

Train Control ETCSsys

ESC TST PLN

Test plan Compatibility Trackside – On Board

Document management

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		25/10/2022	§8.4, §11	New test case ESC_L1LS_Erg_1.
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1. Introduction

1.1 Purpose of the document

This document describes the high level ETCS system compatibility tests (ETCS System Compatibility) as required in [1].

This tests list is compiled and based on current knowledge. New tests could be added or existing tests removed in function of any return of experience.

The detailed ETCS System Compatibility test scenarios are defined in specific documents available for all trackside sub-system types, per trackside sub-system type and per border.

1.2 Base documents

None

1.3 Reference documents

Ref.	Title	Owner
[1]	REGLEMENT D'EXECUTION (UE) 2018/545	European Commission
[2]	PSI (TC,ETCSdata,z) national values 3.2 F	Infrabel
[3]	Exigences nationales d'Infrabel pour les courbes de freinage ETCS Full Supervision du conventional network 1.2 F.pdf	Infrabel
[4]	Exigences nationales d'Infrabel pour les courbes de freinage ETCS Full Supervision Baseline 2 des LGV 1.1 F	Infrabel
[5]	PSI (TC,ETCSsys,z) Borders ESC TST DSC NL 1.1 E	Infrabel
[6]	PSI (TC,ETCSsys,z) Borders ESC TST DSC FR 1.1 E	Infrabel
[7]	PSI (TC,ETCSsys,z) Borders ESC TST DSC 1.4 E	Infrabel

1.4 Annexes

None

1.5 Applicable domain

Infrabel network equipped with ETCS.

1.6 Definitions, symbols and abbreviations

B2	Baseline 2
B3	Baseline 3
BG	Balise Group
EoA	End of Authority
FG	Freight G: Freight train braked in regime G.
FP	Freight P: Freight train braked in regime P.
IREPOS	Function of a BG sending, in one message, an MA Infill and a packet 16.
MR	Maintenance Release
MRSP	Most Restrictive Speed Profile
LGV	Ligne Grande Vitesse (High Speed Line)
LRBG	Last Relevant Balise Group
OBU	OnBoard Unit

PASS Passenger: passenger train.
SoM Start of Mission

1.7 *Known imperfections*

The transitions at the borders of the Infrabel network must be tested specifically. This document lists only the identifier of the border test cases existing at the time of the redaction. The test descriptions in the annexes of [7] could contain new test cases.

2. Attribution of tests to different trackside sub-systems

The tests described in this document have as objective to verify that the on-boards circulating on the Infrabel network are compatible with the design choices made when defining the different types of trackside sub-systems.

The basic functions are considered covered by the on-board's conformity certificate, only the critical functions and functions relying on using ETCS packets considered non-trivial are covered by these tests.

Some tests are present to make sure the hypotheses made when defining the trackside sub-systems are justified. These tests are identified using letter "I" in the table of chapter 11.

The compatibility tests are defined by type of trackside equipment present on the Infrabel network. The different types of trackside equipment are listed in chapter 2.1.

In addition to the tests described in the chapters 5, 6, 7 and 8 specific to the trackside types on which the train is intended to run, each train must also complete the tests of :

- chapter 3 – Tests to be performed on each trackside sub-system
- chapter 4 – Common Tests shared by all trackside sub-systems
- chapter 9 – Internal/External transitions on Infrabel Network, depending on the transitions the train might encounter
- chapter 10 – External Transitions on the Infrabel Network borders, depending on the transitions the train might encounter

2.1 Types of trackside sub-systems

2.1.1 ETCS1 FS conventional network and ETCS1 FS on LGV (L2)

This trackside sub-system is based on set of specification #1 (B2).

To run under the protection of this trackside sub-system, the train must complete the specific tests described in chapter 5 (ETCS1FS).

No specific tests for L2 are necessary.

2.1.2 ETCS2 FS conventional network

This trackside sub-system is based on set of specification #2 (B3 MR1).

To run under the protection of this trackside sub-system, the train must complete the specific tests described in chapter 6 (ETCS2FS).

2.1.3 ETCS1 LS conventional network

This trackside sub-system is based on set of specification #3 (B3 MR2).

To run under the protection of this trackside sub-system, the train must complete the specific tests described in chapter 8 (ETCS1LS).

2.1.4 ETCS2/1 FS HSL network (L3/L4)

This trackside sub-system is based on specifications Baseline Corridor 2007 v2, SRS v2.2.2 (+ CR748, CR770 for level 2).

To run under the protection of this trackside sub-system, the train must complete the specific tests described in chapter 6 (ETCS2FS) and 7 (ETCS2 FS on HSL).

3. Tests to be performed on each trackside sub-system

3.1 *ESC_ALL_1: Driving ergonomics and nominal conditions*

Driving ergonomics in all pertinent levels and modes.

Expected result: no ergonomic issues or unexpected braking invitations detected during the ESC campaign.

Note: no specific scenarios are defined for these tests. Train runs done during the ESC test campaign are used, especially in the transfer between scenario locations.

3.2 *ESC_ALL_2: Braking curves*

Braking curves conform to the requirements.

Expected results:

1. no unexpected braking interventions detected during the ESC campaign.
2. Braking curves analyzed and conform to the requirements defined in [3], [4].

4. Tests shared by all trackside sub-systems

4.1 *ESC_COM_1: Receiving a P203 by an OBU B3*

A train equipped with OBU B3 receives a packet 203.

Expected result: the train registers the national values received.

4.2 *ESC_COM_2: National values of OBU B3 in absence of P203 (default values)*

A train equipped with OBU B3 does not receive P203 and no values for the Belgian NID_C are available on board.

Expected result: the train uses the default national values.

4.3 *ESC_COM_3: National values of OBU B3 in absence of P203 (national values defined on board)*

A train equipped with OBU B3 does not receive P203 and values for the Belgian NID_C are available on board.

Expected result: the train uses the correct national values [2].

4.4 *ESC_COM_4: Receiving a P203 by an OBU B2*

A train equipped with an OBU B2 receives a packet 203.

Expected result: the board rejects the P203 and does not take into account the other packets of the telegram if they are defined for a system version 1.0.

4.5 *ESC_COM_5: Odometer precision*

An error is introduced while encoding the wheel diameter. The train runs with this incorrect value.

Analysis: verification of the odometer error by using the values L_DOUBTUNDER and L_DOUBTOVER.

4.6 *ESC_COM_6: Resetting the confidence interval*

Checking the resetting of the confidence interval when passing a BG when there is linking information on board and when there is no linking on board.

4.7 ESC_COM_7: Technical functions of electrical traction in zone FS (voltage change)

The train enters a zone with changing catenary voltage in mode FS.

Analysis: verify the correct execution when entering the zone where the voltage changes.

4.8 ESC_COM_8

Test case removed.

4.9 ESC_COM_9: Technical functions of electrical traction in zone FS (phase change)

The train enters a zone with a phase change in mode FS on a line powered with 25kV.

Analysis: verify the correct execution when crossing the zone with the phase change.

5. ETCS1FS

5.1 ESC_L1FS_1: Train categories

Verification of the maximum speed in function of the *train categories*:

Expected result: the train is supervised at the speed corresponding to its train category.

Note: if a train category other than FP, FG and PASS is used, the speed profile will correspond to the lowest speed (FG).

5.2 ESC_L1FS_2: IREPOS

The train in ETCS 1 mode FS crosses a BG sending the function IREPOS while this is chained with the NID_BG corresponding to the value "Unknown".

Expected result: taking into account the resting information as well as the infill MA transmitted.

5.3 ESC_L1FS_3

Test case removed.

5.4 ESC_L1FS_4: Passing a closed non-permissive signal without override

Passing a closed non-permissive signal in FS or OS without previous *override* and with an initial speed lower than the *release speed*.

Expected result: emergency break after going into TRIP mode.

5.5 ESC_L1FS_5: Passing a closed non-permissive signal with override

Passing a closed non-permissive signal in FS or OS with previous *override* and with an initial speed lower than the *release speed*.

Expected result: transition to mode SR and absence of Trip upon passing the signal.

5.6 ESC_L1FS_6: Passing a closed permissive signal

Passing a closed permissive signal in mode FS with initial speed lower than the release speed.

Expected result: transition to mode OS.

5.7 ESC_L1FS_7: CR819

A train in mode FS or OS crosses a duplicated BG (BG composed of 2 duplicated balises) of which one balise is covered.

Expected result: the train receives no more than one telegram and treats the information from the duplicated BG.

5.8 ESC_L1FS_8

Test case removed.

6. ETCS2FS

6.1 ESC_L2FS_1

Test case removed.

6.2 ESC_L2FS_2: CES accepted

The train receives a CES for a signal located downstream.

Expected result: the train's EoA is updated for the signal in question, the release speed allows the approach of the signal.

6.3 ESC_L2FS_3: UES

The train receives a UES.

Expected result: the train undergoes a mode transition to Trip.

6.4 ESC_L2FS_4: Reset of the confidence interval

The train crosses a BG that is already used as LRBG by the OBU, for example in case of turning back.

Expected result: the confidence interval is reset.

6.5 ESC_L2FS_5: T_NVCONTACT

Disconnecting the modem when the train is connected to RBC and waiting the appropriate time of T_NVCONTACT (40 seconds).

Expected result: the train undergoes a service brake.

6.6 ESC_L2FS_6

Test case removed.

6.7 ESC_L2FS_7: Change of front

A train equipped with a control post at each end performs a change of front.

Expected result: the scenario plays out correctly.

6.8 ESC_L2FS_8: Multiple message 18

After a trip and reception by the RBC of message 6 (acknowledgment of exit out of trip mode), the RBC sends message 18 (revocation of emergency brake) for all possible NID_EM (0 to 15), even if the NID_EM are not sent to the train.

Expected result: the board does not have any reaction to receiving multiple messages 18.

6.9 ESC_L2FS_9: CR958 – Start of mission with unknown position

The train performs a SoM when the position stored on-board is unknown.

CR958 from BCA Report v1.0.0 report that there could be a different interpretation between RBC and on-board of the requirements for the LRBG use / acceptance might lead to a deadlock situation in start of mission

Expected result: the train is in level 2 SR.

6.10 ESC_L2FS_10: SoM with MaxSFE downstream of a signal

A train whose MaxSFE is located downstream of a signal located in front of it performs a SoM. The signal is open.

Expected result: upon receiving the MA by the RBC, the train must switch to mode OS and not switch to FS until it passes the signal.

Note: an odometer error facilitates this test as it allows to increase the distance travelled in mode OS.

6.11 ESC_L2FS_11: Restart in STM after loss of ETCS 2 FS

The train loses the connection to the RBC. After expiration of T_NVCONTACT, the driver performs a transition to level STM and the train continues its course.

Expected result: The scenario plays out correctly.

6.12 ESC_L2FS_12: RBC-RBC Handover with a single modem

The train crosses an RBC-RBC handover with a single operational modem.

Expected result: the handover is correctly carried out.

6.13 ESC_L2FS_13: Train categories

Verification of the maximum speed in function of the *train categories*:

Expected result: the train is supervised at the speed corresponding to its train category.

Note: if a train category is used other than FP, FG and PASS, the speed profile will correspond to the lowest speed (FG).

6.14 ESC_L2FS_14: OS extension

The driver performs a SoM at a long distance from the first operated signal downstream. This main stop signal is open in large movement.

Expected result: the train receives a MA in mode OS up to the large stop signal and does not perform the transition to FS until after having crossed the signal.

Note: this test is preferably executed with a big odometry error, though not obligatory.

7. ETCS2 FS on HSL

7.1 ESC_L2LGV_1: CR843

Multiple non-revocable TSR are sent in a single message.

Expected result: the train accepts the message and considers all TSR (CR843).

7.2 ESC_L2LGV_2

Test case removed.

8. ETCS1LS

8.1 ESC_L1LS_1: Passing a closed non-permissive signal in LS without prior override

Passing a closed non-permissive signal in LS without prior *override* and with initial speed lower than the *release speed*.

Expected result: emergency brake upon switching to Trip mode.

8.2 ESC_L1LS_2: Passing a closed non-permissive signal in LS with prior override

Passing a closed non-permissive signal in LS with prior *override* and with initial speed lower than the *release speed*.

Expected result: transition to mode SR and absence of Trip when passing the signal.

8.3 ESC_L1LS_3: Reception of a packet 44 by a Baseline 3 train in level NTC (CR1338 non implemented)

A baseline 3 train in level NTC passes a signal showing yellow aspect.

This test case intends to validate the behaviour of a B3 train receiving a P44 formatted like a Baseline 2 P44 but with M_VERSION = 2.

Expected result: TBL1+ yellow lamp is lit on board.

8.4 ESC_L1LS_Erg_1: Passing a signal with a white number announced by a signal presenting an H aspect

The braking curves defined in the subset 26 creates a speed limitation onboard before the actual restriction of the MRSP. This test intends to ensure the length of this additional speed limitation allows the driver to ride according to the lateral signaling.

9. Internal transitions on Infrabel network

9.1 ESC_TR_1: ETCS 1 FS >> ETCS 1 LS

Transition from zone ETCS1FS to zone ETCS1LS

- with OBU B3: Transition from level 1 FS to level 1 LS
- with OBU B2: transition from level 1 FS to STM TBL1+

9.2 ESC_TR_2: ETCS 2 FS >> ETCS 1 LS

Transition from zone ETCS2FS to zone ETCS1LS:

- with OBU B3: Transition from level 2 FS to level 1 LS
- with OBU B2: transition from Level 2 FS to STM TBL1+. The technical solution for this transition is like the transition tested in ESC_TR_1 for B2 trains.

9.3 ESC_TR_3: ETCS 1 LS >> ETCS 1 FS

Transition from zone ETCS1LS to zone ETCS1FS:

- with OBU B3: Transition from level 1 LS to level 1 FS
- with OBU B2: transition from level STM TBL1+ to level 1 FS. No test required, this is a regular transition from STM to ETCS1 FS.

9.4 ESC_TR_4: ETCS 1 LS >> ETCS 2 FS

Transition from zone ETCS1LS to zone ETCS2FS:

- with OBU B3: Transition from level 1 LS to level 2 FS
- with OBU B2: transition from level STM TBL1+ to level 2 FS. No test required, this is a regular transition from STM to ETCS2 FS.

9.5 ESC_TR_5: ETCS 1FS >> TVM430

Transition from zone ETCS1FS to zone TVM430.

This test case is only required for trains running through line 1 (Only line equipped with TVM430 on the Infrabel network).

9.6 ESC_TR_6

Test case removed.

9.7 ESC_TR_7: TVM430 >> ETCS 1FS

Transition from zone TVM430 to zone ETCS1FS.

This test case is only required for trains running through line 1 (Only line equipped with TVM430 on the Infrabel network).

9.8 ESC_TR_8

Test case removed.

9.9 ESC_TR_9: ETCS1 FS >> ETCS 2 FS

Transition from zone ETCS1FS to zone ETCS 2 FS.

9.10 ESC_TR_10: ETCS 2 FS >> ETCS 1 FS

Transition from zone ETCS2FS to zone ETCS 1 FS.

9.11 ESC_TR_11: ETCS 1 LS >> STM TBL1+

Transition from zone ETCS1LS to zone STM TBL1+:

- with OBU B3: Transition from level 1 LS to level STM TBL1+.
- with OBU B2: No transition, the board stays in STM TBL1+. No test required.

9.12 ESC_TR_12: ETCS 1 FS >> STM TBL1+

Transition from zone ETCS1FS to zone STM TBL1+.

9.13 ESC_TR_13: ETCS 2 FS >> STM TBL1+

Transition from zone ETCS2FS to zone STM TBL1+.

9.14 ESC_TR_14: STM TBL1+ >> ETCS 1 LS

Transition from zone STM TBL1+ to zone ETCS 1 LS:

- with OBU B3: Transition from level STM TBL1+ to level 1 LS.
- with OBU B2: No transition, the board stays in STM TBL1+. No test required.

9.15 ESC_TR_15: STM TBL1+ >> ETCS 1 FS

Transition from zone STM TBL1+ to zone ETCS 1 FS.

9.16 ESC_TR_16: STM TBL1+ >> ETCS 2 FS

Transition from zone STM TBL1+ to zone ETCS 2 FS.

9.17 ESC_TR_17: Board reaction in absence of transition acknowledgment

Test the reaction of the train in case of lack of acknowledgment of the transition by the driver one of the transitions.

9.18 Summary of different transitions tested

From 👉	To 👈	ETCS 1 FS	ETCS 2 FS	ETCS 1 LS	STM TBL1+	TVM 430
ETCS 1 FS			0	9.1	9.12	9.5
ETCS 2 FS	9.10			9.2	9.13	No subject
ETCS 1 LS	9.3	9.4			9.11	No subject
STM TBL1+	9.15	9.16	9.14			Out of scope
TVM 430	9.7	No subject	No subject		Out of scope	

10. External transitions on Infrabel network borders

The Infrabel network has borders with Germany, Netherland, Luxemburg and France. A specific design is done on each border taking into account ETCS and NTC systems on both sides. Specific ESC tests will be defined at each countries border and by line, if each line has some specificities.

10.1 ESC_TR_BE-D

Transition zone ETCS Belgium \leftrightarrow zone ETCS/STM Germany

- with OBU B3
- with OBU B2

Specific to each line if needed.

10.2 ESC_TR_BE-NL

Transition zone ETCS Belgium \leftrightarrow zone ETCS/STM Netherlands

- with OBU B3
- with OBU B2

Specific to each line if needed.

The following test cases are defined in [5]. This list is given for information only, the full list is available in the last available version of [5].

ESC_BorderL40_1, ESC_BorderL40_2, ESC_BorderL40_3, ESC_BorderL40_4.

10.3 ESC_TR_BE-L

Transition zone ETCS Belgium \leftrightarrow zone ETCS Luxemburg

- with OBU B3
- with OBU B2

Specific to each line if needed.

10.4 ESC_TR_BE-FR

Transition zone ETCS Belgium \leftrightarrow zone ETCS/STM France

- with OBU B3
- with OBU B2

Specific to each line if needed.

The following test cases are defined in [6]. This list is given for information only, the full list is available in the last available version of [6].

ESC_BorderL96_1, ESC_BorderL96_2, ESC_BorderL96_3.

11. Applicability matrix

Scenario	ETCS 1 FS	ETCS 2 FS	LGV3, LGV4	LGV2	ETCS 1 LS
ESC_ALL_1	S	S	S	S	S
ESC_ALL_2	S	S	S	S	S
ESC_COM_1			S		
ESC_COM_2			S		
ESC_COM_3			S		
ESC_COM_4			S		
ESC_COM_5			I		
ESC_COM_6			S		
ESC_COM_7			S		
ESC_COM_8			-		
ESC_COM_9			S		
ESC_L1FS_1	S				
ESC_L1FS_2	S				
ESC_L1FS_3	-				
ESC_L1FS_4	S				
ESC_L1FS_5	S				
ESC_L1FS_6	S				
ESC_L1FS_7	S				
ESC_L1FS_8	-				
ESC_L2FS_1			-		
ESC_L2FS_2			S		
ESC_L2FS_3			S		
ESC_L2FS_4			S		
ESC_L2FS_5			S		
ESC_L2FS_6			-		
ESC_L2FS_7			S		
ESC_L2FS_8			S		
ESC_L2FS_9			S		
ESC_L2FS_10			S		
ESC_L2FS_11			S		
ESC_L2FS_12			S		
ESC_L2FS_13			S		
ESC_L2FS_14			S		
ESC_L2LGV_1			S		
ESC_L2LGV_2			-		

ESC_L1LS_1					S	
ESC_L1LS_2					S	
ESC_L1LS_3					S	
ESC_L1LS_Erg_1					I	
ESC_TR_1						
ESC_TR_2						
ESC_TR_3						C
ESC_TR_4						
ESC_TR_5						
ESC_TR_6	-					
ESC_TR_7	C					
ESC_TR_8	-					
ESC_TR_9						
ESC_TR_10						
ESC_TR_11						
ESC_TR_12						
ESC_TR_13						C
ESC_TR_14						
ESC_TR_15						
ESC_TR_17						
ESC_TR_18						
ESC_TR_BE-D *	C					
ESC_TR_BE-NL *		C	C		C	
ESC_TR_BE-L *	C					
ESC_TR_BE-FR *	C				C	

S: Success required. The success of the scenario is imperative to assure the system's compatibility.

I: Informative. The scenario is performed to verify if the behaviour of the onboard is compliant to the hypotheses made when conceiving the trackside sub-system. If the test fails, it shall be documented and if the test is not executed, it shall be justified.

C: Success required conditionally. The success of the scenario is imperative to assure the system's compatibility only if the onboards will use those specific transitions.

-: Testcase deleted.

*: The complete list of test cases can be found in the annexes of [7].