

ERTMS UNIT**ETCS TEST PLAN AND METHODOLOGY FOR SS-076****Reference:** ERA_ERTMS_040092**Document type:** Technical**Version:** 4.0.0**Date:** 02/12/2025

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Amendment record

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Version	Date	Section number	Modification/description	Author(s)
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1. OBJECTIVE

1.1 Foreword

- 1.1.1.1** This document has been drafted as an update to the ETCS Baseline 4 of the informative documents in the Subset-076 suite.

1.2 Scope & field of application

- 1.2.1.1** The objective of this document is providing information related to the context in which the mandatory documents of Ss-076 (scope of the test specifications, test cases and test sequences) are defined.
- 1.2.1.2** This document mainly presents the methodology and defines a set of rules related to the way the test cases and the test sequences of the Ss-076 are designed.
- 1.2.1.3** This document is applicable to the ETCS Baseline 4: full envelope and reduced envelopes.

1.3 Document description

- 1.3.1.1** Chapter 3 mainly lists the mandatory and informative documents of Ss-076.
- 1.3.1.2** Chapter 4 presents the methodology to prepare the features and the test cases. A template and the rules to follow to design the test cases are specified.
- 1.3.1.3** Chapter 5 checks the coverage of the onboard requirements of Ss-026 by the test cases of Ss-076.
- 1.3.1.4** Chapter 6 presents the methodology to prepare the test sequences. The purpose of the test sequences is explained and the rules followed to design the test sequences are specified. The way the test cases are covered in the test sequences is defined.
- 1.3.1.5** Chapter 7 checks the correct coverage of the test cases by the test sequences as defined in the previous chapter.
- 1.3.1.6** Annex A describes the defaults Starts of Missions used in the test sequences.
- 1.3.1.7** Annex B gives an example of the braking curves calculation.

2. REFERENCES, ABBREVIATIONS AND DEFINITIONS

2.1 Reference documents

Table 1: Reference documents

Ref. N°	Document Reference	Title
[1]	SUBSET-023	Glossary of Terms and Abbreviations
[2]	SUBSET-026	System Requirement Specification
[3]	SUBSET-027	FFFIS Juridical Recorder-Downloading tool
[4]	SUBSET-036	FFFIS for Eurobalise
[5]	SUBSET-076-5-2	Test Cases
[6]	SUBSET-076-6-3	Test Sequences
[7]	SUBSET-094	Functional requirements for an on-board reference test facility
[8]	ERA_ERTMS_015560	ETCS Driver Machine Interface
[9]	ERA-GUI-05	ERA Braking Curves Simulation Tool
[10]	EIRENE SRS	GSM-R System Requirements Specification
[11]	SUBSET-041	Performance Requirements for Interoperability
[12]	SUBSET-153	Exceptions for on-board reduced envelopes of ETCS system versions

2.2 Abbreviations

Table 2: Abbreviations

Abbreviation	Meaning
BG	Balise Group
CR	Change Request
ERA	European Union Agency for Railways
SoM/EoM	Start/End of Mission
Ss	Subset
TC	Test Case
TCDB	Test Case Database
TS	Test Sequence
MinFront	Minimum safe front end
MaxFront	Maximum safe front end
MinAnt	Minimum safe antenna position

Table 2: Abbreviations

Abbreviation	Meaning
MaxAnt	Maximum safe antenna position
EstAnt	Antenna position
MinRear	Minimum safe rear end

2.3 Definitions

Table 3: Definitions

Definition	Meaning
Test Case	It is a formal, functional and technical description of the tests needed in order to demonstrate the compliance of an ETCS on-board equipment with a finite list of onboard requirements of Ss-026 and/or Ss-153. A test case is defined in a feature (.pdf file), which may contain several test cases.
Test Sequence	It is a concatenation of test cases applied with a specific trackside engineering and a train model. A test sequence is composed by the following files: <ul style="list-style-type: none"> • a test sequence file description (.pdf file), • a test sequence speed profile (.svg file) (not present for a sequence entirely at standstill), • and possibly one or more braking curve simulation for the sequences testing braking curves (.xlsm file)
Feature	It is a group of test cases testing a set of SRS requirements.

3. CONTENT OF SUBSET-076

3.1 Introduction

3.1.1.1 The SUBSET-076 is composed of the following mandatory documents:

a) Scope of the test specifications (SUBSET-076-7)

This document explains the purpose of SUBSET-076 and provides the list of TSs to perform a test campaign. It also identifies clearly the sequences that test optional interfaces (RIU, Euroloop, STM, Train Data acquired from ERTMS/ETCS external sources, Safe consist length information acquired from ERTMS/ETCS external sources) that may not be implemented by every on-board equipment.

Note: Definition of mandatory or optional on-board functions is not in the scope of subset-076.

b) Test cases related to features (SUBSET-076-5-2)

Test Cases are the basis of the SUBSET-076. These are the formal, functional and technical descriptions of the tests needed in order to prove interoperability and to demonstrate the compliance of an ETCS on-board equipment with the SUBSET-026. Each TC includes the set of requirements tested.

c) Test sequences (SUBSET-076-6-3)

A Test Sequence is a set of concatenated TCs starting always in NP and finishing normally in NP mode. A Test Sequence shall be used for an automatic execution of the test cases, by concatenating them into scenarios which can be run within the test environment defined in the SUBSET-094. The complete set of TSs covers all TCs and therefore, all SUBSET-026 onboard requirements testable with this test environment. A Test sequence emerges as a complete defined journey, ready to be implemented in a test environment. The journey speed profile, the driver input and the messages (radio, loop and balise) sent to the on-board equipment are completely defined in each journey.

3.1.1.2 The SUBSET-076 is composed of the following informative documents:

a) ETCS test plan and methodology for SUBSET-076 (ERA/ERTMS/040092 - this document)

This document summarises the set of documents included in the SUBSET-076, provides the methodology to prepare features (test cases) and the methodology for testing on-board equipments.

b) Test Sequences Evaluation and Validation for SUBSET-076 (ERA/ERTMS/040063)

This document explains the ranges for validating in an automatic way the steps of a Test sequence, as well as the mainlines to evaluate the result of a TS execution in a laboratory compliant with SUBSET-094.

3.1.1.3 The creation of SUBSET-076 was supported by proprietary tools:

a) Test Case Designer (MRL-SCT-TCD)

It allows the creator to build a Test Case by defining all the necessary data: the situation events and the responses expected from the OBU, the start and end conditions, the SUBSET-026 and/or SUBSET-153 requirements tested, etc. The tool creates a database of test cases (TCDB) that can be used to create sequences.

b) Test sequence creation tools

This tool is used to build up the Test sequences; it takes the TCs from the TCDB and gives the creator the possibility of building a TS, by defining all the needed data (speed profile, the balise, loop or radio messages, etc...). The tool creates the files corresponding to the test sequence: the pdf file, the speed profile and, if necessary, the braking curve files. Several tools were used.

c) Test sequence coverage tool

This tool has been used to calculate the coverage of requirements by Test cases and the coverage of Test cases by Test sequences. The results are available in sections 5 and 7.

d) Test sequence debugging tools

Several tools in the laboratories simulate the behaviour of an on-board equipment and allow to run the TSs in a lab without need of a real on-board equipment in order to check their correctness.

3.1.1.3.1 SUBSET-076 is independent of those tools.

4. METHODOLOGY TO PREPARE FEATURES

4.1 Feature Principles

- 4.1.1.1** The SUBSET-026 specifies the interoperable system requirements for ETCS, for many requirements it is not possible to test them directly at the standardised interfaces.
- 4.1.1.2** Turning every requirement into a test case would result in a vast number of test cases. To solve the problem, a concept of a reduced number of functional entities, called features, is necessary.
- 4.1.1.3** Every SUBSET-026 requirement shall be identified in at least one feature and vice versa, every feature shall be linked to the corresponding SUBSET-026 requirements.

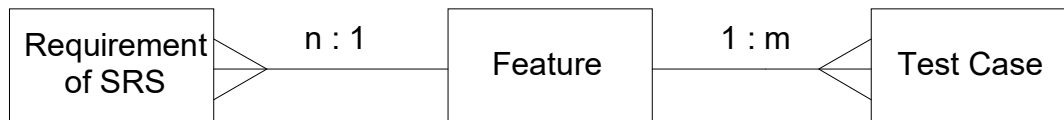


Figure 1: Relationship between Subset-026, feature and testcase

- 4.1.1.4** A feature shall have the following characteristics:
- a) Simplicity: Restriction to the direct stimulation and reaction at the available interfaces to a test stimulation of the test object (single cause/effect relation). The reaction is thereby a mandatory sequence of defined outputs at the available interfaces.
 - b) Independency: The test of a feature should be widely independent of all other features, which could be active at the same time. The essential functionality offers the necessary independence without taking into consideration the implementation of the feature.

4.2 Feature and Test case

4.2.1 Introduction

- 4.2.1.1** The Subset-026 is to be used as a basis for all test cases. The principle objective of the tests is always the verification that the system requirements have been fulfilled. Proceeding from the system requirements that can be unambiguously interpreted and referred to, the step towards the test cases must be comprehensibly made via the creation of features.
- 4.2.1.2** The features in their summary or useful convergence of several requirements form an order criterion of the correlation/interaction in which the requirements will be

tested. A feature can be composed of one or several test cases, it will depend on its complexity and the coverage for the requirements of the feature.

- 4.2.1.3** When creating the test cases, the creator shall always make a reference to the requirements to be proved (for traceability purpose).
- 4.2.1.4** The test cases use the view from outside onto the test object. The test object is considered as "Black Box" with a fixed number of defined interfaces and their determined range of values. The complete interface definition can be taken from the ETCS subsets dealing with the interfaces (FFFIS or FIS) including Ss-094 [7].
- 4.2.1.5** For test execution, a distinction is made between three types of events:
- a) Inputs for influencing the test sequence (IN),
 - b) Outputs for evaluation of test sequence (OUT),
 - c) Time events for the description of timing or sequence.
- 4.2.1.6** These events occur through one of the following interfaces:

Table 4: List of the Step interfaces

Abbreviation	Meaning
RTM	Radio Transmission Module
TIU	Train Interface Unit
DMI	Driver Machine Interface
BTM	Balise Transmission Module
INT	INTERNAL
CMD	Cold Movement Detector
ODO	ODOMETRY
ATO	Automatic Train Operation
JRU	Juridical Recording Unit
LTM	Loop Transmission Module
SIM	Simulation
STM	Specific Transmission Module
NONE	no interface

4.2.2 Template

- 4.2.2.1** The content of a feature and its test cases needs to be formalised in the form of a common template. The following template shall be used to prepare features and the test cases of a feature. The template lists all the possible elements, but reductions according to test cases needs are allowed:

ERTMS/ETCS	
Test cases of Feature <identifier> (<designation of the feature to be tested>) Total: <number> Test case(s)	
REF:	Subset-076-5-2-<identifier>
ISSUE:	Version <number>
DATE:	<dd/mm/yyyy>

Company	Technical Approval	Management approval
CEDEX		
DLR		
ITALCERTIFER		
LEF		
MULTITEL		
RINA		

Modification History

Issue Number Date	Section Number	Modification / Description	Author
Version <identifier> <dd/mm/yyyy>	<section(s)>	<description>	<author>

Test Cases

Test case 1

IDENTIFICATION		
	Title	Unique Number
Tested Equipment	On-board equipment	
Tested Feature	<description>	<identifier>
Test Case of Feature	<description>	<identifier>
Applicable Mode/Level Combinations	< L0 / L1 / L2 / LNTC: FS / OS / SR / SM / SH / UN / SL / SB / TR / PT / SF / IS / NL / LS / SN / RV / PS / NP / AD >	
Target of Test	<description>	
Version	<identifier>	<dd/mm/yyyy>
Author	<author>	
Based on Requirements	ERTMS/ETCS - SRS <version> Compatible with: <Full envelope and/or Reduced envelope>	Subset-026-<requirement>
		Subset-153-<requirement>

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METHOD OF TEST	
Method	
Constraints	

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STARTING CONDITIONS (INTERNAL STATES)		
States of ERTMS/ETCS information	Status/Value	Description
ERTMS/ETCS Mode	<0 / 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10 / 11 / 12 / 13 / 14 / 15 / 16 / 17>	<FS / OS / SR / SM / SH / UN / SL / SB / TR / PT / SF / IS / NL / LS / SN / RV / PS / NP / AD>
ERTMS/ETCS Level	<0 / 1 / 2 / 3>	<L0 / LNTC / L1 / L2>
Adhesion factor	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Axle load speed profile	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Conditional Emergency Stop	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Default Gradient for TSR	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Driver ID	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
EOLM information	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Fixed Text Information (location based)	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Fixed Text Information (not location based)	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Generic LS function marker	<STORED / NOT STORED / NOT RELEVANT / VALID / UNKNOWN>	Free text
Geographical Position	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Gradient Profile	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text

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Inhibition of revocable TSRs from balises in L2	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
International SSP	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Language used to display information to the driver	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Level Crossing information	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Level Transition Order	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Linking	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
List of balises for SH area	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
List of Balises in SR Authority + SR mode speed limit and distance	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
LSSMA display toggle on order	<STORED / NOT STORED / NOT RELEVANT / VALID / UNKNOWN>	Free text
MA Request Parameters	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Mission performed with only one radio system	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Mode Profile	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Movement Authority	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text

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National Values	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Not yet applicable National Values	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Operated System Version	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Permitted Braking Distance Information	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Plain Text Information (location based)	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Plain Text Information (not location based)	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Position Report parameters	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Radio communication session	<ESTABLISHED / NOT ESTABLISHED / STORED / NOT STORED / NOT RELEVANT / VALID / UNKNOWN>	Free text
Radio Infill Area information	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Radio Network information	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Radio system used for safe radio connection	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
RBC ID/Phone Number	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
RBC contact information	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text

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RBC Transition Order	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
RBC/RIU System Version	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Reversing Area Information	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Reversing Supervision Information	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Route Suitability Data	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Signalling related Speed Restriction	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
STM max speed	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
STM system speed/distance	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Stop Shunting on desk opening	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Table of priority of trackside supported levels	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Temporary Speed Restrictions	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Track Ahead Free Request	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Track condition big metal masses	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text

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Track Conditions excluding big metal masses	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Train Data	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Train integrity status information	<NONE / CONFIRMED BY DRIVER / CONFIRMED EXTERNAL SOURCE / LOST>	Free text
Train Position	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Train Running Number	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Unconditional Emergency Stop	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Virtual Balise Covers	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text

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REQUIRED STARTING CONDITIONS ON INTERFACES			
State of interfaces	I/O	Interface	Comments
< NOT RELEVANT / SAFE CONNECTION SET-UP / SAFE CONNECTION NOT SET-UP>	<I/O / ->	RTM	Free text
<NOT RELEVANT / free text>	<I / O / ->	TIU	Free text
<NOT RELEVANT / free text>	<O / ->	DMI	Free text
NOT RELEVANT	-	BTM	-
<NOT RELEVANT / free text>	<I / ->	INT	Free text
< NOT RELEVANT / NOT AVAILABLE / TRAIN MOVED / TRAIN NOT MOVED / FAIL STATE>	<I / ->	CMD	Free text
< NOT RELEVANT / STANDSTILL / MOVING>	<I / ->	ODO	Free text
<NOT RELEVANT / free text>	-	ATO	Free text
NOT RELEVANT	-	JRU	-
NOT RELEVANT	-	LTM	-
NOT RELEVANT	-	SIM	-
NOT RELEVANT	-	STM	-

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SEQUENCE OF TEST									
Step	Previous		Description of Events	I/O	Interface	Comments	Next		Test Result
	Levels	Modes					Levels	Modes	
1	<L0/ LNTC/ L1/ L2>	<FS / OS / SR / SM / SH / UN / SL / SB / TR / PT / SF / IS / NL / LS / SN / RV / PS / NP / AD>					<L0/ LNTC/ L1/ L2>	<FS / OS / SR / SM / SH / UN / SL / SB / TR / PT / SF / IS / NL / LS / SN / RV / PS / NP / AD>	
2	<L0/ LNTC/ L1/ L2>	<FS / OS / SR / SM / SH / UN / SL / SB / TR / PT / SF / IS / NL / LS / SN / RV / PS / NP / AD>					<L0/ LNTC/ L1/ L2>	<FS / OS / SR / SM / SH / UN / SL / SB / TR / PT / SF / IS / NL / LS / SN / RV / PS / NP / AD>	
3	N/A	N/A					N/A	N/A	
...									

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END CONDITIONS (INTERNAL STATES)		
States of ERTMS/ETCS information	Status/Value	Description
ERTMS/ETCS Mode	<0 / 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8 / 9 / 10 / 11 / 12 / 13 / 14 / 15 / 16 / 17>	<FS / OS / SR / SM / SH / UN / SL / SB / TR / PT / SF / IS / NL / LS / SN / RV / PS / NP / AD>
ERTMS/ETCS Level	<0 / 1 / 2 / 3>	<L0 / LNTC / L1 / L2>
Adhesion factor	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Axle load speed profile	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Conditional Emergency Stop	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Default Gradient for TSR	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Driver ID	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
EOLM information	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Fixed Text Information (location based)	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Fixed Text Information (not location based)	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Generic LS function marker	<STORED / NOT STORED / NOT RELEVANT / VALID / UNKNOWN>	Free text
Geographical Position	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Gradient Profile	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text

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Inhibition of revocable TSRs from balises in L2	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
International SSP	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Language used to display information to the driver	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Level Crossing information	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Level Transition Order	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Linking	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
List of balises for SH area	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
List of Balises in SR Authority + SR mode speed limit and distance	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
LSSMA display toggle on order	<STORED / NOT STORED / NOT RELEVANT / VALID / UNKNOWN>	Free text
MA Request Parameters	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Mission performed with only one radio system	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Mode Profile	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Movement Authority	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text

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National Values	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Not yet applicable National Values	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Operated System Version	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Permitted Braking Distance Information	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Plain Text Information (location based)	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Plain Text Information (not location based)	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Position Report parameters	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Radio communication session	<ESTABLISHED / NOT ESTABLISHED / STORED / NOT STORED / NOT RELEVANT / VALID / UNKNOWN>	Free text
Radio Infill Area information	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Radio Network information	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Radio system used for safe radio connection	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
RBC ID/Phone Number	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
RBC contact information	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text

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RBC Transition Order	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
RBC/RIU System Version	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Reversing Area Information	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Reversing Supervision Information	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Route Suitability Data	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Signalling related Speed Restriction	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
STM max speed	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
STM system speed/distance	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Stop Shunting on desk opening	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Table of priority of trackside supported levels	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Temporary Speed Restrictions	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Track Ahead Free Request	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Track condition big metal masses	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text

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Track Conditions excluding big metal masses	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Train Data	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Train integrity status information	<NONE / CONFIRMED BY DRIVER / CONFIRMED EXTERNAL SOURCE / LOST>	Free text
Train Position	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Train Running Number	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Unconditional Emergency Stop	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text
Virtual Balise Covers	<STORED / NOT STORED / NOT RELEVANT / VALID / INVALID / UNKNOWN>	Free text

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END CONDITIONS ON INTERFACES			
State of interfaces	I/O	Interface	Comments
< NOT RELEVANT / SAFE CONNECTION SET-UP / SAFE CONNECTION NOT SET-UP>	<I/O / ->	RTM	Free text
<NOT RELEVANT / free text>	<I / O / ->	TIU	Free text
<NOT RELEVANT / free text>	<O / ->	DMI	Free text
NOT RELEVANT	-	BTM	-
<NOT RELEVANT / free text>	<I / ->	INT	Free text
< NOT RELEVANT / NOT AVAILABLE / TRAIN MOVED / TRAIN NOT MOVED / FAIL STATE>	<I / ->	CMD	Free text
< NOT RELEVANT / STANDSTILL / MOVING>	<I / ->	ODO	Free text
<NOT RELEVANT / free text>	-	ATO	Free text
NOT RELEVANT	-	JRU	-
NOT RELEVANT	-	LTM	-
NOT RELEVANT	-	SIM	-
NOT RELEVANT	-	STM	-

4.2.2.2 Handling of intentionally deleted test cases

- 4.2.2.2.1 For some reason, a test case may be intentionally deleted. In this case, all the test case tables will be deleted but the identification table. This identification table shall be filled like in the example below:

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IDENTIFICATION		
	Title	Unique Number
Tested Equipment	On-board equipment	
Tested Feature	<description>	<identifier>
Test Case of Feature	Intentionally deleted	Intentionally deleted
Applicable Mode/Level Combinations	Intentionally deleted	
Target of Test	Intentionally deleted	
Version	Intentionally deleted	Intentionally deleted
Author	Intentionally deleted	
Based on Requirements	ERTMS/ETCS - SRS <version>	Intentionally deleted
	Compatible with:	

4.2.3 Description of the template

4.2.3.1 The content of the set of test cases for a feature is:

Table 5: Template content of a feature

Abbreviation	Meaning
Header	<ul style="list-style-type: none"> • Explicit identifier of the feature to be tested • Designation of the feature to be tested • Total number of test cases to be tested

4.2.3.2 The content of a specific test case is:

Table 6: Template content of a test case

Abbreviation	Meaning
Identification	<ul style="list-style-type: none"> • Explicit number of test object • Designation of test object • Explicit number of the feature to be tested • Designation of the feature to be tested • Test case number within the feature to be tested • Test case name within the feature to be tested • Target of Test • SUBSET-026 and/or SUBSET-153 Requirement references • Test case version • Name of author • Envelopes with which this test case is compatible
Method of test	<ul style="list-style-type: none"> • Text description of test method • Text description of test constraints
Start Conditions	<ul style="list-style-type: none"> • Internal states of the test object <logical information> = <value> • States of interfaces <interface information> IN: Information OUT: Information

Table 6: Template content of a test case

Abbreviation	Meaning
Sequence of Test	<ul style="list-style-type: none"> IN: Information OUT: Information <p>Information consisting of:</p> <p><interface>.<structure> = <value></p> <p><interface> = Designation of interface</p> <p><structure> = Structure of information</p>
End Conditions	<ul style="list-style-type: none"> Internal states of the test object <p><logical information> = <value></p> <ul style="list-style-type: none"> States of the interfaces <p><interface information> IN: Information OUT: Information</p>

4.3 Inclusion of Features

4.3.1.1 Often used functionality in several different features could be separated in own features. This offers the possibility to test them with all aspects only at once, when the specific software architecture allows that.

4.3.1.2 This kind of feature could be part of the table “sequence of test” of a test case of another feature.

4.3.1.3 Clarification on how to use “Use_F#XXX”:

- a. Usage: the inclusion of “Use_F#XXX” in a TC was as restricted as possible.
- b. Syntax:
 - i. "Use_F#XXXXXXXX" (e.g. "Use_FT3060500") when any TC could be used.
 - ii. "Use_F#XXXXXXXX.W" (e.g. "Use_FT3060500.1" or "Use_FT4070201.59") when a specific TC could be used.
 - iii. "Use_F#XXXXXXXX.W-Y,Z" (e.g. "Use_FT3060500.4-7,9" to use TCs 4,5,6,7 or 9) when several TC could be used.
- c. “I/O” field: for this kind of step, the “I/O” field in the “Sequence of test” table shall be set to “None”.

4.3.1.4 At testing a test case with using another TC completely, the complete used TC is proved. No further testing of the used TC is necessary.

4.3.1.5 In case that it can be proven, by using the specific software architecture, that the separated functionality is realised exactly in the same way for the calling test cases, it is not needed to make the proof by testing the same functionality again and again

for all calling test cases. It is sufficiently to test each test case of the used feature at least one time.

4.4 Test Case design rules

4.4.1 General rules

4.4.1.1 Step descriptions have been standardized in order to ease the understanding of the test cases and the validation of the sequences. Additional information must be put in the Comment field.

4.4.1.2 Some steps in the "Sequence of steps" in a TC can be "optional" (and the reason for this will be added in the "Comment" field) as long as the removal of these steps in a Test Sequence does not affect the testability of any requirement in the "Based on requirements" field of the TC.

4.4.1.2.1 Note: for example, if a TC tests a functionality as a consequence of the reception of some information in L0/L1/L2, and the transmission media of this information is not relevant for the requirements tested by means of the TC, then four different steps should be written in this TC: one BTM step and its corresponding JRU step, and one RTM step and its corresponding JRU step (in the "Comment" column a sentence like "Only if L1/L0" should be added in the first two steps and "Only if L2" should be added in the last ones). Something similar could happen when trying to create (or review) a TC testing the same functionality for different modes and possibly having to add extra steps for certain modes. All this will have to be done with extreme care, in order not to miss any functionality defined by the requirements of a TC.

4.4.1.2.2 The removal of steps because they are optional at TS level will only be possible for steps identified as potentially optional at TC level (with "Only if" or "Optional step" after "Info:" of the in step comment).

4.4.1.3 If a TC is designed to be tested in several modes and levels, it is understood that only one combination of level and mode will be used each time the TC is actually tested in a Test Sequence (and this is independent from the agreement on testing each TC at least once, and hence not being obligatory to test all the TCs in all the possible levels and modes combinations).

4.4.1.4 How to fill in the columns of Previous/Next - Levels/Modes from the Table "Sequence of Test": the Previous Modes and Levels of the first step and Next Modes and Levels of the last step are always filled in with all Modes and Levels applicable at the start of the TC (as specified in the field "Applicable Mode/Level Combinations" from table "Identification") and at the end of the TC. Moreover, if the sequence of the TC includes or tests a level transition and/or a mode change, then the columns are filled in with consistent applicable Modes and Levels at least around the step where the change occurs. For the other steps, they can be filled in with the expression "N/A" (Not Applicable). If no event as Mode change and/or

level transition occurs during the TC, then the 4 columns (except the Previous Modes and Levels of the first step and Next Modes and Levels of the last step) are always filled in with the expression "N/A" (Not Applicable).

4.4.1.5 Chapter 6 TCs will have an extra column named M_VERSION in order to differentiate the message version interchanged between track and train.

4.4.1.6 There should be a related JRU step added for each:

- DMI step mentioning an event for which a DMI symbol is displayed (i.e. it was not displayed before) or removed (i.e. it was displayed before)
- TIU step mentioning a TIU I/O change of status

4.4.1.6.1 The JRU messages 5, 6, 7, 8, 9, and 10 shall immediately follow after the corresponding BTM, RTM or LTM step. Only JRU variables which are not part of the BTM/RTM/LTM message may be specified.

4.4.1.6.2 In case of negative output RTM or DMI step, there is no mandatory rule regarding the presence of a subsequent negative JRU step. However, if a negative JRU step is present, it only applies for the variables described in the output step just above (NID_MESSAGE, possibly with the NID_PACKET(s) mentioned for BTM/LTM/RTM step, or in the variable(s) for DMI step). However, it is recommended to add the negative JRU steps when it is possible and no ambiguity is foreseen whatever the use of the TC at TS level.

4.4.1.7 Only the testable requirements that will actually be tested in a TC have to be included in the "Based on requirements" field of the TC.

4.4.1.8 In chapters 7 and 8, the requirements linked to packets and messages are tested by sampling and are not included in "Based on requirements", mainly because they are repeated in many sub-chapters.

4.4.1.9 In the steps comments, what is part of the step evaluation (mandatory comments) and what is helping for the TC understanding and TS design (informative comments) shall be clearly differentiated. Informative comments shall be written after the "Info:" tag. All mandatory comments shall be written before this "Info:" tag.

4.4.1.10 What is part of the step evaluation shall always be indicated in the step description when it is possible, in order to limit the number of pieces of information to evaluate in the step comments.

4.4.1.11 Starting conditions and End conditions of internal states and interfaces shall not be indicated in the TC when the associated status is "NOT RELEVANT".

4.4.1.12 "NOT ..." shall only be added at the beginning of output steps descriptions. For incoming events that do not occur, there is the possibility to put this information as an informative comment of another step (in general, the next one).

4.4.1.13 Note: For instance, "NOT" RTM input steps shall not be used to indicate that no message is received during a period of time but, in general, an INT step indicating

that a timer expires (which is the proper triggering event) shall rather be used with the information that no message is received as an informative step comment. In addition, if, for the proper test of a TC, one message or active button shall not be acknowledged on the DMI, not adding any DMI input step in the “Sequence of Test” of the TC will be understood as not having to acknowledge it.

- 4.4.1.14** In step descriptions, “/” shall be used to indicate several options (in particular, “|” (logical OR) shall not be used). When the option to retain is linked to a previous event in the TC, it shall be indicated in the step comments at TC level (else, the correct option shall be indicated in the user comments of the TS in which the TC is used).
- 4.4.1.15** In steps descriptions, brackets “<>” shall only be used for information written in natural language (for example: “NID_C=<comment>”), for theoretical value of a variable (for example: “V_TARGET=<V1>”) or when it is necessary to interpret correctly a formal expression (for example: “DMI_SYMB_STATUS=<Bit56=1/Bit66=0>”). On the other hand, brackets “<>” shall not be used to express different possibilities (for example: “The driver selects “Level 0/1/2/NTC””).
- 4.4.1.16** When the position of the direction controller is not consistent with the direction of the train movement, it shall always be specified by a dedicated TIU input step. When the position of the direction controller is a triggering condition for an event (for instance, direction controller in backward position to display the acknowledgement request for Reversing mode), the position of the direction controller shall also be specified by a dedicated step even when it is consistent with the direction of the train movement.
- 4.4.1.17** Note: more generally, if it helps in understanding and adds value to the TC, it is still allowed to specify the position of the direction controller in a dedicated step, even when it is consistent with the direction of the train movement.
- 4.4.1.18** Each time the train starts moving and if no TIU input step has explicitly modified the position of the direction controller during the standstill time, it shall be implicitly considered that the position of the direction controller automatically matches the direction of the train movement (no TIU input step needed).
- 4.4.1.19** Note: therefore, if a dedicated TIU input step modifies the position of the direction controller during the standstill time and it is no longer consistent with the direction of the next train movement, but then the position of the direction controller has to be consistent again with the direction of the train movement when the train starts moving, another dedicated TIU step is needed before the train starts moving.
- 4.4.1.20** Step descriptions specifying that a CAB is active without further precision in step comments shall be understood as CAB A active. To specify that the CAB B is active, the CAB B shall be clearly mentioned in the step description or step comments.

- 4.4.1.21** In some situations, configuration choices (type of brake: service or emergency brake, radio system installed on board, etc.) are not explicitly specified in Subset-026. In these situations, two distinctive steps, one for each option (e.g. service brake and emergency brake) shall be added in the TC with the following step comment to make it clear that the check will depend on the supplier's choice: "Implementation dependent".
- 4.4.1.22** In step descriptions, only regular double quotes " shall be used (opening "or closing" double quotes shall not be used).
- 4.4.1.23** A test case is designed using the language version of the highest envelope with which it is compatible. If a language adaptation is required to include this test case in a sequence with a lower envelope, this adaptation will be made when the sequence is designed. It is allowed to use a lower version of the language if the requirements being tested require it.
- 4.4.1.24** Indication primitives are generally not included after the request primitive but for specific cases these input primitives can be included. When an input step related to the primitive is exceptionally included, details shall be specified in an informative step comment regarding the way to generate it: in a nominal way or not.
- 4.4.2 Management of Odometry interface**
- 4.4.2.1** ODO steps shall only be used when they trigger an event related to the next output step.
- 4.4.2.1.1** Note: for example, the ODO step "The train reaches standstill" is not mandatory when the train is supposed to stop but must only be used when it triggers output events.
- 4.4.2.2** Exception: an ODO step "The train reverts its direction of movement" can be used when the train reverts its movement direction, even if this ODO step does not trigger anything. At least one step must be present at such location.
- 4.4.2.2.1** Note: This exception is explained by the need to have a step located at a standstill in the Test sequence to make the link between the steps and the speed profile in the event of movement(s) in the opposite direction.
- 4.4.2.3** Note: if added at the beginning or the end of the TC, this step must be optional: the train could have already changed its running direction in a previous TC and it might be needed to allow the running direction to be changed again in TS design.
- 4.4.2.4** Note: in particular, an ODO step shall not be used as first step of the TC to specify whether the train shall be at standstill or moving at the beginning of the TC when it does not trigger any event. Instead, if this information is relevant for the TC, it can be specified as starting condition for the ODO interface, as an informative comment of the first step or in the Constraints of the TC.

4.4.2.5 When the train front end is not equal to the engine front (see [2]-3.6.1.3.4), the step comment should indicate it, in order to help for the TS design and/or the evaluation during test campaigns.

4.4.3 Management of DMI interface

4.4.3.1 For steps descriptions indicating that the driver “enters/modifies/selects” a value on the DMI, it shall be understood that the choice also includes the subsequent confirmation when it is required.

4.4.3.2 Note: for instance, no DMI input step indicating that the driver confirms the level is required after a DMI input step indicating that the driver selects the level.

4.4.3.3 In step descriptions, the wording “modifies” shall only be used when previous data exists and it must be modified. The wording “enters” shall be used when the previous data is irrelevant (i. e. no previous data exists or an existing value may or may not be modified).

4.4.3.4 When the current window is not certain (for example at the beginning of the TC), a step to enter the required window (“The driver presses ...”) shall be added.

4.4.3.5 A DMI input step shall not be added in the TC each time the driver has to close a window. The following guidelines shall be used regarding DMI input steps indicating that the driver closes a specific window:

- Such DMI input step shall be used when displaying a window and leaving it afterwards.
- Such DMI input step shall not be used (in general) when entering/modifying/confirming a value but shall be used if other events happen before the window shall be left.
- Such DMI input steps shall not be used to reach the Default Window at the end of the TC.

4.4.3.6 In step descriptions, the wording “Presses” shall always be used for a button pressing action in a window. The wording “Selects” shall be used when there is a choice to make between several options.

4.4.3.7 When the driver modifies and validates the Flexible Train Data, it shall be specified in two successive steps: first “The driver modifies and validates the "...” and then “The driver validates the "Flexible Train Data"”.

4.4.3.8 When the speed and distance monitoring information is not updated but remains displayed on the DMI, the step description “The speed and distance monitoring information is displayed” shall be used with a step comment specifying the information that is not updated on the DMI (for example “TSR is not taken into account”). A step such as “NOT The speed and distance monitoring information is displayed” shall not be used in this case.

4.4.3.9 The verification of the sounds played by the DMI will be based on the verification of JRU messages 20 and 22, which will demonstrate the consistency between the sound played and the status displayed.

4.4.4 Variables

4.4.4.1 Message/Telegram description table linked to any BTM/RTM/LTM step: when it is not necessary to assign a particular value to a variable to cover the requirements of a TC, the wording "FINITE VALUE" shall be used to fill the "Value" column.

4.4.4.2 In order to check the value of a variable belonging to the common header of JRU messages, the following wording (example with M_LEVEL) shall be used when the ID of the JRU message that will be generated cannot be determined: "Any message (NID_MESSAGE_JRU=ALL; M_LEVEL=1) is recorded".

4.4.4.3 When variables are mentioned in BTM/RTM/LTM/JRU step descriptions, both options shall be possible considering the value to be checked:

- with "=" after the variable name in the step description. If no specific value can be indicated at TC level or if this value is detailed in the step comments or if it is inherited from a previous value mentioned in the TC, a tag in natural language (like "<V1>") can be used.
- without "=" after the variable name in the step description.

4.4.4.4 Variables used in BTM/RTM/LTM/JRU step descriptions shall be real variables defined in Subset-026 or Subset-027. Group of variables (like TRAIN_POSITION defined in Subset-027) or single meta variables (like SYSTEM_VERSION and MODE) shall not be used as a variable in step descriptions.

4.4.4.5 For the variable Q_MARQSTREASON, the following wording shall be used to specify the value to check in the step description in a TC: "Q_MARQSTREASON=<xx1xx>" (using x if the bit value is unknown).

4.4.4.6 When specific variable values are required in the TC, they shall be included in the step description or in the step comment.

4.4.5 Packets

4.4.5.1 The way to describe a packet sent/received in a BTM/RTM/LTM step differs following the type of packet:

- Mandatory packets are always included when the TC is implemented in a TS
 - Example: In a TC containing a switch from SR to FS, the packet 12 is mandatory
 - Way to describe in the TC: These packets must be mentioned in the sequence of steps table (step descriptions) and described fully in the message description table
 - For a BTM/LTM step the mandatory Packet 255 does not have to be listed in the TC step description (except when it is explicitly needed) but must be included in the message table.

- Mandatory position report packet with choice between packet 0 and 1: for a list of radio messages, the inclusion of a position report is mandatory; generally, the choice between packet 0 and packet 1 is not made at the TC level, because most of the time, no constraint requests it before the TC is implemented in a TS
 - Way to describe in the TC: in the sequence of steps table, if the choice cannot be made at TC level, the text “containing packet 0/1” shall be used in the step description (if the choice can be made at TC level, only the correct packet shall be mentioned). In the message description table a packet 0 or 1 shall be included (packet 0 by default if the choice cannot be made at TC level). In case the choice cannot be made at TC level, an informative step comment can be added to indicate that a packet 0 or 1 has to be used and a comment must be added for the line NID_PACKET in the message description table to make clear that packet 1 must be used if position report is based on 2 BG.
- Optional packets related to the TC are optionally included when the TC is implemented in a TS
 - Example: In a TC containing a switch from SR to FS/LS/OS, the packet 80 is optional because it is included only when the TC is implemented in a TS with the switch from SR to LS/OS, but not when the TC is implemented with the switch from SR to FS
 - Way to describe in the TC: These packets must be mentioned in the "Comment" column of the concerned step with a meaningful comment (for example: "This Packet 80 will only be sent when testing the TC in OS or LS mode"), but must not be described in the message description table
- Optional packets not related to the TC, but whose inclusion is not forbidden when the TC implemented in a TS
 - Example: In a TC whose aim is a switch from SR to FS, the packet 67 is optional and has nothing to do with the TC aim, but it is not forbidden to include it if the message sending the packet 12 (for the switch to FS) is merged with a message from another TC dealing with track conditions that sends a packet 67
 - Way to describe in the TC: These packets must not be mentioned in the sequence of steps table nor in the message description table.

4.4.5.2 By default, a packet 255 shall be used at the end of every balise/loop telegram/message in the message table. Exception: the previous requirement shall not apply for a TC testing the reaction of the onboard equipment in the absence of packet 255 in a balise/loop telegram/message.

4.4.5.3 Subject to compliance with the previous requirements, in some cases it shall be possible to define a BTM/RTM/LTM step description without any packet.

4.4.5.4 When there are several packets mentioned in a step description, they shall be separated by a “,” (in particular, “and” shall not be used). “Or” shall never be used as well to separate packets in step descriptions since a choice between packets is not permitted in step descriptions. For the same reason, the wording “Packet x” shall not be used in step descriptions.

4.4.5.4.1 Exception: for a Position Report a choice between Packets 0 and 1 is possible as described in 4.4.5.1.

4.4.5.5 For negative steps, the step descriptions shall also contain the mandatory packages. There is no message table for negative steps.

4.4.6 Test Cases compatible with Reduced Envelopes

4.4.6.1 The test cases shall indicate whether they are compatible with the Full Envelope and/or one or more Reduced Envelopes.

4.4.6.2 This information is placed under the Baseline reference (see 4.2.2). For example:

ETCS Baseline 4 Release 1

Compatible with:

Full envelope of ETCS system versions up to 3.0

Reduced envelope of ETCS system versions up to 2.2

Reduced envelope of ETCS system versions up to 2.1

4.4.6.3 In order to rationalise the test cases created, a general principle is used: any information that is not compatible with an envelope must be ignored when this test is used in this envelope.

4.4.6.3.1 Note: for example, in the case of a testcase compatible with all envelopes and applicable in SM mode, it is understood that the modes are only applicable when they are available and will not be applicable when the testcase is used in the context of a reduced envelope.

4.4.6.4 The requirements listed in the Based on Requirements table include all the requirements covered by this test case in all the Envelopes with which it is compatible. In particular, this list may contain testable requirements for only some of the compatible envelopes, if they contain an exception for onboard reduced envelopes [12]. The list of requirements for each envelope is available in the requirements coverage (see Chapter 5).

4.4.6.5 In TCs compatible for reduced envelope up to SV 2.1 but not only, “packet 72/73” or “packet 74/76” can be used in the step descriptions (packets 72 and 76 only to use for reduced envelope up to SV 2.1). In the other fields of the TCs, references to plain/fixed text information are rather used in general.

4.4.6.6 When a test case contains steps which are only applicable for a certain Envelope, a tag is added to the step comment to indicate that it should be removed as optional when the test case is used in a sequence designed for a lower reduced envelope (e.g. “/NOT applicable in SV lower or equal than 2.2/”).

5. REQUIREMENTS COVERAGE

- 5.1.1.1** The attached file verifies that, for each envelope, each testable requirement is covered by at least one Test Case compatible with that envelope:



Traceability_matrix_3
60_400_allEnveloppes

- 5.1.1.2** Coverage strategy for the tables presents in SS-026:

Table	Coverage strategy
Chapter 3	
Table 1	tested through each condition listed by Table 2
Table 2a	each Information is at least covered in a Testcase
Table 2b	tested through each condition listed by Table 2c
Table 3 and 4	tested indirectly through the TCs testing subchapter 3.13
Table 5 - 16	each condition or transition is at least covered in a Testcase
Table A.3.1 - A3.2	each type of Data is at least covered in a Testcase
Table 17	tested indirectly through the TCs testing the listed requirements
Table A.3.4	each type of Data is tested in each group of situations
Table A.3.11	each type of Data is at least covered in a Testcase
Chapter 4	
4.5.2.1 table	each ONBOARD-FUNCTION is at least tested in active and inactive situations
4.6.2 Transitions Table	each transition is covered in a Testcase
4.6.3 Transitions Conditions Table	each condition is covered in a Testcase
4.7.2 tables – Input/Output information	for each information, condition A is testable at least in a specific mode
4.8.3, 4.8.4, 4.10.1.3 table	each information is at least covered in each possible situation A, R with or without exception
4.11.1.1 table	each transition is tested
4.12.1.2 table	each Brake command reason is tested in each possible situation M, R with or without exception
Chapter 5	

5.4.3.1 table	each #ID is at least tested under all possible conditions or output #ID
5.4.3.3 table	each Transition conditions is covered in a Testcase
5.6.2.2 table	each #ID is at least tested under all possible conditions or output #ID
5.10.4.1 table	each LX/LY transition is at least covered in a Testcase
5.11.2.2 table	each #ID is at least tested under all possible conditions or output #ID
5.17.2.2 table	each #ID is at least tested under all possible conditions or output #ID
5.21.2.2 table	each #ID is at least tested under all possible conditions or output #ID
Chapter 6	
All tables listing a 'translation of information'	<ul style="list-style-type: none"> • all T's and R's are tested at least once • all translations [#] are tested at least once • at least one U is tested, the others being tested by sampling in the other Testcases

6. METHODOLOGY AND RULES TO PREPARE TEST SEQUENCES

6.1 Purpose of test sequences

6.1.1.1 The purpose of building up TS is justified in the following issues: TC [5] are generic functional test units, which main purpose is to build the bridge between the Subset-026 requirements and the test specifications. However, they cannot be tested directly because:

- a) The ETCS Level and Mode are not fixed.
- b) The ETCS message description is not complete.
- c) The train movement information is just an isolated spot.
- d) The track description, in terms of track features with impact in on-board equipment interfaces (e.g. gradients, radio holes, etc), is missing.
- e) The train description is missing (for a proper train simulation).
- f) The train parameters loaded into the on-board equipment are missing.
- g) The way to bring the on-board equipment to the required starting conditions can only be done respecting the black box principle.

6.1.1.2 TS are just an organized set of TC, where the above-mentioned undefined issues are solved:

- a) The TCs are customised to a specific ETCS Level and Mode.
- b) The ETCS messages are completely defined with values selected among the appropriate values defined in the TCs according to the need of the underlying requirements.
- c) A continuous and realistic train speed profile starting and ending at standstill is defined.
- d) The track description complementary to the train speed profile is provided.
- e) The train description to build the continuous train speed profile is provided.
- f) The train parameters loaded into the on-board equipment are provided.
- g) The overall TC arrangement conforms with a fully testable scenario, where the starting and ending conditions of every TC are properly checked to match to the adjacent TC.

6.1.1.3 Taking into account that some of the previous items (e) and f)) are only be available prior to testing and are subject to change and due to the increased number of optional functionalities to be implemented on-board, a dynamic procedure is recommended to build up the Test Sequences.

6.1.1.4 In order to guarantee a reliable and reproducible set of TS, this chapter shall provide clear rules to build up TS from the TC, covering the complete list of issues above mentioned.

6.1.1.5 For each envelope (Full envelope of ETCS system versions up to 3.0, Reduced envelope of ETCS system versions up to 2.2 and Reduced envelope of ETCS system versions up to 2.1), a set of sequences will cover the test cases compatible with that envelope.

6.2 General rules on test sequences

6.2.1 Default values

6.2.1.1 In the present section default values are defined.

6.2.1.2 A default value shall be used if no other value is requested by the tested requirement.

6.2.1.3 A default value shall be changed if another value is requested by the tested requirement.

6.2.2 Content

6.2.2.1 A TS is a list of the events to be evaluated and validated to check the correct functioning of the on-board equipment. Other events not described in the test sequence can occur but are not used for evaluation and validation purposes.

6.2.2.1.1 Example: There is no need to check the record of every event in the JRU or each position report sent by the on-board equipment. This saves time when editing, running and validating the TS.

6.2.2.2 The TSs shall be designed according to the strategy defined in 6.3.1.

6.2.2.3 The objective is to obtain a set of simpler TS in which the link to the Subset-026 [2] is clearer.

6.2.2.4 A TS should be realistic from the engineering, operational and track layout point of view. Unrealistic circumstances are allowed for the testing of error conditions.

6.2.3 Length

6.2.3.1 A TS shall be composed of at least one TC.

6.2.3.2 To reduce testing costs (see 6.3.1.1.1), the sequences are intended to be short. There is no upper limit for the number of TCs in a TS but the total number of steps in a TS shall be less than 400. This total number of steps shall take into account all steps in the TS including the steps related to the SoM and to the EoM.

6.2.3.3 Note: It is recommended to have a number of steps between 150 and 200.

6.2.3.4 The objective is to obtain a set of shorter TSs, avoiding the need to « cut » a TS to test its second part if the first one can't be performed.

6.2.4 Starting conditions of a TS

6.2.4.1 Pre-sequences (sequences out of the testing scope) shall not be used. In order to fulfil the starting conditions of the first Test Case of Type 3 (see 6.3.1.2) in a test sequence, harmonised procedures shall be used (see 6.3 and A) by default.

6.2.4.1.1 Note: If the train transits from NP mode with defined starting conditions, the steps to reach those conditions are part of the TS. This avoids divergences between test sequences to reach the starting conditions.

6.2.4.2 Test sequences shall start in NP mode, never in SB mode. This allows a proper identification of the test results to be evaluated and validated in the log files.

6.2.4.3 The TS designer shall be careful with the data stored on-board that are not deleted nor reset when entering in NP, because at the TS execution, the value of those data could be kept from the preceding TS execution.

6.2.4.3.1 To test specific situations, the TS may require the non-volatile memory to be reset.

6.2.4.4 The data stored on-board that are unchanged when entering in NP are: National Values, Immediate Level Transition Order/Conditional Level Transition Order, Accumulated underestimation / overestimation in measuring the movements over a defined total distance, Not yet applicable table of priority of trackside supported levels, Radio Network information (Radio Network type and GSM-R Radio Network ID), Operated System Version, Virtual Balise Covers, Language used to display information to the driver, Generic LS function marker, ATO selector position (see 4.10 in Subset-026 [2]).

6.2.4.5 The data stored on-board that are invalidated when entering in NP are: EOLM information, Train Position, ERTMS/ETCS level, Table of priority of trackside supported levels, RBC contact information (or RBC ID/Phone Number in Reduced Envelopes sequences) (see 4.10 in Subset-026 [2]).

6.2.4.5.1 Those data are influenced by the Cold Movement Detection when exiting NP.

6.2.4.5.2 At the beginning of the TS, the status of the ERTMS/ETCS level information is invalid. As the value of this information depends on the last TS that was executed before, the level value shall not be used until the driver has validated it (with or without modification).

6.2.4.6 It shall be considered default national values are used at the beginning of a TS. This is ensured by 6.2.5.1.

6.2.5 Ending conditions of a TS

6.2.5.1 If national values different from the default ones are sent in a TS, the default national values shall be sent at the end of this TS. The reason why is to avoid using

other national values inherited from the previous test sequence executed in the next test sequence (see 6.2.4.6).

- 6.2.5.2** A TS shall end with a switch to NP implemented by FT4060300.1.
- 6.2.5.3** It is not requested to include the radio messages exchange related to the EoM to finish a TS.
- 6.2.5.4** A TS shall end with the train speed at zero.
- 6.2.5.5** If a generic LS function marker is stored by the on-board in a TS the marker shall be deleted again in the end.
- 6.2.5.6** If an Operated System Version different from the highest supported system version is stored by the on-board in a TS, this data shall be changed again to the highest supported system version in the end.
- 6.2.5.7** If a Virtual Balise Cover is stored by the on-board in a TS, this data shall be deleted again in the end.
- 6.2.5.8** If a Language used to display information to the driver different from English is stored by the on-board in a TS, this data shall be deleted again in the end, and the value shall be set back to English.

6.2.6 Available RBCs/RIUs

- 6.2.6.1** Each RBC/RIU used during the TS shall be listed in the available RBC/RIU section of the TS description.
- 6.2.6.2** This listing shall describe each RBC/RIU with the following information:
 - a) Name: A unique name in the TS shall be used to refer to each RBC/RIU: RBC1/RIU1 for the first RBC/RIU, RBC2/RIU2 for the second RBC/RIU, RBC3/RIU3 for the third RBC/RIU and RBC4/RIU4 for the fourth RBC/RIU.
 - b) Country (NID_C): see Table 17 in Subset-094 [7]
 - c) RBC/RIU Identifier (NID_RBC/NID_RIU): see Table 17 in Subset-094 [7]
 - d) RBC/RIU ETCS Identifier: see Table 17 in Subset-094 [7]
 - e) Phone Number (NID_RADIO): A fixed value shall be used: 003265342101FFFF for first RBC/RIU, 003265342102FFFF for the second RBC/RIU, 003265342103FFFF for the third RBC/RIU and 003265342104FFFF for the fourth RBC/RIU.
- 6.2.6.3** NID_RADIO (phone number) shall be set to 1500FFFFFFFFFFFFFF for the use of the short number (default number for most appropriate RBC according to §9.8.4 Table 9-10 in EIRENE SRS [10]).

6.2.7 GSM-R Radio networks

6.2.7.1 Each GSM-R Radio network used during the TS shall comply with the following values:

- a) Name: A unique name shall be used to refer to each radio network: Network1 for the first network and Network2 for the second network.
- b) Identity of GSM-R Radio Network (NID_MN): 654321 for the first network and 654322 for the second network.

6.2.7.2 Each TS shall be designed by default under the assumption that the stored radio network type is GSM-R at the beginning of the TS.

6.2.7.2.1 Exception: TS requiring a specific radio system installation configuration, can be designed with another stored radio network type than GSM-R at the beginning of the TS.

6.2.8 Track to train information

6.2.8.1 Radio messages

6.2.8.1.1 Default values

6.2.8.1.1.1 T_TRAIN (trainborne clock) shall be set to 0, but the value 0 shall not be used during the TS run, because it is not possible to know the T_TRAIN value before the run of the TS.

6.2.8.1.2 Time/Position delays and Performances

6.2.8.1.2.1 Time and Position delays and performances shall follow the defined values in Table 9. They shall apply for the delays and back delays of the radio messages.

6.2.8.1.2.2 The delay and back delay definition is described in Figure 1. An example is given in Figure 2.

6.2.8.1.2.3 The presence of a back delay is not mandatory. When a back delay is used for a message, the value of the back delay shall be equal to the value of the delay of the message.

6.2.8.1.2.4 The delay and the backdelay shall start counting when the previous input step at the same distance is executed or, if this time cannot be determined, when the step distance is reached.

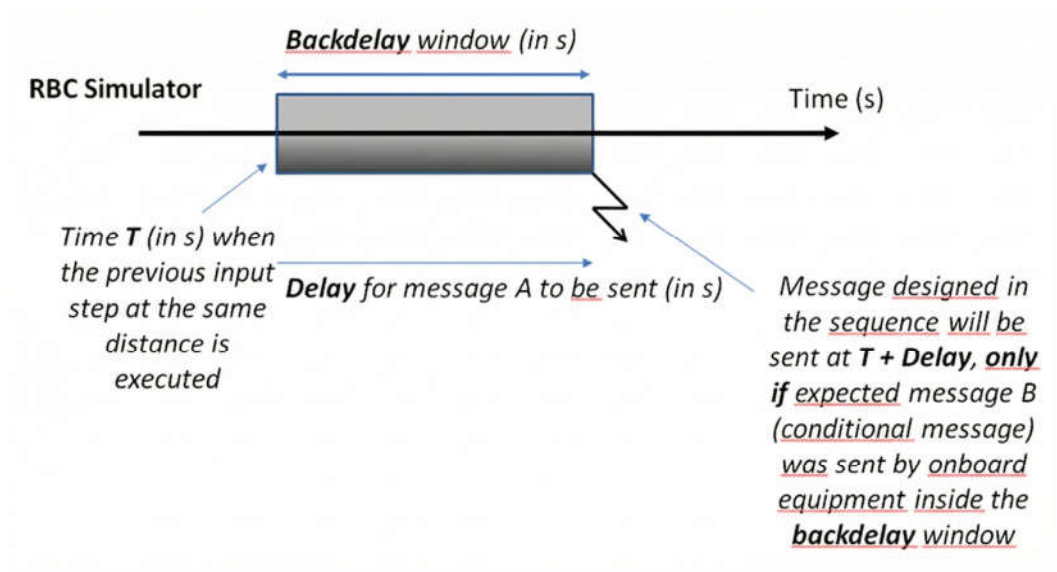
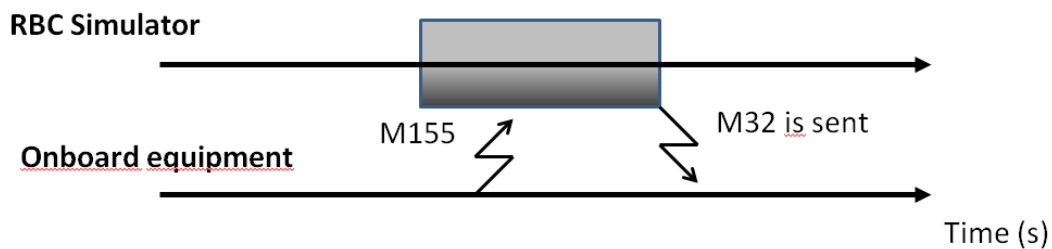


Figure 1: Delay and Back delay definition

Example 1: message 32 can be sent by RBC Simulator because onboard equipment message is in the backdelay window



Example 2: message 32 cannot be sent by RBC Simulator because onboard equipment message is not in the backdelay window



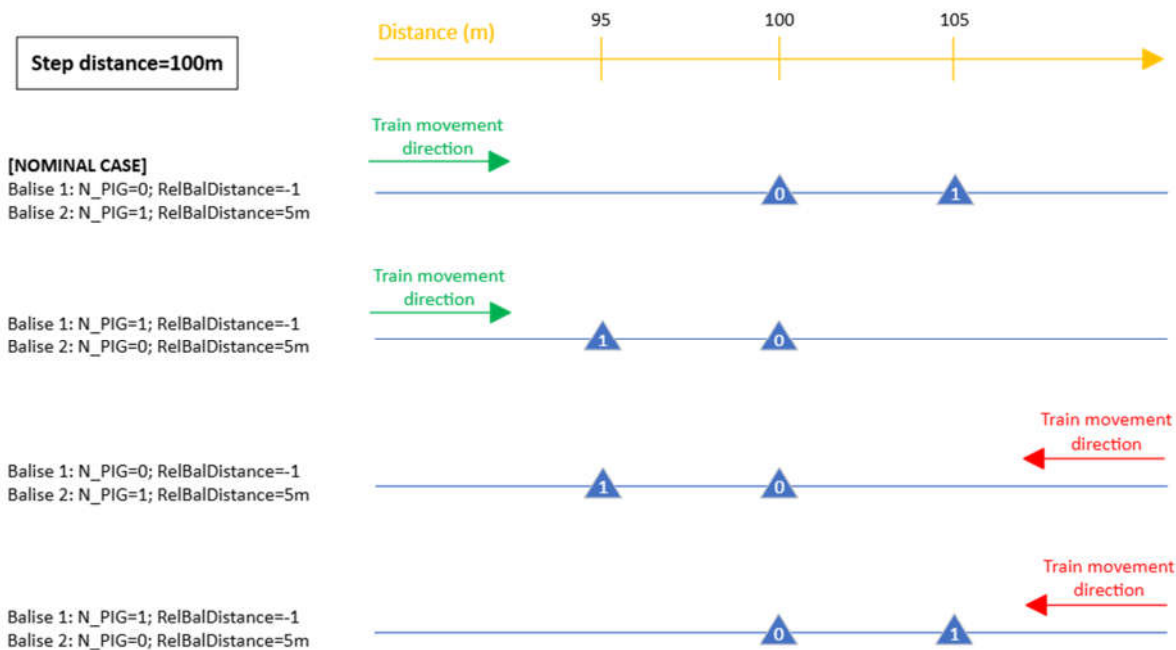
Figure 2: Delay and Back delay example

6.2.8.2 BG messages

6.2.8.2.1 BG engineering default values

- 6.2.8.2.1.1 Distance between 2 balises: 5m (in order to enable the good reception of telegrams even with a speed of 500 km/h according to 5.6.3 in Subset-036 [4]).
- 6.2.8.2.1.2 Default location accuracy of a balise group: 12 m.
- 6.2.8.2.1.3 The balises inside a BG shall be defined in the order in which the train will encounter them.
- 6.2.8.2.1.4 Note: consequently, the distances at which the balises are located depend on the train movement direction when the train encounters the balise group (direction in which the step distance increases or not).
- 6.2.8.2.1.5 For each but the first balise inside a BG a relative distance shall be given with respect to the balise previously encountered.
- 6.2.8.2.1.6 The step distance shall refer to the position of the reference balise.

Table 7: examples of the various possibilities for BG



- 6.2.8.2.2 Content of messages
- 6.2.8.2.2.1 N_TOTAL shall be set to the number of balises contained in the balise group minus 1.
- 6.2.8.2.2.2 M_MCOUNT (message counter) shall be set to 0 or 255.
- 6.2.8.2.2.3 NID_C of BG header shall be set to 64 or 352.
- 6.2.8.2.2.4 Q_DIR (validity direction of transmitted data) shall be set to 1 for nominal situations that do not test specific cases.
- 6.2.8.2.2.5 By default, a packet 255 shall be used at the end of every balise telegram.

6.2.8.2.2.5.1 Exception: the previous requirement shall not apply for a TC testing the reaction of the on-board equipment in the absence of packet 255 in a balise telegram.

6.2.8.3 Loop messages

6.2.8.3.1 Content of messages

6.2.8.3.1.1 By default, a packet 255 shall be used at the end of every loop message.

6.2.8.3.1.1.1 Exception: the previous requirement shall not apply for a TC testing the reaction of the on-board equipment in the absence of packet 255 in a loop message.

6.2.9 Train to track information

6.2.9.1 Default values

6.2.9.1.1 L_DOUBTOVER (over-reading error) shall be set to 0, but the value 0 shall not be used during the TS run, because it is not possible to know the L_DOUBTOVER value before the run of the TS.

6.2.9.1.2 L_DOUBTUNDER (under-reading error) shall be set to 0, but the value 0 shall not be used during the TS run, because it is not possible to know the L_DOUBTUNDER value before the run of the TS

6.2.9.1.3 T_TRAIN (trainborne clock) shall be set to 0, but the value 0 shall not be used during the TS run, because it is not possible to know the T_TRAIN value before the run of the TS.

6.2.9.1.4 NID_ENGINE (on-board ETCS identity) shall be set to 76000d.

6.2.9.2 Report Last Relevant Balise Group

6.2.9.2.1 The on-board equipment shall report a Last Relevant Balise Group (LRBG) if the RBC has to use it later in the TS.

6.2.10 Train parameters

6.2.10.1 One important item for the design of reliable and unified TSs is the set of default train parameters to be used in a sequence. It shall follow Subset-094 [7] Annex A.1.

6.2.10.2 The default train parameters shall not be used in specific cases where other train parameters need to be entered to test some Subset-026 [2] clauses (e.g. 3.18.3.2.1).

6.2.10.3 The accomplishment of braking requirements shall be verified for the two generic categories of trains: Freight and passengers trains. That requires two sets of Test Sequences for the verification of the Braking curves.

6.2.11 Driver inputs

6.2.11.1 Certain DMI input steps require a choice which specific input is selected by the driver, e.g. choosing a level. Such a selection shall be provided as content of the step and mentioned in the user comment.

6.2.12 Train movement

6.2.12.1 Speed

6.2.12.1.1 By default, the sequence shall be run at constant speed.

6.2.12.1.2 A speed profile shall be specified in the sequence if the sequence is not entirely at standstill.

6.2.12.1.2.1 The speed profile shall describe the speed the test bench will try to provide to the on-board during the run of the sequence.

6.2.12.1.2.2 The decelerations resulting from the command of the brake application by the on-board equipment may slightly differ from the speed profile.

6.2.12.1.2.3 When the crossing of a limit shall test the limit shall be exceeded by at least 0.5 km/h and for at least 1.5 s to enable the laboratory to reproduce it and the train to recognise it.

6.2.12.1.2.4 The speed shall stay 1 km/h clear of the next limit (if one exists).

6.2.12.1.2.5 The distances in the Speed Profile refer to the front end of the engine.

6.2.12.2 Acceleration

6.2.12.2.1 The acceleration curve shall follow the default parameters in Table 8.

Table 8: Acceleration curve

Position (m)	Time (s)	Speed (m/s)	Speed (km/h)
0	0	0	0
25	7	7	25
50	10	10	36
100	14	14	51
150	17	17	62
200	20	20	72
300	24	24	88
400	28	28	102
500	32	32	114
600	35	35	125
700	37	37	135
800	40	40	144

Position (m)	Time (s)	Speed (m/s)	Speed (km/h)
900	42	42	153
1000	45	45	161
1200	49	49	176
1400	53	53	190
1600	57	57	204
1800	60	60	216
2000	63	63	228
2200	66	66	239
2400	69	69	249
2600	72	72	260
2800	75	75	269
3000	77	77	279
3200	80	80	288
3400	82	82	297
3600	85	85	305
3800	87	87	314
4000	89	89	322

6.2.12.3 Deceleration and brakes

6.2.12.3.1 For the decelerations, please refer to A.3.2, A.3.7, A.3.8, A.3.9, A.3.12, A.3.13 in Subset-026 [2] and use the ERA Braking Curves Simulation Tool [9] adapted to the tested envelope.

6.2.12.3.2 In case of SB or EB application, the deceleration in the speed profile shall remain within $[0.8 \text{ m/s}^2; 1.5 \text{ m/s}^2]$ – most common value to be used being 1 m/s^2 - to avoid trains reaching standstill before the standstill point defined in the speed profile but due to specific conditions in the TS (small distances, uphill section, SR distance to be overpassed...) decelerations in the SP may be defined outside of the boundaries.

6.2.12.3.3 Note: for decelerations in speed profile not due to SB or EB application, deceleration rates lower than 0.8 m/s^2 can be used.

6.2.12.4 Delays

6.2.12.4.1 Delays shall follow the default values in Table 9.

Table 9: Delays

Task				Timing
Description	Start Event	End Event	Level	Speed Profile
Set-up radio connection (501/506)	On-board equipment sends Msg 501	On-board equipment receives Msg 506	All	10s
Release radio connection (502/508)	On-board equipment sends Msg 502	On-board equipment receives Msg 508	All	10s
Msg exchange (X/Y) where (X/Y) is (155/32), (157/43 41 40), (129/8), (132/3), (156/39), (130/28), (136/6), (159/38), (133/7), (131/4) or (131/5)	On-board equipment sends Msg X	On-board equipment receives Msg Y	All	5s
MA Request timeout	On-board equipment sends Msg 132	Timer expires	L2	60s
Entering new Driver ID or Train running number	Driver ID or Train running number window is available	Driver ID or Train running number entered	All	10s
Entering new RBC ID & Phone number	Driver selects "Enter RBC data" window	RBC data entry completed	L2	30s
Entering new train data	Driver selects "Train data"	Train data entry completed	All	20s
Validating existing data (Driver ID, Train running number, RBC ID & Phone number)	Data entry window is available	Data validated	All	5s
Validating existing Train data	Train Data entry window is available	Train Data validated	All	10s
Start of Mission L0/LNTC/L1	Driver ID window is displayed	On-board equipment is in L0/UN or LNTC/SN or L1/SR	L0/L1/LNTC	50s

Task				Timing
Start of Mission L2	Driver ID window is displayed	On-board equipment is in L2/FS	L2	120s
Driver selection time	A button is enabled	Driver selects the button	All	5s
Driver checks a button is enabled	A button is enabled	Driver checked the button is enabled	All	5s
Driver checks all buttons are selectable			All	30s
Brake release time	On-board equipment receives Msg 2, Msg 3 or Driver acknowledgment	On-board equipment releases brakes	L2	5s
Tolerance on the standstill position after braking	The train overpasses the standstill absolute distance defined in the TS step	The train reaches standstill	All	10s
Driver opens/closes the desk	The last event before opening/closing the desk occurs	The desk is open/closed	All	5s

6.2.12.5 Step distance

6.2.12.5.1 The distance specified in each input step shall correspond to the travelled distance the odometer is transmitting to the on-board when the step event occurs: intentional errors in the distance, for example due to slippery rails, can so be introduced for specific test purposes.

6.2.12.5.1.1 Exception: For BTM steps, the balise telegram of the location reference balise has to be sent when the balise antenna reaches the location defined in the step.

6.2.12.5.1.2 Exception: An ODO step may describe a - physical or virtual - point of the train or the engine (that is one of min safe front end, max safe front end, estimated front end, min safe antenna, max safe antenna, estimated antenna, min safe rear end) which has reached the given distance. This means the step distance equals the travelled distance transmitted by the odometer corrected with the offset between the first CAB of the engine activated in the test sequence and the specified point of the engine or the train.

6.2.12.5.1.3 Exception: RTM input steps related to the exchange of radio messages that contain delays will happen with the specified delay in relation to the previous input

step at the same distance or, if this time cannot be determined, to the time when the step distance is reached (see 6.2.8.1.2). Conditional emissions should be avoided when the use of ODO steps makes the time/position at which the delay is triggered ambiguous.

6.2.12.5.2 The distance specified in each output step shall equal that of the previous input step. Output steps shall be placed at the same distance as the step of which they are an immediate consequence. Any delay either uncertain (e.g. internal computation, juridical recordings) or inherent (e.g. reaching the second balise of a group) of the event is ignored.

6.2.12.5.2.1 Exception: if no previous input step can be defined as triggering step at the same distance, the distance specified for the output step shall correspond to the travelled distance the odometer is transmitting to the on-board when the step event is expected to occur.

6.2.12.5.3 A forward movement of the train related to the first cab open in the sequence shall induce increments of step distance or, in case of successive steps distances that do not refer to the same point of the train/engine, decrements of step distance shorter than the relative distance between these two points of the train/engine.

6.2.12.5.4 If two cabs are defined in a sequence, a forward movement of the train related to the second cab shall induce decrements of step distance or, in case of successive steps distances that do not refer to the same point of the train/engine, increments of step distance shorter than the relative distance between these two points of the train/engine.

6.2.12.5.4.1 When the train length/safe consist length is not received through external sources, in case of change of active cab of the engine, it implicitly means that a reconfiguration of the train occurred:

- a) the new active cab of the engine is in front of the train;
- b) the train length remains the same (part of the train that was at the rear of the engine is now on the other side on the engine).

6.2.12.5.4.2 Note: this reconfiguration allows to run the TS with the same train type (and therefore train length) in case of change of active cab.

6.2.12.5.5 Q_DIRTRAIN shall be set to Unknown at standstill in the TS.

6.2.12.5.6 Sequences are designed taking into account that both balise and loop antennas are at the same position.

6.2.12.5.7 When the train front end is not equal to the engine front (see [2]-3.6.1.3.4), the step comment or the user comment should indicate it, in order to help for the TS design and/or the evaluation during test campaigns.

6.2.13 TSs for testing braking curves

- 6.2.13.1** If a Test Case aims to test explicitly any supervision limit defined in the chapter 3.13 of Subset-026 [2], the Test Sequence where this TC is tested will be designed using an appropriate tool for the calculation of the braking curves (the ERA tool [9] by default).
- 6.2.13.2** The train parameters (including the different brake parameters) that will be introduced in the ERA tool will be the ones defined in Subset-094 [7] Annex A both for Gamma and Lambda trains.
- 6.2.13.3** The track parameters and the National Values will be chosen freely as long as they respect the design constraints mentioned in the corresponding Test Cases.
- 6.2.13.4** The resulting curves will be used to set the different locations where the events will be checked in the Test Sequences (see the B for an example).
- 6.2.13.5** Note: the resulting curves will also be used to design some of the curves in the Speed Profile of the TSs.

6.2.14 Train integrity device

- 6.2.14.1** The default value for the integrity device is "information not available" (see M_TRAININTEGRITY_ST in Subset-094 [7] 8.3.3.40).

6.3 Cover a test case in a test sequence

6.3.1 Test case coverage strategy

6.3.1.1 Introduction

- 6.3.1.1.1** The multiple uses of the same TC shall be minimised by means of a convenient design of every TS. The reason is to reduce the testing time and the waste of resources.
- 6.3.1.1.2** Each TC belongs to a feature and each feature is related to a section of Subset-026 [2] (see Subset-076-5-2 [5]).
- 6.3.1.1.3** For each section of Subset-026, Table 10 defines a Type and a coverage strategy that applies to the TCs of the features related to this section.

Table 10: Sections overview

Chapter number	Section	Type	Comment	Coverage Strategy
3	3.4	3		Dedicated TS
3	3.5	1 , 2 , 3 , 4	Radio Communication	Scattered
3	3.6-3.12	3		Dedicated TS
3	3.13	3	Braking curves	Dedicated TS

Chapter number	Section	Type	Comment	Coverage Strategy
3	3.14-3.20	3		Dedicated TS
3	A.3.1-A.3.13	3		Dedicated TS or Scattered
4	4.4	3		Dedicated TS
4	4.5	3		Scattered
4	4.6	2	Mode Transition	Scattered
4	4.7	3	DMI display	Scattered
4	4.8	2 , 3	Reception of information	Dedicated TS or Scattered
4	4.9	3		Scattered
4	4.10	3		Dedicated TS or Scattered
4	4.11-4.12	3		Scattered
5	5.4	1	SoM	Scattered
5	5.5	4	EoM	Scattered
5	5.6-5.9	3		Dedicated TS
5	5.10	2	Level Transition	Scattered
5	5.11	3 , 4	Trip	Dedicated TS or Scattered
5	5.12-5.22	3		Dedicated TS
6	6.6	3	Older system versions	Dedicated TS
7	7.3-7.5	3	Language	Dedicated TS or Scattered
8	8.4-8.7	3	Messages	Dedicated TS or Scattered

6.3.1.2 Test case type

6.3.1.2.1 In Table 10, the Type column classifies the TCs following the context of their application as described in Figure 3.

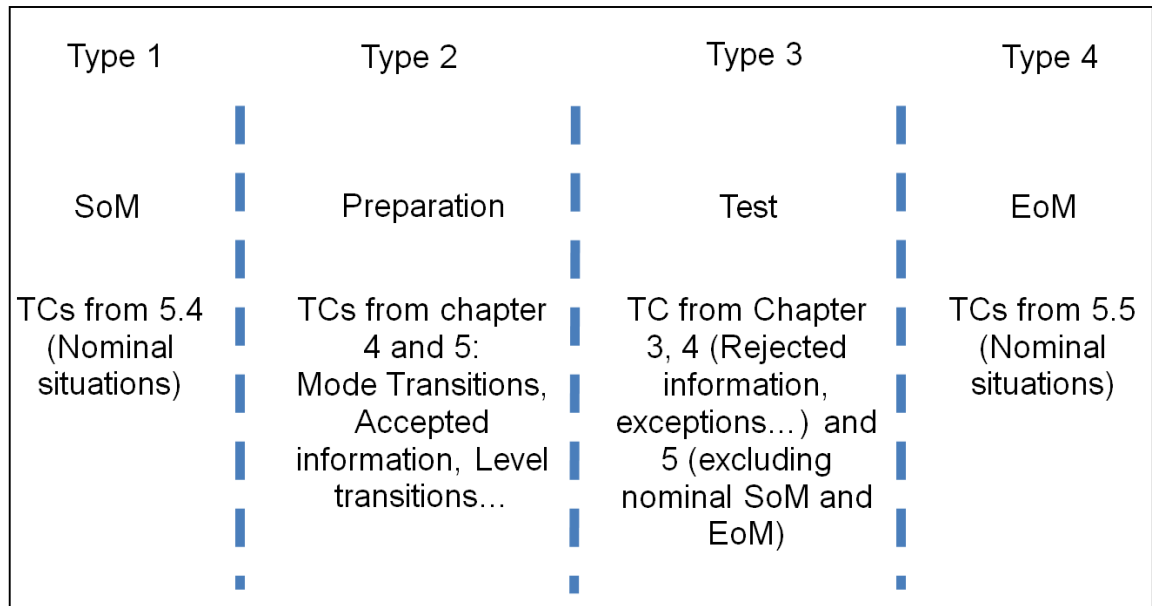


Figure 3: Test Sequences Structure (Typology N)

6.3.1.3 Section coverage strategy

6.3.1.3.1 In Table 10, the coverage strategy column defines the strategy to be applied to introduce a TC in a TS:

- a) Dedicated TS: The TCs are covered in one or several dedicated TSs
- b) Scattered: The TCs are scattered to be covered in the entire set of TSs
- c) Dedicated TS or Scattered: Both solutions apply

6.3.1.3.1.1 Exception: The TCs testing any of the optional interfaces (RIU, Euroloop, STM, Train Data acquired from ERTMS/ETCS external sources, Safe consist length information acquired from ERTMS/ETCS external sources) shall be introduced in dedicated TSs.

6.3.1.3.1.2 Exception: The TCs testing any of the functionalities that may not be implemented by every on-board equipment can be covered in generic TSs if they are not interfering with the coverage of the generic TCs in this TS. If not possible, those TCs shall be introduced in dedicated TSs.

6.3.1.3.1.2.1 The functionalities that may not be implemented by every on-board equipment are: Train integrity , Level NTC, Cold Movement Detector.

6.3.1.3.1.3 TCs covering requirements specific to a radio system installation configuration shall be put in dedicated TS (without any coverage of “generic” requirements in these TS), as the other “functionalities that may not be implemented by the on-board equipment”.

6.3.1.3.1.4 The TCs covering general requirements and used in dedicated TSs covering TCs testing optional interfaces or functionalities that may not be implemented by all on-

board equipment, should also be covered in one or several TSs covering only common interfaces and functionalities.

- 6.3.1.3.1.5 TCs covering general requirements and used in TSs dedicated to backward compatibility should also be covered in one or more TSs covering only the main system version.

6.3.1.4 Generic test sequence build-up process

- 6.3.1.4.1 The TS designer shall follow the following process (see Figure 3) to build-up the TSs:

- a) Select one Type 3 TC
- b) Select level and mode for this TC
- c) Select Type 1 TCs compatible with the level under choice
- d) Select Type 2 TCs driving the on-board equipment to the selected mode and required starting conditions in Type 3 TC
- e) Not mandatory: select Type 4 TCs compatible with ending conditions in Type 3 TC
- f) Fix the train description (compatible with Subset-094 [7] Annex A.2)
- g) Fix the train parameters (compatible with Subset-094 [7] Annex A.1)
- h) Fix the track description (compatible with train description and Type 3 TC requests)
- i) Build up the train speed profile (compatible with train and track description and Type 3 TC requests)
- j) Assign location (and time) information to every step of the TS (compatible with train speed profile)
- k) Complete "Input" messages (compatible to previous sets of information)

- 6.3.1.4.2 If possible, the TS designer shall include several Type 3 TCs in the same TS. Each Type 3 TC requires to be preceded by Type 2 TCs driving the on-board equipment to the selected mode and level and to the required starting conditions in the Type 3 TC.

6.3.2 Introducing a TC

6.3.2.1 Nominal TCs

- 6.3.2.1.1 In the TS, to cover a TC A, it is usually necessary to include before it a TC B that is used to set the on-board equipment in the starting conditions of TC A. It often happens TC B is already covered in another TS. This is the case e.g. for the TC that are used for the SoM and that are necessary for each TS. In such situation,

the TC B with the minimum number of steps out of all the TC B that would be suitable for preceding TC A shall be chosen.

- 6.3.2.1.2 This is done by defining a list of "Nominal TCs" to be used in a list of situations:
- a) When drafting the beginning of a TS, the default SoMs specified in A shall be used by default. These harmonised procedures avoid unnecessary checks on the DMI and repetition of radio messages. This saves time when editing, running and validating the TSs. The default SoMs are options taken from the SoM procedure flowchart (5.4.4 in [2]) and used by default. E.g. Default SoM in L2 consists in a default SoM in L1 followed by the reception of orders to contact RBC and to switch to L2. This does not prevent that the different SoM possibilities will be tested among the set of TSs of [6].
 - b) The sending of an empty BG requested e.g. for the reset of odometry.

6.3.2.2 Coverage of a TC

- 6.3.2.2.1 The coverage of the entire set of TCs is ensured in chapter 7.
- 6.3.2.2.2 One inclusion of any TC in a TS is sufficient to cover the concerned TC, i.e. to cover every requirement of the TC. Thus each TC shall be included at least once in a TS with all its steps.
- 6.3.2.2.2.1 Exception: A TC is considered as covered if it is included in a TS with all its steps but steps removed for a reason described in 6.3.2.2.5, 6.3.2.2.7 or 6.3.3.1.3. The steps removed during the design are not taken into account during the execution nor validation.
- 6.3.2.2.2.2 Removed steps and the reason for removal are internal information and do not appear in the published sequences used for a test campaign.
- 6.3.2.2.3 If a TC is designed to be tested in several modes and levels, there is no obligation to test it in all the possible levels and modes combinations.
- 6.3.2.2.4 To cover a TC Y, it shall be first checked if this TC Y appears in a "Use_FTXXXXXXX.Y" (where XXXXXXXX is the feature number and Y is the TC number) to cover TC Y during this "Use_FTXXXXXXX.Y". This reduces unnecessary redundancy.
- 6.3.2.2.5 Some steps in the "Sequence of steps" in a TC are "optional" as long as the removal of these steps in a TS does not affect the coverage of any requirement in the "Based on requirements" field of the TC. These steps shall be identified with "Only if" or "Optional step" after "Info:" in the step comment of the TC.
- 6.3.2.2.5.1 Example: An "optional" step is removed from the TS if the mode or level chosen for the TS makes it not applicable, if the step specifies that the driver presses a button to enter a DMI window whereas the window is already displayed, if the step specifies that the driver requests the speed and distance monitoring information to be displayed whereas this information is already displayed...

- 6.3.2.2.5.2 The reason for removal shall be specified starting with the syntax "OPTIONAL_STEP".
- 6.3.2.2.6 When it is absolutely needed for the TS design, the removal of a step from a TC in a TS for another reason than the ones mentioned in 6.3.2.2.5, 6.3.2.2.7 and 6.3.3.1.3 is allowed as long as the TC is covered somewhere else.
- 6.3.2.2.6.1 The reason for removal shall be specified starting with the syntax "INCOMPATIBLE_STEP".
- 6.3.2.2.7 Some TCs need to use other TCs (they are identified in the steps with the clause "Use_FTXXXXXXX" where XXXXXXXX is the feature number) to cover their requirements. In this case, when drafting a sequence, the complete list of the requirements of the TC shall be covered (e.g. 4.10 and A.3.4 in Subset-026 [2]).
- 6.3.2.2.7.1.1 If a TC is used instead of a step, this step shall be removed from the TS. The reason for removal shall be specified starting with the syntax "Use_FTXXXXXXX.Y" where XXXXXXXX is the feature number and Y is the TC number. This identifies the TC used instead of the removed step.
- 6.3.2.2.7.1.2 The TS step number of the first step of the TC used instead of the removed step shall be specified in the "Replacing Step" field.
- 6.3.2.2.7.2 Example: In the **Error! Reference source not found.**, the step 55 "Use_FT4080401.1" (FT3050300.22 Step 13) does not appear because it is removed. The reason why is that the TC 1 of FT4080401 is used instead. The reason for removal starts with "Use_FT4080401.1" and the "Replacing Step" mentions 56 that is the TS step where the first step of FT4080401.1 is included.
- 6.3.2.2.8 A BTM, LTM or RTM step shall contain all packets given in the step description. Further optional packets may be added if they do not interfere with the TC. Such an inclusion shall be described in the comment or in the user comment of the step.
- 6.3.2.2.9 If a step is described in a TC in such a way that the tested situation in the TS is ambiguous, a comment shall be added to the TS to clarify the situation.


6.3.3 Concatenation of TC


- 6.3.3.1.1 When a TC B is concatenated at the end to a TC A, the designer shall check the ending conditions of TC A match the starting conditions of TC B.
- 6.3.3.1.1.1 This always includes at least checking that the level/mode combination implemented in the TS at the end of TC A is the same as the one implemented at the start of TC B. Moreover, this level/mode combination shall be allowed in the starting/ending conditions tables at the end of TC A as well as at the start of TC B.
- 6.3.3.1.1.2 Similar checks on other information shall be necessary when the starting/ending conditions of the TC are not limited to the level/mode combination.


- 6.3.3.1.2 When a TC is concatenated to another, if there are BTM/RTM steps in each TC that are able to be merged together, they shall be merged instead of removing one of the 2 steps. One of the two related JRU steps shall be removed with the reason starting with the syntax "DUPLICATE_OF_FTXXXXXXX.Y.Z" (see 6.3.3.1.3). This ensures a full coverage of all the steps of the 2 concatenated TCs.
- 6.3.3.1.2.1 Example: In the Default process to use to reach L2, the BTM step 39 (FT5100100.37 Step 1) is merged with the BTM step 41 (FT3050300.22 Step 1). This means both steps refer to the same balise group message. These messages are described in the same table. Table related to step 39 specifies the telegram of the first balise that contains a packet 41 requested by the step 39 and a packet 42 requested by the step 41.
- 6.3.3.1.3 When a TC is concatenated to another, if there is a step in a TC that is duplicated in the other TC, one of the 2 steps shall be removed from the TS. The reason for removal shall be specified starting with the syntax "DUPLICATE_OF_FTXXXXXXX.Y.Z" where XXXXXXXX is the feature number, Y is the TC number, and Z is the step number in the TC. This identifies the step that replaces the removed step. The TS step number that replaces the removed step shall be specified in the "Replacing Step" field.
- 6.3.3.1.3.1 Example: In the definition of the default SoM to use in L0 (Annex A), the DMI step 33 "The Mode symbol "Acknowledge Unfitted" is displayed" (FT4060300.58.1) does not appear because it is removed. The reason why is that step 33 is a duplicate of the DMI step 31 (FT5040300.27.3). As the content of step 33 is encompassed by the content of step 31, the step 33 is removed from the test sequence. The reason for removal starts with "DUPLICATE_OF_FT5040300.27.3" and the "Replacing Step" mentions 31. This ensures a full coverage of all the steps of the 2 concatenated TCs.
- 6.3.3.1.4 Single steps are steps not included in the TCs and not covering any requirement of the Subset-026. Single steps shall not be used to draft TSs because they are not considered to be part of the TCs [5].

7. TEST CASES COVERAGE

7.1.1.1 The below attached file checks each test case is covered in at least one test sequence.


20250601_B4R1_TC_
coverage_by_TS_SV3I



20250601_B4R1_TC_c
overage_by_TS_SV22.:


20250601_B4R1_TC_c
overage_by_TS_SV21.:

7.1.1.2 The necessary conditions to ensure a test case is covered in a sequence are defined in section 6.3.2.2.

7.1.1.3 The below attached file checks that test cases that are just covered in test sequences that test optional interfaces (RIU, Euroloop, STM, Train Data acquired from ERTMS/ETCS external sources, Safe consist length information acquired from ERTMS/ETCS external sources) that may not be implemented by every on-board equipment:

- a) only test requirements related to these specific interfaces or functionalities
- b) OR also test “generic” requirements but these requirements are also tested in other test cases that are covered by test sequences that do not test optional interfaces or miscellaneous functionalities that may not be implemented by every on-board equipment.


20250601_B4R1_TC_c
overage_by_TS_SV30

7.1.1.3.1 In concrete terms, this analysis is divided into 3 phases:

- a) search for testcases covered in sequences testing an optional interface and identification of testcases not covered elsewhere;
- b) search for requirements covered by the identified testcases and extraction of those not covered elsewhere;
- c) requirements not covered elsewhere than in testcases only covered in sequences testing optional interfaces are linked to an optional interface.

A.DEFAULT STARTS OF MISSIONS

Definition of the default SoM to use in L0



Subset-076-6-3_SO
M_L0_UN_v400_SV30

Definition of the default SoM to use in L1



Subset-076-6-3_SO
M_L1_SR_v400_SV30

Definition of the default process to reach L2



Subset-076-6-3_SOM
_L2_SR_v400_SV30.do

Definition of the default SoM to use in LNTC



Subset-076-6-3_SO
M_LNTC_SN_v400_SV

B. AN EXAMPLE OF THE BRAKING CURVES CALCULATION

The following files contains the results of the braking curves for testing the FT3130232.TC1 with a Gamma 1 train and a Lambda 1 train in two different Test Sequences (Subset-076-6-3_3130232_01_v400_SV30.xlsm and Subset-076-6-3_3130232_02_v400_SV30.xlsm, respectively):

- Annex_B_Subset-076-6-3_3130232_01_v400_SV30.xlsm
- Annex_B_Subset-076-6-3_3130232_02_v400_SV30.xlsm

For sequences testing an ERTMS/ETCS on-board equipment that is said to support a reduced envelope of ETCS system versions up to 2.1 or up to 2.2, the equivalent files are below:

- Annex_B_Subset-076-6-3_3130232_01_v400_SV22.xlsm
- Annex_B_Subset-076-6-3_3130232_02_v400_SV22.xlsm