

RCA



Reference CCS Architecture

*An initiative of the ERTMS users group and
the EULYNX consortium*

A. System Specification RCA – Glossary

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REVISION HISTORY

Version	Date	Superseded documents/description/details	Change Request No
Gamma.1	27.11.2019	Joined the general glossary from RCA and the glossary from the RCA specifications	

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1. TERMS

Name	Description
Advanced Protection System	A group of components in the RCA interface architecture, aggregates approximately the function of today's interlockings
Application Lifecycle Management	Application Lifecycle Management is the product lifecycle management (governance, development, and maintenance) of computer programs and continues after development until the application is no longer used.
Application Programming Interface	In computer programming, an Application Programming Interface is a set of subroutine definitions, communication protocols, and tools for building software.
APS Fixed Object Transactor	A device abstraction component in the RCA interface architecture. See SubSys APS-FOT .
APS Mobile Object Transactor	A device abstraction component in the RCA interface architecture. See SubSys APS-MOT
APS Movement Authority Transactor	A device abstraction component in the RCA interface architecture. See SubSys APS-MT
APS Object Aggregation	Object Abstraction component in the RCA interface architecture. See SubSys APS-OA
APS Safety Logic	Safety Control component in the RCA interface architecture. See SubSys APS-SL
APS Safety Manager	Safety control component in the RCA interface architecture. See SubSys APS-SM
ATO GoAx	ATO is an operational safety enhancement device used to help automate operations of trains. See Grade of Automation .
ATO Transactor	Device Abstraction component in the RCA interface architecture. See SubSys ATO-AT
ATO Vehicle	A device control component in the RCA interface architecture. See SubSys ATO-AV
Business Continuity Management	The process of creating systems of prevention and recovery to deal with potential threats to a company. In addition to prevention, the goal is to permit ongoing operation, before and during execution of Disaster recovery.

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Name	Description
Change Control Board	A Change Control Board is a committee that consists of Subject Matter Experts and Technical Chiefs, who will make decisions regarding whether or not proposed changes to a software project should be implemented.
Change Request	A change request is a document containing a call for an adjustment of a system; it is of great importance in the change management process.
Cluster Management Committee	Organization group in EULYNX .
Comand, Control and Signaling	The systems, which are ensuring the safe operation of the railways as e.g. the train control system or the interlocking.
Community of European Railway and Infrastructure Companies	CER's role is to represent the interests of its members on the EU policy-making scene, in particular to support an improved business and regulatory environment for European railway operators and railway infrastructure companies. www.cer.be
Confidentiality, Integrity, and Availability	Confidentiality, integrity and availability, also known as the CIA triad, is a model designed to guide policies for information security within an organization. The elements of the triad are considered the three most crucial components of security.
Consortium Management Bureau	The Consortium Management Bureau forms the central core team of the consortium and consists of the Technical Lead, Liaising expert and the support staff.
Design Rationales	Explains the reason for a certain design decision
Device	A Device is a "technical thing" in the real world like a TA , a VD , etc.
Device & Configuration Management	Generic function component in the RCA interface architecture. See SubSys DCM
Diagnostics & Monitoring	Generic Function component in the RCA interface architecture. See SubSys DM
Digital Railway	DR is the name of the British programme for digitalization of CCS System (see DSD , SR40).
Digitale Schiene Deutschland	Digitale Schiene Deutschland is the German programme for digitization of CCS Systems (see also DR , SR40).
Driver Machine	The interface to enable direct communication between the ERTMS/ETCS on-board

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Name	Description
Interface	equipment and the driver.
Engineering & Data Preparation	Generic Function component in the RCA interface architecture. See SubSys EDP
ERTMS Users Group	The mission of the ERTMS Users Group is to help the railway companies in applying ERTMS/ETCS in a harmonized and interoperable way, to enable the free flow of trains and a competitive railway. www.ertms.be
EULYNX	EULYNX is a European initiative in the area of railway signaling, with the aim of reducing the cost and installation time of signaling equipment. Currently, there are 12 members from North and Central Europe, with baseline 1 published in March 2017 and baseline 2 published in December 2017. The project documents lay down a system architecture for interlocking systems, including standard interfaces for the individual interlocking components, that can be used in any of the participating countries. The objective is to turn interlockings into modular systems, where different parts of one interlocking can be supplied by different manufacturers while maintaining the high safety and reliability levels required of a critical railway safety system. Link: https://www.eulynx.eu/ (Source: wikipedia)
European Committee for Electrotechnical Standardization	CENELEC is the European Committee for Electrotechnical Standardization and is responsible for standardization in the electrotechnical engineering field. www.cenelec.eu < http://www.cenelec.eu
European Rail Infrastructure Managers	The role of EIM is to provide a single voice to represent its members (infrastructure managers vis-à-vis to the relevant European institutions and sector stakeholders. EIM also assists members to develop their businesses through the sharing of experiences and contributing to the technical and safety activities of the Agency (ERA). www.eimrail.org
European Rail Traffic Management System	The European Rail Traffic Management System is a major industrial project developed by eight UNIFE members - Alstom Transport, Ansaldo STS, AZD Praha, Bombardier Transportation, CAF, Mermec, Siemens Mobility and Thales - in close cooperation with the European Union, railway stakeholders and the GSM-R industry.
European Train Control System (Level x)	The European Train Control System is the signaling and control component of the European Rail Traffic Management System (ERTMS). It is a replacement for legacy train protection systems and designed to replace the many incompatible safety systems currently used by European railways. ETCS is specified at four numbered levels (x = 0, 1, 2, 3).
European Union Agency for Railways	The European Union Agency for Railways is established to provide the EU Member States and the Commission with technical assistance in the development and implementation of the Single European Railway Area. www.era.europa.eu

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Name	Description
European Union Public Licence	The European Union Public Licence is a free software licence that has been created and approved by the European Commission.
European Vital Computer	The European Vital Computer is the heart of local computing capabilities in the driving vehicle. It is connected with external data communication, internal controls to speed regulation of the loco, location sensors and all cab devices of the driver.
Flank Protection	A means of protecting movements of trains across junctions by the setting of Point (either manually or automatically) that prevent any other unauthorised movement coming into contact with it. (Source: https://safety.networkrail.co.uk)
Form Fit Function Interface Specification	Form, Fit, and Function is the identification and description of characteristics of a part or assembly. Each defines a specific aspect of the part to help engineers match parts to needs. The FFF framework increases design change flexibility by allowing changes to the part with minimal documentation and design cost as long as the fit, form and function of the product are maintained.
Future Railway Mobile Communication System	FRMCS has the objective to become the worldwide standard, conforming to European regulation as well as responding to the needs and obligations of rail organizations outside of Europe. As such, the UIC FRMCS project duly associates non-European members and is a first concrete application of UIC strategy to build a Global Rail Traffic Management System for the whole rail industry. www.uic.org/frmcs
Global Navigation Satellite System	Global Navigation Satellite System refers to a constellation of satellites providing signals from space that transmit positioning and timing data to GNSS receivers. The receivers then use this data to determine location.
Global Positioning System	The Global Positioning System is a satellite-based radio navigation system owned by the United States government and operated by the United States Air Force. It is a global navigation satellite system that provides geolocation and time information to a GPS receiver anywhere on or near the earth where there is an unobstructed line of sight to four or more GPS satellites.
Global system for mobile communication Railway	GSM-R is an international wireless communications standard for railway communication and applications.
Grade of Automation	Grade of Automation refers to the degree of automation in remote train control (ATO). The list of automatable activities of the driver is divided into 5 categories: GoA 0: No automation, everything is in the hands of the driver. GoA 1: The driver is prevented from unsafe actions (e.g. driving over a signal). GoA 2: The train driver is present, but during the journey a system takes over the speed control or at the station the door control (autopilot). GoA 3: No person is present in the driver's cab, most processes are automated. In situations that are difficult to automate (e.g. driving on sight in the event of faults),

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Name	Description
	<p>manual remote control is provided by the train attendant or the operations centre, for example.</p> <p>GoA 4: All train control processes are automated. Intervention groups only intervene on site in the event of locomotive malfunctions or evacuations.</p>
Hardware	Hardware includes the physical, tangible parts or components of a computer.
Horizon 2020	Horizon 2020 is the financial instrument implementing the Innovation Union, a Europe 2020 flagship initiative aimed at securing Europe's global competitiveness. https://ec.europa.eu/programmes/horizon2020/en
Identity and Access Management	IAM is, in computer security, the security and business discipline that "enables the right individuals to access the right resources at the right times and for the right reasons". Generic Function component in the RCA interface architecture. See SubSys IAM
Independent Verification & Validation	Independent Verification & Validation is targeted at safety-critical software systems and aims to increase the quality of software products, thereby reducing risks and costs through the operational life of the software. IVV provides assurance that software performs to the specified level of confidence and within its designed parameters and defined requirements.
Infrastructure Manager	A railway infrastructure manager is any body or undertaking that is responsible in particular for establishing and maintaining railway infrastructure. This also includes the management of infrastructure control and safety systems.
Institute of Electrical and Electronics Engineers	IEEE is the world's largest technical professional organization dedicated to advancing technology for the benefit of humanity. IEEE and its members inspire a global community through its highly cited publications, conferences, technology standards, and professional and educational activities. www.ieee.org
Intellectual Property Rights	Intellectual property is a category of property that includes intangible creations of the human intellect. Intellectual property encompasses two types of rights; industrial property rights (trademarks, patents, designations of origin, industrial designs and models) and copyright.
Interlocking	In railway signalling, an interlocking is a system composed by a set of signal apparatus that prevents trains from conflicting movements through only allowing trains to receive authority to proceed, when routes have been set, lock and detected in safe combinations. See also APS
International Electrotechnical Commission	The IEC is the world's leading organization for the preparation and publication of International Standards for all electrical, electronic and related technologies. These are known collectively as "electrotechnology". www.iec.ch

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Name	Description
International Organization for Standardization	ISO is an independent, non-governmental international organization with a membership of 164 national standards bodies. Through its members, it brings together experts to share knowledge and develop voluntary, consensus-based, market relevant International Standards that support innovation and provide solutions to global challenges. www.iso.org
International Requirements Engineering Board	The International Requirements Engineering Board , a non-profit organization, is the provider of the CPRE (Certified Professional for Requirements Engineering) certification scheme. The board consists of leading RE representatives, who come from science, research, industry and consulting.
Level Crossing	A place where a railway and a road cross at the same level. (Source: https://safety.networkrail.co.uk)
Life Cycle Cost	Life Cycle Cost refers to the total cost of ownership over the life of an asset. Costs considered include the financial cost which is relatively simple to calculate and also the environmental and social costs which are more difficult to quantify and assign numerical values. Typical areas of expenditure which are included in calculating the whole-life cost include planning, design, construction and acquisition, operations, maintenance, renewal and rehabilitation, depreciation and cost of finance and replacement or disposal.
Man Machine Interface	The Man Machine Interface (also called User Interface) is the space where interactions between humans and machines occur. The goal of this interaction is to allow effective operation and control of the machine from the human end, whilst the machine simultaneously feeds back information that aids the operators' decision-making process.
Mean Time to Recovery resp. Repair	Mean Time to Recovery is the average time that a device will take to recover from any failure.
Middleware	Middleware is computer software that provides services to software applications beyond those available from the operating system. It can be described as "software glue".
Mission	Any train movement started under the supervision of an ERTMS/ETCS on-board equipment in one the following modes: FS, LS, SR, OS, NL, UN, or SN. The ETCS mission is ended when any of the following modes is entered: SB, SH. A concept used in the ETCS Standard. Source: ETCS Specification SUBSET-023 v330
Mobile Object	Objects like persons, cars that are close to the track.

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Name	Description
Mobile Object Locator	A device control component in the RCA interface architecture. See SubSys MOL
Model-Based Systems Engineering	Model-Based Systems Engineering is a systems engineering methodology that focuses on creating and ex-ploiting domain models as the primary means of information exchange between engineers, rather than on document-based information exchange.
Movement Authority	Movement Authority is the permission for a train to move to a specific location within the constraints of the infrastructure and with supervision of speed. End of Authority is the location to which the train is permitted to proceed and where target speed is equal to zero. See Movement Authority
National Safety Authority	Authority for authorization of CCS components and systems.
Non Functional Requirement	In systems engineering and requirements engineering, a Non Functional Requirement is a requirement that specifies criteria that can be used to judge the operation of a system, rather than specific behaviors.
Object	An Object is an abstract, logical representation of one or several Devices .
Object Controller	A device control component in the RCA interface architecture. The different OC component types and their interfaces are defined in EULYNX . See SubSys OC
On Board Unit	The ETCS equipment located on the driving vehicle.
Open CCS Onboard Reference Architecture	European initiative to define the CCS vehicle architecture. Confirms with the COAT program of smartrail 4.0.
Operating State	The Operating State is the representation of all relevant objects known to the Advanced Protection System , including their state. It is the only true representation of all safety critical objects and their states.
Operating System	An Operating System is system software that manages computer hardware and software resources and provides common services for computer programs.
Operation Point	Infrastructure elements such as railway stations. In TAF/TAP Operation Points are called locations
Operational Train	A number which, within certain limits, defines the type of train, the traffic relationship and the direction of travel and enables the unambiguous identification of the moving

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Name	Description
Number	unit.
Overlap	Overlap is the space of the track beyond the end of Movement Authority , that is kept clear in case the trains overruns the end of Movement Authority .
Person Supervisor & Locator	A device control component in the RCA interface architecture. See SubSys PSL
Platform of Rail Infrastructure Managers in Europe	PRIME was established between DG MOVE and Infrastructure Managers at the end of 2013 with the objective to improve the cooperation of rail infrastructure managers across borders, support implementation of Europe-an rail policy and develop performance benchmarking for the exchange of best practices.
Point	A junction of two railway lines that can be set to guide a train onto one of two alternative routes, or allow two lines to merge into one. Points can either be in "Reverse" or "Normal". Reverse being : The position of points where the reversed position indicates that the points are set for the less commonly used route. Normal being: The position of Point where the normal position indicates that the points are set for the more commonly-used route, usually straight running. (Source: https://safety.networkrail.co.uk)
Radio Block Centre	A Radio Block Centre is a specialized computing device with specification Safety Integrity Level (SIL4) for generating Movement Authority s and transmitting it to trains. It gets information from signaling control and from the trains in its section. It hosts the specific geographic data of the railway section and receives cryptographic keys from trains passing in. According to conditions the Radio Block Centre will attend the trains with Movement Authority until leaving the section.
Railway Undertaking	Rail transport undertaking means a private or public undertaking which is authorized to carry persons or goods by rail and which ensures traction or which only ensures traction.
RCA Architecture Overview	RCA Architecture Overview Document, published on the ERTMS Website. Version: Alpha.1. Source: https://ertms.be/sites/default/files/2019-02/RCA_Alpha_Architecture_Overview_1.pdf
RCA Workbench	A component in the RCA interface architecture. See SubSys RCA-WB
Reference CCS architecture	Reference CCS architecture is an initiative by the members of EUG and EULYNX to define a harmonized architecture for the future railway CCS , with the main goal to substantially in-crease the performance/TCO ratio of CCS in comparison with today's implementations.
Reliability, Availability,	RAMS constitutes the key element of the assessment in the rail industry today. For rail

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Name	Description
Maintainability (and Safety)	system operator, RAMS means a safe, reliable, high-quality service and lower operating and maintenance costs. For the rail system provider, RAMS is representing a high-quality system and product.
Research and Development	Research and Development refers to the work a business conducts for the innovation, introduction and improvement of its products and procedures. It is a series of investigative activities to improve existing products and procedures or to lead to the development of new products and procedures.
Safety Integrity Level	Safety Integrity Level is defined as a relative level of risk reduction provided by a safety function, or to specify a target level of risk reduction. In simple terms, Safety Integrity Level is a measurement of performance required for a safety instrumented function. The Safety Integrity Levels are defined in the European norm EN 50128.
Shift2Rail	Shift2Rail fosters the introduction of better trains to the market (quieter, more comfortable, more dependable, etc.), which operate on an innovative rail network infrastructure reliably from the first day of service introduction, at a lower Life Cycle Cost , with more capacity to cope with growing passenger and freight mobility demand.
SIL4	Safety Integrity Level 4. Level 4 is the highest level.
smartrail 4.0	With the smartrail 4.0 program, the Swiss railway industry is harnessing digitalization and the potential of new technologies to further increase capacity and safety, make more efficient use of railway infrastructure, save costs and thus maintain the railway's competitiveness in the longer term. www.smartrail40.ch
Software	Software is a collection of data or computer instructions that tell the computer how to work. Software includes computer programs, libraries and related non-executable data, such as online documentation or digital media.
Systems Modeling Language	The Systems Modeling Language is a general purpose architecture modeling language for systems engineering applications. Systems Modeling Language supports the specification, analysis, design, verification and validation of a broad range of systems and systems-of-systems. These systems may include hardware, software, information, processes, personnel, and facilities. www.sysml.org
Technical Specification for Interoperability	The Technical Specification for Interoperability are specifications drafted by the European Railway Agency and adopted in a decision by the European Commission, to ensure the interoperability of the trans-European rail system. The interoperability issues apply to the lines within the Trans-European Rail network.
TIMS	Abbreviation for Train Integrity Monitoring System
TMS ATO Execution	A movement control component in the RCA interface architecture. See SubSys TMS-

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Name	Description
	AE
TMS Plan Execution	A movement control component in the RCA interface architecture. See SubSys TMS-PE
Total Cost of Ownership	Total Cost of Ownership is a financial estimate intended to help buyers and owners determine the direct and indirect costs of a product or system. It is a management accounting concept that can be used in full cost accounting or even ecological economics where it includes social costs.
Trackside Asset	Trackside Assets are installations such as rail points, level crossing barriers, signals, Train Detection System (axle counters, track circuits), etc. Trackside Asset are external actors in the RCA interface architecture. See TA
Traffic Management System	Traffic Management System provide permanent control across the network, automatically sets routes for trains and logs train movements as well as detects and solves potential conflicts.
Train Detection System	Train Detection System is a system which determines the occupancy status of track vacancy proving sections. Train detection system may be a track circuit or an axle counting system. (Source: EULYNX Glossary)
Train Integrity Monitoring System	System to monitor and confirm train integrity when train detection is absent.
Train Position Report	ToDo
Union des Industries Ferroviaires Européennes	Union des Industries Ferroviaires Européennes is representing the European rail manufacturing industry. Union des Industries Ferroviaires Européennes ' purpose is to represent its members' interests at international and EU level. The mission of the association is to proactively foster an environment where its members can provide competitive railway systems for the growing demand for rail transport. www.unife.org
Union Industry of Signaling	Union Industry of Signaling is a working group of UNIFE with the goal to create the ERTMS/ETCS specifications.
Union Internationale des Chemins de fer or International Union of Railways	The worldwide railway organization. www.uic.org

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Name	Description
Unique Selling Proposition	A Unique Selling Proposition refers to the unique benefit exhibited by a company, service, product or brand that enables it to stand out from competitors. The Unique Selling Proposition must be a feature that highlights product benefits that are meaningful to consumers.
Vehicle Devices	An external actor in the RCA interface architecture, See VD
Vehicle Locator	a device control component in the RCA interface architecture. See SubSys VL
Vehicle Supervisor	A device control component in the RCA interface architecture. See SubSys VS
Verification and Validation	Verification and validation are independent procedures that are used together for checking that a product, service, or system meets requirements and specifications and that it fulfills its intended purpose.

Table 1 Terms

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2. ABBREVIATIONS

Name	Description
ALM	Abbreviation for Application Lifecycle Management
API	Abbreviation for Application Programming Interface
APS	Abbreviation for Advanced Protection System
APS-FOT	Abbreviation for APS Fixed Object Transactor
APS-MOT	Abbreviation for APS Mobile Object Transactor
APS-MT	Abbreviation for APS Movement Authority Transactor
APS-OA	Abbreviation for APS Object Aggregation .
APS-SL	Abbreviation for APS Safety Logic
APS-SM	Abbreviation for APS Safety Manager
ATO	Abbreviation for Automatic Train Operation
ATO-AT	Abbreviation for ATO Transactor
ATO-AV	Abbreviation for ATO Vehicle
BCM	Abbreviation for Business Continuity Management
CCB	Abbreviation for Change Control Board
CCS	Abbreviation for Comand, Control and Signaling
CENELEC	Abbreviation for European Committee for Electrotechnical Standardization
CER	Abbreviation for Community of European Railway and Infrastructure Companies

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Name	Description
CIA	Abbreviation for Confidentiality, Integrity, and Availability
Class1	
CMB	Abbreviation for Consortium Management Bureau
CMC	Abbreviation for Cluster Management Committee
CR	Abbreviation for Change Request
DCM	Abbreviation for Device & Configuration Management
DM	Abbreviation for Diagnostics & Monitoring
DMI	Abbreviation for Driver Machine Interface
DPL	Abbreviation for Drive Protection Level
DPS	Abbreviation for Drive Protection Section
DR	Abbreviation for Digital Railway
DSD	Abbreviation for Digitale Schiene Deutschland
EDP	Abbreviation for Engineering & Data Preparation
EIM	Abbreviation for European Rail Infrastructure Managers
ERA	Abbreviation for European Union Agency for Railways
ERTMS	Abbreviation for European Rail Traffic Management System
ETCS	Abbreviation for European Train Control System (Level x)

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Name	Description
EUG	Abbreviation for ERTMS Users Group
EUPL	Abbreviation for European Union Public Licence
EVC	Abbreviation for European Vital Computer
FFFIS	Abbreviation for Form Fit Function Interface Specification
FRMCS	Abbreviation for Future Railway Mobile Communication System
GNSS	Abbreviation for Global Navigation Satellite System
GoA	Abbreviation for Grade of Automation
GPS	Abbreviation for Global Positioning System
GSM-R	Abbreviation for Global system for mobile communication Railway
HW	Abbreviation for Hardware
IAM	Abbreviation for Identity and Access Management
IEC	Abbreviation for International Electrotechnical Commission
IEEE	Abbreviation for Institute of Electrical and Electronics Engineers
IM	Abbreviation for Infrastructure Manager
IPR	Abbreviation for Intellectual Property Rights
IREB	Abbreviation for International Requirements Engineering Board
ISO	Abbreviation for International Organization for Standardization
IVV	Abbreviation for Independent Verification & Validation

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Name	Description
IXL	Abbreviation for Interlocking
LCC	Abbreviation for Life Cycle Cost
MA	Abbreviation for Movement Authority .
MBSE	Abbreviation for Model-Based Systems Engineering
MMI	Abbreviation for Man Machine Interface
MO	Abbreviation for Mobile Object
MOB	Abbreviation for Moveable Object
MOL	Abbreviation for Mobile Object Locator
MP	Abbreviation for Movement Permission
MTTR	Abbreviation for Mean Time to Recovery resp. Repair
MW	Abbreviation for Middleware
NFR	Abbreviation for Non Functional Requirement
NSA	Abbreviation for National Safety Authority
OBU	Abbreviation for On Board Unit
OC	Abbreviation for Object Controller
OCORA	Abbreviation for Open CCS Onboard Reference Architecture
OS	Abbreviation for Operating System

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Name	Description
OTN	Abbreviation for Operational Train Number
PRIME	Abbreviation for Platform of Rail Infrastructure Managers in Europe
PSL	Abbreviation for Person Supervisor & Locator
R&D	Abbreviation for Research and Development
RAM(S)	Abbreviation for Reliability, Availability, Maintainability (and Safety)
RBC	Abbreviation for Radio Block Centre
RCA	Abbreviation for Reference CCS architecture
RCA WB	Abbreviation for RCA Workbench
RU	Abbreviation for Railway Undertaking
S2R	Abbreviation for Shift2Rail
SIL	Abbreviation for Safety Integrity Level
SoM	Abbreviation for Start of Mission. A Term used in ETCS .
SR40	Abbreviation for smartrail 4.0
SW	Abbreviation for Software
SysML	Abbreviation for Systems Modeling Language
TA	Abbreviation for Trackside Asset
TCO	Abbreviation for Total Cost of Ownership
TDS	Abbreviation for Train Detection System .

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Name	Description
TMS	Abbreviation for Traffic Management System
TMS-AE	Abbreviation for TMS ATO Execution
TMS-PAS	Abbreviation for TMS Planning System
TMS-PE	Abbreviation for TMS Plan Execution
TSI	Abbreviation for Technical Specification for Interoperability
UI	Abbreviation for user interface. See Man Machine Interface
UIC	Abbreviation for Union Internationale des Chemins de fer or International Union of Railways
UML	Abbreviation for Unified Modelling Language
UNIFE	Abbreviation for Union des Industries Ferroviaires Européennes
USP	Abbreviation for Unique Selling Proposition
V&V	Abbreviation for Verification and Validation
VD	Abbreviation for Vehicle Devices
VL	Abbreviation for Vehicle Locator
VS	Abbreviation for Vehicle Supervisor

Table 2 Abbreviations