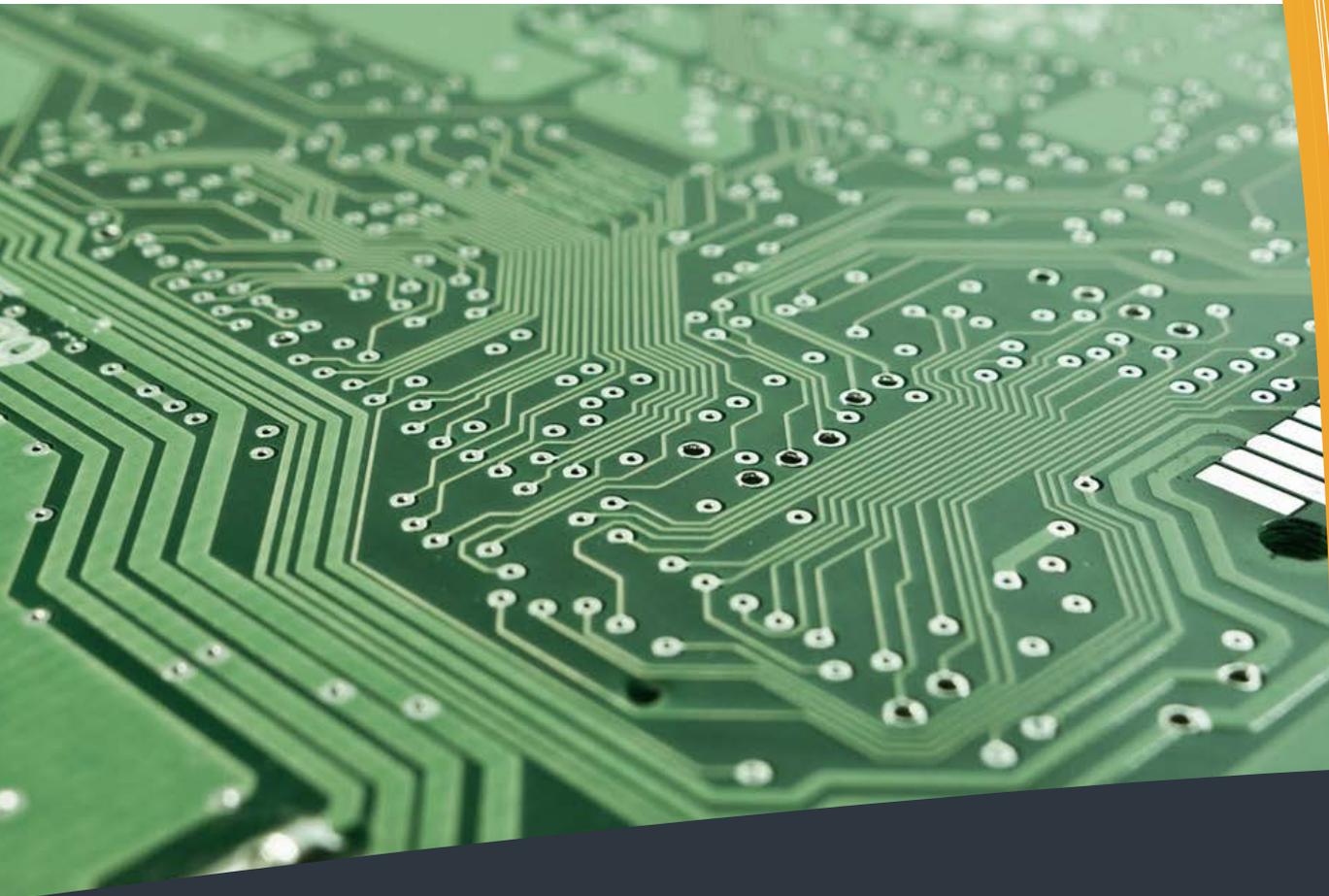


EuroSpec



Specification TCMS Data Service



SBB CFF FFS

Specification TCMS Data Service

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Version	Date	Change

1 FOREWORD

EuroSpec is a group of European train operating companies providing harmonised product specifications for use in train procurement and refurbishment.

The main target is to improve the reliability and quality of trains by using common and standardised functional and non-functional specification and verification methods.

The benefits of using EuroSpec:

- Increase of reliability by sharing good practice and experience;
- Simplification of the tender process in time and cost as a result of fewer variations in requirements between tenders;
- Standardised products and cost reduction due to harmonisation of train operators' requirements.

The EuroSpec specifications comprise merged functional and product basic requirements. All EuroSpec specifications focus on technical aspects exclusively based on the existing national requirements.

A EuroSpec specification is a voluntary specification designed to be used within the European region. The primary field of application is the European rolling stock domain and all associated interfaces.

Regarding the hierarchy this common specification can be positioned as follows, in order of prevalence:

- EN standards
- UIC/ UNIFE Technical Recommendations (TecRecs)
- UIC Codes (leaflets)
- EuroSpec Specifications
- Company Specifications

2 INTRODUCTION

This document is a voluntary specification, produced by SNCF-MOBILITES, Rail Delivery Group (RDG), Deutsche Bahn (DB), Nederlandse Spoorwegen (NS), Österreichische Bundesbahnen (ÖBB) and Schweizerische Bundesbahnen (SBB).

Individual companies may choose to mandate it through internal instructions/procedures or contract conditions.

Purpose of this document

This document provides a voluntary specification for a functional description for data service (called TCMS_DS), including a functional interface description from TCMS to non-TCMS functions for use by companies in the rail sector if they so choose.

The purpose of this document is to provide a common specification for TCMS_DS in rolling stock between train operators. This document is to replace individual company specific functional requirements and constitutes a common reference being used for tendering and verification.

Application of this document

- This specification is voluntary. Individual companies may however elect to mandate all or part of its use through company procedures or contract conditions. Where this is the case, the company concerned must specify the nature and extent of application.
- Specific compliance requirements and dates of application have therefore not been identified since these will be the subject of the internal procedures or contract conditions of those companies that choose to adopt this standard.

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3 SCOPE

This specification is applicable to rolling stock that is equipped with TCMS_DS.

It shall be possible for the operators to choose a subset of the TCMS_DS requirements depending on their train operation in order to reduce hardware costs.

This specification is an add-on to the Technical Specifications of Interoperability (TSI). In addition to this specification additional operator specific specifications might be defined. The specification contains requirements at system level of the TCMS_DS and its interfaces, and unifies the requested performances of the different operators.

This specification is not intended to block innovation or to prevent improvement. For this purpose each requirement is followed by a rationale.

If applicable, the requirements are referenced to the EN 15380 structure. It is foreseen that more requirement sets and European standards will make use of this common reference structure.

4 NORMATIVE REFERENCES

The following referenced documents are indispensable for the application of this document. ENs are developed by CEN¹ or CENELEC², UIC leaflets are developed by UIC³ and are made available from their members.

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

EN 50159	Railway applications - Communication, signalling and processing systems - Safety-related communication in transmission systems.	To cover safety and some parts of Security.
UIC 559	Specification "Diagnostic Data Transmission" from railway vehicles	To cover the diagnostic data transmission
IEC 61375-2-6	Electronic railway equipment – Train communication network (TCN) – Part 2-6: On-board to ground communication	To guarantee that the TCMS is able to send information to the ground through the Mobile Communication Gateway.
NMEA 0183	National Marine Electronics Association 0183: standard for interfacing marine electronic devices	GPS standard

¹ Comité Européen de Normalisation / European Committee for Standardization - www.cen.eu

² Comité Européen de Normalisation Électrotechnique / European Committee for Electrotechnical Standardization - www.cenelec.eu

³ Union internationale des chemins de fer / International Union of Railways - www.uic.org

5 TERMS, DEFINITIONS AND ABBREVIATIONS

ATP	Automatic Train Protection
CSM	Common Safety Methods. Defined in Directive (EU) 2016/798 of the European Parliament and of the Council of 11 May 2016 on railway safety (recast): Article 3 Definitions: (6) - 'common safety methods' (CSMs) means the methods describing the assessment of safety levels and achievement of safety targets and compliance with other safety requirements.
EN	EuroNorm
FAI	First Article Inspection
GW	GATEWAY
HMI	Human Machine Interface
HVAC	Heating, Ventilation, Air-Conditioning
HW	Hardware
IT	Information Technologies
PIS	Passengers Information System
SIL	Software or Safety Integrity Level
TCMS	Train Control and Monitoring System / Train Control and Management System
TCMS_DS	TCMS Data Service
TOC	Train Operating Company
TSI	Technical specification for Interoperability
UIC	Union Internationale des Chemins de fer
VLAN	Virtual Local Area Network
WIFI	Wireless Fidelity

For this document the following definitions apply.

TCMS

A set of train functions linked by an onboard train network containing all functions which evolutions shall be assessed by the authorities. These functions are called "safety functions" in this document. TCMS can also contain non-safety functions.

NOTE: It is assumed that this document deals with the IT architecture principles - the focus is placed on a logical view rather than a technical view.

Data Service

A means for applications to use information generated in a given environment, in a uniform way, and not depending on the application itself or its environment.

GATEWAY

A functional unit that interconnects two computer networks with different network architectures.

Functional Zones

A group of functions characterised by the same safety or/and security requirements. For a functional zone characterised by a given safety or/and security level, it is allowed to include some function characterised by a lower level of safety or/and security level, but it is forbidden to include any function characterised by a higher level of safety or/and security level.

6 GOAL OF THE DOCUMENT

During the lifetime of the rolling stock, onboard software will require bug-fixing, even when the train is in commercial service. Adjusting and updating the software often requires a new authorisation process by the national authorities, even when the updated software is not safety relevant. This authorisation process takes time, effort and requires a certain budget.

For this purpose this document specifies the principles used to completely control the communication between the TCMS and the rest of the train (see Figure 1 for the principle). The concept is detailed in the following paragraphs.

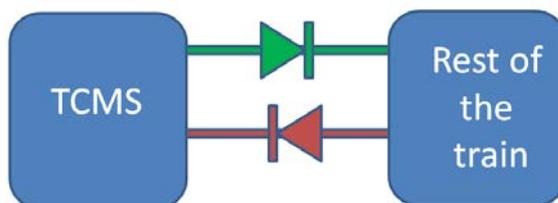


Figure 1: Principles of communication control between TCMS and the Rest of the train

A way to optimise the functional design of this communication is to prevent non-safety functions having an impact on this authorisation process. A concrete solution is to introduce the concepts of functional zones, GATEWAY and TCMS_DS.

Using Data Service is a principle to make information available to all the functions needing it. The Data Service can allow for the exchange of information inside one given functional zone or between two functional zones. It also permits:

- Increasing availability of a function by using a different source of information
- Better definition of the interface between the functional zones by using clear separation of dataflow
- Better control of the interface leading to better control of its IT Security
- Project specific distribution of the functions among the functional zones
- To allow or disallow the exchange of information between two functional zones.

The following figures describe the concept of functional zones, an example of its implementation and possible solutions of separation of the functional zones.

Figure 2 shows the different functional zones:

- Customer functional zone (non-safety functions) - green
- Operator functional zone (non-safety functions) - blue
- TCMS functional zone (safety functions and can include non-safety functions). It can contain non-safety functions up to the customer functional zone.

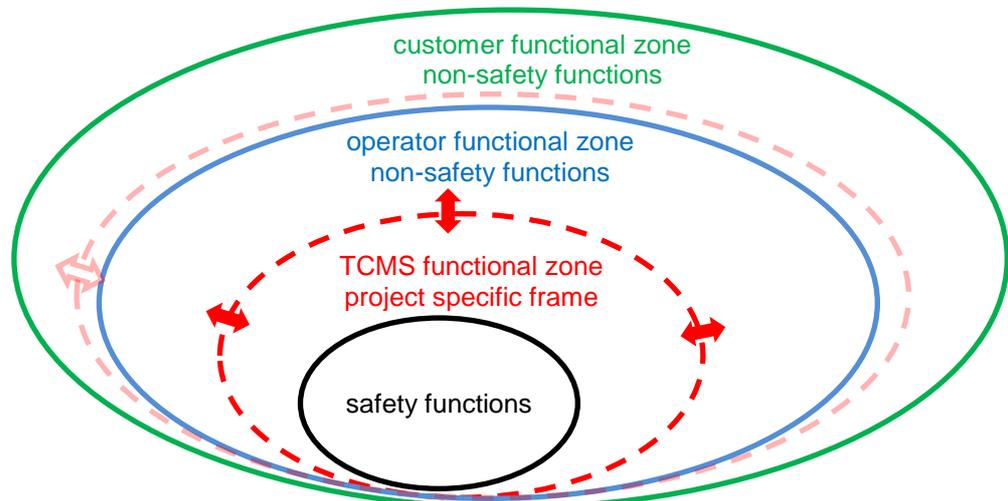


Figure 2: Concept of functional zones

NOTE to Figure 2: This figure does neither imply that the TCMS is a subset of operator functions nor that the operator functions are a subset of customer functions.

Figure 3 shows an example of an architecture using these concepts.

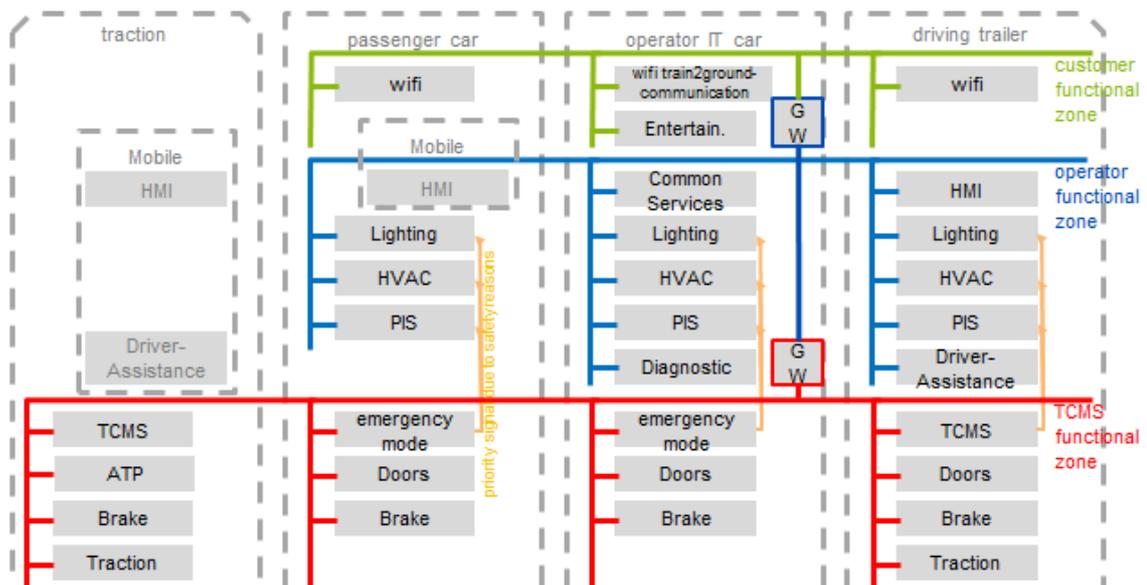


Figure 3: Example of implementation

Figure 4 below shows the link between the implementations described above and the type of separation achieved.

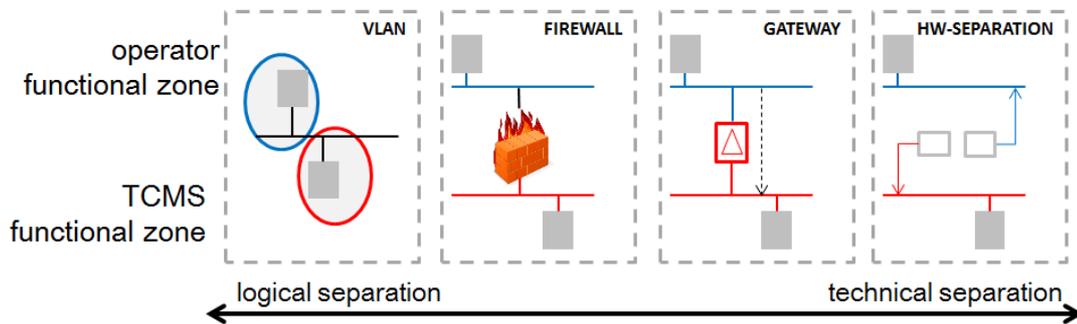


Figure 4: Overview of some separation solutions

The functional zone containing safety functions needs to be separated from the functional zone containing non-safety functions. There are at least four possible implementations:

- Logical GATEWAY implementation: Functions are physically connected to the same network, but separated functional zones are created by communicating with each other via logical/virtual connections (e.g. VLANs);
- Firewall GATEWAY implementation: A firewall is used to connect two different networks/ functional zones. Functions from different functional zones communicate with each other through this firewall which has a set of communication rules implemented;
- Unidirectional GATEWAY implementation (named GATEWAY in the document): Networks/ functional zones are connected, however, direct (digital) communication between functions from different functional zones is only allowed in one direction. In this case the GATEWAY acts as a diode. If for some reason communication is required in the other direction, this has to be performed hard-wired;
- Hardware Separation implementation: Networks/zones are not connected to each other at all, so no information exchange is possible at all. Each functional zone has to take care of its own information needs (e.g. if PIS and TCMS need the speed signal, then it has to be generated or distributed twice).

7 SPECIFICATIONS

This chapter describes the requirements and their objectives. For several requirements verifications are included. Verification describes how compliance to the requirement will be verified.

The columns of the specification are subsequent defined:

ID

Unique Identification of the requirement

Requirement classification

Importance and legal status of the requirement to the project. To differentiate between the requirements with regard to relevance and legal status like Requirement (RE - mandatory), Design Recommendation (DR), Optional Requirement (OR), or Information (INFO).

Requirement-text

Description of the requirement

Rationale

Reason to state the requirement

Status

Indication of the approval state of the requirement. To describe a defined status of a requirement in a standard database or requirement maturity level during a project

Change since last release

Description of the modifications that have been made to one or more attributes of this requirement since the last release

Verification

Verification type and point of time

NOTE: It is assumed that the reader of this EuroSpec has an IT knowledge in order to reduce misinterpretation of the requirements.

Further information can be found in the document "EuroSpec Requirements Management" at www.eurospec.eu

ID	Req. class.	Requirement-text	Rationale	Verification		
				Design Review	FAI	Take-over
		TCMS_DS generic requirements				
TCMS_DS.1	OR	TCMS_DS shall deliver data of several accuracy levels.	Not all the functions in non-TCMS zones require data (e.g. speed) of the same accuracy. For example, for location data: - High accuracy level data may be used for train location at stations (e.g. to determine the right track). - Medium accuracy level data may be used by non-safety functions (e. g. PIS). This requirement is highly recommended when the TOC wants to implement service-oriented architecture.			Type test
TCMS_DS.2	RE	The TCMS_DS shall not change (even improve) the data quality level.	The data accuracy level has to be processed including the proper reaction by the functions (e.g. at the application level).			Type test
TCMS_DS.3	RE	TCMS_DS shall have no influence on the operation of the TCMS.	This requirement helps to avoid any new authorisation when the TCMS_DS is extended to new data entries. For example no change of the input data is allowed.	Design review, Information to authorisation authorities		authorisation
TCMS_DS.4	RE	TCMS_DS shall only consider digital data.	Digital data may represent status, values, texts, etc. The TCMS_DS is not concerned by analogue signals unless they are digitised by equipment of the TCMS.			Type test

ID	Req. class.	Requirement-text	Rationale	Verification		
				Design Review	FAI	Take-over
TCMS_DS.5	RE	The output data of the TCMS_DS shall not be used for safety functions.	The reason is to keep a reasonable SIL for the TCMS_DS. If the SIL of the TCMS_DS is too high (SIL 2 or more), the flexibility (e.g. avoiding re assessment) is not met. For details see topic "assessment".	Design review, Information to authorisation authorities		authorisation
TCMS_DS.6	RE	The TCMS_DS shall at least use configuration files for the following data: - The input list - Basic configuration.	This is to make the list of inputs easily changeable. The basic configuration may depend on the physical location of the TCMS_DS and shall also be easily updatable. See also TCMS_DS.100.	Design review, Information to authorisation authorities		authorisation
TCMS_DS.7	DR	If TCMS_DS is developed as an independent device, a First Article Inspection shall proceed.	In this case, the TCMS_DS is considered to be a new hardware system.		FAI	
TCMS_DS.8		Separation of zones generic requirements				
TCMS_DS.9	RE	All the information from the TCMS_DS shall be allowed to travel from the TCMS functional zone to the operator functional zone.	The TCMS_DS is the provider of information coming from the TCMS for some functions in the operator functional zone. This information includes diagnostic data. The train to ground GATEWAY that is used to send the diagnostic data could be located in the operator functional zone.			Type test
TCMS_DS.10	OR	The separation solution shall be compatible with the document IEC 61375-2-6.	This is to guarantee that the TCMS is able to send information to the ground through the Mobile Communication Gateway.			Type test

ID	Req. class.	Requirement-text	Rationale	Verification		
				Design Review	FAI	Take-over
TCMS_DS.11	RE	The separation solution shall control the interface between the TCMS functional zone and the operator functional zone.	This is to avoid reassessment of the TCMS if some functions are modified or added in the operator functional zone.	Design review, Information to authorisation authorities		authorisation
TCMS_DS.12	DR	If in addition to TCMS_DS.9, any data coming from the operator functional zone is required by the TCMS functional zone, two solutions may be used: - Wired I/O ports - Identified and analysed data.	It is essential that the permitted data entering the TCMS functional zone (even by Mobile Communication Gateway) are completely characterised and listed, in order to avoid unknown data leading to any unsafe behaviour of the train.	Design review, Information to authorisation authorities		authorisation
TCMS_DS.13	RE	Analysis of data shall consist at least of: - Identifying data (including its source) - Checking against predefined authorized content.	It is essential that the permitted data entering the TCMS functional zone (even by the Mobile Communication Gateway) are completely characterised and listed, in order to avoid unknown data leading to any unsafe behaviour of the train.			Type test
TCMS_DS.14	RE	If necessary the analysis of data (see TCMS_DS.13) shall lead to its rejection.	It is essential that the permitted data entering the TCMS functional zone (even by the Mobile Communication Gateway) are completely characterised and listed in order to avoid unknown data leading to any unsafe behaviour of the train.			Type test
TCMS_DS.15	OR	The separation solution shall fulfil the requirement of EN 50159 for Category 3 networks.	EN 50159 deals with safety / security in this area.			Type test

ID	Req. class.	Requirement-text	Rationale	Verification		
				Design Review	FAI	Take-over
TCMS_DS.16	RE	The separation solution shall not change the format of the data coming from both zones except for network usage.	The separation solution is not allowed to have any impact on the behaviour of the train, thus the operational data must not be changed. As a GATEWAY, it may have a role in re-addressing data going from a network to another one. One example is addressing.			Type test
TCMS_DS.17		Train information				
TCMS_DS.18	INFO	The information listed in the requirements TCMS_DS.19 to TCMS_DS.59 about train information are operator-specific set and minimum set of information. This minimum set of information is mandatory.	The minimum set of information is the information considered as essential for train operation. The operator-specific set of information may be requested specifically by an operator but is not commonly considered as essential for train operation.			
TCMS_DS.19	RE	The TCMS_DS of the trainset shall share the train configuration information.	To make sure that the train configuration of the whole train is available in the operator functional zone of each individual trainset.			Type test
TCMS_DS.20		Train information: Speed and location				
TCMS_DS.21	RE	TCMS_DS shall deliver speed information.	Location function may use precise speed. Lower precision speed is used by non-safety functions like entertainment and / or PIS.			Type test
TCMS_DS.22	RE	TCMS_DS shall deliver standstill information.	Used e.g. by door management or PIS.			Type test

ID	Req. class.	Requirement-text	Rationale	Verification		
				Design Review	FAI	Take-over
TCMS_DS.23	RE	TCMS_DS shall deliver train moving information.	Used e.g. by door management or PIS.			Type test
TCMS_DS.24	OR	TCMS_DS shall deliver information regarding train km to each coach.	Used e.g. by maintenance staff. Its starting point depends on the maintenance policy of each operator. The important fact is to be able to send information in km.			Type test
TCMS_DS.25	OR	TCMS_DS shall deliver the position data in the format according to National Marine Electronics Association 0183	Used e.g. by PIS.			Type test
TCMS_DS.26		Train information: status information				
TCMS_DS.27	RE	TCMS_DS shall deliver "minimum set" train status information: coupling mode.	It might be e.g. "coupled", "waiting for coupling", etc. Used e.g. by PIS.			Type test
TCMS_DS.28	RE	TCMS_DS shall deliver "minimum set" train status information: train mode.	It might be e.g. "activated", "standby", "driving", "towing", "maintenance", etc. Used e.g. by PIS, or maintenance staff.			Type test
TCMS_DS.29	RE	TCMS_DS shall deliver "minimum set" train status information: direction.	It might be e.g. "forward", etc. Used e.g. by PIS.			Type test
TCMS_DS.30	OR	TCMS_DS shall deliver "operator-specific set" train status information: energy mode.	It might be e.g. "main", "battery", etc. Used e.g. by PIS.			Type test

ID	Req. class.	Requirement-text	Rationale	Verification		
				Design Review	FAI	Take-over
TCMS_DS.31	OR	TCMS_DS shall deliver "operator-specific set "train status information ": operator mode.	It might be e.g. "cleaning", "tunnel", "washing", etc. Used e.g. by lighting control.			Type test
TCMS_DS.32		Train information: "Alarm" Notification				
TCMS_DS.33	RE	TCMS_DS shall deliver alarm notification information from the subsystem's "minimum set": passenger alarm.	It might be e.g. "mode", "identification", "emergency brake", etc. Used e.g. by operator staff.			Type test
TCMS_DS.34	RE	TCMS_DS shall deliver alarm notification information from the subsystem's "minimum set": smoke/fire detection.	It might be e.g. "mode", "identification", etc. Used e.g. by operator staff.			Type test
TCMS_DS.35	RE	TCMS_DS shall deliver alarm notification information from the subsystem's "minimum set": call for aid.	It might be e.g. "mode", "identification", etc. Used e.g. by operator staff.			Type test
TCMS_DS.36	OR	TCMS_DS shall deliver alarm notification information from the subsystem's "operator specific set": service call.	It might be e.g. "mode", "identification", etc. Used e.g. by operator staff.			Type test
TCMS_DS.37		Train information: subsystem status information				
TCMS_DS.38	RE	TCMS_DS shall deliver "minimum set" external-door information: door release status to the train.	Information is: identification and e.g. released left, released right, released left and right, not released. Used e.g. by PIS.			Type test

ID	Req. class.	Requirement-text	Rationale	Verification		
				Design Review	FAI	Take-over
TCMS_DS.39	OR	TCMS_DS shall deliver "operator specific set" external-door information: door release status to each consist and each coach.	Information is: identification and e.g. released left, released right, released left and right, not released. Used e.g. by PIS.			Type test
TCMS_DS.40	OR	TCMS_DS shall deliver "operator specific set" external-door information: door status to each door.	Information is: identification and e.g. closed, opening, open, closing, blocked, failure. Used e.g. by PIS and by train staff.			Type test
TCMS_DS.41	OR	TCMS_DS shall deliver "operator specific set" external-door information: door release status to each door.	Information is: identification and e.g. preselected, release, no release. Used e.g. by PIS.			Type test
TCMS_DS.42	OR	If the internal door is located in the TCMS functional zone, TCMS_DS shall deliver "operator specific set" internal-door information: door status to each internal door.	Information is: identification and e.g. automatic, manual, blocked, failure. Used e.g. by train conductors.			Type test
TCMS_DS.43	OR	TCMS_DS shall deliver "operator specific set" sliding steps status information: to each sliding step.	Information is: identification and e.g. out-of-order, extended, retracted. Used e.g. by train conductors.			Type test
TCMS_DS.44	OR	If HVAC is located in the TCMS functional zone, TCMS_DS shall deliver "operator specific set" HVAC status information: to each HVAC.	Information is: identification and e.g. running, off, overload, reduced, failure. Used e.g. by train conductors.			Type test

ID	Req. class.	Requirement-text	Rationale	Verification		
				Design Review	FAI	Take-over
TCMS_DS.45	OR	If HVAC is located in the TCMS functional zone, TCMS_DS shall deliver "operator specific set" HVAC air conditioning information: to each coach.	Information is: identification, temperature, humidity, CO ₂ level , preset temperature. Used e.g. by train conductors.			Type test
TCMS_DS.46	OR	If HVAC is located in the TCMS functional zone, TCMS_DS shall deliver "operator specific set" HVAC air conditioning information: to each consist (identification, external temperature, external humidity).	Used e.g. by train conductors.			Type test
TCMS_DS.47	OR	If a toilet is located in the TCMS functional zone, TCMS_DS shall deliver "operator specific set" toilet status information: to each coach and each toilet.	Information is: identification and e.g. occupied, vacant, locked, out-of-order. Used e.g. by PIS.			Type test
TCMS_DS.48	OR	If a toilet is located in the TCMS functional zone, TCMS_DS shall deliver "operator specific set" toilet information: to each consist and toilet (identification, % fresh water, % waste water).	Used e.g. by train conductors			Type test
TCMS_DS.49	OR	If a toilet is located in the TCMS functional zone, TCMS_DS shall deliver "operator specific set" toilet information: smoke detection for each consist and toilet.	Information is: e.g. identification, smoke detection. Used e.g. by train conductors			Type test

ID	Req. class.	Requirement-text	Rationale	Verification		
				Design Review	FAI	Take-over
TCMS_DS.50	RE	TCMS_DS shall deliver "minimum set" train status information for energy consumption.	Used e.g. by the Driver or maintenance staff. Its starting point depends on the maintenance policy of each operator. The important fact is to be able to send information consisting in Watts.			Type test
TCMS_DS.51	OR	If a vehicle call is located in the TCMS functional zone, TCMS_DS shall deliver "operator specific set" vehicle call information with each vehicle call: location, status (ready, activated, failure).	Used e.g. by train conductors, driver (this is not public address but rather the communication system used between the driver and the onboard staff).			Type test
TCMS_DS.52	OR	If the passenger compartment audio unit is located in the TCMS functional zone, TCMS_DS shall deliver "operator specific set" passenger compartment audio unit information: to each passenger compartment audio unit: location, state (ready, activated manually, activated automatically, failure).	Used e.g. by train conductors.			Type test
TCMS_DS.53	OR	If the passenger alarm system is located in the TCMS functional zone, TCMS_DS shall deliver "operator specific set" passenger alarm system information: to each passenger alarm system: location, status (ready, activated, failure), timestamp.	Used e.g. by train conductors.			Type test

ID	Req. class.	Requirement-text	Rationale	Verification		
				Design Review	FAI	Take-over
TCMS_DS.54	OR	If a smoke detector is located in the TCMS functional zone, TCMS_DS shall deliver "operator specific set" smoke detector information " : to each smoke detector: location, state (ready, activated, failure), timestamp.	Used e.g. by train conductors.			Type test
TCMS_DS.55	OR	If the galley is located in the TCMS functional zone, TCMS_DS shall deliver "operator specific set" galley component information: to each galley: location, status (open, closed) for each galley component: location, status (ready, activated, failure) .	Used e.g. by logistics, train conductors.			Type test
TCMS_DS.56	OR	If the emergency light is located in the TCMS functional zone, TCMS_DS shall deliver "operator specific set" emergency light information: to each coach location, status (on, off, defect).	Used e.g. by train conductors.			Type test

ID	Req. class.	Requirement-text	Rationale	Verification		
				Design Review	FAI	Take-over
TCMS_DS.57	OR	If the passenger compartment light control unit is located in the TCMS functional zone, TCMS_DS shall deliver "operator specific set" passenger compartment light information: to each coach and compartment: location, status (lighting scenario, off, failure).	Used e.g. by train conductors.			Type test
TCMS_DS.58	OR	TCMS_DS shall deliver "minimum set": PIS relevant information: operational train number, inauguration state (inaugurated, off, failure), and list consists and coaches by the location of each coach.	Used e.g. by PIS.			Type test
TCMS_DS.59	RE	TCMS_DS shall deliver "operator specific set" diagnostic information according to the UIC 559 format.	Used e.g. by train conductors.			Type test
TCMS_DS.60		Assessment				
TCMS_DS.61	RE	TCMS_DS shall not require a new assessment process in case additional data that is already available in the TCMS is added to the input list.	This requirement helps to avoid any new assessment when the TCMS_DS is extended to new data entries that are already available in the TCMS.	Design review, Information to authorisation authorities		authorisation

ID	Req. class.	Requirement-text	Rationale	Verification		
				Design Review	FAI	Take-over
TCMS_DS.62	RE	The separation solution shall supervise the interface between the TCMS functional zone and the operator functional zone.	This means that all the relevant requirements are fulfilled at this point. This is to avoid reassessment of the TCMS when some functions are modified or added in the operator functional zone.	Design review, Information to authorisation authorities		authorisation
TCMS_DS.63	RE	TCMS_DS shall separate the TCMS functional zone and operator functional zone virtually or physically.	This is to avoid reassessment of the TCMS when some functions are modified or added in the operator or customer functional zone. Changes in the operator area should not affect assessment of the TCMS.	Design review, Information to authorisation authorities		authorisation
TCMS_DS.64	RE	TCMS_DS shall not require a new assessment process where changes are made to the functionality of the operator or customer functional zone	Changes to the operator or customer functional zone will come with life cycle management of components in the operator or customer functional zone. The idea is to avoid even safety assessment.	Design review, Information to authorisation authorities		authorisation
TCMS_DS.65		Maintainability				
TCMS_DS.66	OR	All the TCMS_DS (if more than one) shall be accessible from a single access point.	In order to minimise the connection time to find the failures/errors. More than one TCMS_DS can be used for redundancy reasons.			Type test
TCMS_DS.67	RE	The access to the TCMS_DS for maintenance purposes shall be controlled depending on the level of authorisation of the maintenance staff.	For example, standard maintenance staff may have a lower level of information than the expert maintenance staff.			Type test

ID	Req. class.	Requirement-text	Rationale	Verification		
				Design Review	FAI	Take-over
TCMS_DS.68	OR	Updating the TCMS_DS shall be possible from a single access point.	In order to avoid multiple connections to systems located in various areas of the train.			Type test
TCMS_DS.69	OR	The hardware type of each TCMS_DS shall be identifiable through the TCMS.	To be able to identify the configuration of the TCMS_DS on the train.			Type test
TCMS_DS.70	OR	The software type of each TCMS_DS shall be identifiable through the TCMS.	To be able to identify the configuration of the TCMS_DS on the train.			Type test
TCMS_DS.71	RE	If an error occurs due to some incompatibilities of the interfaces for the TCMS_DS, it shall be transmitted to the operator.	In order to help maintenance staff to identify these errors.			Type test
TCMS_DS.72	RE	There shall be a code identifying each type of failure likely to happen in the TCMS_DS.	In order to help maintenance staff to identify these failures.			Type test
TCMS_DS.73		Safety requirements				
TCMS_DS.74	INFO	It is recommended to develop the TCMS_DS in such a way that it has no impact on the Common Safety Methods (CSM) application when the functions using it evolve.	To minimise the work needed to demonstrate a given level of safety in case there is a change of a function using this TCMS_DS.			

ID	Req. class.	Requirement-text	Rationale	Verification		
				Design Review	FAI	Take-over
TCMS_DS.75		Operation requirements				
TCMS_DS.76	RE	The changes of the TCMS_DS shall have no impact on the inauguration time (or start-up time, coupling/uncoupling) of the TCMS.	Independence of the TCMS inauguration, start-up, coupling/uncoupling time from the TCMS_DS type.			Type test
TCMS_DS.77		Reliability				
TCMS_DS.78	DR	The preferred solution to guarantee high reliability and availability for the TCMS_DS is to have a redundant implementation.	Subsystems in the operation functional zone are dependent on information coming from the TCMS/safety functional zone. Therefore, the reliability of the TCMS_DS shall be high enough. If this cannot be guaranteed, the preferred implementation is to have a redundant TCMS_DS.			Type test
TCMS_DS.79		Availability				
TCMS_DS.80	RE	When the TCMS_DS is not available or has a reduced availability, this shall be logged by a diagnostic failure message.	It shall be registered and known when the TCMS_DS is not working correctly. This helps with finding errors.			Type test
TCMS_DS.81	RE	The TCMS_DS shall be operational in all the operation modes when the TCMS is operational.	TCMS_DS is a part of the TCMS so it has to be available when the TCMS is available.			Type test

ID	Req. class.	Requirement-text	Rationale	Verification		
				Design Review	FAI	Take-over
TCMS_DS.82		Generic GATEWAY requirements				
TCMS_DS.83	DR	The technology with which the output interface of the TCMS_DS will be implemented (e.g. Ethernet) should be fixed at the start of the design phase.	In any case the TCMS_DS depends on the TCMS and train network and when this is defined, then the TCMS_DS is also defined. At this time, the Ethernet is a common solution, but this could be operator and even train specific. It shall at least be agreed upon before the design starts otherwise it will lead to a delay and major costs in the project.			Type test
TCMS_DS.84	DR	The design constraint for having a push or pull mechanism at the output of the TCMS_DS should be fixed at the start of the design phase.	In any case the TCMS_DS depends on the TCMS and train network and when this is defined, then the TCMS_DS is also defined. Data can be provided by the TCMS_DS either by pushing it to the subsystems in the operator functional zone, or by subsystems fetching it from the TCMS_DS (pull). Operators will have a preference for push or pull and it should be decided at the start of the design phase which one will be implemented. If this will not be fixed at the beginning of the design phase it will lead to a delay and major costs of the project.			Type test

ID	Req. class.	Requirement-text	Rationale	Verification		
				Design Review	FAI	Take-over
TCMS_DS.85		Testability				
TCMS_DS.86	OR	The Software and Hardware testing process consists of at least out of the following components: <ul style="list-style-type: none"> - Test plan - Test strategy - Traceability matrix - Test cases (functional, non-functional, negative, regression). - The relevant verification reports. 	TCMS_DS test procedures' testing methods and scope have to be on the same quality level as the same type of documents for TCMS. This is a minimum set, to be completed by each operator, which requires its own set of documents depending of the standards it uses.			Type test
TCMS_DS.87	RE	All requirements are separately tested by at least one functional test case (positive function testing according to the traceability matrix).	Classical test method.			Type test
TCMS_DS.88	RE	Non-functional tests shall be defined to verify the stability, performance and the quality of the TCMS_DS.				Type test
TCMS_DS.89	RE	Fault test cases shall be defined to prove the robustness against misuse / operator error / technical fault.	Testing fault cases during the procurement phase reduces the errors during the operational life of the train.			Type test
TCMS_DS.90	RE	Test case shall be defined for all levels of the architecture (e.g. unit tests, integration tests, interface tests, system tests, acceptance tests).				Type test

ID	Req. class.	Requirement-text	Rationale	Verification		
				Design Review	FAI	Take-over
TCMS_DS.91	RE	Regression test cases shall be defined to prove that software changes have no influence on the unmodified part.				Type test
TCMS_DS.92		Diagnostic				
TCMS_DS.93	RE	A diagnostic data set shall at least contain the following information - The identifier of the failure - Date, time and location of the failure - Environment data before and at the time of the failure (more than one sample).	These diagnostic data are related to the TCMS_DS itself. Each component should have the possibility to give diagnostic information.			Type test
TCMS_DS.94		Security Requirements				
TCMS_DS.95	RE	TCMS_DS shall detect and log unexpected behaviour of communication to and from TCMS and from non-TCMS zones.	Avoid 'spamming', 'intrusion detection' or any other unwanted behaviour by subsystems on TCMS or other zones.			Type test
TCMS_DS.96	RE	All TCMS_DS configuration file entries shall have a defined range (e.g. lower and upper range)	Assign properties to the TCMS_DS configuration file entries to determine 'normal' operation and its boundaries.			Type test
TCMS_DS.97		Scalability				
TCMS_DS.98	INFO	Scalability of the TCMS_DS and its interfaces is a precondition for future adaptation.	The operator's needs for data exchange between the TCMS and the other functional zone may change in order to deliver new data or better data accuracy.			

ID	Req. class.	Requirement-text	Rationale	Verification		
				Design Review	FAI	Take-over
TCMS_DS.99	DR	The preferred solution to ensure scalability is to define the input list for the TCMS_DS in a separate configuration file.	This design proposal helps the scalability of the TCMS_DS by easing changes of its interface with the TCMS functional zone.			Type test
TCMS_DS.100	RE	Communication between TCMS_DS and TCMS: The performance of the TCMS_DS shall be such that it is able to send and receive the maximum set of data defined in the input list.	The operator needs to be ensured that all data generated by the TCMS can be handled by the TCMS_DS.			Type test
TCMS_DS.101	RE	Communication between TCMS_DS and operator and customer zones: TCMS_DS response time shall be proportionate to the requested frequency of data by the functions and systems that use this data in operator- or customer zones.	The response time of the system should not cause additional delays affecting performance of the systems in operator- and customer specific zones.			Type test
TCMS_DS.102	RE	TCMS_DS performance shall take into account a spare capacity with a minimum of 30% to be proven at the first delivery of the trainset.	Take into account possible growth in data for future development with needs for information from TCMS. NOTE: The operator might define a minimum percentage of spare capacity after the guarantee period.			Type test
TCMS_DS.103		Verification				
TCMS_DS.104	DR	The supplier shall describe the selected solution principle for separation (e.g. VLAN, firewall, GATEWAY, HW-separation).	Understanding the selected solution principle is the base for further understanding of the solution. It is used to verify requirement TCMS_DS.9.	Concept, including drawings		

ID	Req. class.	Requirement-text	Rationale	Verification		
				Design Review	FAI	Take-over
TCMS_DS.105	DR	The supplier shall describe the network-architecture for coach, consist and train.	Understanding the network-architecture gives an insight to the solution. It is used to verify requirements TCMS_DS.66, TCMS_DS.68, TCMS_DS.76, TCMS_DS.78, TCMS_DS.83, TCMS_DS.84.	Drawing		
TCMS_DS.106	DR	The supplier shall describe the TCMS_DS internal functional architecture.	Understanding the TCMS_DS internal functional architecture gives an insight to the solution. It is used to verify requirement TCMS_DS.76, TCMS_DS.95.	Model-based drawing		
TCMS_DS.107	DR	The supplier shall describe the data architecture for coach, consist and train, including the source of data, format and non-functional values.	Understanding the data-architecture gives an insight to the solution. It is used to verify requirement TCMS_DS.16 to TCMS_DS.59, TCMS_DS.93, TCMS_DS.99	Model-based drawing		
TCMS_DS.108	DR	The supplier shall provide the Concept related to the TCMS_DS performance spare capacity.	It is used to verify scalability requirement TCMS_DS.99 to TCMS_DS.102.	Concept, incl. calculation		
TCMS_DS.109	DR	The supplier shall provide the list of error codes.	The list of error codes is used to verify requirement TCMS_DS.71, TCMS_DS.72, TCMS_DS.78.	List of error codes		
TCMS_DS.110	DR	The supplier shall describe the user access concept.	The user access concept is used to verify requirement TCMS_DS.67.	User access concept		

8 APPENDIX

The Excel document TCMS_DS with all attributes is available on request (see contact on website: <https://eurospec.eu/contact/>).

9 BIBLIOGRAPHY

EN 50126 part 1	Railway applications - The specification and demonstration of Reliability, Availability, Maintainability and Safety (RAMS) - Part 1: Basic requirements and generic process.	To make the link with "safety", as it is used in the definitions.
EN 61508 part 4	Functional safety of electrical / electronic / programmable electronic safety-related systems - Part 4: Definitions and abbreviations	Definition of 'safety function' in 3.5.1.
CSM	Common Safety Methods Defined at: https://www.era.europa.eu/activities/common-safety-methods_en	

EuroSpec

“EuroSpec” stands for European Specifications for railway rolling stock. The activity is an initiative of several European train operating companies (TOC). The main focus is on trains consisting of self-propelled carriages, using electricity as the motive power (EMU).

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