TRAFIKVERKET			Jernbaneverket		
Approved			Approved		
SPECIFIC TRANSMISSION MODULE (STM) – EBICAB GENERAL TECHNICAL REQUIREMENTS					
100 200 E 004					*Version* v. 5.2

GRS

STM General Technical Requirements Specification

Document Modification History

Version	Modification	Valid from	Prepared	Approved
5.2	Updated requirements according to [STM-Delta-FRS-List-v1.26].	8 Oct.2014	B Bryntse, ÅF	
5.1	Updated or new national requirements: G64, G57A, G57B. Index chapter added. Improved format of text and headers.	28.10.2009	B Bryntse, Teknogram	
5.0	Update of national requirements	26.6.2009	S Wallin	
4.2	"STM Delta-GRS-List ver A" is introduced		K.Hallberg	
4.1	Final corrections	15.2.2007	U.Svensson	F. Åhlander
4.0	I/F C deleted, recorder info changed		U.Svensson	
3.0	Changes according to STM National, new I/F F		U.Svensson	
2.1	Clarification G 58, G34 and G35	15.4.2003	J Öhrström	S-H Nilsson
2.0	Added info regarding radio I/F chapter 2.3	20.6.2002	F Åhlander	S-H Nilsson
1.4	For approval by RHK, JBV, BV	6.6.2002	F Åhlander	S-H Nilsson

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1 INTRODUCTION

This document specifies the general technical requirements for the Specific Transmission Module, STM. A majority of the listed requirements will form the basis for the development of a generic product (GP) that will be used for STM applications in Norway, Sweden and Finland i.e EBICAB700 and EBICAB900.

EBICAB700 is the common definition used for the ATP system in Norway and Sweden, ATC-2. This definition is used in the TSI for Control/Command (EG directive 96/48) and covers balises and other ATC-2 products from both existing suppliers.

EBICAB900 is the definition used for the ATP system in Finland, ATP-VR. This definition will be used in the TSI for Control/Command (EG directive 2001/16) and covers balises and other ATP-VR products from both existing suppliers.

In this document, mandatory national requirements are designated G*nn*, while additional requirements are designated A*nn*.

1.1 Applicable standards

G1 The STM and development of the STM shall comply with the standards listed below. If the standards are not consistent with the Basis for Tender, the Basis for Tender overrides the standard.

BVF 814.1	Miljöbaskrav vid upphandling av tjänster och varor (Basic environmental requirements at tenders of services and products)

UNISIG ERTMS ETCS Class1 specification	System Requirement Specification for ERTMS/ETCS, EURORADIO and STM

EN 50121	Railway applications – Electromagnetic compatibility
EN 50125	Railway applications – Environmental conditions for equipment, 1999-10-29
EN 50155	Railway applications – Electronic equipment used on rolling stock, 2001-11-30
EN 50238	Railway Applications – Compatibility between rolling stock and train detection systems, 2003
NUP-T2	Community of Nordic Railways (CNR), Specification for Electronic Equipment used on Rolling Stock, edition 09.09.1996

SS-EN 50126	Railway applications – Specification and demonstration of Reliability, Availability, Maintainability and Safety (RAMS)
SS-EN 50128	Railway applications – Communications, signalling and processing systems – Software for railway control and protection systems.
SS-EN 50129	Railway applications – Safety related electronic systems for signalling.

1.2 List of definitions

Expression	Explanation
Antenna	The vehicle antenna, which is used for reading passed balises. Mounted on the underside of the engine.
ATC	Automatic Train Control, automatic speed supervision. Two main parts: ❑ The onboard equipment, with both ETCS and STM units. ❑ The track equipped mainly by ATC-2/ATP-VR balises, but Eurobalises can also be used.
ATC equipment	A common name of the track and train equipment that is included in the ATC system.
Balise	A transponder that is placed between the rails. When requested, it transmits information to passing trains.
ERTMS	European Rail Traffic Management System.
ETCS	European Train Control System.
EVC	European Vital Computer.
FRS	Functional Requirements Specification
H(8, 4)	Hamming code 8, 4.
H(16, 11)	Hamming code 16, 11.
I/F	Interface.
M(8, 4)	Modified Hamming code 8, 4.
M(16, 11)	Modified Hamming code 16, 11.
STM	Specific Transmission Module.
STM SRS	STM System Requirements Specification.
Synchronisation	Method to identify the beginning and end of message in a serial data flow.
Telegram	A message, received by the onboard equipment. The telegram is surrounded by synchronisation words (EBICAB700) or features an embedded synchronization sequence (EBICAB900).

1.3 System definition

The Specific Transmission Module, STM, is an on-board constituent fully defined by its functionality, interfaces and performance. The basic functionality of the STM is specified as a list of requirements in the Functional Requirements Specification (FRS). All other technical requirements, including specifications of interfaces and performance requirements are listed in this document.

The following figure defines the STM system borders:

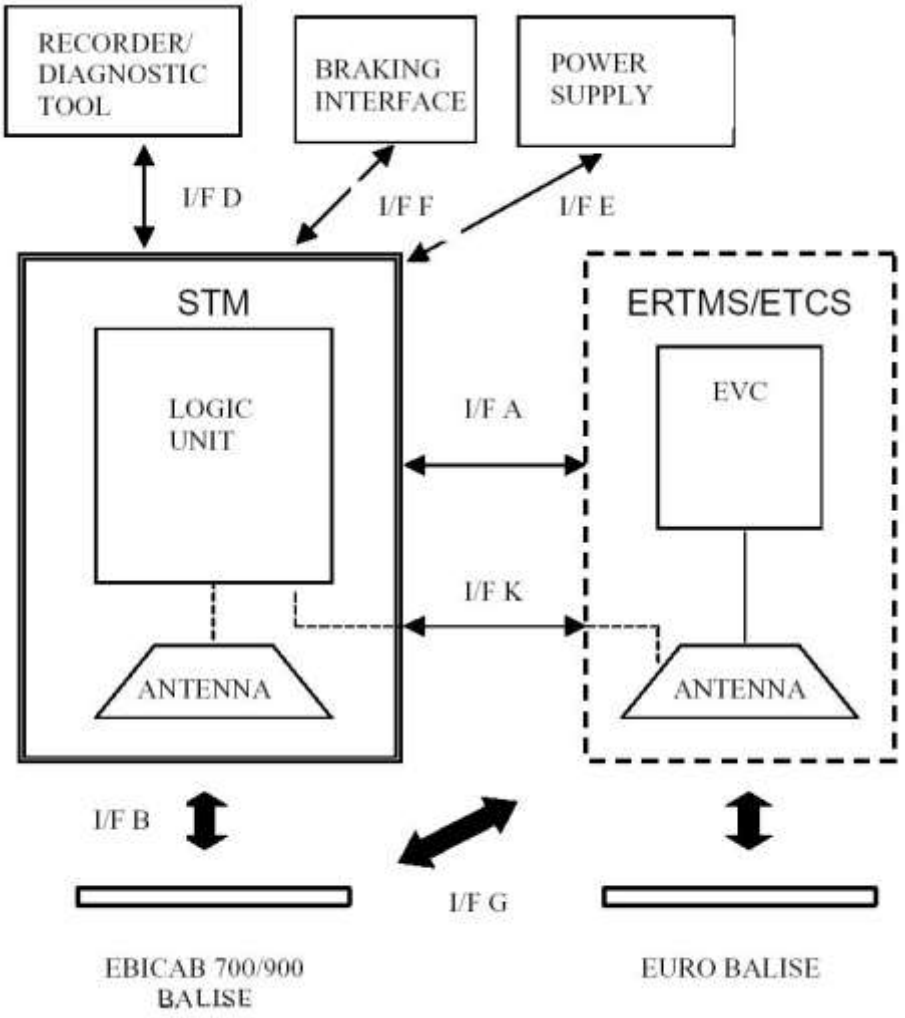

Figure 1: STM System borders and interfaces

The STM includes two internal parts defined as Logic unit and Antenna.

The STM includes the following interfaces:

- Interface A – FFFIS I/F between the STM and ERTMS/ETCS kernel and/or DMI
- Interface B – FFFIS I/F between the STM and EBICAB 700/900 Balises
- Interface D – FFFIS I/F between the STM and a recorder or a diagnostic tool
- Interface E – FFFIS I/F between the STM and the power supply
- Interface F- FFFIS I/F between the STM and the braking system
- Interface K – FFFIS I/F between the STM and a combined ATC/ETCS Antenna

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2 INTERFACES

2.1 Interface A

Interface A is defined as the basic communication interface between the STM and the ERTMS/ETCS kernel and/or DMI. Depending on the physical arrangement of the STM, requirement G2A *or* G2B shall be fulfilled.

G2.51a The STM shall include an Interface A based on the following subsets of the UNISIG ERTMS/ETCS Class 1 specification.

a) SUBSET–026-v2.3.0 (ERTMS/ETCS SRS)

b) SUBSET–035-v2.1.1 (STM FFFIS)

c) SUBSET–056-v2.2.0 (Safe time layer)

d) SUBSET–057-v2.2.0 (Safe link layer)

e) SUBSET–058-v2.1.1 (Application layer)

f) SUBSET–059-v2.1.1 (STM Performance requirements)

g) SUBSET–108-v1.2.0 (Interoperability-related consolidation on TSI annex A documents)

A2.51b ***Alternative:*** For an internal STM (the STM is integrated in the ETCS hardware) the communication hardware may be omitted and the protocol may be adapted to the actual system structure.

The functionality as seen from a user standpoint must still fulfill the following subsets:

a) SUBSET–026-v2.3.0 (ERTMS/ETCS SRS)

b) SUBSET–035-v2.1.1 (STM FFFIS), except for chapter 14 (Profibus)

c)-e) Reserves.

f) SUBSET–059-v2.1.1 (STM Performance requirements)

g) SUBSET–108-v1.2.0 (Interoperability-related consolidation on TSI annex A documents)

2.2 Interface B

Interface B is defined as the airgap interface between the STM and EBICAB 700/900 balises.

The airgap specification for interface G (UNISIG SUBSET 100 - Interface 'G' Specification, issue 1.0.1) can be applied also to interface B.

A3 The STM shall include an interface B according to subset 100, alternative see below. The interface shall be designed for full compatibility with all existing balise types in the track systems of JBV/BV.

Alternative: A transmission system that is approved for usage with ATC-2 can be accepted even if its specification should deviate from Subset 100.

2.2.1 Transmission system test function

The purpose of the test function is to ensure that the transmission system is able to detect balises. In case of transmission system deficiencies, the system shall immediately revert to a safe behaviour, either braking or giving an alarm. This is described in the FRS.

2.2.2 Telepowering control

A4.51a Reserve.

A5.51a Reserve.

A-Table. Reserve.

2.2.3 Conditions for balise detect

The basis for safe operation of any ATC system is the safe detection of all balises. The detection scheme (24-bit Swedish/Norwegian) is described in the FRS.

2.2.4 Telegrams

Telegram content and synchronisation is described in the FRS.

2.2.5 Switching between antennas

The maximum allowed distance between the antenna in use and the first axle shall be 6.4 meters, otherwise problems can occur with signals going to a stop aspect before the balises have been read. If this distance cannot be kept with a single antenna, the transmission system must be switched between two antennas, placed within the allowed limit.

In vehicles with two antennas, the transmission system shall select antenna according to which cab is active. The forward antenna shall always be used.

2.3 Interface D

Interface D is defined as the interface between the STM and a recorder or a diagnostic tool.

A6 The STM shall include an interface D. The interface shall be designed according to the following requirement:

- The physical and electrical interface shall make it possible to connect the STM to a COM port or a USB port of a standard PC.

This requirement does not by itself imply that a recorder function is mandatory.

2.4 Interface E

Interface E is defined as the interface between the STM and the power supply. For an internal STM (integrated in the ETCS hardware), interface E is not applicable.

G7 An external STM shall include an interface E.

The interface E shall fulfill the following requirements:

G8 The STM equipment shall be powered from the battery of the vehicle.

G9 The STM shall be fully operable at any of the following battery voltages on the vehicle.

Nominal	Variation
24V	According to EN 50155 Interruption class S2 (10 ms)
48V	
60V	
72V	
110V	

G10 The equipment shall function adequately with a non-earthed DC supply and with an earth fault which could possibly occur on either side of the two battery poles.

2.5 Interface F

Interface F is defined as the interface between the STM and the braking system.

G62 The STM shall have access to a feedback from the braking system. This is necessary to fulfill the braking curve requirements stated in the FRS. The feedback may be physically included in interface F, but as an alternative the STM may use other sources for pressure feedback,
as long as it provides the same function.

G63 Reserve

G64.50a **A** safe direct emergency brake connection shall be implemented on-board in the following case:

a) The response time from the combined systems STM and ETCS > 0,5 s, where

- The response time is counted from the event (received balise or other information) that is required to activate the emergency brake, until the emergency brake relay contact is opened.

b) Reserve.

Note: This means that the STM has to be able to give an emergency brake order either through both interfaces A and F, or only through interface A, depending on whether interface F is implemented or not.

A65 It shall be possible to choose by the time of installation whether the safe connection to the emergency brake shall be implemented or not.

A66.51n a) The STM shall have access to the status of the EP brake (EP brake active / EP brake not active).

b) This status input shall control the value of the parameter EPA when EPX = Mixed EP Interface.

Note. EPA can not be changed manually in this case.

A67.51n The STM shall have direct service brake connection.

Note. This enables STM service brake test when the Start of mission procedure is performed in an ETCS-equipped area.

A68.51n The STM shall provide an additional, direct output to control soft service braking.

2.6 Interface K

Interface K is defined as the interface between the STM and the ERTMS/ETCS transmission system. Interface K is mandatory for the use of a combined ATC/ETCS antenna.

A11 The STM shall include an interface K according to subset 101. For an internal STM, other interfaces can be accepted.

Note: Even if interface K is not a national requirement, it is strongly recommended that it is included in all external STM:s.

2.7 Balise reading

G12 The STM shall provide a means for reading ATC-2 balises, either via interface B or interface K.

G13 Reserved.

G14 Reserved.

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3 ENVIRONMENT

This section specifies the environmental requirements on the STM equipment. Requirements are specified below for:

- ambient temperature
- solar radiation
- humidity
- wind and pressure pulses
- altitude
- water and precipitation
- pollutants and contaminants
- mechanical
- electromagnetic compatibility

3.1 Operational Environmental Requirements

G15 The equipment shall have full functionality within the requirements specified below. Full functionality of STM means that no malfunction may arise as a cause of any combination of environmental conditions within the specified requirements.

G16 If STM is exposed to environmental conditions outside specified requirements, malfunctions that may occur shall not affect the overall safety of the STM.

3.1.1 Ambient temperature

G17 Temperature requirements that shall be fulfilled by the STM are specified in the table 1.

INSTALLATION LOCATION	**Ambient temperature**
Train (Outdoor)	-40 to +70
Train (Indoor)	-25 to +70

Table 1 Temperatures

3.1.2 Solar radiation

G18 Requirements for exposure of solar radiation that shall be fulfilled by the STM are specified in the table 2.

INSTALLATION LOCATION	**Solar radiation**
Train (Outdoor)	1120 W/m^2
Train (Indoor)	
Engine Room	700 W/m^2
Equipment Room	700 W/m^2
Drivers Cab	1120 W/m^2
Coach	700 W/m^2

Table 2 Solar radiation

3.1.3 Humidity

G19 Requirements for external humidity levels that shall be fulfilled by the STM are specified in the table 3.

Duration	**Limit Value**
Yearly average	10-75% Relative Humidity
On 30 days in the year, continuously	10-95% Relative Humidity
On the other days, occasionally	30g/m^3 occurring in tunnels

Table 3 Humidity - Trainborne equipment

3.1.4 Wind and pressure pulses

Requirements for wind and pressure pulses are specified in this chapter.

G20 Exposure of permanent crosswinds of 35m/s and exceptional gusts of 50 m/s and duration of 1 second per gust shall not affect the equipment that are placed on the outside of the vehicle. For gusts longer than 1 second the equipment performance may be affected but without permanent damage.

G21 Exposure of pressure pulses caused by trains passing in tunnels shall not affect the equipment. Particular local air pressure conditions may exist due to the effects of trains running through a tunnel. However, as a minimum, all equipment shall function correctly when subjected to the following severity of pressure pulse:

$$\Delta P = \pm 5 \text{ kPa}$$

The associated rate of change of pressure is:

$$\Delta P/\Delta t = 1 \text{ kPa/s}$$

3.1.5 Altitude

Altitude requirements are specified in this chapter.

G22 The equipment shall not be affected at altitudes between -120m (below sea level) and 2000m (above sea level), which corresponds to an air pressure range of approximately 101.3 kPa to 79.5 kPa.

3.1.6 Water and precipitation

Water and precipitation requirements are specified in this chapter.

G23 The equipment shall not be affected when subjected to all forms of precipitation. In this respect, considerations shall be given to (but not limited to) the following:

- The effects of snow, ice and hail penetrating equipment housings.
- De-icing with high temperature steam, water or pressure air.
- The effects of snow melting and freezing again.
- Hailstones of a maximum diameter of 15mm.
- Light dew

G24 The equipment shall not be affected when subjected to the severities of water and precipitation specified in Table 4.

INSTALLATION LOCATION	**Precipitation (mm/min)**	**Water from sources other than rain (m/s)**
Train (Outdoor)	15	3
Train (Indoor)		
Engine Room	N/A	0.3
Equipment Room	N/A	0.3

INSTALLATION LOCATION	Precipitation (mm/min)	Water from sources other than rain (m/s)
Drivers Cab	N/A	N/A

Table 4 Water and precipitation*

3.1.7 Pollutants and contaminants

Pollutants and contaminants requirements are specified in this chapter.

G25 The equipment shall not be affected when being exposed to following chemical pollution in the environment:

- Sulphur dioxide: 0.3 mg/m^3
- Hydrogen sulphide: 0.1 mg/m^3
- Chlorine: 0.01 mg/m^3
- Nitrogen dioxidxe: 0.1 mg/m^3
- Ozone: 0.05 mg/m^3

* NOTES
N/A denotes that the classification is not applicable for this installation location.

G26 The equipment shall not be affected with the debris layers on the balise and under the antenna unit specified by the table 5 and 6

Material	**Description**	**Layer [mm]**
Water	Clear	100
	0.1 % NaCl (weight)	100
Snow	Fresh, 0°C	300*
	Wet, 20 % water	300*
Ice	Non porous	100
Ballast	Stone	100
Sand	Dry	20
	Wet	20
Mud	Without salt water	50
	With salt water, 0.5 % NaCl (weight)	10
Iron Ore	Taconite	20
	Magnetite	10
Iron dust†	Braking dust	10
Coal dust	8 % sulphur	10
Oil and Grease		50

Table 5 Debris layers on top of the Balise

* 300 mm or up to the bottom of the Antenna unit.
† A non-conductive mixture of grease and iron oxide which is normally encountered in Railway environment.

Material	**Description**	**Layer [mm]**	
		Minimum	**Maximum**
Snow	Fresh, 0°C	20	top of Balise
	Wet, 20 % water	10	top of Balise
Ice		10	top of Balise
Mud	Without salt water	10	50
	With salt water, 0.5 % NaCl (weight)	-	50
Iron Ore	Taconite	-	5
	Magnetite	-	5
Iron dust	Braking dust	2	5
Coal dust	8 % sulphur	-	5
Oil and Grease		2	20

Table 6 Debris under the Antenna unit (for Balise)

G27 The manufacturer shall state the performance of the Antenna unit and the maximum allowed debris layers for this antenna.

3.1.7.1 Mechanical

Mechanical stress requirements are specified in this chapter.

G28 Track ballast can cause serious damage to outdoor equipment attached to the train. The design shall take into account the effect of ballast and stones up to a diameter of 15mm.

G29 Trainborne equipment and its mountings shall be capable of withstanding without deterioration or malfunction all mechanical stresses that occur in service.

3.1.7.2 Vibrations

G30 The equipment and its mountings shall be designed to withstand the continuous sinusoidal vibration stresses, in all the three major axis as specified in table 7.

Installation location	Mass of equip-ment [kg]	Frequen-cy range [Hz]	Cross-over frequen-cy [Hz]	Displacement amplitude below crossover frequency [mm]	Acceleration amplitude above crossover frequency [m/s^2]
Underframe/ body/roof - Directly mounted equipment	> 2000 < 2000	1 - 35 5 - 100	8.2 7.1	0.75 1.5	2 3
Underframe/ body/roof - Equipment in frames and boxes	> 30 3 - 30 0.3 - 3 < 0.3	5 - 150	8.2 8.4 8.7 22.5	1.5 2.5 5 1.5	4 7 15 30
Bogie	No limit	5 - 100*	8.3*	7.5*	20*
On the wheel set	No limit	5 - 100	20.5	12	200

Table 7 Mechanical vibrations for trainborne equipment

3.1.7.3 Shock

G31 The equipment and mountings shall be designed to withstand the shock stresses specified in table 8.

Installation location	Peak value of amplitude / half sine duration†		
	Vertical	Transverse	Longitudinal
Underframe/body/roof – Directly mounted equipment	3g / 30 ms	3g / 30 ms	3g / 100 ms
Underframe/body/roof – Equipment in frames and boxes	3g / 30 ms	3g / 30 ms	5g / 30 ms
Bogie	30g / 18 ms	30g / 18 ms	30g / 18 ms
Wheel set	100g / 6 ms	100g / 6 ms	100g / 6 ms

Table 8 Mechanical shocks for trainborne equipment

* For frequencies above 22 Hz use the following values:
22 - 32 Hz displacement amplitude 1 mm
32 - 100 Hz acceleration amplitude 40 m/s^2

† Half sine form in accordance with IEC 68.2.27 Test Ea

3.1.7.4 Other acceleration forces

G32 Trainborne equipment and mountings shall also be capable of functioning when subjected to tilting and centrifugal acceleration forces. The equivalent maximum values of transverse acceleration applied to the body of the vehicle shall be taken as 4 m/s^2 (less than 50 ms duration) or 2 m/s^2 when the duration exceeds 50 ms.

G33 During traction and braking operations, trainborne equipment shall be capable of functioning when subjected to longitudinal acceleration forces of 7 m/s^2 with a duration higher than 50 ms.

3.1.8 Electromagnetic compatibility

Electromagnetic compatibility requirements are specified in this chapter.

Operational requirements for trainborne requirements are specified in the CENELEC standard EN 50121. Railway applications - Electromagnetic compatibility: Rolling stock - Apparatus.

G34 With regard to immunity from electromagnetic disturbance of components, the limiting specified in EN 50121-3-2 shall apply.

G35 The defined limits for electromagnetic compatibility are valid for all equipment, installations, sub-systems and systems. Furthermore, it shall be ensured that the equipment functions correctly when disturbance currents are caused by traction units, either in normal operation or in the event of a failure. Immunity for electromagnet disturbance shall be according to what is specified by EN 50 121.

3.2 Environmental Requirements for Storage

G36 The environment that the STM equipment is stored within shall fulfil storage requirements specified below.

G37 Full functionality is not required during storage, but the equipment shall not be damaged temporarily or permanently if the specified conditions below are kept within.

G38 If STM is exposed to environmental conditions outside specified requirements malfunctions that may occur shall not affect the overall safety of the STM.

3.2.1 Ambient temperature

G39 Temperature requirements that shall be fulfilled by the STM are specified in the table 9.

LOCATION	Ambient temperature
Outdoor	-40 to +85
Indoor	-40 to +85

Table 9 Temperatures

G40 For all other environmental requirements the specified operational environmental requirements listed in the above chapters shall apply.

3.3 CE certificate

G41 The STM and the antenna shall be CE marked.

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4 COMPATIBILITY

G42 The STM shall be fully compatible with all currently existing ATC trackside equipment in Norway and Sweden. This includes all approved balise types and any combination of balises from existing suppliers, e.g. parallel EBICAB700, serial EBICAB700 and Ansaldo mini-balise.

G43 Compatibility shall be verified by testing, for all existing balise types within the trackside network of JBV and BV. Verification shall be made against a sufficient number of balises of each type.

5 MODULARITY

G44 Reserve

A45 It shall be possible to install the STM (the logic unit) without the antenna. Information from the balises shall then be available through interface K utilising a combined ATC/ETCS antenna.

A46 The installation of STM without a dedicated separate STM antenna shall comply with all technical requirements in the Basis for Tender i.e. this type of installation shall have no influence on functionality, performance, safety etc. compared to an installation with a special STM antenna.

G47 The STM shall have at least 20% of spare capacity regarding memory size and CPU power in order to make future updates and/or upgrades feasible.

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6 RECORDER/DIAGNOSTIC TOOL

A48 It shall be possible to connect, temporarily or permanently, a Recorder and/or a Diagnostic tool to the STM.

A49 The Recorder analysing tool and the Diagnostic tool shall consist of software applications running on a standard PC with a Windows based operating system, including Windows NT and Windows XP.

6.1 Recorder

The recorder function is divided into two parts namely recording of essential STM data in real-time and analysis of recorded data. The recording of data can be done internally in the STM or externally using a specially designed recorder unit. The recorded data will then afterwards be analysed using a Recorder analysing tool.

A50 The recorder shall be used for recording events concerning the STM and its functionality.

A51 Recorded data shall be saved for at least 48 hours or more.

A52 All input data to the STM and all output data from the STM, including balise information marked with time and position, shall be recorded by the STM recorder.

A53 It shall be possible to select, analyse, display and print out the recorder information, in on-line (real time) or off-line mode, supported by an external PC with a software application. The recorded data may either be stored as "raw data" or as completely formatted data, ready for output to a screen or a printer.

A54 The following internal information shall be recorded, as a minimum, at the occasions specified:

Information	**Recorded:**
STM identity and program version(s)	At start of mission
STM and recorder status	At every change / error
Internal time (in the recorder unit, ≤ 0,5 s resolution)	At every time any other information is recorded
Internal lamps used by the STM	At every change
Entered vehicle specific STM train data	When entered
STM condition	STM state + area

Information	Recorded:
Service program indications (optional)	At every change

Table 10

A55 Unchanged data shall be stored at regular intervals, even if no change has occurred. This is to enable readout of data from the beginning of memory, even if the originally stored data (e.g. program identity from start-up, or train data) has been overwritten. This repetition shall occur at least every 15 minutes.

6.2 Diagnostic tool

6.2.1 General

A56 Externally controlled service functions shall be performed during normal STM operation in co-operation with a special Diagnostic tool that can be connected to the STM. The results shall be shown on the screen of the tool (except for tests performed by the STM, as possible braking or display tests).

6.2.2 List of functions and data

A57 The following data or commands, where as a minimum the mandatory, shall be output by the STM to the Diagnostic tool. The data shall be updated at least once per second.

Manda-tory	Service display or function	Comment
X	Train speed	(km/h)
X	Passed balise groups	At least the two latest
X	System data	STM identity and program version
	Train data	Train data, National values
	Odometer	Nom/min/max (m)
	ETCS/STM condition	ETCS mode, STM state, STM area
	Error information	Error messages
	Memory contents	Display contents of memory location or I/O port according to selected address
	Optional functions	Determined by supplier

Table 11

6.3 Recording to the JRU

The purpose of this recording is to facilitate investigations of hazardous railway events.

G57A.50n Recording shall be performed to the juridical recording unit of the ETCS, the JRU.

G57B.51a The following STM related information shall be recorded as a minimum, at the occasions specified as a minimum:

	RECORDED STM DATA	OCCASION [1) 2) 3)]
a)	ETCS and STM train data	Every change
b)	Brake pressure	Pressure change ≥ 10 kPa
c)	STM odometer information	Speed change ≥ 5 km/h (2 km/h below 5 km/h) Position change ≥ 100 m
d)	Balise information	Received
e)	Balise error code F1, F2, F3	Balise error
f)	STM state	Every change
g)	Shunting state	Every change
h)	STM area	Every change
i)	Direction controller & cab activation	Every change
j)	Max speed, target speed, release speed and remaining target distance	Change of: Max speed ≥ 2 km/h. Target and release speed ≥ 5 km/h. Remaining target distance when other data in j) is recorded
k)	STM emergency brake status	Every change
l)	STM system failure	Every change
m)	Buttons, indicators & sounds	Every change
n)	Text messages	Every change
o)	Brake commands and brake states	Every change

Table 12. Recording to the JRU

Table explanations

1) General rule: recorded data shall be marked with time and position.
2) General exception: not needed to be recorded, if already recorded by the ETCS.

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7 MECHANICAL CONSTRAINTS

The STM is divided into two basic parts, Logic unit and Antenna. The following specifies the mechanical constraints of the two parts separately.

7.1 Logic unit

G58 The STM Logic Unit (LU) shall fulfil the following mechanical requirements:

- If the LU is to be mounted in a 19 inch rack system it shall not need more vertical space than 890 mm (20 HE) and a maximum of 600 mm in depth.
- If the LU is designed differently the total volume shall not exceed 0.25 m^3.
- The total weight of the LU shall not exceed 30 kg.

7.2 STM Antenna

G59 The STM Antenna (if a separate STM antenna is used) shall fulfil the following mechanical requirements:

- The size of the STM Antenna shall not exceed the size of existing antennas for EBICAB700/900 systems. This means in practice a maximum size of 700*700*300 mm (L*W*H)
- The total weight of the Antenna shall not exceed 30 kg.
- The Antenna shall have a standardised mechanical attachment to the vehicle so that adaptation to different types of vehicles is easily made.

8 PERFORMANCE

G60.51a The STM shall be able to discriminate between adjacent balise groups and to promptly detect, read and act on balise information if the balises are placed as described in [STM FRS, chapter 3, section 3.2.5.1] and for a maximum train speed of 300 km/h.

G61 The STM shall be fully functional for all train speeds within the range of 0-300 km/h

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9 INDEX

9.1 Changes since v5.1, figures, tables & general references