ERTMS/ETCS – Class 1
Methodology for testing FFFIS STM

REF : SUBSET-074-1
ISSUE : 1.0.0
DATE : 13.10.2005

Company	Technical Approval	Management approval
ALCATEL		
ALSTOM		
ANSALDO SIGNAL		
BOMBARDIER		
INVENSYS RAIL		
SIEMENS		

1. MODIFICATION HISTORY

Issue Number Date	Section Number	Modification / Description	Author
0.0.1 05.11.2003	All	First draft	R. Ramos (Invensys Rail)
0.0.2 02.12.03		Modified after STM WP Meeting in Brussels 26/11/03	R. Ramos (Invensys Rail)
0.0.3 21.01.04		Modified during the STM meeting in Braunschweig 21/01/04	R. Ramos (Invensys Rail)
0.0.4 02.02.04		Homework from the STM meeting in Braunschweig 21/01/04	R. Ramos (Invensys Rail)
0.0.5 09.03.04		Modified according to the conclusions of the Charleroi meeting	R. Ramos (Invensys Rail)
0.0.6 15.04.04		Modified during the STM meeting in Braunschweig 15/04/04	R. Ramos (Invensys Rail)
0.0.7 28.04.04		Modified during the STM meeting in Brussels 28/04/04	R. Ramos (Invensys Rail)
0.0.8 12.05.2004		Modified during the STM meeting in Brussels 12/05/04	R. Ramos (Invensys Rail)
0.0.9 18.05.04		Modified according to the decisions taken during the meeting in Brussels 12/05/04	R. Ramos (Invensys Rail)
0.0.10 26.05.2004		Modified during the STM meeting in Stuttgart 26/05/04	R. Ramos (Invensys Rail)
0.0.11 14.06.2004		Modified according to the decisions taken during the meeting in Stuttgart 26/05/04	R. Ramos (Invensys Rail)
0.0.12 16.06.2004		Modified during the STM meeting in Brussels 16/05/04	R. Ramos (Invensys Rail)
0.0.13 17.06.2004		Modified according to the decisions taken during the meeting in Brussels 16/06/04	R. Ramos (Invensys Rail)
0.0.14 2004-07-08		Modified during the STM meeting in Berlin	P. Lührs (Siemens AG)
0.0.15 07.09.2004		Modified during the STM meeting in Madrid	R. Ramos (Invensys Rail)

0.0.16 21.10.2004		Modified during the STM meeting in Brussels	R. Ramos (Invensys Rail)
0.0.17 08.11.2004		Modified during the STM meeting in Stuttgart	R. Ramos (Invensys Rail)
0.0.18 12.12.2004		Updated according to the decisions taken in STM meeting in Brussels on 29.11.04	R. Ramos (Invensys Rail)
0.0.19 2004-12-16		Modified during the STM meeting in Madrid	P. Lührs (Siemens AG)
0.0.20 2004-12-21		Modified based on review comments	P. Lührs (Siemens AG)
0.1.0 22.12.2004		Editorial changes for preliminary delivery	R. Ramos (Invensys Rail)
0.1.1 21.01.05		Updated according to the decisions taken in Paris meeting on the 13.01.05	R. Ramos (Invensys Rail)
0.1.2 27.01.05		Updated during Paris meeting on the 27.01.05	R. Ramos (Invensys Rail)
0.2.0 27.01.05		Editorial for delivery	R. Ramos (Invensys Rail)
1.0.0 13.10.2005		Editorial changes for delivery	R. Ramos (Invensys Rail)

2. TABLE OF CONTENTS

3.   REFERENCES

3.1.1.1   /SUBSET-056/; Safe Time Layer

3.1.1.2   /SUBSET-057/; Safe Link Layer

3.1.1.3   /SUBSET-035/; FFFIS STM, issue 2.1.1

3.1.1.4   /SUBSET-058/; FFFIS STM Application Layer, issue 2.1.1

3.1.1.5   /SUBSET-059/; Performance Requirements for STMs

3.1.1.6   /SUBSET-094/; UNISIG Functional requirements for an Onboard Reference Test Facility. issue 1.0.0

3.1.1.7   /SUBSET-076/; Test Specification of SUBSET-026

3.1.1.8   /SUBSET-026/; SRS ERTMS/ETCS Class 1, issue 2.2.2

4. DEFINITIONS

4.1 Functional identity

4.1.1.1 Group of requirements related to the same functionality of the system, e.g. Start of Mission.

4.2 Test case

4.2.1.1 Sequence of steps that test the fulfilment of requirements (or a subset of requirements) related to a defined functional identity.

4.3 Test sequence

4.3.1.1 Concatenation of different test cases in order to produce a complete and logical sequence of steps that is able to be run in a lab.

4.3.1.2 A test sequence should always start with a start of mission test case.

4.4 DUT (Device under test)

4.4.1.1 The DUT shall be the STM National, STM European or the ETCS On-board.

5. INTRODUCTION

In the FFFIS STM (/SUBSET-035/, /SUBSET-056/, /SUBSET-057/, /SUBSET-058/), UNISIG specified the requirements necessary for interoperability between ETCS on-board systems and STM systems.

This document specifies the Methodology to be followed for the creation of the Test Specification and gives information about the test environment for the FFFIS STM Specification within UNISIG.

STM European is currently out of the scope of this test specification, because the requirements for the European STM are still to be defined in the FFFIS STM.

The purpose of this test specification is to ensure the interoperability between ETCS on-board systems and STM systems according to the FFFIS STM specifications. The validation of the STM interface of the ETCS on-board and/or the STMs is not the scope of this test specification.

The objective is to test the nominal equipments to be installed in trains. Consequently, the main target is to test the nominal functions of the specification, degraded situations are not covered by this test specification.

It is not the purpose of this test specification to test national systems behaviour. Therefore, STM tests will be limited to test the interoperability, which is just focussed on the functionality of the start up, establishing the connections until the STM device is in HS and DA, the data transmission between the STM and the ETCS on-board, and the correct implementation of the state transition table. But for the ETCS, a complete set of test cases for STM FFFIS interoperability will be created.

Justification: Testing national systems behaviour will lead to complex test facilities, for simulating the national trackside systems and connection to the reference test architecture, which are really not related to the interoperability.

The traceability between the FFFIS STM requirements and the packets defined in the FFFIS STM Application Layer and the corresponding test cases shall be documented. All requirements defined in /SUBSET-035/ and all the packets defined in /SUBSET-058/ will be included in at least one test case, taking into account that there are some packets which are not mandatory for the STM or the ETCS to send or to process. Not all possible combinations of values within a packet or a variable will be tested.

At the time being, no specific test cases for the safety layers (/SUBSET-056/ and /SUBSET-057/) will be produced. However the test case performed for the application layer will include the nominal behaviour of the safety layer (connection establishment, transmission of application data, etc).

It is not the purpose of this test specification to test the performance requirements of the FFFIS STM (/SUBSET-059/).

6. TEST ARCHITECTURE

6.1 Introduction

In order to be able to verify the correct behaviour of the DUT according to what is described in the test cases defined in the FFFIS STM Test specification, the observable interfaces are the PROFIBUS (FFFIS STM), and the interfaces defined for the ETCS On-board systems: TIU / BIU, DMI, JRU, DRU (optional), BTM.

Note: RTM is not needed, because all the features related to the RTM is tested in the /SUBSET-076/.

The Test architecture for FFFIS STM Test Specification shall be based on the test architecture defined in /SUBSET-094/, this architecture shall simulate the behaviour of an STM or an ETCS On-board depending which is the DUT (ETCS on board or STM).

6.2 Test architecture for FFFIS STM Test Specification

6.2.1 Test architecture for the ETCS On-board

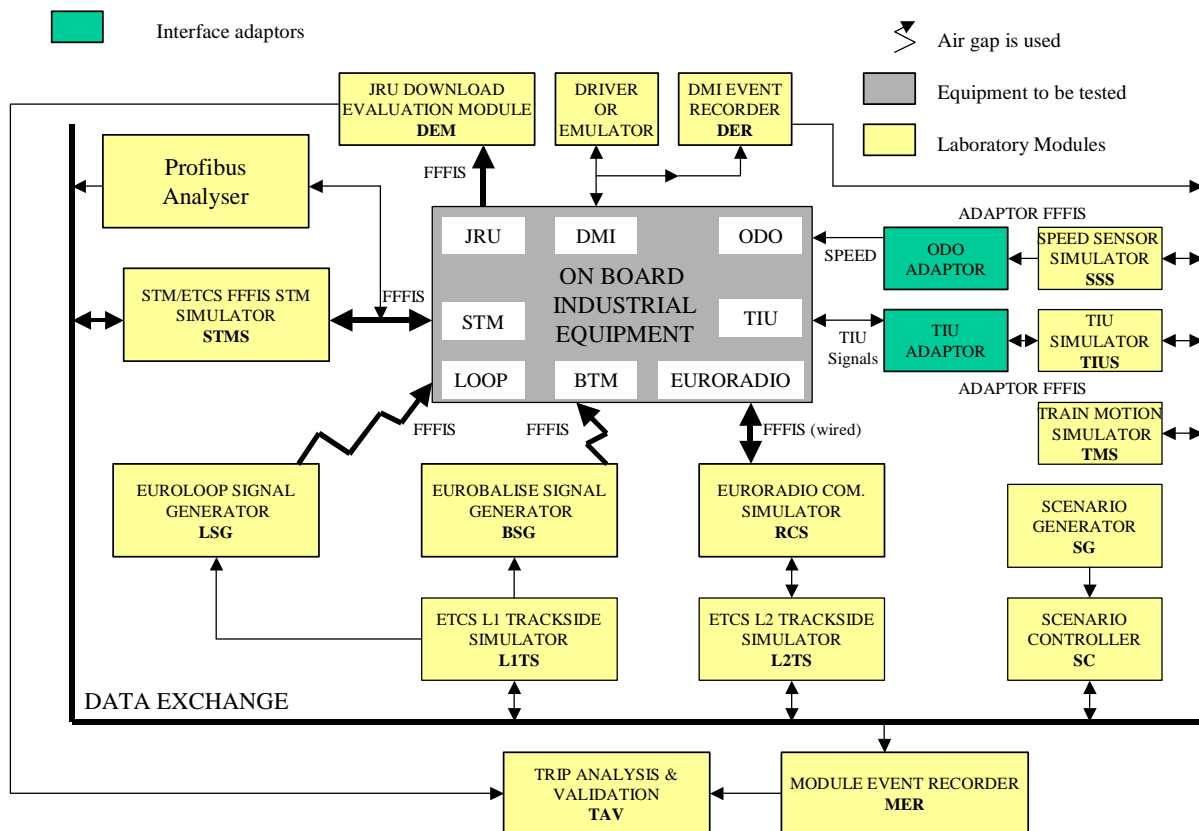The test architecture when the DUT is the ETCS On-board as defined within /SUBSET-094/ is:

Figure 1: Test Architecture for the ETCS on-board test

This figure is taken from /SUBSET-094/. The following changes are made:

- The colour of the interface adaptors (ODO ADAPTOR and TIU ADAPTOR) were changed as these are not part of the equipment to be tested.

- The "STM/ETCS FFFIS STM SIMULATOR STMS" and the "PROFIBUS ANALYSER" were introduced to replace the "ETCS LEVEL STM TRACKSIDE SIMULATOR LSTMTS" and the "STM CODING AND COMMUNICATION STMCC".

Note   The "EUROLOOP SIGNAL GENERATOR LSG" and the "EURORADIO COM. SIMULATOR RCS" as well as the "ETCS L2 TRACKSIDE SIMULATOR L2TS" will not be used in this test specification.

The requirements for the different test tools except for the STM related ones are specified in /SUBSET-094/. Additional requirements are included in this specification, see 6.2.3 and 6.2.4.

6.2.2   Test architecture for the STM
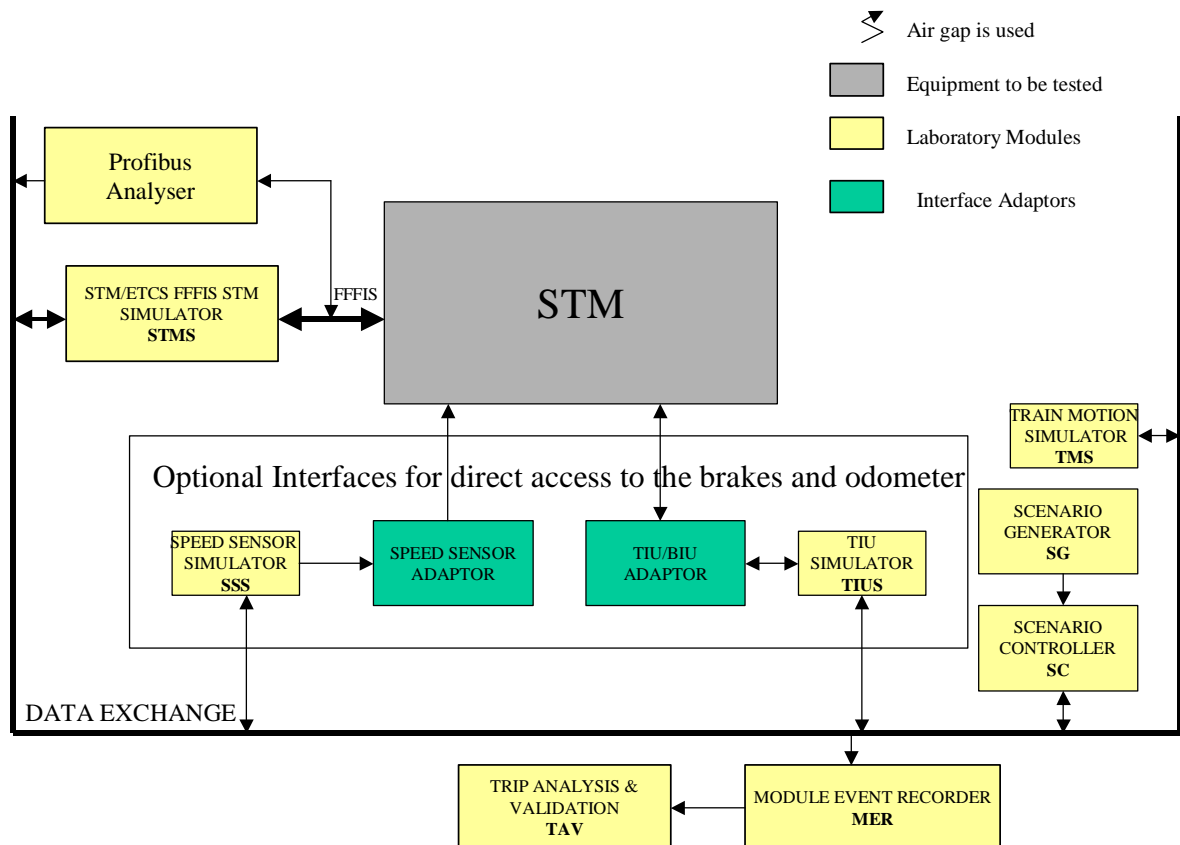
The test architecture when the DUT is the STM is:

Figure 2: Test Architecture for the STM test

6.2.3 Additional general requirements for the test equipment

6.2.3.1 The test equipment shall be able to handle different branches of the test cases in parallel, see 7.2.

6.2.4 Additional functional requirements for the Scenario Generator SG

6.2.4.1 The Scenario Generator SG shall calculate automatically the values of the variables L_MESSAGE and L_PACKET.

6.2.5 Functional requirements for the STM/ETCS FFFIS STM Simulator STMS

6.2.5.1.1 The STMS is a FFFIS STM Simulator. It shall simulate an ETCS on-board or an STM equipment depending on which is the device under test.

6.2.5.1.2 The STMS shall simulate the behaviour of a generic ETCS or STM, according to the specifications of the FFFIS STM /SUBSET-035/ and /SUBSET-058/.

6.2.5.1.3 The STMS shall implement the safety layers of the FFFIS STM (SLL and STL) according to the specifications (/SUBSET-056/ and /SUBSET-057/).

6.2.5.1.4 The STMS shall be able to simulate more than one STM to be connected to the ETCS on-board at the same time (in fact, it shall be able to simulate up to the maximum number of STMs specified in /SUBSET-059/).

6.2.5.1.5 The messages to be sent by the STMS and the reason to send the messages will be defined off-line with the Scenario Generator Tool. The reason to send the messages may contain different type of triggers such as a distance, time, or under the reception of a message.

6.2.5.1.6 During the configuration phase of the test equipment, the STMS shall be able to receive a set of predefined messages from the Scenario Controller that will be sent to the DUT, to simulate an STM or an ETCS on-board. The STMS shall also receive information about when to send the messages (time or distance).

6.2.5.1.7 The reasons to send the messages shall be predefined, being necessary that some conditions are fulfilled to send the messages (for example, receiving a certain telegram from the on-board equipment).

6.2.5.1.8 During the dynamic phase of the test equipment (the simulation), the STMS reads the travelled distance from Speed Sensor Simulation (SSS) via the DATA EXCHANGE bus, to know when it shall send the messages.

6.2.5.1.9 The STMS shall monitor the status of all connections to the DUT. Every time the status of a connection changes, a message shall be included in the test report, telling the new state of the connection.

6.2.5.1.10 The STMS shall provide for a command for the opening and closing (final and non-final) of each connection between the STMS and the DUT on SLL, STL as well as

Application Layer. With this command all necessary telegrams (including the ETCS/STM version number) to open or close a connection shall be transmitted via the FFFIS STM.

6.2.5.1.11 The STMS shall provide for a command for the opening and closing (final and non-final) of each connection between the STMS and the DUT on SLL and STL. With this command all necessary telegrams (excluding the ETCS/STM version number) to open or close a connection shall be transmitted via the FFFIS STM.

6.2.5.1.12 The STMS shall be able to make time stamping in application messages using the reference time.

6.2.6 Functional requirements for the PROFIBUS Analyser

6.2.6.1 The PROFIBUS Analyser shall detect and record all the messages exchanged within the PROFIBUS for off-line analysis.

6.2.6.2 The PROFIBUS Analyser shall not interfere the communication between the DUT and the test architecture.

7. FFFIS STM TEST SPECIFICATION

7.1 General

In order to create the test specification for the FFFIS STM the /SUBSET-035/ has been analysed to extract the requirements which have to be tested (see SUBSET-074-3 which is part of the FFFIS STM test specification). Each statement in the /SUBSET-035/ was classified as a "Requirement" or "No Requirement" (e. g. titles of the chapters and definition are no requirements) and as to be "Testable" or "Not Testable" (e. g. requirements belonging to the ETCS or STM like when to perform the self-test are assigned as not testable as they are internal to the equipments) and as to be linked to a "Normal" or "Degraded" situation (e. g. transmission of inconsistent information on the PROFIBUS). This leads to a list of requirements which shall be tested in this test specification (all statement with are classified as "Requirement", "Testable" and "Normal").

In order to facilitate the creation of the test cases, and the splitting of the work, the requirements were assigned to **Functional Identities**.

Several requirements belong to different Functional Identities. As this test specification is not for the validation of the STM interface, the requirements will not be tested in all assigned Functional Identities, but at least in one.

For each Functional Identity, different test cases will be created covering all the assigned requirements to be tested in this Functional Identity.

The functional identities are:

1. **Start of Mission (NP -> PO -> CO -> DE/CS ->HS -> DA)**: This functional Identity is linked to the start up of the ETCS on-board. This functional Identity will cover the states NP, PO, CO and the transition to DE or CS, HS and DA on the ETCS side

2. **Application Start Up (NP -> PO -> CO -> DE/CS)**: This functional Identity is linked to the start up of the STM. This functional Identity will cover the states NP, PO, CO and the transition to DE or CS on the STM side

3. **Level Transitions ETCS->STM (CS –> HS -> DA)**: Level Transitions ordered by the trackside. This functional identity will cover the transitions from CS to HS, CS to DA and HS to DA

4. **Level Transitions STM->ETCS (DA ->CS)**: Level Transitions ordered by the trackside

5. **Level Transitions STM->STM**: Level Transitions ordered by the trackside

6. **Data Available functionality**: For testing DMI requirements or odometry requirements for example

7. **JRU**

   Note: All testable requirements regarding the Functional Identity JRU are covered in the other Functional Identities. Therefore no test cases are required for this Functional Identity.

8. **DRU**

   Note: As the DRU Function is out of the scope of the ERTMS/ETCS Class 1 specifications, all the test cases related to this Functional Identity are optional.

   Note: All testable requirements regarding the Functional Identity DRU are covered in the other Functional Identities. Therefore no test cases are required for this Functional Identity.

9. **Failure (including the state transitions PO/CO/DE/CS/HS/DA -> FA)**

10. **Procedure Specific Data entry/Data View (including the state transitions CO -> DE, DE -> CS)**

11. **Procedure STM Operational Tests**

12. **Procedure Override**

For each Functional Identity, a **test diagram** showing the different test cases, according to the requirements assigned to the Functional Identity was created (see 7.2).

Based on the diagrams, the **test cases** were created (see 7.2.1).

By defining the starting and the end conditions in the test cases, it should be possible to create sequences of test cases to be tested within a lab.

7.2 Test Diagram creation

For every Functional Identity, a test diagram is created. This diagram shall give an indication in which order the requirements are executed by the equipments. It includes branches in case different requirements imply different behaviour of the systems.

When different requirements may happen in parallel, the test diagram should contain "Synchronisation points". The synchronisation points shall indicate the starting and ending points in which different branches will occur independently from each other and without a defined order.
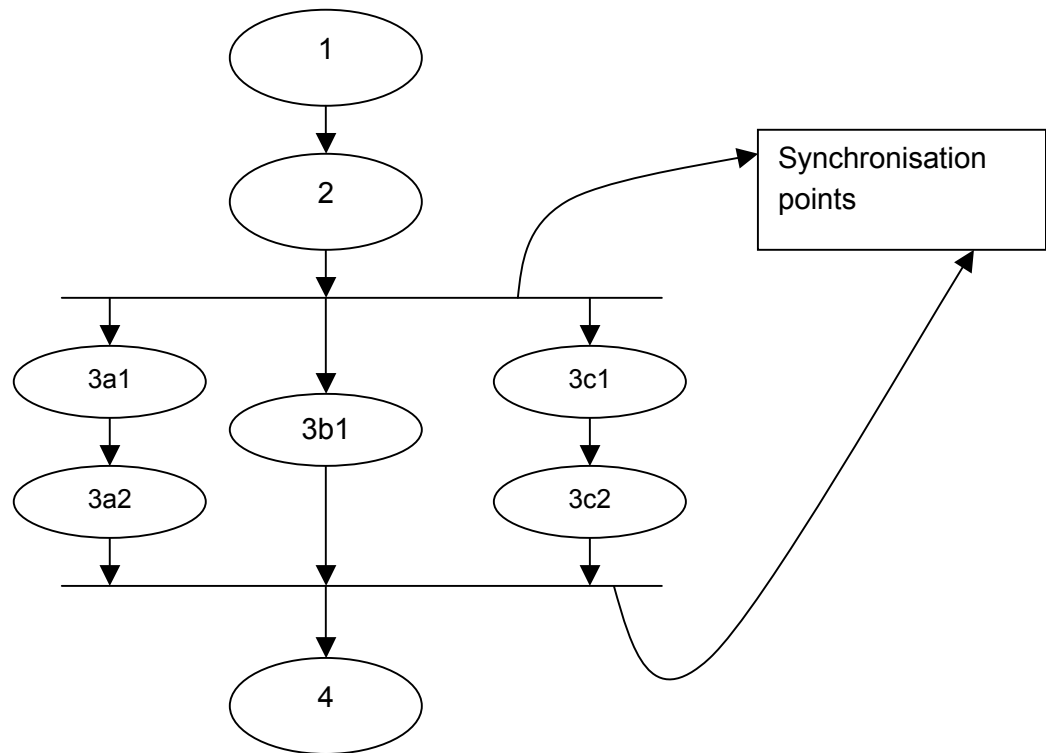
Figure 3: Synchronisation points example

The test diagram for a Functional Identity shall include the requirements assigned to the Functional Identity (copy from the specifications). Requirements from /SUBSET-026/ and requirements which are not assigned to the Functional Identity may be included to give a better overview of the Functional Identity.

Requirements or parts of requirements which are tested in the Functional Identity are written in bold letters.

The text colour for the requirements shall be

- blue for STM requirements,

- red for ETCS requirements and

- black in case the requirements apply to STM and ETCS.

7.2.1 Example for a Test Diagram

Figure 4: Test Diagram example

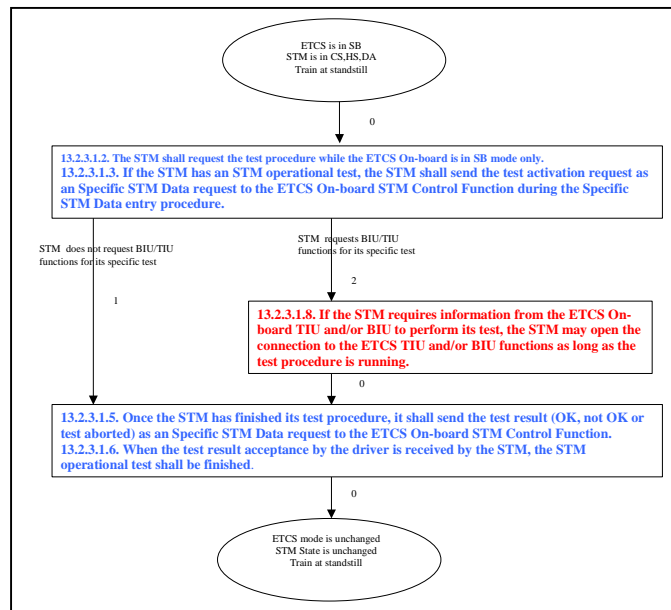## 7.3 Test Case creation

The Test Cases are created based on the Test Diagrams. Every path (branch) of the Test Diagram is included in at least one Test Case.

As all paths (branches) of the Test Diagram are numbered, the sequence of the numbers in the Test Diagram together with the number of the Functional Identity (see 7.1) define the ID of the Test Cases (the example in 7.2.1 leads to the test cases "X.0.1.0" and "X.0.2.0.0" where "X" is the number of the Functional Identity).

Every Test Case includes the following information:

- Test Case header

  This includes a description of the Test Case, a list of the tested requirements, a list of the transmitted packet on the PROFIBUS.

- Starting condition

  The starting conditions which are relevant for the test itself are clearly specified (e. g. STM State, TIU Status), so it will be possible to test the test case if the DUT (STM or ETCS) state is the one defined in the starting conditions.

  The possible special situation or constraints that are relevant for the test case should be also clearly specified (e. g. the STM under test will not send any STM_Max Speed at the Level Transition, or if the train is at standstill).

- Test Case description (sequence of Test Steps to be performed)

  A complete sequence of steps should be written describing all the relevant events necessary for the test in the order they occur. The description of these events should include the interface where the event was initiated and the event on this input interface (if possible) and a clear description of the output interface which has to be checked with the event.

  The different test steps are indicated by numbers.

  For test step n+1, the output action of step n shall be already checked.

  In case one event causes several actions at the same time without a defined order (e. g. packets sent or received in these steps are sent together in the same telegram, or separately in different telegrams) no new number is used.

- Transmitted messages

  All the messages sent between the ETCS on-board and the STM as well as air gap messages should be clearly specified, indicating as much as possible the real values that the different variables should have for the correct execution of the test case.

  By default all the values in the messages are specified in decimal. Binary values shall be indicated with a 'b' at the end of the number. Hexadecimal values shall be indicated with a 'h' at the end of the number. Characters should be specified between quotation marks (e. g. "X").

- End conditions

  The end conditions of the Test Case are clearly specified (e.g. STM State, connection status).

7.3.1   Example for a Test Case

The format of the Test Cases is as follows:

Test case 1

TEST CASE HEADER	
Test case Identification	Functional identity
	Description of the test case
ETCS Requirements Tested	Subset-035 requirements
	Subset-026 requirements
STM Requirements Tested	Subset-035 requirements
	Subset-026 requirements
Packets Transmitted via FFFIS STM	Packet STM-2, STM-15, …
Comments and constraints	Comments to the test case

Starting Conditions	Value	Comments
STM_STATE	NP/PO/CO/CS/HS/DA/FA	
ETCS Mode	NP/SB/SR/FS/OS/NL/SL/UN/SE/ SN/IS/FA/TR/PT/RV/SH	
ETCS Level	0/1/2/3/STM	
Train State	Standstill/Moving/Not Relevant	
Train Data	Valid/Invalid/Unknown	
Additional Data	Valid/Invalid/Unknown	
National Values	Valid/Invalid/Unknown	
STM Control Function Connection	Established/Not Established	
DMI Connection	Established/Not Established/Not Relevant	
Odometry Data	Transmitted/Not Transmitted/Not Relevant	

Starting Conditions	Value	Comments
Reference Time Data	Transmitted/Not Transmitted/Not Relevant	
TIU Connection	Established/Not Established/Not Relevant	
BIU Connection	Established/Not Established/Not Relevant	
JRU Connection	Established/Not Established/Not Relevant	
Other connections	Established/Not Established/Not Relevant	
TIU Regenerative Brake Command	Allow/Suppress/Not Command/Not Relevant	
TIU Magnetic Shoes Command	Allow/Suppress/Not Command/Not Relevant	
TIU Eddy Current Brake Command	Allow/Suppress/Not Command/Not Relevant	
TIU Inhibit Passenger Emergency Brake Command	Allow/Suppress/Not Command/Not Relevant	
TIU Pantograph Command	Lift/Lower/No command/Not Relevant	
TIU Air Tightness Command	Open/Closed/No command/Not Relevant	
TIU Main Switch / Circuit Breaker Command	Open/Closed/No command/Not Relevant	
TIU Traction Cut Off Command	Cut/Not Cut/ No command/Not Relevant	
TIU Sleeping Status	Sleeping/Not Sleeping	
TIU Traction Cut Off Status	Active/Inactive/Failure/Not Available/Not Relevant	
TIU Direction Controller Position Status	Forward/Neutral/Backward/Not available/Not Relevant	

Starting Conditions		Value	Comments
TIU Cab Status (Desk Status)		Desk A opened/Desk B opened/Desk A&B opened/Desk A&B closed/Not available/Not Relevant	
BIU Status		Active/Inactive/Failure/Not Available/Not Relevant	
BIU Emergency Brake Command		Apply/Release/No command/Not Relevant	
BIU Service Brake Command		Apply/Release/No command/Not Relevant	
BIU Emergency Brake Status		Apply/Release/Not available/Not Relevant	
BIU Service Brake Status		Apply/Release/Not available/Not Relevant	
STM Version Number	Subset-026	According to the FFFIS STM version to be tested	SRS 2.2.2 is 1.0
	Subset-035	According to the FFFIS STM version to be tested	Version 2.1.1 is 3.0.Z
	Subset-058	According to the FFFIS STM version to be tested	Version 2.1.1 is 3.0.Z
	Subset-056	According to the FFFIS STM version to be tested	Version 2.2.0 is 3.0.Z
	Subset-057	According to the FFFIS STM version to be tested	Version 2.2.0 is 3.0.Z
ETCS Version Number	Subset-026	According to the FFFIS STM version to be tested	Version 2.2.2 is 1.0
	Subset-035	According to the FFFIS STM version to be tested	Version 2.1.1 is 3.0.Z
	Subset-058	According to the FFFIS STM version to be tested	Version 2.1.1 is 3.0.Z

Starting Conditions		Value	Comments
	Subset-056	According to the FFFIS STM version to be tested	Version 2.2.0 is 3.0.Z
	Subset-057	According to the FFFIS STM version to be tested	Version 2.2.0 is 3.0.Z
Track Adhesion		Slippery/Non Slippery/Not Relevant	

ETCS Test Case

Step	Description/Comments	Input I/F	Input Action	DUT	Output I/F	Output action
1	ETCS STM Control Function establishes the communication session with the STM	Power Supply	The STM is switched on	ETCS	Prof	Communication established between the STM and the STM Control Function
2	STM Control Function sends its version number after the STM has sent its version number	Prof	STM Control Connection: Message-1 Packet STM-1 STM/ETCS function version number	ETCS	Prof	STM Control Connection: Message–2 Packet STM-1 STM/ETCS function version number
Steps that may occur in a different order						
3	Once the version number of the STM is checked the ETCS sends its current technical mode to the STM	Prof	STM Control Connection: Message-4 Packet STM-4 STM parameters data and product identity	ETCS	Prof	STM Control Connection: Message–3 Packet STM-5 ETCS Status Data
	ETCS sends its Product identity			ETCS	Prof	STM Control Connection: Message-5 Packet STM-2 ETCS On-board physical addresses, safety levels and Product identity
4	ETCS sends the order to CO State after receiving the request for CO state	Prof	STM Control Connection: Message-7 Packet STM-13 State request from STM	ETCS	Prof	STM Control Connection: Message-6 Packet STM-14 State order to STM
The following steps shows the way for time dependant steps						
5	Time: T0		Input action	ETCS		Output action

Step	Description/Comments	Input I/F	Input Action	DUT	Output I/F	Output action
6	Time T0 + t1 Note: t1 can be a constant or directly a value.		Input action 2	ETCS		Output action 2
Steps for checking ETCS MRSP						
7	Time: T0 + 10 seconds STM max Speed is received and processed (supervised) by the ETCS On-board.	Prof	STM Control Connection: Message-10 Packet STM-16 Transition variables STM max. speed from STM	ETCS	DMI	The target speed / target distance is updated
The following steps shows a synchronisation point						
7	STM is ordered to HS (This is the trigger of the synchronisation point)					
8a1	STM open the connection with the DMI					
8a2	STM sends the current state					
8b1	STM sends the HS state to the STM control function					
8c1	STM open the connection with the BIU					
8c2	STM sends the current state					
9	ETCS orders STM to Data Available					

STM Test case

Step	Description/Comments	Input I/F	Input Action	DUT	Output I/F	Output action
Initial Condition for the Test Case (e.g. the National Values have to have a specific value to perform the Test Case correctly) are indicated by a '-' in the "Step" column and the inclusion of 'Initial Condition:' in the "Description/Comments" column.						
-	Initial Condition: Set the National Values for the "Override EoA" procedure to defined values suitable for this Test Case.	BTM	Telegram-B1 (3 – National Values) Telegram-B2	-	-	-

Step	Description/Comments	Input I/F	Input Action	DUT	Output I/F	Output action
1	STM establishes the communication with the STM Control Function	Power Supply	The STM is switched on	STM	Prof	Communication established between the STM and the STM Control Function
2	STM sends its version number	-	-	STM	Prof	STM Control Connection: Message-1 Packet STM-1 STM/ETCS function version number
3	STM checks the version number after receiving the version number from the ETCS considering the communication as established. It sends its state to the STM Control Function	Prof	STM Control Connection: Message–2 Packet STM-1 STM/ETCS function version number	STM	Prof	Message – 2 Sent packet STM - 1 STM/ETCS function version number
4	STM sends its type and product identity to the STM control Function	-	-	STM	Prof	STM Control Connection: Message-4 Packet STM-4 STM parameters data and product identity
For the cases that an input triggers several actions without a defined order, the structure of the steps should be as follows (see that the step number is only relevant in the first one, there is no step numbering in the triggered actions)						
10	-	I/F	Input event that triggers several actions, without an specified order	STM	-	-
-	STM action1 due to previous input	-	-	STM	I/F	Action1
-	STM action2 due to previous input	-	-	STM	I/F	Action2

Message 1 (Packet STM-1): STM → ETCS			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM which the EVC is connected to
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	15	State Report from STM
L_PACKET	13	COMPUTED	Packet length
NID_STMSTATE	4	1	Power On

Message 1 (Packet STM-1): STM → ETCS			
VARIABLE	Length	VALUE	COMMENTS
NID_PACKET	8	1	STM/ETCS function version number
L_PACKET	13	COMPUTED	Packet length
N_058_VERMAJOR	8	3	
N_058_VERMID	8	0	
N_058_VERMINOR	8	0	
N_035_VERMAJOR	8	3	
N_035_VERMID	8	0	
N_035_VERMINOR	8	0	
N_SRS_VERMAJOR	8	1	
N_SRS_VERMINOR	8	0	
PADDING_BITS	COMPUTED	COMPUTED	

Message 2 (Packet STM-1): ETCS → STM			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM which the EVC is connected to
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	1	STM/ETCS function version number
L_PACKET	13	COMPUTED	Packet length
N_058_VERMAJOR	8	3	
N_058_VERMID	8	0	
N_058_VERMINOR	8	0	
N_035_VERMAJOR	8	3	
N_035_VERMID	8	0	
N_035_VERMINOR	8	0	
N_SRS_VERMAJOR	8	1	
N_SRS_VERMINOR	8	0	
PADDING_BITS	COMPUTED	COMPUTED	

Message 3 (Packet STM-5): ETCS → STM			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM which the EVC is connected to
L_MESSAGE	8	33	
NID_PACKET	8	5	ETCS Status Data
L_PACKET	13	COMPUTED	Packet length
M_LEVEL	3	2	ETCS level 1
M_MODE	4	0	Full Supervision
PADDING_BITS	COMPUTED	COMPUTED	

Other Message specifications

End Conditions	Value	Comments
STM_STATE	NP/PO/CO/CS/HS/DA/FA/unchanged	
ETCS Mode	NP/SB/SR/FS/OS/NL/SL/UN/SE/SN/IS/FA/TR/PT/RV/SH/unchanged	
ETCS Level	0/1/2/3/STM/unchanged	
Train State	Standstill/Moving/unchanged	
Train Data	Valid/Invalid/Unknown/unchanged	
Additional Data	Valid/Invalid/Unknown/unchanged	
National Values	Valid/Invalid/Unknown/unchanged	
STM Control Function Connection	Established/Not Established/unchanged	
DMI Connection	Established/Not Established/unchanged	

End Conditions	Value	Comments
Odometry Data	Established/Not Established/unchanged	
Reference Time Data	Transmitted/Not Transmitted/Not Relevant	
TIU Connection	Established/Not Established/unchanged	
BIU Connection	Established/Not Established/unchanged	
JRU Connection	Established/Not Established/unchanged	
Other connections	Established/Not Established/unchanged	
TIU Regenerative Brake Command	Allow/Suppress/Not Command/unchanged	
TIU Magnetic Shoes Command	Allow/Suppress/Not Command/unchanged	
TIU Eddy Current Brake Command	Allow/Suppress/Not Command/unchanged	
TIU Inhibit Passenger Emergency Brake Command	Allow/Suppress/Not Command/unchanged	
TIU Pantograph Command	Lift/Lower/No command/unchanged	
TIU Air Tightness Command	Open/Closed/No command/unchanged	
TIU Main Switch / Circuit Breaker Command	Open/Closed/No command/unchanged	
TIU Traction Cut Off Command	Cut/Not Cut/ No command/unchanged	
TIU Sleeping Status	Sleeping/Not Sleeping/unchanged	

End Conditions	Value	Comments
TIU Traction Cut Off Status	Active/Inactive/Failure/Not Available/unchanged	
TIU Direction Controller Position Status	Forward/Neutral/Backward/Not available/unchanged	
TIU Cab Status (Desk Status)	Desk A opened/Desk B opened/Desk A&B opened/Desk A&B closed/Not available/unchanged	
BIU Status	Active/Inactive/Failure/Not Available/unchanged	
BIU Emergency Brake Command	Apply/Release/No command/unchanged	
BIU Service Brake Command	Apply/Release/No command/unchanged	
BIU Emergency Brake Status	Apply/Release/Not available/unchanged	
BIU Service Brake Status	Apply/Release/Not available/unchanged	
STM Version Number	unchanged	
ETCS Version Number	unchanged	
Track Adhesion	Slippery/Non Slippery/unchanged	

7.4 Data Dictionary

7.4.1 Special values for variables

7.4.1.1 FINITE VALUE: When the value of a variable should be defined for a concrete scenario to be run in a lab, "FINITE VALUE" shall be written. For example, NID_STM value.

7.4.1.2 COMPUTED: When the value of a variable needs to be computed by the Test tools, "COMPUTED" shall be included. For example L_MESSAGE, L_PACKET.

8. ANNEX: TEST SPECIFICATION DOCUMENT STRUCTURE

The following documents are part of the STM FFFIS Test Specification:

- **subset-074-1** Methodology for testing FFFIS STM
- Test cases documents:
  - **subset-074-2-1** (FFFIS STM test cases of Functional Identity 001 Start of Mission)
  - **subset-074-2-2** (FFFIS STM test cases of Functional Identity 002 Application Start up)
  - **subset-074-2-3** (FFFIS STM test cases of Functional Identity 003 Level Transitions ERTMS -> STM)
  - **subset-074-2-4** (FFFIS STM test cases of Functional Identity 004 Level Transitions STM -> ERTMS)
  - **subset-074-2-5** (FFFIS STM test cases of Functional Identity 005 Level Transitions STM->STM)
  - **subset-074-2-6** (FFFIS STM test cases of Functional Identity 006 Data Available Functionality)
  - **subset-074-2-7** intentionally not created
  - **subset-074-2-8** intentionally not created
  - **subset-074-2-9** (FFFIS STM test cases of Functional Identity 009 Failure)
  - **subset-074-2-10** (FFFIS STM test cases of Functional Identity 010 Procedure Specific Data entry/Data View)
  - **subset-074-2-11** (FFFIS STM test cases of Functional Identity 011 Procedure STM operational tests)
  - **subset-074-2-12** (FFFIS STM test cases of Functional Identity 012 Procedure Override)
- **subset-074-3** FFFIS STM Test Specification traceability of test cases with Specific Transmission Module FFFIS
- **subset-074-4** FFFIS STM Test Specification traceability of testing the packets specified in the Application Layer