1. *Current status for Class B systems* ... 533
      2.2.2. *Measures taken to ensure open market conditions* ... 537
3. TECHNICAL MIGRATION STRATEGY ... 537
   3.1. **Technical migration strategy for ETCS part** ... 537
      3.1.1. *Baseline and levels update strategy* ... 539
   3.2. **Technical migration strategy for Radio part** ... 540
   3.3. **Technical migration strategy for ATO part** ... 544
   3.4. **Technical migration strategy for Train Detection part** ... 546
   3.5. **Migration strategy of specific cases** ... 548
   3.6. **Technical migration strategy for on-board CCS subsystems** ... 548
4. TRACKSIDE AND ON-BOARD FINANCIAL INFORMATION ... 548
5. PLANNING ... 548
   5.1. **Planning for train protection part** ... 548
      5.1.1. *Dates when ETCS is placed in service* ... 548
      5.1.2. *Decommissioning of Class B train protection systems* ... 548
      5.1.3. *Information on cross-border lines* ... 549
      5.1.4. *Information on nodes* ... 549
   5.2. **Planning for radio part** ... 549
      5.2.1. *Dates when GSM-R is placed in service* ... 549
      5.2.2. *Decommissioning of Class B radio systems* ... 550
      5.2.3. *Dates when FRMCS is placed in service* ... 551

5.2.4. *Decommissioning of GSM-R* 551

5.2.5. *Information on cross-border lines* 552

5.2.6. *Information on nodes* 552

5.3. **Planning for ATO part** 552

5.3.1. *Information on cross-border lines* 552

5.3.2. *Information on nodes* 552

5.4. **Planning for train detection part** 552

5.4.1. *Information on cross-border lines* 553

5.4.2. *Information on nodes* 553

5.5. **Planning for on-board CCS subsystems.** 553

5.5.1. *Information on cross-border vehicles* 553

6. NEW MANDATORY ON-BOARD REQUIREMENTS 553

1. GENERAL MIGRATION STRATEGY INTRODUCTION

[This section is open for the Member State to describe the general strategy for the deployment.]

2. GENERAL CONTEXT DESCRIPTION OF THE CURRENT STATUS

2.1. **Context description of the Class A systems, ATO and train detection part**

2.1.1. *Current status of deployment for Class A systems, ATO and train detection part*

[This section shall include facts and figures on the current status of installed Class A (both train protection and radio), ATO and train detection systems.

This information should be provided including a map and a table of relevant information with the current deployment situation for each of the systems.

The template to be filled in to provide the information in this section is given below.]

— **Current status of deployment for Class A train protection system**

[If relevant, include here an explanatory text in relation to the current status of ETCS deployment.]

Figure 1

Current status of ETCS deployment

[Include in this gap the map that shows the current status of ETCS deployment. The map include shall clearly identified whether the ETCS is already in operation or only installed but not yet in operation.

Even if only those lines that are at least already installing ETCS are outlined on the map, the map shall show all network lines in scope of the TSI including the nodes and last mile connections. The map and its key legend shall be clearly visible.]

Table 1

Current status of ETCS deployment

ID	Line	Current status of deployment		Mandatory deadline of ETCS application	Additional information			Note
		Current status	Date when ETCS was placed in service		Length	Level(s)	Baseline and system version	
[Include here the line identification number]	*[Include here the name of the line]*	*[Include here the current status of the ETCS deployment on the line. ETCS in operation/ETCS installed]*	*[For lines with ETCS already in operation. Include here the date when ETCS was placed in service]*	*[Include here the latest deadline for equipment of the line with ETCS established by EU regulations]*	*[Include here the total length of the line]*	*[Include here the ETCS level(s) implemented]*	*[Include here the baseline and the system version of the ETCS implemented]*	*[If relevant, include here additional comments]*

— **Current status of deployment for ATO system**

[This point is only mandatory in case the ATO deployment has already started]

[If relevant, include here an explanatory text in relation to ATO deployment.]

Figure 2

Current status of ATO deployment

[Include in this gap the map that shows the current status of ATO deployment. The map include shall clearly identified whether the ATO is already in operation or only installed but not yet in operation. *Even if only those lines that are at least already installing ATO are outlined on the map, the map shall show all network lines in scope of the TSI including the nodes and last mile connections. The map and its key legend shall be clearly visible.]*

Table 2

Current status of ATO deployment

ID	Line	Current status of ATO deployment		Additional information			Note
		Current status	Date when ATO was placed in service	Length	Baseline	Other relevant aspects for ATO deployments (For example GoA)	
[Include here the line identification number]	*[Include here the name of the line]*	*[Include here the current status of the ATO deployment on the line. ATO in operation/ATO installed]*	*[For lines with ATO already in operation. Include here the date when ATO was placed in service]*	*[Include here the total length of the line]*	*[Include here the baseline of the ATO implemented]*	*[Include here …]*	*[If relevant, include here additional comments]*

— **Current status of deployment for Class A radio system**

[If relevant, include here an explanatory text in relation to the current status of Class A radio system.]

Figure 3

Current status of GSM-R deployment

[Include in this gap the map that shows the current status GSM-R deployment. The map include shall clearly identified whether the GSM-R is already in service or only installed but not yet in service. *Even if only those lines that are at least already installing GSM-R are outlined on the map, the map shall show all network lines in scope of the TSI including the nodes and last mile connections. The map and its key legend shall be clearly visible.]*

Figure 4

Current status of FRMCS deployment

[Include in this gap the map that shows the current status of FRMCS deployment. The map include shall clearly identified whether the FRMCS is already in service or only installed but not yet in service. *Even if only those lines that are at least already installing FRMCS are outlined on the map, the map shall show all network lines in scope of the TSI including the nodes and last mile connections. The map and its key legend shall be clearly visible.* *Including this map is only mandatory in case the FRMCS deployment has already started.]*

Table 3

Current status of GSM-R deployment

		Current status of GSM-R deployment		Additional information			Note
ID	Line	Current status	Date when GSM-R was placed in service	Length	GSM-R voice/GSM-R data	Baseline	
[Include here the line identification number]	*[Include here the name of the line]*	*[Include here the current status of GSM-R deployment on the line. GSM-R in service/GSM-R installed*	*[For lines with GSM-R radio system already in operation. Include here the date when Class A radio system was placed in service]*	*[Include here the total length of the line]*	*[Specify here whether GSM-R voice or data is installed]*	*[Include here the baseline of the GSM-R implemented]*	*[If relevant, include here additional comments]*

Table 4

Current status of FRMCS deployment

		Current status of FRMCS deployment		Additional information			Note
ID	Line	Current status	Date when FRMCS was placed in service	Length	GSM-R condition	Baseline	
[Include here the line identification number]	*[Include here the name of the line]*	*[Include here the current status of FRMCS deployment on the line. FRMCS in service/FRMCS installed]*	*[For lines with FRMCS radio system already in operation. Include here the date when Class A radio system was placed in service]*	*[Include here the total length of the line]*	*[Specify here the condition of the line in relation to GSM-R. GSM-R in service/GSM-R not in service]*	*[Include here the baseline of the FRMCS implemented]*	*[If relevant, include here additional comments]*

[Including Table 4 Current status of FRMCS deployment is only mandatory in case the FRMCS deployment has already started.]

— **Current status of deployment for TSI compliant train detection system**

[If relevant, include here an explanatory text in relation to TSI compliant train detection deployment.]

Figure 5

Current status of TSI COMPLIANT TRAIN DETECTION deployment

[Include in this gap the map that shows the current status of TSI compliant train detection deployment. The map include shall clearly identified whether the TSI compliant train detection is already in service, only installed but not yet in service.

Even if only those lines that are at least already installing TSI compliant train detection are outlined on the map, the map shall show all network lines in scope of the TSI including the nodes and last mile connections. The map and its key legend shall be clearly visible.]

Table 5

Current status of TSI compliant train detection deployment

ID	Line	Current status of TSI compliant train detection deployment		Additional information		Note
		Current status	Date when TSI compliant train detection was placed in service	Length	*[Other relevant aspects for TSI Compliant train detection deployments]*	
[Include here the line identification number]	*[Include here the name of the line]*	*[Include here the current status of the TSI compliant train detection deployment on the line. TSI compliant train detection in service/TSI compliant train detection installed]*	*[For lines with TSI compliant train detection already in service. Include here the date when TSI compliant train detection was placed in service]*	*[Include here the total length of the line]*	*[Include here …]*	*[If relevant, include here additional comments]*

2.1.2. *Benefit for capacity, safety, reliability and performance aspects*

[This section shall include information of the benefits provided by TSI compliant Class A (both train protection and radio), ATO and train detection systems in relation to capacity, safety, reliability and performance.

For completeness, the section shall include both the method used to measure the benefits and the facts and figures of the impact.

The template to be filled in to provide the information in this section is given below.]

[Include here the description of the methods/indicators used to measure benefits in capacity, safety, reliability and performance.]

Table 6

Expected benefits in capacity, safety, reliability and performance

Benefits in:	System impact	Social impact	Stakeholder
Capacity	*[Include here the indicators of the impact in the system regarding capacity.* *For example: % driving time reduction per train, % interval time reduction…]*	*[Include here the indicators of the social impact regarding capacity.* *For example: hours of travel time in a year saved by all passengers]*	*[Include here the stakeholder expressing the need and agreements made within the MS for the expressed needs]*
Safety	*[Include here the indicators of the impact in the system regarding safety.* *For example: % decrease SPAD]*	*[Include here the indicators of the social impact regarding safety.* *For example: Reduction of number of fatalities per year]*	*[Include here the stakeholder expressing the need and agreements made within the MS for the expressed needs]*
Reliability	*[Include here the indicators of the impact in the system regarding reliability.* *For example: % reduction of train delay due to malfunctions]*	*[Include here the indicators of the social impact regarding reliability.* *For example: reduction of expected number of passengers lost hours]*	*[Include here the stakeholder expressing the need and agreements made within the MS for the expressed needs]*
Performance	*[Include here the indicators of the impact in the system regarding performance]*	*[Include here the indicators of the social impact regarding performance]*	*[Include here the stakeholder expressing the need and agreements made within the MS for the expressed needs]*
…	…	…	

[The list of benefits and impacts can be adapted depending on the analysis realized by the MS.]

2.1.3. *Current mandatory onboard requirements*

[This section shall include the current legal national reference to the CCS onboard requirements. In case these requirements differ between the different lines of the network, it has to be clearly defined which requirements are applicable in each case.

The template to be filled in to provide the information in this section is given below.]

[If relevant, include here an explanatory text in relation to the current legal national reference to the CCS onboard requirements.]

Table 7

Investment plan information

Year	Stakeholder	Action
[Include here the year when the investment will be done]	*[Include here which stakeholder(s) will realise the investment]*	*[Include here which are the action(s) foreseen with this investment]*

Table 8

Current CCS on-board requirements

Geographical scope	Legal national reference to the CCS onboard requirements
[Include here the geographical scope in which the specific requirements are currently applicable. For example: Complete network or specific lines]	*[Include here the legal reference to the CCS on-board requirements or specify here the applicable requirement]*

2.1.4. *Current status of deployment for on-board CCS subsystems*

[This section shall include facts and figures on the current status of on-board CCS subsystems based on available information.]

2.1.5. *information on the ESC/RSC Type linked with lines and activities for trackside/on-board integration*

[This section shall include the current status of the ESC/RSC types as long as they exists.]

2.1.6. *Information on cross-border lines*

[This section shall provide the current status on cross-border lines.]

2.1.7. *Information on nodes*

[This section shall provide the current status on nodes.]

2.2. **Context description of Class B systems**

[This section will not be mandatory in those Member States that have already completed Class B decommissioning.]

2.2.1. *Current status for Class B systems*

[This section shall include a context description of Class B systems current status and their economic lifetime. For completeness, it shall include at least:

— *Context description of installed Class B systems;*

— *Remaining economic lifetime of existing Class B systems.*

The information of the Class B system currently installed in each line shall be provided including a map and a table of relevant information.

The template to be filled in to provide the information in this section is given below.]

— **Current status for Class B train protection system**

[Include here explanatory text of the different Class B train protection systems currently installed and the remaining economic lifetime of each of them.]

Figure 6

Class B train protection system installed

[Include in this gap the map that shows which lines currently remain with Class B train protection system installed.

The map include shall clearly identified whether the Class B train protection system is still in operation, installed but not in operation or already being decommissioned. If there is more than one existing Class B train protection system, the map shall also identify the Class B installed in each line.

Even if only those lines that still have a Class B train protection system installed are outlined on the map, the map shall show all network lines in scope of the TSI including the nodes and last mile connections. The map and its key legend shall be clearly visible.]

Table 9

Class B train protection systems installed

ID	Line	Current status	Length	Class B train protection system installed	Note
[Include here the line identification number]	*[Include here the name of the line]*	*[Include here the current status of the Class B train protection system on the line. In operation/Installed but not in operation/Being decommissioned]*	*[Include here the total length of the line]*	*[Include here the Class B train protection system installed]*	*[If relevant, include here additional comments]*

— **Current status for Class B radio system**

[Include here explanatory text of the different Class B radio systems currently installed and the remaining economic lifetime of each of them.]

Figure 7

Class B radio systems installed

[Include in this gap the map that shows which lines currently remain with Class B radio system installed.

The map include shall clearly identified whether the Class B radio system is still in service, installed but not in service or already being decommissioned. If there is more than one existing Class B radio system, the map shall also identify the Class B installed in each line.

Even if only those lines that still have a Class B radio system installed are outlined on the map, the map shall show all network lines in scope of the TSI including the nodes and last mile connections. The map and its key legend shall be clearly visible.]

Table 10

Class B radio systems installed

ID	Line	Current status	Length	Class B radio system installed	Note
[Include here the line identification number]	*[Include here the name of the line]*	*[Include here the current status of the Class B radio system on the line. In operation/Installed but not in operation/Being decommissioned]*	*[Include here the total length of the line]*	*[Include here the Class B radio system installed]*	*[If relevant, include here additional comments]*

2.2.2. *Measures taken to ensure open market conditions*

[This section shall include the description of the measure taken to ensure open market conditions for its legacy Class B systems as set out in paragraph 7.2.3.

The template to be filled in to provide the information in this section is given below]

[Include here the specific measures taken to ensure open market conditions for the legacy Class B systems installed in the network as set out in paragraph 7.2.3. In the information provided it shall be clearly defined the specific measure for each of the Class B systems installed, i.e. at least the following information shall be included:

— *Type of Class B product and/or specifications that are openly available for integration with any ETCS onboard in existing rolling stock.*

— *Measure taken to ensure availability of the Class B product and/or specification.*

— *Confirmation of availability of functional and interface specifications. Including link to the specifications.*

— *If for technical or commercial reasons the availability cannot be ensured, specify the mitigation measures.]*

3. TECHNICAL MIGRATION STRATEGY

3.1. **Technical migration strategy for ETCS part**

[This section shall include information and planning of technical migration strategy of ETCS part, including ETCS Level and system version required per line and per network.

For completeness at least the following information shall be included:

— *Reasons for the decision on the ETCS level and system version in each line or type of line.*

— *Deployment strategy. Overlay on-board or overlay at trackside.*

— *Table which includes for each line the planning dates of deployment, ETCS level, System version, planning dates for Class B decommissioning on the line and other relevant information. The table shall provide the complete information of changes in the following 20 years.*

The lines included in this table together with the lines included in Table 1: Current status of ETCS deployment *shall cover all network lines in scope of the TSI including the nodes and last mile connections.*

The template to be filled in to provide the information in this section is given below.]

— **Description of the solution implemented**

[Include here the different solutions implemented and the specific reasons for selecting this solution for the network or for each type of line.]

— **Deployment strategy for the implementation of ETCS**

[Include here the details of the migration strategy for the implementation of ETCS. *For example: Overlay onboard or overlay at trackside, foreseen dates when ETCS only equipped vehicles operation will be allowed…]*

— **Planning for ETCS deployment and Class B decommissioning**

[If relevant, include here an explanatory text in relation to planning of ETCS deployment and Class B decommissioning.]

Table 11

Planning for ETCS deployment and Class B train protection decommissioning

ID	Line	Planning for ETCS deployment			Planning for Class B train protection decommissioning			Additional deployment information				Note
		Current status	Date when ETCS will be placed in service	Mandatory deadline of ETCS application	Dates when ETCS-only equipped vehicles are allowed to run	Dates when Class B operation is not allowed any more	Dates when Class B is taken out of service	Length	Level(s)	Baseline and system version	Type of action	
[Include here the line identification number]	*[Include here the name of the line]*	*[Include here the current status of the ETCS deployment on the line. Under construc-tion/not yet under construction]*	*[Include here the date when ETCS will be placed in service]*	*[Include here the latest deadline for equipment of the line with ETCS established by EU regulations]*	*[include when the vehicles with ETCS only are allowed to run on the line]*	*[If the line is equipped with a Class B train protection system, include here the date when Class B operation is not allowed anymore.]*	*[If not similar to the previous column, include here the date when Class B system is taken out of service]*	*[Include here the total length of the line]*	*[Include here the ETCS level(s) that will be implemented]*	*[Include here the baseline and the system version of the ETCS that will be implemented]*	*[Include here the type of ETCS action. New/rene-w/upgrade]*	*[If relevant, include here additional comments]*

3.1.1. *Baseline and levels update strategy*

[If applicable, this section shall include information and planning of technical migration strategy for ETCS Baselines, for example from Baseline 2 to Baseline 3 and/or from Level 1 to Level 2.]

3.2. **Technical migration strategy for Radio part**

[This section shall include information and planning of the technical migration strategy for Radio part, including information on radio systems (e.g radio circuit switching or packet switching, radio infill options for ETCS).

For completeness at least the following information shall be included:

— *Strategy for the introduction of GSM-R. Overlay on-board or overlay at trackside for Class A radio part introduction.*

— *Strategy for the introduction of the next generation communication system(s).*

— *Table which includes for each line the planning dates of GSM-R deployment and Class B radio part decommissioning, radio circuit switching implemented or only packet switching and other relevant information. The table shall provide the complete information of changes in the following 20 years.*

— *Table which includes for each line the planning dates of FRMCS deployment, if applicable radio infill options, planning for GSM-R decommissioning and other relevant information. The table shall provide the complete information of changes in the following 20 years.*

The lines included in these tables together with the lines included in Table 3: Current status of GSM-R deployment *and* Table 4: Current status of FRMCS deployment *shall cover all network lines in scope of the TSI including the nodes and last mile connections.*

The template to be filled in to provide the information in this section is given below.]

— **Strategy for the introduction of GSM-R**

[Include here the information of the strategy followed for the introduction of GSM-R. *For example: Migration strategy (overlay onboard or at trackside) in relation to the Class B radio part, radio circuit switching implementation or only packet switching…]*

— **Strategy for the introduction of the next generation communication system(s).**

[Include here the details of the migration strategy for the introduction of the next generation of communication systems.]

— **Planning for GSM-R deployment and Class B radio system decommissioning**

[If relevant, include here an explanatory text in relation to planning of GSM-R deployment and Class B radio part decommissioning.]

Table 12

Planning for GSM-R deployment and Class B radio part decommissioning

ID	Line	Planning for GSM-R deployment			Planning for Class B radio decommissioning		Additional information					Note
		Current status	Realization	Date when GSM-R is placed in service	Dates when Class B operation is not allowed any more	Dates when Class B is taken out of service	Length	GSM-R voice/GSM-R data	Baseline	Circuit switching/Packet switching	Type of action	
[Include here the line identification number]	*[Include here the name of the line]*	*[Include here the current status of the GSM-R deployment on the line. Under construction/not yet under construction]*	*[Include here the date when the construction started or is expected to start]*	*[Include here the date when GSM-R will be placed in service]*	*[If the line is equipped with a Class B radio system, include here the date when Class B operation is not allowed anymore]*	*[If not similar to the previous column, include here the date when Class B system is taken out of service]*	*[Include here the total length of the line]*	*[Specify here whether GSM-R voice or data is installed]*	*[Include here the baseline of the GSM-R to be implemented]*	*[Include here if radio circuit switching is implemented or only packet switching]*	*[Include here the type of Radio part action. New/renew/upgrade]*	*[If relevant, include here additional comments]*

— **Planning for FRMCS deployment and GSM-R decommissioning**

[If relevant, include here an explanatory text in relation to planning of FRMCS deployment and GSM-R decommissioning.]

Table 13

Planning for FRMCS deployment and GSM-R decommissioning

ID	Line	Planning for FRMCS deployment			Planning for GSM-R decommissioning		Additional information				Note
		Current status	Realization	Date when FRMCS is placed in service	Dates when GSM-R operation is not allowed any more	Dates when GSM-R is taken out of service	Length	Baseline	Pre-existing GSM-R condition	Type of action	
[Include here the line identification number]	*[Include here the name of the line]*	*[Include here the current status of the FRMCS deployment on the line. Under construc-tion/not yet under construction]*	*[Include here the date when the construction started or is expected to start]*	*[Include here the date when FRMCS will be placed in service]*	*[If the line is equipped with GSM-R system, include here the date when GSM-R operation is not allowed anymore]*	*[If not similar to the previous column, include here the date when GSM-R system is taken out of service]*	*[Include here the total length of the line]*	*[Include here the baseline of the FRMCS to be implemented]*	*[Specify here the condition of the line in relation to GSM-R. GSM-R in service/GSM-R will be in service before FRMCS/Pre-existing GSM-R not foreseen]*	*[Include here the type of Radio part action. New/rene-w/upgrade]*	*[If relevant, include here additional comments]*

3.3. **Technical migration strategy for ATO part**

[This section shall include information and planning of technical migration strategy of ATO part, including information on the need for deployment of ATO.

For completeness at least the following information shall be included:

— *Deployment strategy. Reason for deployment of ATO.*

— *Table which includes for each line the planning dates of ATO deployment and other relevant information. The table shall provide the complete information of changes in the following 20 years. Including this table is only mandatory if the ATO is expected to be implemented in the next 20 years.*

The template to be filled in to provide the information in this section is given below.]

— **Deployment strategy for ATO**

[Include here the details of the deployment strategy of ATO, including information on the reason for deployment.]

— **Planning for ATO deployment**

[If relevant, include here an explanatory text in relation to planning of ATO deployment.]

Table 14

Planning for ATO deployment

ID	Line	Planning for ATO deployment		Additional information			Note
		Current status	Date when ATO is placed in service	Length	Baseline	Other relevant aspects for ATO deployments (For example GoA)	
[Include here the line identification number]	*[Include here the name of the line]*	*[Include here the current status of the ATO deployment on the line. Under construction/not yet under construction]*	*[Include here the date when ATO will be placed in service]*	*[Include here the total length of the line]*	*[Include here the baseline of the ATO to be implemented]*	*[Include here …]*	*[If relevant, include here additional comments]*

3.4. **Technical migration strategy for Train Detection part**

[This section shall include information and planning of the technical migration strategy of TSI compliant train detection part.

For completeness at least the following information shall be included:

— Deployment strategy. Information on the migration to the TSI compliant train detection system.

— Table which includes for each line the planning dates of TSI compliant train detection system deployment and other relevant information. The table shall provide the complete information of changes in the following 20 years.

The template to be filled in to provide the information in this section is given below.]

— **Deployment strategy for TSI compliant train detection system**

[Include here the details of the migration strategy to the TSI compliant train detection system.]

— **Planning for TSI compliant train detection system deployment**

[If relevant, include here an explanatory text in relation to planning of the TSI compliant train detection system deployment.]

Table 15

Planning for TSI compliant train detection deployment

ID	Line	Planning for TSI compliant train detection deployment		Additional information			Note
		Current status	Date when TSI compliant train detection is placed in service	Length	Type of action	*[Other relevant aspects for TSI Compliant train detection deployments]*	
[Include here the line identification number]	*[Include here the name of the line]*	*[Include here the current status of the* TSI compliant train detection *deployment on the line. Under construction/not yet under construction]*	*[Include here the date when TSI compliant train detection will be placed in service]*	*[Include here the total length of the line]*	*[Include here the type of train detection part action. New/renew/upgrade]*	*[Include here …]*	*[If relevant, include here additional comments]*

3.5. **Migration strategy of specific cases**

[This section shall include information and planning of the technical migration strategy for specific cases state on section 7.7 of the CCS TSI.

The template to be filled in to provide the information in this section is given below.]

[Include here the details of the migration strategy of the specific cases stated on section 7.7 of CCS TSI.

It shall be clearly defined in the information provided to which specific route or networks are each specific case limited to and if applicable, the relevant dates for the migration.]

3.6. **Technical migration strategy for on-board CCS subsystems**

[This section shall include information and planning of the technical migration strategy for on-board CCS subsystems.]

4. TRACKSIDE AND ON-BOARD FINANCIAL INFORMATION

[This section shall provide information about available funds, sources of financing and necessary financial needs.]

5. PLANNING

[For all the network maps to be included in this section, the map shall provide a planning overview of changes in the next 20 years.]

5.1. **Planning for train protection part**

5.1.1. *Dates when ETCS is placed in service*

[This section shall include a network map providing an overview with dates when ETCS is placed in service.

This section is not mandatory for those Member States which have already completed the ETCS deployment in all lines in scope of the TSI including the nodes and last mile connections and do not foreseen any upgrade, renew or new line in the next 20 years.

The template to be filled in to provide the information in this section is given below.]

Figure 8

Network map. dates when ETCS is placed in service

[Include in this gap the network map providing the overview of dates when ETCS is placed in service in the next 20 years. The map include shall clearly identified the dates when ECTS is placed in service, the level and the system version.

Even if only those lines on which new, upgraded or renewed ETCS implementation of ETCS is foreseen are outlined on the map, the map shall show all network lines in scope of the TSI including the nodes and last mile connections. The map and its key legend shall be clearly visible.]

5.1.2. *Decommissioning of Class B train protection systems*

[This section shall include a network map providing an overview with dates when Class B operation is not allowed anymore. If not similar, this section shall also include a network map providing and overview with dates where Class B system is taken out of service.

This section is not mandatory for those Member States which have already completed the decommissioning of its Class B protection systems or which have never used a Class B train protection system.

The template to be filled in to provide the information in this section is given below.]

Figure 9

Network map. dates when Class B operation is not allowed anymore

[Include in this gap the network map providing the overview of dates when Class B operation is not allowed anymore in the next 20 years.

Even if only those lines on which is planned to not allow Class B operation anymore are outlined on the map, the map shall show all network lines in scope of the TSI including the nodes and last mile connections. The map and its key legend shall be clearly visible.]

Figure 10

Network map. Dates where Class B train protection system is taken out of service

[Include in this gap the network map providing the overview of dates where Class B system is taken out of service in the next 20 years.

Even if only those lines on which is planned to take out of service *Class B train protection are outlined on the map, the map shall show all network lines in scope of the TSI including the nodes and last mile connections. The map and its key legend shall be clearly visible.*

Including this map is not mandatory if similar to the previous one – Figure 9: Network map. dates when Class B operation is not allowed anymore.*]*

5.1.3. *Information on cross-border lines*

[This section shall provide detailed information on the planning on cross-border lines.]

5.1.4. *Information on nodes*

[This section shall provide detailed information on the planning on nodes.]

5.2. **Planning for radio part**

5.2.1. *Dates when GSM-R is placed in service*

[This section shall include a network map providing an overview with dates when GSM-R is placed in service.

This section is not mandatory for those Member States that have already completed the GSM-R deployment in all lines in scope of the TSI including the nodes and last mile connections.

The template to be filled in to provide the information in this section is given below.]

Figure 11

Network map. Dates when GSM-R is placed in service

[Include in this gap the network map providing an overview with dates when GSM-R is placed in service in the next 20 years. The map include shall clearly identified the dates when GSM-R is placed in service and if GSM-R voice or data is implemented.

Even if only those lines on which GSM-R implementation is foreseen are outlined on the map, the map shall show all network lines in scope of the TSI including the nodes and last mile connections. The map and its key legend shall be clearly visible.]

5.2.2. *Decommissioning of Class B radio systems*

[This section shall include a network map providing an overview with dates when Class B radio operation is not allowed anymore. If not similar, this section shall also include a network map providing and overview with dates where Class B radio system is taken out of service.

This section is not mandatory for those Member States which have already completed the decommissioning of its Class B radio systems.

The template to be filled in to provide the information in this section is given below.]

Figure 12

Network map. Dates when Class B radio operation is not allowed anymore

[Include in this gap the network map providing an overview with dates when Class B radio operation is not allowed anymore in the next 20 years.

Even if only those lines on which is planned to not allow *Class B radio operation anymore are outlined on the map, the map shall show all network lines in scope of the TSI including the nodes and last mile connections. The map and its key legend shall be clearly visible.]*

Figure 13

Network map. Dates where Class B radio system is taken out of service

[Include in this gap the network map providing and overview with dates where Class B radio system is taken out of service in the next 20 years.

Even if only those lines on which is planned to take out of service *Class B radio are outlined on the map, the map shall show all network lines in scope of the TSI including the nodes and last mile connections. The map and its key legend shall be clearly visible.*

Including this map is not mandatory if similar to the previous one – Figure 12: Network map. Dates when Class B radio operation is not allowed anymore.*]*

5.2.3. *Dates when FRMCS is placed in service*

[This section shall include a network map providing an overview with dates when FRMCS is placed in service.

This section is not mandatory for those Member States that do not foresee FRMCS implementation in the next 20 years.

The template to be filled in to provide the information in this section is given below.]

Figure 14

Network map. Dates when FRMCS is placed in service

[Include in this gap the network map providing an overview with dates when FRMCS is placed in service in the next 20 years. The map include shall clearly identified the dates when FRMCS is placed in service.
Even if only those lines on which FRMCS implementation is foreseen are outlined on the map, the map shall show all network lines in scope of the TSI including the nodes and last mile connections. The map and its key legend shall be clearly visible.]

5.2.4. *Decommissioning of GSM-R*

[This section shall include a network map providing an overview with dates when GSM-R radio operation is not allowed anymore. If not similar, this section shall also include a network map providing an overview with dates where GSM-R system is taken out of service.

This section is not mandatory for those Member States which do not foresee GSM-R decommissioning in the next 20 years.

The template to be filled in to provide the information in this section is given below.]

Figure 15

Network map. Dates when GSM-R radio operation is not allowed anymore

[Include in this gap the network map providing an overview with dates when GSM-R radio operation is not allowed anymore in the next 20 years.
Even if only those lines on which is planned to not allow *GSM-R operation anymore are outlined on the map, the map shall show all network lines in scope of the TSI including the nodes and last mile connections. The map and its key legend shall be clearly visible.]*

Figure 16

Network map. Dates where GSM-R system is taken out of service

[Include in this gap the network map providing an overview with dates where GSM-R system is taken out of service in the next 20 years.
Even if only those lines on which is planned to take out of service GSM-R *radio are outlined on the map, the map shall show all network lines in scope of the TSI including the nodes and last mile connections. The map and its key legend shall be clearly visible.*

Including this map is not mandatory if similar to the previous one – Figure 15: Network map. Dates when GSM-R radio operation is not allowed anymore.*]*

5.2.5. *Information on cross-border lines*

[This section shall provide detailed information on the planning on cross-border lines.]

5.2.6. *Information on nodes*

[This section shall provide detailed information on the planning on nodes.]

5.3. **Planning for ATO part**

[This section shall include a network map providing an overview with dates when ATO is placed in service.

This section is not mandatory for those Member States that do not foresee to put ATO into service in the next 20 years.]

The template to be filled in to provide the information in this section is given below.]

Figure 17

Network map. Dates when ATO is placed in service

[Include in this gap the network map providing an overview with dates when ATO is placed in service in the next 20 years. The map include shall clearly identified the dates when ATO is placed in service.

Even if only those lines on which ATO implementation is foreseen are outlined on the map, the map shall show all network lines in scope of the TSI including the nodes and last mile connections. The map and its key legend shall be clearly visible.]

5.3.1. *Information on cross-border lines*

[This section shall provide detailed information on the planning on cross-border lines.]

5.3.2. *Information on nodes*

[This section shall provide detailed information on the planning on nodes.]

5.4. **Planning for train detection part**

[This section shall include a network map providing an overview with dates when TSI compliant train detection system is placed in service.

The template to be filled in to provide the information in this section is given below.]

Figure 18

Network map. Dates when TSI compliant train detection system is placed in service

[Include in this gap the network map providing an overview with dates when TSI compliant train detection system is placed in service in the next 20 years. The map include shall clearly identified the dates when TSI compliant train detection system is placed in service.

Even if only those lines on which TSI compliant train detection system implementation is foreseen are outlined on the map, the map shall show all network lines in scope of the TSI including the nodes and last mile connections. The map and its key legend shall be clearly visible.]

5.4.1. *Information on cross-border lines*

[This section shall provide detailed information on the planning on cross-border lines.]

5.4.2. *Information on nodes*

[This section shall provide detailed information on the planning on nodes.]

5.5. **Planning for on-board CCS subsystems**

[This section shall include a description of the planning and dates for the installation of the on-board CCS subsystems.]

5.5.1. *Information on cross-border vehicles*

[This section is optional and should provide detailed information on the planning on cross-border vehicles.]

6. NEW MANDATORY ON-BOARD REQUIREMENTS

[This section shall include information of new mandatory onboard requirements that will be required for operating on the network, ensuring that notifications to RUs are provided at least 5 years in advance.

The template to be filled in to provide the information in this section is given below.]

[If relevant, include here an explanatory text in relation to new mandatory onboard requirements that will be required for operating on the network.]

Table 16

New mandatory on-board requirements

Geographical scope	New CCS on-board requirements	Date of application
[Include here the geographical scope in which the specific requirements will be applicable. For example: Complete network or specific lines]	*[Include here the legal reference to the new CCS on-board requirements or specify here the new CCS onboard requirements]*	*[Include here date of application of the new CCS on-board requirement. At the earliest, a 5-year period is required]*

ANNEX II

Table of contents

Page

1. INTRODUCTION 555
2. ABBREVIATIONS, ACRONYMS 555
3. CLASS B SYSTEMS 555
   3.1. **Conditions for Class B systems** 555
   3.2. **Use of this Annex** 555
   3.3. **List of Class B train protection systems** 555
   3.4. **List of Class B voice radio systems** 558

1. INTRODUCTION

This Annex contains the list of train protection and voice radio legacy systems referred in the Control-Command and Signalling TSI.

2. ABBREVIATIONS, ACRONYMS

The acronyms used as names of legacy systems are explained in the tables in sections 3.3 and 3.4.

RDD: Reference Document Database (https://rdd.era.europa.eu/RDD/).

3. CLASS B SYSTEMS

3.1. **Conditions for Class B systems**

Class B systems for the trans-European rail system network are a limited set of train protection and voice radio legacy systems that were already in use in the trans- European rail network before 20 April 2001.

Class B systems for other parts of the network of the rail system in the European Union are a limited set of train protection and voice radio legacy systems that were already in use in those part of the network before 1 July 2015.

3.2. **Use of this Annex**

This is an Annex based on information received from Member States, Norway, Switzerland and United Kingdom, and in accordance with the provisions of this TSI.

As stated in point 3.1 of the Annex I of this Regulation, 'The requirements for Class B systems are the responsibility of the relevant Member State'. Details on the technical specifications can be found in the RDD.

3.3. **List of Class B train protection systems**

Member State	Name of the legacy system ([1])	Scope	Version identification	Date of latest authorisation to placing into service
Austria	INDUSI I 60 ([2])	Whole network		
	PZB 90 ([3])	Whole network	AT/DE	
	LZB (LZB L72, LZB L72 CE I and LZB L72 CE II)	Whole network		
Belgium	Crocodile	Whole network		
	TBL 1	Whole network		
	TBL 2	Whole network		
	TVM 430	Whole network		
	TBL1+	Off-TEN only		
	KVB	Access to high speed line 1		
Bulgaria	EBICAB 700	Whole network	BU	
Croatia	INDUSI I 60 ([2])	Whole network		
Czechia	LS	Whole network		
Denmark	ZUB 123	Whole network	SW02A (version 1.37 edition 04)	2.2.2004
Estonia	ALSN	Whole network		

Finland	ATP-VR/RHK	Whole network		
France	Crocodile	Whole network		
	KVB	Whole network		
	TVM 300	High speed lines		
	TVM 430	High speed lines		
	KVBP	(sub)urban area of Paris		
	KCVP	(sub)urban area of Paris		
	KCVB	(sub)urban area of Paris		
	NEXTEO	(sub)urban area of Paris		
	DAAT	Whole network		
Germany	PZB 90	Whole network	AT/DE	
	LZB (LZB L72, LZB L72 CE I and LZB L72 CE II) ([4])	Whole network		
	GNT (Geschwindigkeitsüberwachung für NeiTech-Züge) ([5])	Whole network (routes with higher lateral acceleration for tilting trains)		
Hungary	EVM	Whole network		
Ireland	CAWS	Whole network		
	ATP	Whole network		
Italy	SCMT + RSC	Whole network		
	SCMT	Whole network		
	SSC	Off-TEN only		
Latvia	ALSN	Whole network		
Lithuania	ALSN	Whole network		
Norway ([6])	ATC ([7])	Whole network	2	1993
Poland	SHP	Whole network		
	PKP radio system with Radiostop function	Whole network		
Portugal	INDUSI I 60	Cascais line Off-TEN	PT	
	EBICAB 700 (CONVEL)	Whole network		
Romania	INDUSI I 60 ([2])	Whole network		
Slovak Republic	LS	Whole network	LS04, LS05, LS06	

Slovenia	INDUSI I 60 ([2])	All main lines and also 3 regional lines		
Spain	ASFA	Whole network		
	EBICAB 900	Mediterranean Corridor. Section 'La Encina – Barcelona Sants'	ES	
	LZB	High Speed Line 'Madrid – Sevilla/Toledo/Málaga' C5 Commuter Line (Madrid). Section 'Humanes – Mostoles el Soto'	ES	
Sweden	ATC ([7])	Whole network except Linköping-Västervik/Kisa	2	
		Linköping-Västervik/Kisa	R	
Switzerland ([6])	EuroSIGNUM ([8])	Whole network		
	EuroZUB ([6])	Whole network		
The Netherlands	ATB First generation	Whole network		
	ATB new generation	Whole network		
UK for Northern Ireland	GW ATP	limited to specific routes only		
	RETB	limited to specific routes only		
	TPWS/AWS	Whole network		
	Chiltern-ATP	limited to specific routes only		
	Mechanical Trainstops	limited to specific routes only		

([1]) The fact that two or more Member States use the same system does not imply that they are compatible: the versions shall be taken into account.
([2]) Rolling stock equipped with higher versions (eg PZB 90) is accepted.
([3]) All new authorised vehicles must be equipped with PZB 90.
([4]) Leading vehicles for operation on LZB lines have to be equipped with an onboard system which can connect at least to L72 and CE I.
([5]) GNT can only work in connection with PZB 90.
([6]) For information.
([7]) Formerly referred as 'EBICAB 700'.
([8]) Rolling stock equipped with higher versions (eg PZB 90) is accepted.

3.4. **List of Class B voice radio systems** [1]

Member State	Name of the legacy system [1]	Scope	Version identification	Date of latest authorisation to placing into service
Austria	UIC Radio Chapter 1-4+6			
Bulgaria	UIC Radio Chapter Bulgaria			
Croatia	Analogue railway radio system (RDU) – in compliance with UIC 751-3			
Czechia	SRD			
Estonia	The Estonian Railways train communication network	Whole network		
Germany	Analogue Radio Germany - in compliance with UIC 751-3 (all chapters):			
	— TGL 43886 März 1987, UKW-Verkehrsfunk-technik, Zugfunksystem	Lines of the former GDR installed before 1990		
	— functional requirement specification radio for low frequency traffic routes (Lastenheft Zugfunk auf Strecken mit einfachen betrieblichen Verhältnissen), detailed standard for an open simplex mode	Low frequency traffic routes		

[1] This list is based on the information in Commission Decision 2006/860/EC of 7 November 2006 concerning a technical specification for interoperability relating to the control-command and signalling subsystem of the trans-European high speed rail system and modifying Annex A to Decision 2006/679/EC concerning the technical specification for interoperability relating to the control-command and signalling subsystem of the trans-European conventional rail system (OJ L 342, 7.12.2006, p. 1) and in Commission Decision 2006/679/EC of 28 March 2006 concerning the technical specification for interoperability relating to the control-command and signalling subsystem of the trans-European conventional rail system (OJ L 284, 16.10.2006, p. 1).

	— functional requirement specification for dual mode user interface for digital and analogue cab radio and digital shunting radio – part 2 (Lastenheft Dualmode Bedienteil für digitalen und analogen Zugfunk digitalen Rangierfunk – Teil 2 – Funktionale Anforderungen), detailed standard for the DMI for cab radio with the function to switch between GSM-R and analogue train radio, used in the migration period	Routes not covered by the GSM-R network		
Greece	CH — Greek Railways radio system (VHF)	Whole network except Kiato-Athens airport section and Egio-Kiato (open line).		
Hungary	UIC Radio Chapter 1-4 UIC Radio Chapter 1- 4 + 6 (Irish system)			
Ireland	UIC Radio Chapter 1- 4 + 6 (Irish system)			
Italy	GSM-P	On lines not covered with GSM-R		
Latvia	LDZ radio system DMR	Whole network		
Lithuania	The Lithuanian Railways train radio system Shunting Radio Communication System	All line sections between stations in border areas Whole network (for manoeuvring)		
Poland	PKP radio system	Whole network		
Portugal	UIC Radio Chapter 1-4 (TTT radio system installed at Cascais line) TTT radio system CP_N (RSC – Rádio Solo-Comboio)	Cascais line Off TEN Whole network		

Romania	Radio Network of CFR			
Slovakia	450 Mhz UIC (Channel C) Multikom (160 MHz and 450 MHz) BOSCH (160 MHz) OMEGA (160 MHz) SRO (160 MHz)	1. Local track radio network (stations Vrutky, Presov, Plavec, Kysak) 2. Local track radio network (the area of lines Bratislava – Zilina, Bratislava – Dunajska Streda – Komarno, Trnava – Kuty) 3. Local track radio network (the area of line Nove Mesto nad Vahom – Myjava) 4. Internal radio network of ZSR (ZSR's departments in the area of Zvolen, Zilina and Trnava) 5. Track radio network SRO for local lines		
Slovenia	Analogue railway radio system called RDZ – in compliance with UIC 751-3	All main lines and 5 regional lines		
Spain	UIC Radio Chapter 1-4+6			
UK for Northern Ireland	RETB (voice)	RETB lines only		

(1) The fact that two or more Member States use the same system does not imply that they are compatible: the versions shall be taken into account.