Train Control
ETCS sys

ETCS System Compatibility Borders

Document Management

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History

Author	Version	Date	§ Adapted	Reason
T. Destrée	1.1 draft 1	23/03/2020	/	Creation of the document
T. Destrée	1.1 draft 2	06/10/2021		Review comments.
T. Destrée	1.1	11/10/2021		Major version.
T. Destrée	1.2 draft 1	7/12/2021	1.1 1.5 3.2.2	Correction of the link to TSI's. Minor adaptations L37 chapter completed.
	1.2 draft 2	29/03/2022	3.1.2, 3.1.3, 3.1.5, 4.1, 4.2, 4.3, 4.4.	Update according to ProRail remarks: • Reference to Dutch ESC tests for L12 and L4. • Detailed verifications added in ESC_BorderL40_1, ESC_BorderL40_2, ESC_BorderL40_3, • New test case ESC_BorderL40_4.
	1.2 draft 3	13/04/2022		Review comments.
	1.2	3/05/2022		Review comments from ProRail on test cases of L40.
			§3.4.4, §4.5, §4.6, §4.7	ESC tests for L96

Abrogated documents

Name	Version	Date

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1. Introduction

1.1 Purpose of the document

The purpose of this document is to define the test scenarios to perform in order to prove the ETCS System Compatibility (ESC) between the On-board and the trackside at the Infrabel network borders. The success of these test scenarios shall prove the technical compatibility between ETCS On-board and the Trackside part ETCS of the CCS subsystems within the ETCS area on Infrabel network.

The technical specification for interoperability used for the border depends on the type program:

- Level 1 LS lines: [3] and [4];
- Level 2 FS lines: [5], [6] and [7];
- Level 1 FS lines: [6] and [7].

These test scenarios for ETCS system compatibility do not cover all design rules used in an ETCS area. If required, Infrabel can provide additional operational test scenarios performed during the verification that the trackside subsystem complies with the requirement of the TSI.

In case of doubt concerning the ESC of the board with the trackside, the railway undertaking shall take the required action with his supplier and inform Infrabel.

1.2 Basic documents

Ref.	*Title*	*Owner*
[1]	PSI (TC,ETCSsys,z) ESC TST PLN 1.4	Infrabel
[2]	Masterplan ETCS and IL 1.1 - Visie 2025 - Situatie ETCS	Infrabel

1.3 Reference documents

Title		*Owner*
[3]	Commission Regulation (EU) 2016/919 of 27 May 2016	EU
[4]	Corrigendum to Commission Regulation (EU) 2016/919 of 27 May 2016	EU
[5]	Commission Decision (EU) 2015/14 of 5 January 2015	EU
[6]	Commission Decision (EU) 2012/88/EU of 25 January 2012	EU
[7]	Commission Decision (EU) 2012/696/EU of 6 November 2012	EU
[8]	TD/011REC1028	ERA

1.4 Annexes

Ref.	*Title*	*Owner*
[9]	None	

1.5 Scope

This document is applicable for all trains that would run under the protection of ETCS on lines close to an external border of the Infrabel network.

1.6 Definitions, symbols and abbreviations

CCS	Control Command System
DMI	Driver Machine Interface
ESC	ETCS System Compatibility
ETCS	European Train Control System
IBG	Infill Balise Group
LS	Limited Supervision
NR	Not Relevant

SBG	Signal Balise Group
TSI	Technical Specification for Interoperability
VBC	Virtual Balise Cover

1.7 *Known imperfections*

This document lists all international borders, but this version does not contain the test descriptions for all of them. It will be completed in next versions.
This version of the document has been reviewed by ProRail but a major version of the document is required before they can sign the document. It will be signed in the next release.

2. On-board Equipment

Out of scope of railway manager Infrabel.

3. Lines with an external border

3.1 *With the Netherlands*

3.1.1 L55

This border will be equipped with ETCS1 LS, test description to be defined.

3.1.2 L12

This line is equipped with ETCS2 FS at the Dutch border.

The transition to The Netherlands consists of two independent transitions:

- The first one is a transition from ETCS2 to level STM with the design used on the Belgian network. This transition is tested in test case ESC_TR_13.
- The second transition is the STM-STM transition from MEMOR trackside to ATB trackside (see remark below).

The transition to Belgium also consists of two transitions:

- The first one is a STM-STM transition from ATB trackside to MEMOR trackside (see remark below).
- The second transition is a transition from level STM to ETCS2 with the design used on the Belgian network. This transition is tested in test case ESC_TR_16.
  The only difference with the transition used in the Belgian network is the NID_C of the first balise groups. In the case of this border, the NID_C of the first BG's up to the SBG of the first Belgian signal is the Dutch one.

The two transitions are more than 5 km apart.

Remark :
The STM-STM transitions involving ATB and MEMOR are covered by the Dutch ESC tests (see [8]) : test cases 5.1.3.1, 5.1.3.2, 5.1.3.3 and 5.1.3.4 (ESC type "Class B track border Belgium").

3.1.3 L4

This border is equipped with ETCS2 on a high-speed line. This transition is covered by the Dutch ESC tests (see [8]) : test cases 5.8.1 and 5.8.2 (ESC type "ERTMS track HSL-South border Belgium").

3.1.4 L19

This border will be equipped with ETCS1 LS, test description to be defined.

3.1.5 L40

Line 40 is equipped with ETCS1 LS (and TBL1+) in Belgium and ATB (and crocodiles) in The Netherlands. The transition to ATB (and crocodiles) is like the transitions to STM used in Belgium, only the levels of the P41 is modified (Figure 1).

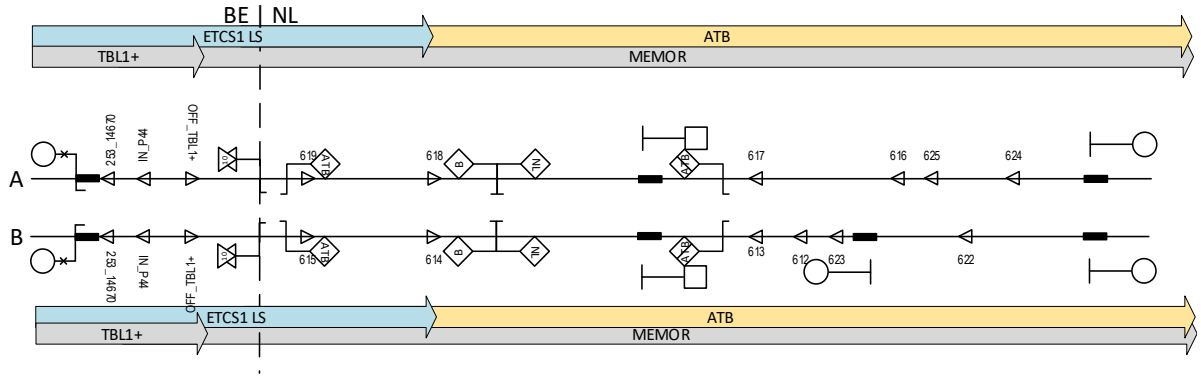

Figure 1 : L40 to The Netherlands

The transition to Belgium is composed of two transitions (Figure 2) :

- The first one is a transition to ETCS1 LS, sent with an ETCS1 LS MA and the ID of a virtual balise cover. This transition to ETCS1 LS is sent by M_VERSION 2 balises and shall be ignored by the Baseline 2 trains due to incompatible system versions.
- The transition to ETCS1 LS is followed by a transition to STM TBL1+. This second transition is ignored by Baseline 3 trains due to virtual balise covers and orders to Baseline 2 trains to changes to Level STM (TBL1+).

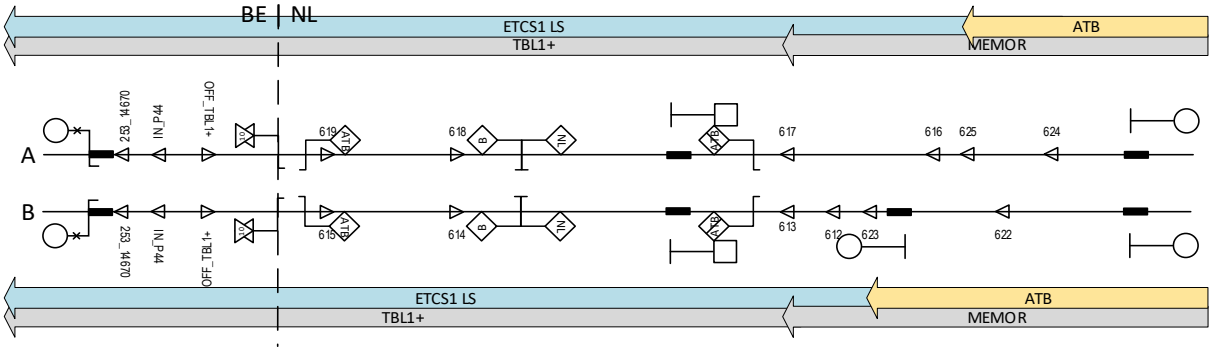

Figure 2 : L40 to Belgium

A specific test case should check also the degraded situation in case the ATB announcement BG is missed e.g. due to balise group failure or reversing between the announcement (A-BG, 428_619 or 428_615) and execution BG (E-BG, 428_618 or 428_614) of the transition to ATB (See ESC_BorderL40_4).

The border can be tested according to the test cases ESC_borderL40_1, ESC_borderL40_2, ESC_borderL40_3 and ESC_BorderL40_4 described in chapter 4.

3.2 *With Germany*

3.2.1 L24

This border will be equipped with ETCS1 FS, test description to be defined.

3.2.2 L37

This border is equipped with ETCS1 FS in Belgium and STM (PZB and TBL1+) in Germany.
The transition to ETCS1 FS is the same as the transition STM -- ETCS1 FS elsewhere on the network done one a single signal (ESC_TR_15).
The exit of ETCS1 FS is also similar at the exception of the content of the P41. In this case, German STM's are in the highest priority (ESC_TR_12).

No specific ESC tests are required.

3.3 *With Luxembourg*

3.3.1 L42

This border is equipped with ETCS1 FS, test description to be defined.

3.3.2 L162

This border is equipped with ETCS1 FS, test description to be defined.

3.4 *With France*

3.4.1 165/1

This border is equipped with ETCS1 FS, test description to be defined.

3.4.2 165/2

This border is equipped with ETCS1 FS, test description to be defined.

3.4.3 L130A

This border will be equipped with ETCS1 LS, test description to be defined.

3.4.4 L96

Line 96 is equipped with ETCS1 LS (and TBL1+) in Belgium and KVB (and crocodiles) in France. The transition to KVB is composed of an execution BG and an announcement BG (BG E and BG A) like the transitions to STM used in Belgium, but the levels of the P41 are modified and national values are sent (Figure 1).

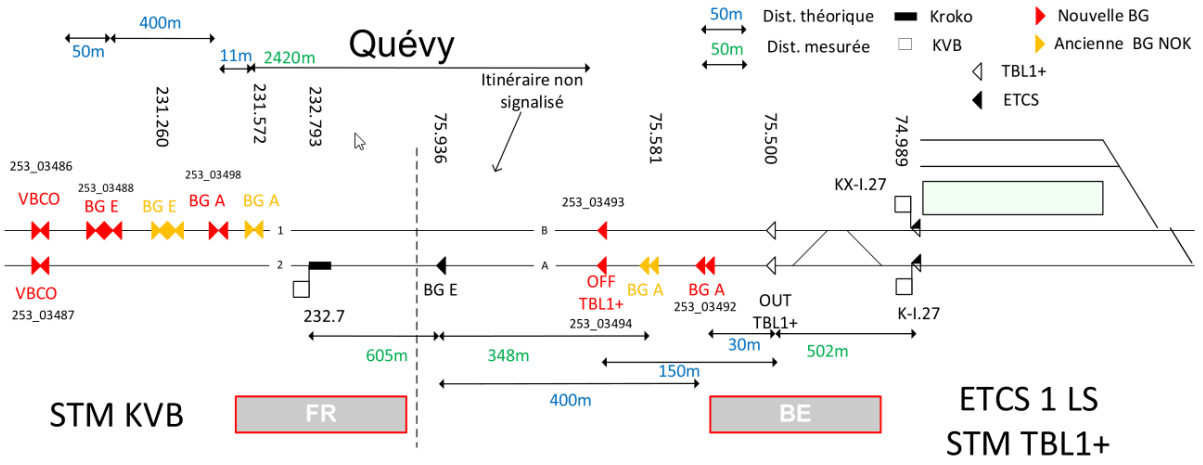

Figure 3 : L96 to France[1]

The transition to Belgium is composed of : (Figure 2) :

- A BG sending a virtual balise cover order (VBCO).
- Two BG's for the transition to STM TBL1+. The packet 200 is sent in each balises of the BG A and BG E to inhibit the transition for Baseline 3 trains (red BG A and BG E).
- A BG announcing the transition to level 1 Limited Supervision (Ann_L1).
- The SBG of the first Belgian signal sending the execution of the transition to Level 1 LS with the corresponding MA (SBG of B771 and mx-i.27).

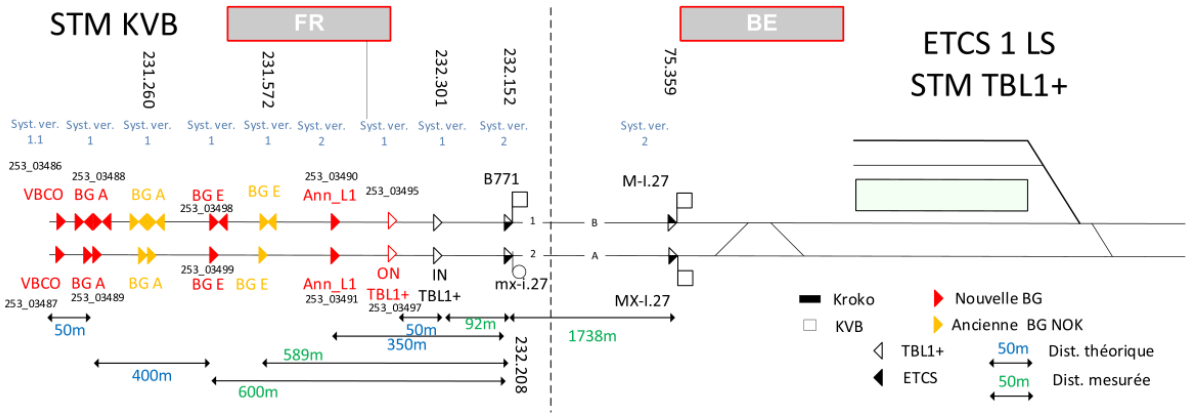

Figure 4 : L96 to Belgium

The border can be tested according to the test cases ESC_borderL96_1, ESC_borderL96_2 and ESC_borderL96_3 described in chapter 4.

3.4.5 L1

Out of scope, this border is not equipped with ETCS.

3.4.6 L94

This border is equipped with ETCS1 FS, test description to be defined.

3.4.7 L75

This border will be equipped with ETCS1 FS, test description to be defined.

[1] Yellow BG's are not installed and are replace by red ones.

4. Test scenarios

4.1 *ESC_BorderL40_1*

4.1.1 Description

ID	Date	Location / Line
	<dd/mm/yyyy>	Line 40
Description	Transition to ETCS1 LS **for Baseline 3 train** (From the Netherlands to Belgium) This test is not applicable to Baseline 2 trains for which ESC_BorderL40_2 is applicable.	

Signal passed	
Name	Trackside datafile in service
(NL) 905 is open	
(B) t-k.44 is open	
(B) T-K.44 is closed	

Test Scenarios	
Starting condition	Train is in the station of Eijsden in the level NTC mode SN used on the Dutch side of the border. Allowed NTC's are ATB, TBL1+, TBL2, TBL1. Memor, KVB.
	Be sure all authorisations are filled in before performing the test scenarios

Sequences of the test scenario

Step	Step description	Description of what to be tested	Statement	Comment
1	Train starts in direction of Belgium and passes the announcement BG 428_622.	a. DMI announces a level transition to Level 1. b. Train remains in level NTC. c. No brakes are applied.	Pass / Fail	
2	Train front end passes start of level acknowledgement window.	DMI shows level acknowledgement request.	Pass / Fail	
3	Driver acknowledges the level transition.	Train remains in level NTC.	Pass / Fail	
4	Train passes execution BG 428_623.	a. Train changes to level 1, mode LS. b. No brakes are applied.	Pass / Fail	

5	Train continues toward Visé and passes BGs : • 428_612 • 428_613 • 428_614 • 428_615	a. Train remains in level 1 mode LS. b. No brakes are applied.	Pass / Fail	
6	Train passes independent warning signal t-k.44.	a. LSSMA 0 is displayed on the DMI. b. modem is registered to the Belgian network c. no brakes are applied	Pass / Fail	
Test scenario finished				

4.1.2 Scenario diagram

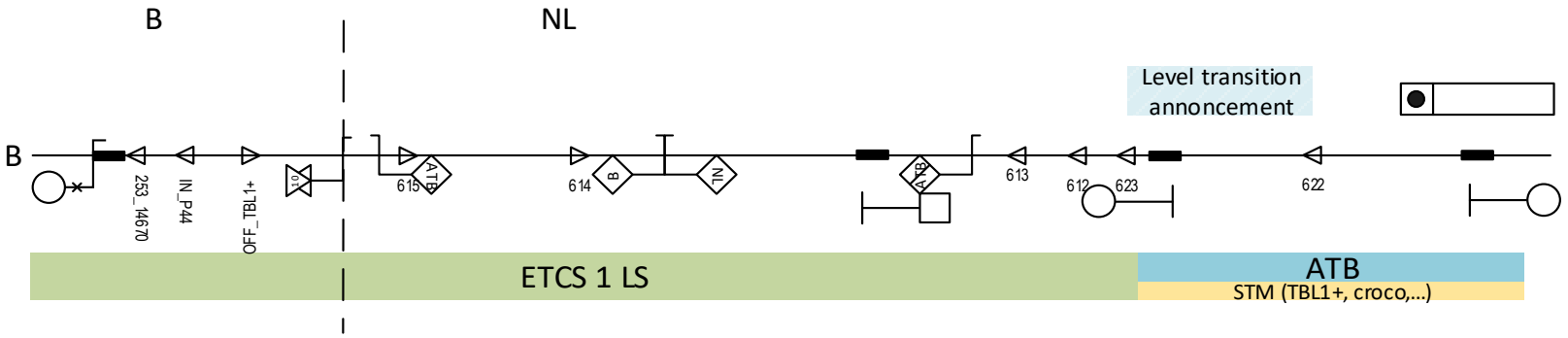

Figure 5 : L40 to Belgium

Final State	Train is in ETCS1 LS downwards t-k.44

4.2 *ESC_BorderL40_2*

4.2.1 Description

ID	Date	Location / Line
	<dd/mm/yyyy>	Line 40
Description	Transition to STM_YYY **for Baseline 2 trains** (From the Netherlands to Belgium). STM_XXX is the STM used in The Netherlands. It could be ATB, TBL1+, TBL2, TBL1. Memor, KVB. STM_YYY is the STM used in Belgium. It should be TBL1+ (or TBL2 if TBL1+ onboard is activated by TBL2 STM). This test is not applicable to Baseline 3 trains for which ESC_BorderL40_1 is applicable.	

Signal passed	
Name	Trackside datafile in service
(NL) 905 is open	
(B) t-k.44 is open	
(B) T-K.44 is closed	

Test Scenarios	
Starting condition	Train is in the station of Eijsden in the STM mode used on the Dutch side of the border.
	Be sure all authorisations are filled in before performing the test scenarios

Sequences of the test scenario

Step	Step description	Description of what to be tested	Statement	Comment
1	Train starts in direction of Belgium and passes BG's : 428_622 and 428_623 with M_VERSION 2.0.	a. Train remains in level STM mode SN, STM_XXX. b. No brakes are applied	Pass / Fail	
2	Train passes announcement BG 428_612.	a. DMI announces a level transition to Level STM_YYY (unless train already is in STM_YYY) b. No brakes are applied.	Pass / Fail	

		c. Data to be used by applications outside ERTMS/ETCS is forwarded to the relevant system. d. National Values for braking curves are discarded; other information of the balise groups shall be considered		
3	Train front end passes the start of level acknowledgement window.	DMI shows level acknowledgement request. (unless train already is in STM_YYY)	Pass / Fail	
4	Driver acknowledges the level transition.	No reaction, train remains in level STM mode SN.	Pass / Fail	
5	Train passes the execution BG 428_613.	a. Train changes to level STM_YYY (unless train already was in STM_YYY in previous steps). b. No brakes are applied. c. Data to be used by applications outside ERTMS/ETCS is forwarded to the relevant system. d. National Values for braking curves are discarded; other information of the balise groups shall be considered	Pass / Fail	
6	Train continues toward Visé and passes BGs : • 428_614 • 428_615	a. DMI shows mode remaining level STM_YYY mode SN b. No brakes are applied.	Pass / Fail	
7	Train passes independent warning signal t-k.44.	a. Yellow lamp lights up. b. modem is registered to the Belgian network c. no brakes are applied d. DMI shows mode remaining level STM_YYY mode SN	Pass / Fail	
Test scenario finished				

4.2.2 Scenario diagram

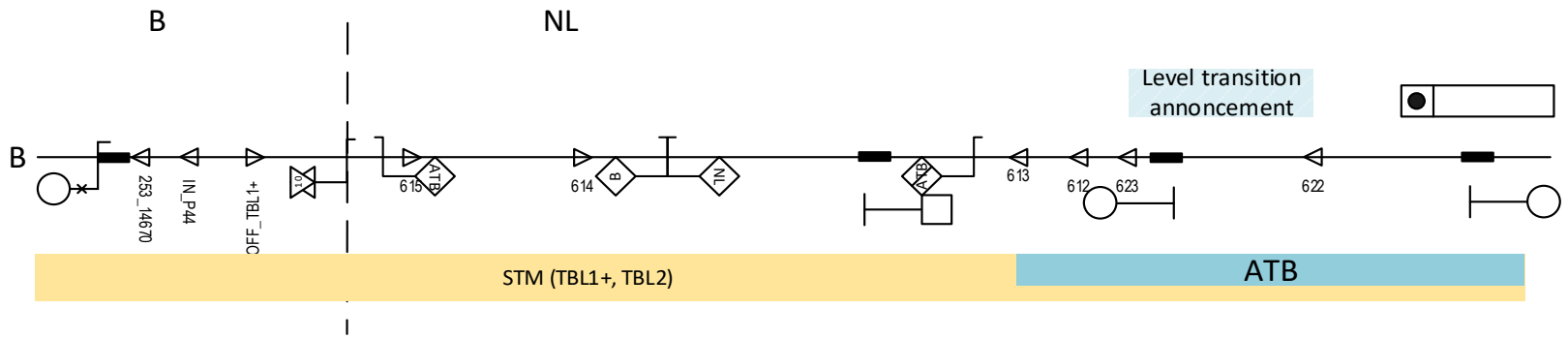

Figure 6 : L40 to Belgium

Final State	Train is in STM(TBL1+) downwards t-k.44

4.3 *ESC_BorderL40_3*

4.3.1 Description

ID	Date	Location / Line
	<dd/mm/yyyy>	L40
Description	Transition to STM_XXX on line 40 (From Belgium to the Netherlands) STM_XXX is the NTC/STM used in The Netherlands. It could be in order of priority ATB, TBL1+, TBL2, TBL1. Memor, KVB.	

Signal passed	
Name	Trackside datafile in service
S.K-44 is open.	

Test Scenarios	
Starting condition	Train is in order of priority: 1. In ETCS1 LS for B3 trains 2. in STM(TBL1+) for B2 trains equipped with TBL1+ STM 3. In STM(TBL2) for B2 trains using STM TBL2 to activate TBL1+ onboard.
	Be sure all authorisations are filled in before performing the test scenarios

Sequences of the test scenario				
Step	Step description	Description of what to be tested	Statement	Comment
1	Train runs from Belgium towards the Netherlands.	No reaction expected.	Pass / Fail	
2	Train passes the ATB announcement BG 428_619.	a. DMI announces a level transition to Level NTC/STM (STM_XXX) unless train already is in STM_XXX. b. Train remains in initial level and mode. c. No brakes are applied. d. National Values for braking curves are discarded by baseline 2 trains; other	Pass / Fail	

		information of the balise groups shall be considered		
3	Train front end passes the start of level acknowledgement window.	DMI shows level acknowledgement request (unless train already is in STM_XXX)	Pass / Fail	
4	Driver acknowledges the level transition.	Train remains in initial level and mode.	Pass / Fail	
5	Train passes the execution BG 428_618.	a. Train changes to Level NTC/STM (STM_XXX) unless train already is in STM_XXX b. No brakes are applied. c. Data to be used by applications outside ERTMS/ETCS is forwarded to the relevant system.	Pass / Fail	
6	Train passes BG 428_617.	a. modem is registered to the Dutch network b. DMI shows mode remaining level NTC/STM mode SN (STM_XXX) c. No brakes are applied.	Pass / Fail	
7	Train passes Network registration BG 428_616	a. no brakes are applied b. DMI shows mode remaining mode SN	Pass / Fail	
8	Train passes BG's 428_625 and 428_624.	a. no brakes are applied b. DMI shows mode remaining mode SN	Pass / Fail	
Test scenario finished				

4.3.2 Scenario diagram

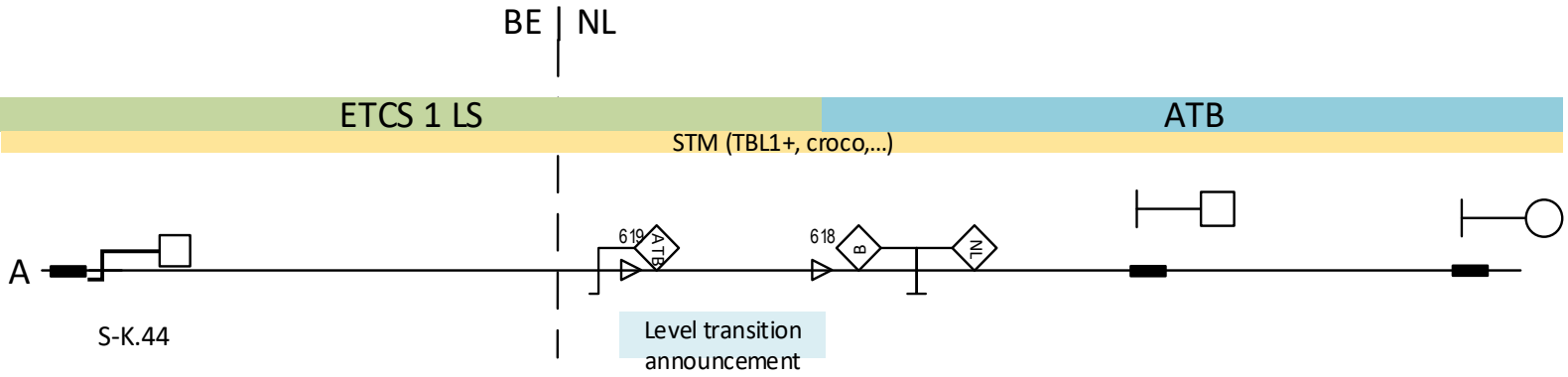

Figure 7 : L40 to The Netherlands

Final State	Train is in NTC/STM (ATB) if equipped or in a NTC/STM reading crocodiles otherwise.

4.4 *ESC_BorderL40_4*

4.4.1 Description

ID	Date	Location / Line
	<dd/mm/yyyy>	L40
Description	Transition from Level 1 LS / STM_YYY to NTC/STM (STM_XXX) without announcement. (From Belgium to The Netherlands) STM_XXX is the NTC/STM used in The Netherlands. It could be ATB, TBL1+, TBL2, TBL1. Memor, KVB. STM_YYY is the STM used in Belgium. It should be TBL1+ (or TBL2 if TBL1+ onboard is activated by TBL2 STM).	

Signal passed	
Name	Trackside datafile in service
S.K-44 is open.	

Test Scenarios	
Starting condition	Train is in order of priority: 1. In ETCS1 LS for B3 trains 2. in STM(TBL1+) for B2 trains equipped with TBL1+ STM 3. In STM(TBL2) for B2 trains using STM TBL2 to activate TBL1+ onboard..
	Train is at standstill downwards the ATB announcement BG (428_619).
	Be sure all authorisations are filled in before performing the test scenarios

Sequences of the test scenario				
Step	Step description	Description of what to be tested	Statement	Comment
1	Driver performs a start of mission without changing level or type of STM.	Trains is in level 1 SR, STM (TBL1+) or STM (TBL2).	Pass / Fail	
2	Train runs and passes execution of the transition BG 428_618.	a. DMI shows level changes to Level NTC/STM (STM_XXX) unless if onboard without STM (ATB) and in Level STM (TBL1+ or TBL2). b. DMI shows mode is mode SN c. DMI shows level acknowledgement request	Pass / Fail	

3	Driver acknowledges level transition within 5 seconds after passing transition location.	No brakes are applied.	Pass / Fail	
4	Train passes BG 428_617.	a. modem is registered to the Dutch network b. DMI shows mode remaining level STM_XXX mode SN c. No brakes are applied.	Pass / Fail	
5	Train passes Network registration BG 428_616	a. no brakes are applied b. DMI shows mode remaining mode SN	Pass / Fail	
6	Train passes BG's 428_625 and 428_624.	a. no brakes are applied b. DMI shows mode remaining mode SN	Pass / Fail	
Test scenario finished				

4.4.2 Scenario diagram

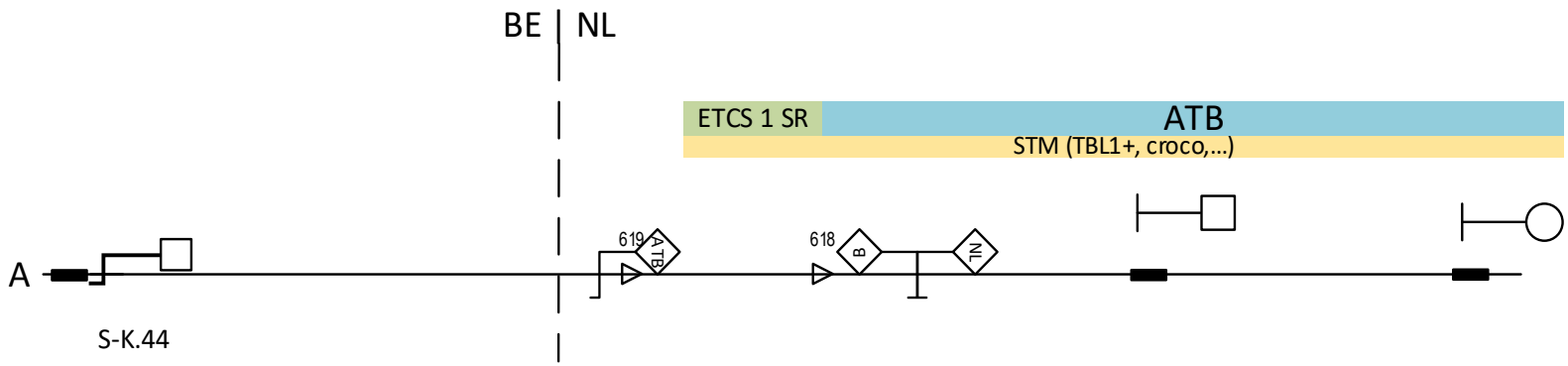

Figure 8 : L40 to The Netherlands

Final State	Train is in NTC/STM (ATB) if equipped or in a STM reading crocodiles otherwise.

4.5 *ESC_BorderL96_1*

4.5.1 Description

ID	Date	Location / Line
	<dd/mm/yyyy>	Line 96
Description	Transition to ETCS1 LS **for Baseline 3 train** (From France to Belgium) This test is not applicable to Baseline 2 trains for which ESC_BorderL96_2 is applicable.	
Signal passed		

Name			Trackside datafile in service	
B771 : first Belgian signal.				
Test Scenarios				
Starting condition	Train is in the station of Maubeuge in the NTC_XXX. NTC_XXX is the NTC allowed in France. It can be in order of priority: KVB or RPS.			
	All signals are open.			
	Be sure all authorizations are filled in before performing the test scenarios			
Sequences of the test scenario				
Step	Step description	Description of what to be tested	Statement	Comment
1	Train starts in direction of Belgium and passes the VBCO BG (253_03486).	a. Train remains in level NTC_XXX b. modem is registered to the Belgian network	Pass / Fail	
2	Train passes BG_A and BG_E, the transition BG's to TBL1+ (253_03488, 253_03498)	a. Train remains in level NTC_XXX b. No brakes are applied	Pass / Fail	
3	Train passes the Ann_L1, ON TBL1+ and IN_P44 BG. (253_03490, 253_03495, 253_15080)	a. DMI announces a level transition to Level 1. b. Train remains in level NTC_XXX. c. No brakes are applied	Pass / Fail	
4	Driver acknowledges the transition to level 1.	a. Train remains in level NTC_XXX b. No brakes are applied.	Pass / Fail	
5	Train passes the signal B771.	a) Train changes to ETCS1 Limited Supervision. b) No brakes are applied.	Pass / Fail	
Test scenario finished				

4.5.1 Scenario diagram

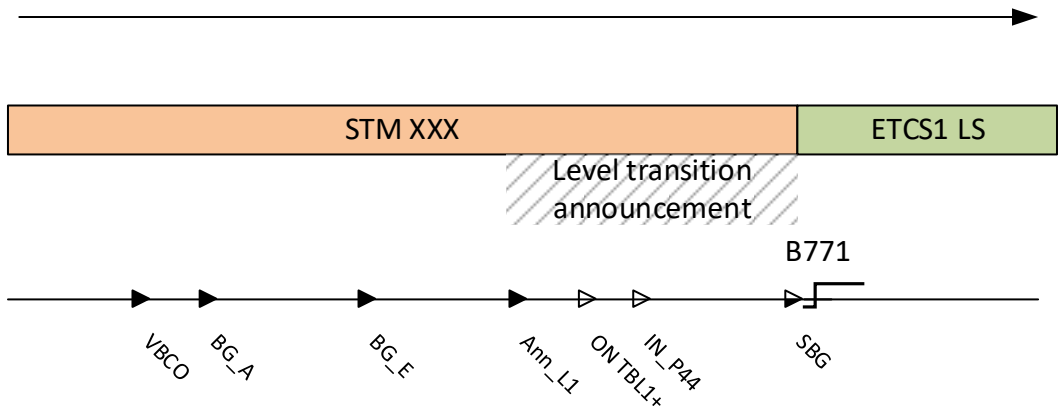

Figure 9 : L96 to Belgium

Final State	Train is in ETCS1 LS downwards B771

4.6 *ESC_BorderL96_2*

4.6.1 Description

ID	Date	Location / Line
ESC_BorderL96_2	<dd/mm/yyyy>	Line 96
Description	Transition to ETCS1 LS **for Baseline 2 train** (From France to Belgium) This test is not applicable to Baseline 3 trains for which ESC_BorderL96_1 is applicable.	
Signal passed		
Name		Trackside datafile in service
B771 : first Belgian signal		
Test Scenarios		
Starting condition	Train is in the station of Maubeuge in the Level STM_XXX. STM_XXX is the STM allowed in France. It can be in order of priority: KVB or RPS.	
	All signals are open.	
	Be sure all authorizations are filled in before performing the test scenarios	

Sequences of the test scenario				
Step	Step description	Description of what to be tested	Statement	Comment
1	Train starts in direction of Belgium and passes the VBCO BG (253_03486).	a. Train remains in level STM_XXX b. modem is registered to the Belgian network	Pass / Fail	
2	Train passes BG_A (253_03488)	a. Train remains in level STM_XXX b. DMI display the announcement to STM_TBL1+ and request acknowledgement. c. No brakes are applied	Pass / Fail	
3	Driver acknowledges the transition to STM TBL1+.	a. Train remains in level STM_XXX b. No brakes are applied.	Pass / Fail	
4	Train passes BG_E (253_03498)	a. Train changes to level STM_TBL1+ b. No brakes are applied.	Pass / Fail	

5	Train passes the Ann_L1 (253_03490).	a. Train remains in level STM_TBL1+ b. No brakes are applied.	Pass / Fail	
6	Train passes the ON TBL1+ and IN_P44 BG. (253_03495, 253_15080)	a. TBL1+ activates in mode NCV.	Pass / Fail	
7	Train passes the signal B771.	a) Train continues in level STM TBL1+. b) No brakes are applied.	Pass / Fail	
Test scenario finished				

4.6.2 Scenario diagram

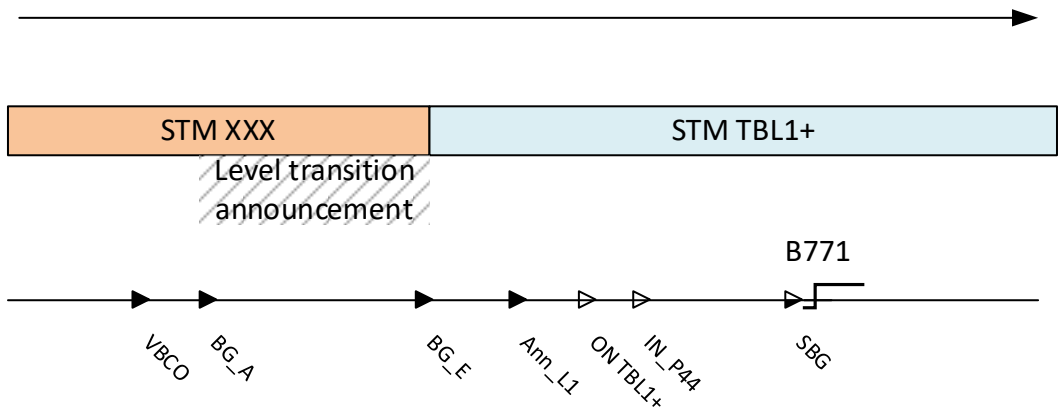

Figure 10 : L96 to Belgium

Final State	Train is in level STM TBL1+ downwards B771

4.7 *ESC_BorderL96_3*

4.7.1 Description

ID	Date	Location / Line
ESC_BorderL96_3	<dd/mm/yyyy>	Line 96
Description	Transition Level_YYY to STM_XXX (From Belgium to France) This test is applicable for Baseline 2 and Baseline 3 trains.	

Signal passed	
Name	Trackside datafile in service
K-I.27 : Last Belgian signal.	
232.7: First French signal	

Test Scenarios	
Starting condition	Train is in the station of Quevy in Level_YYY. • Level_YYY is the Level allowed in Belgium. It can be ETCS1 LS for Baseline 3 trains and STM_TBL1+ for Baseline 2 trains. • NTC_XXX is the NTC allowed in France. It can be in order of priority: KVB or RPS.
	All signals are open.
	Be sure all authorizations are filled in before performing the test scenarios

Sequences of the test scenario				
Step	Step description	Description of what to be tested	Statement	Comment
1	Train passes the signal K-I.27 and OUT_P44 BG.	a) Train continues in Level_YYY b) No brackes are applied.	Pass / Fail	
2	Train passes the BG_A (253_03492).	a) Train remains in Level_YYY b) DMI display the announcement to NTC_XXX and request acknowledgement. c) National values are updated on board with the French national values. d) No brakes are applied	Pass / Fail	

3a[2]	Train passes OFF_TBL1+ (253_03494).	a) Train remains in Level_YYY.	Pass / Fail	
3b	Driver acknowledges the level transition.	a) Train remains in Level_YYY.	Pass / Fail	
4	Train passes BG_E (255_00050).	a) Train changes to level NTC_XXX	Pass / Fail	
5	Train passes signal 232.7.	a) Train remains in level NTC_XXX b) Train reads the crocodile.	Pass / Fail	
6	Train passes VBCO BG (253_03487).	a) Train remains in level NTC_XXX b) The French national values are used onboard.	Pass / Fail	
Test scenario finished				

4.7.2 Scenario diagram

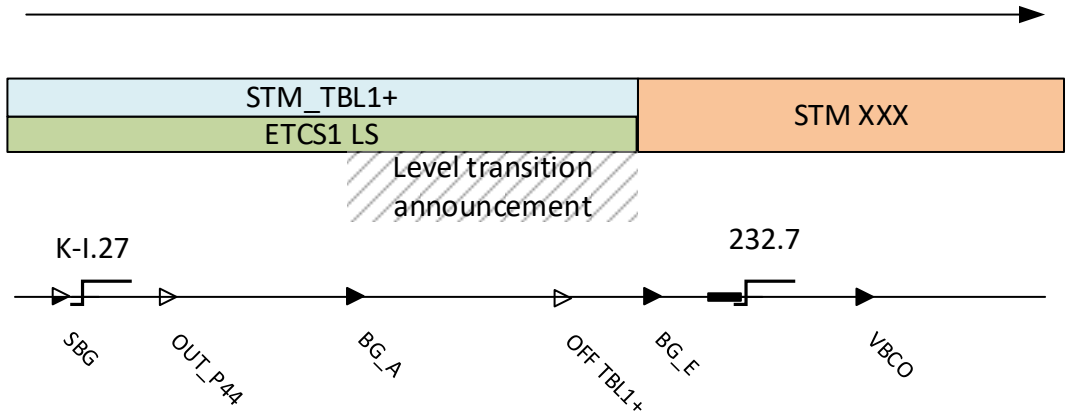

Figure 11 : L96 to France

Final State	Train is in STM_XXX downwards 232.7

[2] 3a and 3b steps could be freely interchanged.