



ERTMS/ETCS

FFFIS STM test cases of Functional identity 001

START OF MISSION

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CAF		
HITACHI RAIL STS		
MERMEC		
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THALES		



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3.9.1 25/11/22	-	Formal update for the 2 nd consolidation review for Baseline 4 1 st release version	Sven Adomeit (Siemens)



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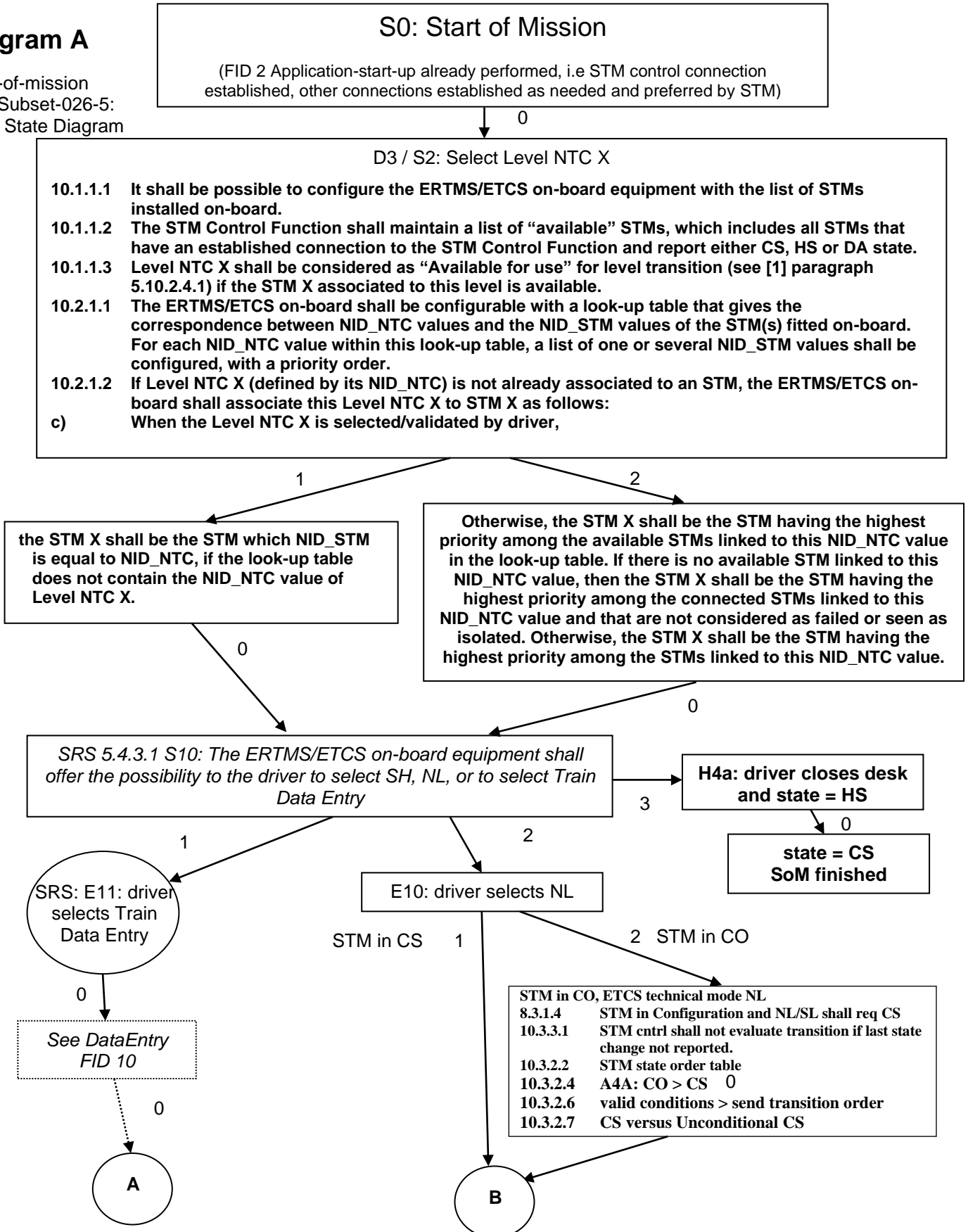


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Diagram A

Start-of-mission
Ref: Subset-026-5:
5.4.4 State Diagram



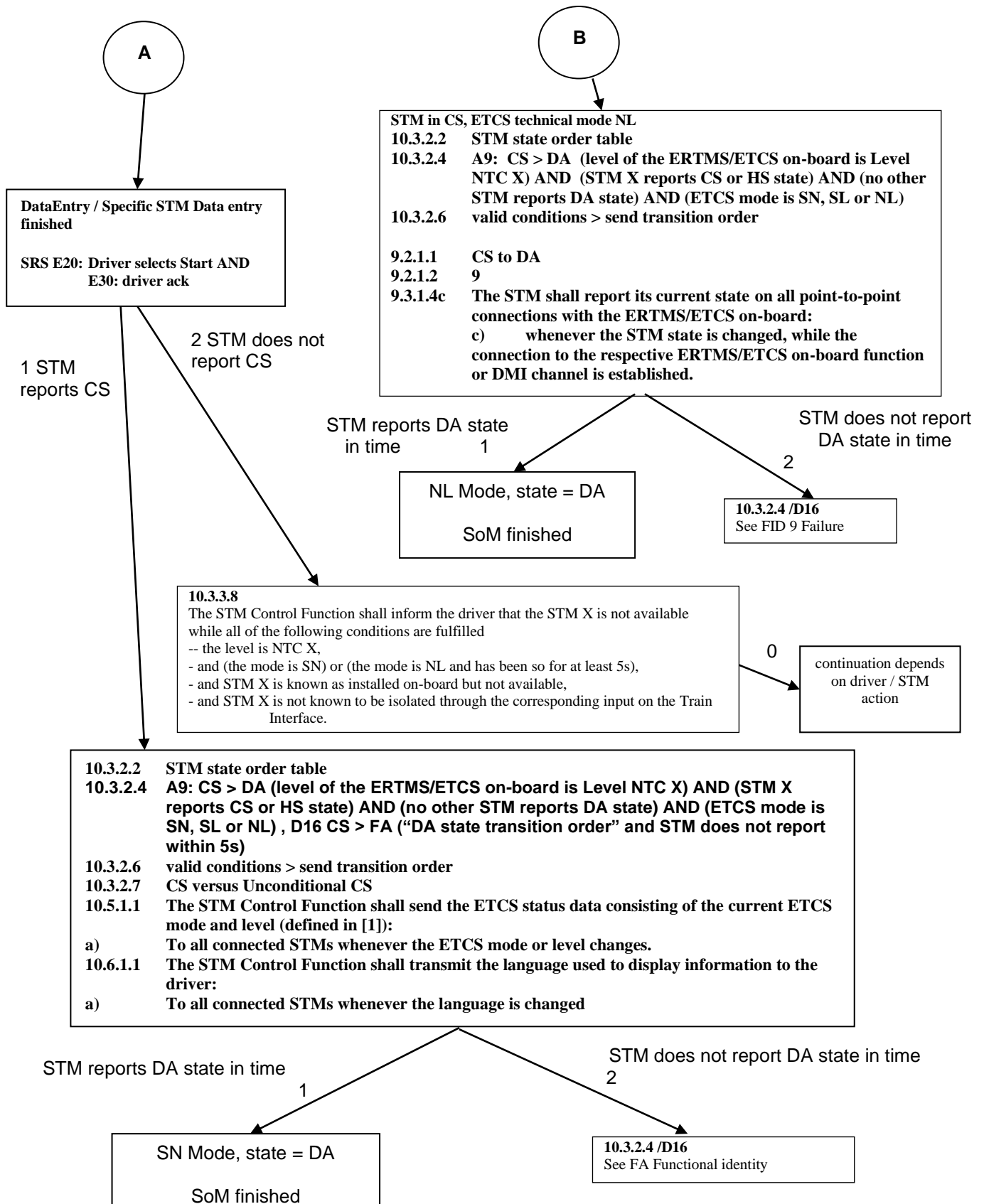


Diagram B

Sleeping

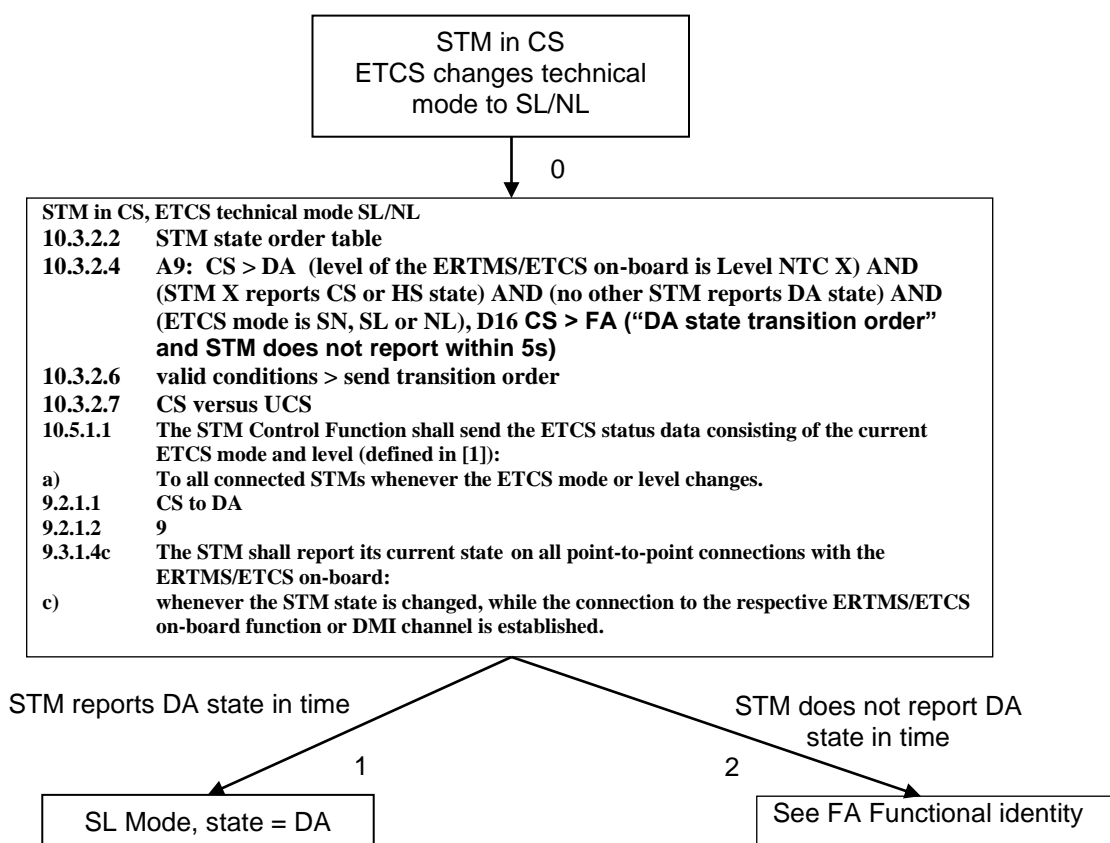
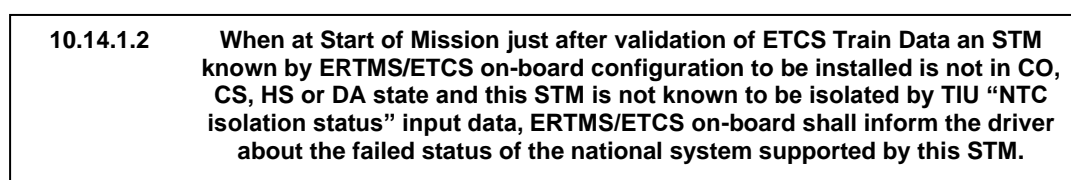


Diagram C

Failed STM status reporting





Supplier-specific delays table

#	Supplier of	Start time	End time
Ts1		<i>No longer used</i>	
Ts2		<i>No longer used</i>	
Ts3	ETCS	Reference time at which mode or level is changed	Time-stamp of message including STM-5 ETCS status data
Ts4	ETCS	Reference time at which NL mode is selected	Time-stamp of message including STM-14 state order DA/HS
Ts5		<i>No longer used</i>	
Ts6	ETCS	Reference time at which NTC X is selected, no other STM in HS	Time-stamp of message including STM-14 state order HS
Ts7	ETCS	Reference time at which Start is selected	Reference time at which ETCS propose SN mode to the driver
Ts8	ETCS	Reference time at which SN mode is acknowledged	Time-stamp of message including STM-14 state order DA
Ts9	ETCS	Reference time at which SN mode is acknowledged	Time-stamp of message including STM-5 ETCS Status data SN
Ts10	ETCS	Time-stamp of message including STM-14 state order DA (no response from STM to state order)	Time-stamp of message including STM-14 state order FA
Ts11	ETCS	Time-stamp of message including STM-14 state order DA (No response from STM to state order)	Reference time at which Information about failed STM displayed on DMI
Ts14	ETCS	Reference time at which different language is selected	Time-stamp of message including STM-30 driver language
Ts15	ETCS	Time-stamp of message including STM-15 state report CS/HS	Time-stamp of message including STM-14 state order DA
Ts16	ETCS	Reference time at which desk is closed	Time-stamp of message including STM-14 state order CS
Ts17	ETCS	Time-stamp of message including STM-13 state request CS state	Time-stamp of message including STM-14 state order CS
Ts18	ETCS	Time-stamp of message including STM-15 state report CS (mode = NL, STM is	Time-stamp of message including STM-14 state order DA

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		selected STM, previously in CO state and mode SN)	
<i>Ts19</i>		<i>No longer used</i>	
Ts20	STM	NL mode reported by ETCS, STM is selected and in CO state	Time-stamp of message including STM-13 STM requests CS state
Ts21	ETCS	Reference time at which Sleeping signal detected	Time-stamp of message including STM-5 ETCS status SL
Ts22	ETCS	Time-stamp of message including packet STM-5 ETCS status data status change	Time-stamp of message including STM-14 state order DA
Ts23	ETCS	Reference time at which ETCS train data is validated	Reference time at which DMI indicates a missing STM
Ts24	ETCS	Reference time at which SN mode is acknowledged by driver	Reference time at which ETCS DMI informs driver that STM X is not available
Ts25	ETCS	Reference time at which STM reports CS	Reference time at which ETCS DMI no longer informs driver that STM X is not available



Test case 1a.1

TEST CASE HEADER	
Test case Identification	Start of mission
	1a.0.1.0.2.1.1
	“Stored position” is not valid. The driver selects NL and then selects ETCS Level = NTC x, STM state is CS, the ETCS sends the order to DA, STM reports DA late but in time.
ERTMS/ETCS on-board Requirements Tested	Subset-035 10.1.1.1; 10.1.1.2; 10.1.1.3; 10.2.1.1; 10.2.1.2 c1; 10.3.2.2, 10.3.2.4 A9; CS to DA; 10.3.2.6;
STM Requirements Tested	Subset-035; 9.2.1.1 CS to DA 9; 9.2.1.2 9; 9.3.1.4c;
Packets Transmitted via FFFIS STM	STM-5; STM-13; STM-14; STM-15; STM-32; STM-35;
ERTMS/ETCS on-board Configuration	STM x is not in the lookup table. No DMI configuration data.
Comments and constraints	<p>The non-leading input is active. “Stored position” is not valid. In this test case it is foreseen that there is no STM reporting HS, so the ETCS sends directly the order to switch to DA. All status changes for the STM are in due time. The final STM status is DA.</p> <p>The driver has already entered the driver id and the level selection is displayed to the driver.</p>



Starting Conditions	Value	Comments
STM State	CS	
ETCS Mode	SB	
ETCS Level	Not NTC X	
Train State	Standstill	
ETCS Train Data	Not relevant	
Active DMI channel Connection	Not relevant	
Other DMI channel Connections	Not relevant	
TIU Connection	Not relevant	
BIU Connection	Not relevant	
JD Connection	Not relevant	
TIU Regenerative Brake Command	Not Relevant	
TIU Magnetic Shoes brake Command	Not Relevant	
TIU Eddy Current Brake Command for Emergency Brake	Not Relevant	
TIU Eddy Current Brake Command for Service Brake	Not Relevant	
TIU Pantograph Command	Not Relevant	
TIU Air Tightness Command	Not Relevant	
TIU Main Switch / Circuit Breaker Command	Not Relevant	
TIU Traction Cut Off Command	Not Relevant	
TIU Traction Status	Not Relevant	
TIU Direction Controller Position Status	Not Relevant	
TIU Cab Status (Desk Status)	Cab A or B active	
BIU Emergency Brake Command	Not Relevant	
BIU Service Brake Command	Not Relevant	
BIU Emergency Brake Status	Not Relevant	
BIU Service Brake Status	Not Relevant	
NTC isolation status	Not Isolated	



ERTMS/ETCS on-board Test Case

Step	Description/Comments	Input I/F	Input time	Input Action	Output I/F	Output time limit	Output action
1	Driver selects NL	DMI	T0	Driver selects NL	PROF	Ts4	STM Control Connection Message – 5 Sent packet STM-5 ETCS status data.
2	ETCS displays a list of selectable levels including NTCs to the driver	DMI	T0+3s	Driver chooses to change level to Level NTC X (handled by STM X)	DMI		Level selection window closed.
					PROF	Ts3	STM Control Connection Message – 8 Sent packet STM-5 ETCS status data + packet STM - 14 State order DA to STM. Time T1.
3	STM reports DA late but in time	PROF	T1 + 4s	STM Control Connection: STM reports DA State Message 4 received packet STM-15 State report from STM 4s after receiving state order			-
4	STM opens the communication	PROF	T1 + 4.5s	STM opens the connection with the DMI function if closed		-	-
5	STM sends DMI requests	PROF	T1 + 5s	DMI Connection: Message 9 received. (STM-15 - state report from STM, STM-32 - button request, STM-35 - indicator request)	DMI	1.5s	ETCS shows STM information on DMI



STM Test case

Step	Description/Comments	Input I/F	Input time	Input Action	Output I/F	Output time limit	Output action
1	STM Control orders STM to DA State. STM switches to DA and reports its new state	PROF	T0	STM Control Connection ETCS orders DA Message 8 received packet STM-14 State order to STM	PROF	5s	STM Control Connection Message - 4 Sent packet STM – 15 State report from STM in time.

Message 4: STM → ETCS (Packet STM-15)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	15	State report from the STM
L_PACKET	13	COMPUTED	
NID_STMSTATE	4	7	Data Available
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message 5: ETCS → STM(Packet STM-5)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	5	ETCS Status data

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L_PACKET	13	COMPUTED	
M_LEVEL	3	2	Level 1
M_MODE	4	11	Non-leading
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message 8: ETCS → STM(Packet STM-14)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	5	ETCS Status data
L_PACKET	13	COMPUTED	
M_LEVEL	3	1	Level NTC
NID_NTC	8	FINITE VALUE	The NID_NTC selected by the driver
M_MODE	4	11	Non-Leading
NID_PACKET	8	14	State order to STM
L_PACKET	13	COMPUTED	
NID_STMSTATEORDER	4	7	Order DA State
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message-9: STM → ETCS DMI Function (Packet STM-15, STM-32, STM-35)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	any valid value for NID_STM
L_MESSAGE	8	COMPUTED	message length

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Message-9: STM → ETCS DMI Function (Packet STM-15, STM-32, STM-35)

VARIABLE	Length	VALUE	COMMENTS
NID_PACKET	8	15	State report from STM (STM-15)
L_PACKET	13	COMPUTED	packet length
NID_STMSTATE	4	7	state DA
NID_PACKET	8	32	Button Request (STM-32)
L_PACKET	13	COMPUTED	packet length
N_ITER	5	2	request for 2 buttons
NID_BUTTON(1)	8	1	
NID_BUTPOS(1)	5	1	
NID_ICON(1)	8	0	
M_BUT_ATTRIB(1)	10	1000000001B	white text on dark blue (black is not supported) background, not flashing
L_CAPTION(1)	6	9	
X_CAPTION(1,1)	8	'A'	
X_CAPTION(1,2)	8	'T'	
X_CAPTION(1,3)	8	'T'	
X_CAPTION(1,4)	8	'E'	
X_CAPTION(1,5)	8	'N'	
X_CAPTION(1,6)	8	'T'	
X_CAPTION(1,7)	8	'I'	
X_CAPTION(1,8)	8	'O'	
X_CAPTION(1,9)	8	'N'	
NID_BUTTON(2)	8	2	
NID_BUTPOS(2)	5	3	
NID_ICON(2)	8	0	
M_BUT_ATTRIB(2)	10	1000000001B	white text on dark blue (black is not supported) background, not flashing
L_CAPTION(2)	6	4	
X_CAPTION(2,1)	8	'H'	
X_CAPTION(2,2)	8	'E'	
X_CAPTION(2,3)	8	'L'	
X_CAPTION(2,4)	8	'P'	

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Message-9: STM → ETCS DMI Function (Packet STM-15, STM-32, STM-35)

VARIABLE	Length	VALUE	COMMENTS
NID_PACKET	8	35	Indicator Request (STM-35)
L_PACKET	13	COMPUTED	packet length
N_ITER	5	3	request for 3 indicators
NID_INDICATOR(1)	8	1	
NID_INDPOS(1)	5	1	
NID_ICON(1)	8	0	
M_IND_ATTRIB(1)	10	1000000001B	white text on dark blue (black is not supported) background, not flashing
L_CAPTION(1)	6	1	
X_CAPTION(1,1)	8	'A'	
NID_INDICATOR(2)	8	2	
NID_INDPOS(2)	5	2	
NID_ICON(2)	8	0	
M_IND_ATTRIB(2)	10	1000000001B	white text on dark blue (black is not supported) background, not flashing
L_CAPTION(2)	6	1	
X_CAPTION(2,1)	8	'B'	
NID_INDICATOR(3)	8	3	
NID_INDPOS(3)	5	3	
NID_ICON(3)	8	0	
M_IND_ATTRIB(3)	10	1000000001B	white text on dark blue (black is not supported) background, not flashing
L_CAPTION(3)	6	1	
X_CAPTION(3,1)	8	'C'	
PADDING_BITS	COMPUTED	NOT RELEVANT	



End Conditions	Value	Comments
STM State	DA	
ETCS Mode	NL	
ETCS Level	NTC	
Train State	Standstill	
ETCS Train Data	Not Relevant	
Active DMI channel Connection	ETCS TC: Established STM TC: not relevant	ETCS TC: 2 buttons and 3 indicators shown on DMI / STM TC: not relevant
Other DMI channel Connections	Not Established	
TIU Connection	Not Relevant	
BIU Connection	Not Relevant	
JD Connection	Not Relevant	
TIU Regenerative Brake Command	Not Relevant	
TIU Magnetic Shoes brake Command	Not Relevant	
TIU Eddy Current Brake Command for emergency brake	Not Relevant	
TIU Eddy Current Brake Command for service brake	Not Relevant	
TIU Pantograph Command	Not Relevant	
TIU Air Tightness Command	Not Relevant	
TIU Main Switch / Circuit Breaker Command	Not Relevant	
TIU Traction Cut Off Command	Not Relevant	
TIU Traction Status	Not Relevant	
TIU Direction Controller Position Status	Not Relevant	
TIU Cab Status (Desk Status)	Not Relevant	
BIU Emergency Brake Command	Not Relevant	
BIU Service Brake Command	Not Relevant	
BIU Emergency Brake Status	Not Relevant	
BIU Service Brake Status	Not Relevant	
NTC isolation status	Not Isolated	



Test case 1a.2

TEST CASE HEADER	
Test case Identification	Start of mission
	1a.0.2.0.1.0.1.1
	The driver selects Level NTC X, the ETCS technical mode is SB. The driver then selects data entry. Test case is suspended at start of Specific NTC Data Entry, to continue in a Data Entry functional ID test case, then return after data entry (not applicable for STMs that do not have Specific Data Entry). Driver selects Start and acknowledges SN mode. Test case ends in DA and SoM finished.
ERTMS/ETCS on-board Requirements Tested	Subset-035 10.1.1.1; 10.1.1.2; 10.1.1.3; 10.2.1.1; 10.2.1.2 c2; 10.5.1.1a; 10.3.2.2, 10.3.2.4 B6 CS to HS, A9 HS to DA; 10.3.2.6; 10.3.2.7; Subset-26 <u>4.7.2 table: ack of SN mode</u>
STM Requirements Tested	Subset-035 9.2.1.1, 9.2.1.2 6 CS to HS, 9 HS to DA ; 9.3.1.4c;
Packets Transmitted via FFFIS STM	STM-5; STM-15; STM-14;
ERTMS/ETCS on-board Configuration	ETCS shall include a suitable configuration list of STM(s) with their Level NTC associations, including NTC X.
Comments and constraints	The driver has already entered the driver id and the level selection dialog is displayed to the driver. STM may start in state CO or CS (two test-cases). There is no other STM for the NTC.



Starting Conditions	Value	Comments
STM State	CS/CO	Two test-cases.
ETCS Mode	SB	
ETCS Level	Not Level NTC X	
Train State	Standstill	
ETCS Train Data	Not relevant	
Active DMI channel Connection	Not relevant	
Other DMI channel Connections	Not relevant	
TIU Connection	Not relevant	
BIU Connection	Not relevant	
JD Connection	Not relevant	
TIU Regenerative Brake Command	Not Relevant	
TIU Magnetic Shoes Brake Command	Not Relevant	
TIU Eddy Current Brake Command for Emergency Brake	Not Relevant	
TIU Eddy Current Brake Command for Service Brake	Not Relevant	
TIU Pantograph Command	Not Relevant	
TIU Air Tightness Command	Not Relevant	
TIU Main Switch / Circuit Breaker Command	Not Relevant	
TIU Traction Cut Off Command	Not Relevant	
TIU Traction Status	Not Relevant	
TIU Direction Controller Position Status	Not Relevant	
TIU Cab Status (Desk Status)	Cab A or B active	
BIU Emergency Brake Command	Not Relevant	
BIU Service Brake Command	Not Relevant	
BIU Emergency Brake Status	Not Relevant	
BIU Service Brake Status	Not Relevant	
NTC isolation status	Not Isolated	



ERTMS/ETCS on-board Test Case

Step	Description/Comments	Input I/F	Input time	Input Action	Output I/F	Output time limit	Output action
1	ETCS displays a list of selectable levels including NTCs to the driver. Driver selects level NTC X	DMI	T0	Driver chooses to change level to Level NTC X (=> the STM X)	PROF	2s	Level selection window closed.
2	If STM is in state CS, ETCS orders STM to HS (if in CO, no action)				PROF	Ts6	STM Control Connection: Message – 9 Sent packet STM - 14 State order to STM
3	If STM got state order HS, STM reports HS in time	PROF	T0 + 10s	STM Control Connection: Sent message 5 packet STM-15 STM State report			
	Driver selects Train Data Entry, Specific Data Entry performed, see test-cases for FID 10						
4	Data entry finished , Driver selects Start and acknowledges SN mode selection	DMI	<i>Immediate on return from FID 10</i>	Driver selects Start and presses ack			
	ETCS sends the order to DA		-	Order to DA state	PROF		STM Control Connection: Message – 10 Sent packet STM - 14 State order to STM Time T1.
	ETCS reports its new status (mode SN)		-	ETCS sends status report	PROF	Ts9	STM Control Connection: Message- 12 Sent packet STM - 5 ETCS Status data
5	STM reports DA in time	PROF	T1 + 3s	STM Control Connection: STM reports DA in due time message 4 packet STM-15 STM State report			Nothing to do



STM Test case A (applicable for STMs that do not request STM Specific data)

Step	Description/Comments	Input I/F	Input time	Input Action	Output I/F	Output time limit	Output action
1	ETCS displays a list of the connected STMs to the driver for selecting the needed STM. Driver selects NTC X (\Rightarrow STM X), validates train data and then selects Start and acknowledges SN mode. STM is ordered to HS and reports HS.	PROF	T0	Message 12 received packet STM-5 Level NTC X SN mode, Message – 9 received packet STM - 14 State order to STM		10s	STM Control Connection: Message - 5 Sent packet STM – 15 state report HS.
2	ETCS orders STM to DA and STM reports its new state	PROF	T0 + 0.5s	STM Control Connection: ETCS orders DA Message 10 received packet STM-14 State order to STM	PROF	5s	STM Control Connection: Message - 4 Sent packet STM – 15 state report DA. Check time-delay, should be < 5s with some margin.



STM Test case B (applicable for STMs that request STM Specific data)

Step	Description/Comments	Input I/F	Input time	Input Action	Output I/F	Output time limit	Output action
	ETCS displays a list of the connected STMs to the driver for selecting the needed STM. Driver selects level NTC X		T0	Message 12 received packet STM-5 Level NTC X			
1	ETCS orders STM to HS	PROF	T0 + 0.5s	STM Control Connection: Message – 9 Sent packet STM - 14 State order to STM			
2	STM reports HS in time				PROF	10s	STM Control Connection: Sent message 5 packet STM-15 STM State report
	Driver selects Train Data Entry, Specific Data Entry performed, see test-cases for FID 10						
3	Data entry finished , Driver selects Start and acknowledges. ETCS sends the order to DA	PROF	T1	STM Control Connection: Message- 11 Sent packet STM - 5 ETCS Status data			
4	ETCS reports its new status (mode SN), STM reports DA in time	PROF	T1 + 0.5s	STM Control Connection: Message – 10 Sent packet STM - 14 State order to STM	PROF	5s	STM Control Connection: Sent message 4 packet STM-15 STM State report

Message 4: STM → ETCS (packet STM-15)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	



NID_PACKET	8	15	State report from the STM
L_PACKET	13	COMPUTED	
NID_STMSTATE	4	7	Data Available
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message 5: STM → ETCS (packet STM-15)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	15	State report from the STM
L_PACKET	13	COMPUTED	
NID_STMSTATE	4	6	HS
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message 9: ETCS → STM (packet STM-14)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	14	State order to STM
L_PACKET	13	COMPUTED	
NID_STMSTATEORDER	4	6	Order HS State

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PADDING_BITS	COMPUTED	NOT RELEVANT	
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Message 10: ETCS → STM (packet STM-14)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	14	State order to STM
L_PACKET	13	COMPUTED	
NID_STMSTATEORDER	4	7	Order DA State
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message 11: ETCS → STM (packet STM-5)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	5	ETCS Status data
L_PACKET	13	COMPUTED	
M_LEVEL	3	1	Level NTC
NID_NTC	8	FINITE VALUE	The NID_NTC selected by the driver
M_MODE	4	13	STM National
PADDING_BITS	COMPUTED	NOT RELEVANT	

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Message 12: ETCS → STM (packet STM-5)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	5	ETCS Status data
L_PACKET	13	COMPUTED	
M_LEVEL	3	1	Level NTC
NID_NTC	8	FINITE VALUE	The NID_NTC selected by the driver
M_MODE	4	6	Stand By
PADDING_BITS	COMPUTED	NOT RELEVANT	



End Conditions	Value	Comments
STM State	DA	
ETCS Mode	SN	
ETCS Level	NTC	
Train State	Standstill	
ETCS Train Data	Not relevant	
Active DMI channel Connection	Not relevant	
Other DMI channel Connections	Not relevant	
TIU Connection	unchanged	
BIU Connection	unchanged	
JD Connection	unchanged	
TIU Regenerative Brake Command	unchanged	
TIU Magnetic Shoes Brake Command	unchanged	
TIU Eddy Current Brake Command for Emergency Brake	unchanged	
TIU Eddy Current Brake Command for Service Brake	unchanged	
TIU Pantograph Command	unchanged	
TIU Air Tightness Command	unchanged	
TIU Main Switch / Circuit Breaker Command	unchanged	
TIU Traction Cut Off Command	unchanged	
TIU Traction Status	unchanged	
TIU Direction Controller Position Status	unchanged	
TIU Cab Status (Desk Status)	unchanged	
BIU Emergency Brake Command	unchanged	
BIU Service Brake Command	unchanged	
BIU Emergency Brake Status	unchanged	
BIU Service Brake Status	unchanged	
NTC isolation status	Not Isolated	



Test case 1a.3

TEST CASE HEADER	
Test case Identification	Start of mission
	1a.0.2.0.1.0.1.2
	The driver selects Level NTC X from the look-up table, the ETCS technical mode is SB. The driver then selects data entry. Test case is suspended, to be continued in Specific Data Entry functional ID test case, then return after data entry. The driver selects “Start” and acknowledges SN mode. The ETCS sends the order to switch to DA but the STM does not follow the DA State order in time.
ERTMS/ETCS on-board Requirements Tested	Subset-035 10.1.1.1; 10.1.1.2; 10.1.1.3; 10.2.1.1; 10.2.1.2c2; 10.5.1.1a; 10.3.2.2, 10.3.2.4 B6 CS to HS, A9 HS to DA, D16 HS to FA; 10.3.2.6; Subset-26 4.7.2 table: ack of SN mode
STM Requirements Tested	Subset-035 None
Packets Transmitted via FFFIS STM	STM-5; STM-14;
ERTMS/ETCS on-board Configuration	ETCS shall include a suitable configuration list of STM(s) with their Level NTC associations, including NTC X.
Comments and constraints	This is an ETCS test case for applying the safe action in the case an STM does not follow a state transition order. There is no other STM for the NTC.



Starting Conditions	Value	Comments
STM State	CS	
ETCS Mode	SB	
ETCS Level	Not NTC X	
Train State	Standstill	
ETCS Train Data	Not relevant	
Active DMI channel Connection	Not relevant	
Other DMI channel Connections	Not relevant	
TIU Connection	Not relevant	
BIU Connection	Not relevant	
JD Connection	Not relevant	
TIU Regenerative Brake Command	Not Relevant	
TIU Magnetic Shoes Brake Command	Not Relevant	
TIU Eddy Current Brake Command for Emergency Brake	Not Relevant	
TIU Eddy Current Brake Command for Service Brake	Not Relevant	
TIU Pantograph Command	Not Relevant	
TIU Air Tightness Command	Not Relevant	
TIU Main Switch / Circuit Breaker Command	Not Relevant	
TIU Traction Cut Off Command	Not Relevant	
TIU Traction Status	Not Relevant	
TIU Direction Controller Position Status	Not Relevant	
TIU Cab Status	Cab A or B active	
BIU Emergency Brake Command	Not Relevant	
BIU Service Brake Command	Not Relevant	
BIU Emergency Brake Status	Not Relevant	
BIU Service Brake Status	Not Relevant	
NTC isolation status	Not Isolated	



ERTMS/ETCS on-board Test Case

Step	Description/Comments	Input I/F	Input time	Input Action	Output I/F	Output time limit	Output action
1	Desk is opened, ETCS displays a list of levels available, including the connected STMs, to the driver for selecting NTC (STM)	DMI	T0	Driver opens desk	DMI		List of levels including connected STMs is displayed to the driver for selecting the relevant
2	Driver selects NTC X (=>STM X)	DMI	T0 + 5s	Driver selects NTC X	DMI	2s	Level selection window closed.
	ETCS sends its current level to the STM				PROF	Ts3	STM Control Connection: Message - 1 Sent packet STM-5 ETCS status data (level NTC-X) + packet – 14 State order HS to the STM. Time = T3
3	STM reports HS	PROF	T3 + 3s	STM Control Connection: STM reports HS State Message 7 packet STM-15 STM State report			
4				(Driver selects Train Data Entry and may enter train data in FID 10), then selects Start and acknowledges SN mode.			
	ETCS sends its current technical mode to the STM				PROF	Ts9	STM Control Connection: Message - 2 Sent packet STM-5 ETCS status data (SN mode)
	ETCS sends the order to DA		T1		PROF	Ts8	STM Control Connection: Message – 3 Sent packet STM - 14 State order DA to STM Time T2.
5	No response from STM, ETCS sends the order to FA		T2	No response time-out	PROF	5s +Ts10	STM Control Connection: Message – 4 Sent packet STM - 14 State order to STM
					DMI	Ts11	Information about the failed STM is displayed on the DMI

Message 1: ETCS → STM (packet STM-5 + STM-14)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver



L_MESSAGE	8	COMPUTED	
NID_PACKET	8	5	ETCS Status data
L_PACKET	13	COMPUTED	
M_LEVEL	3	1	Level NTC
NID_NTC	8	FINITE VALUE	The NID_NTC selected by the driver
M_MODE	4	6	SB
NID_PACKET	8	14	State order to STM
L_PACKET	13	COMPUTED	
NID_STMSTATEORDER	4	6	HS
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message 2: ETCS → STM (packet STM-5)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	5	ETCS Status data
L_PACKET	13	COMPUTED	
M_LEVEL	3	1	Level NTC
NID_NTC	8	FINITE VALUE	The NID_NTC selected by the driver
M_MODE	4	13	National System
PADDING_BITS	COMPUTED	NOT RELEVANT	

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Message 3: ETCS → STM (packet STM-14)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	14	State order to STM
L_PACKET	13	COMPUTED	
NID_STMSTATEORDER	4	7	Order DA State
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message 4: ETCS → STM (packet STM-14)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	14	State order to STM
L_PACKET	13	COMPUTED	
NID_STMSTATEORDER	4	8	Order FA State
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message 7: STM → ETCS (Packet STM-15)			
VARIABLE	Length	VALUE	COMMENTS



NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	15	State report from STM
L_PACKET	13	COMPUTED	
NID_STMSTATE	4	6	HS
PADDING_BITS	COMPUTED	NOT RELEVANT	

End Conditions	Value	Comments
STM State	FA	
ETCS Mode	SN	
ETCS Level	NTC	
Train State	Standstill	
ETCS Train Data	unchanged	
Active DMI channel Connection	Closed	
Other DMI channel Connections	Closed	
TIU Connection	Closed	
BIU Connection	Closed	
JD Connection	Closed	
TIU Regenerative Brake Command	Not relevant	
TIU Magnetic Shoes Brake Command	Not relevant	
TIU Eddy Current Brake Command for Emergency Brake	Not relevant	
TIU Eddy Current Brake Command for Service Brake	Not relevant	
TIU Pantograph Command	Not relevant	
TIU Air Tightness Command	Not relevant	
TIU Main Switch / Circuit Breaker Command	Not relevant	
TIU Traction Cut Off Command	Not relevant	
TIU Traction Status	Not relevant	

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TIU Direction Controller Position Status	Not relevant	
TIU Cab Status (Desk Status)	Not relevant	
BIU Emergency Brake Command	Not relevant	
BIU Service Brake Command	Not relevant	
BIU Emergency Brake Status	Not relevant	
BIU Service Brake Status	Not relevant	
NTC isolation status	Not Isolated	



Test case 1a.4

TEST CASE HEADER	
Test case Identification	Start of mission
	1a.0.1.0.1.0.0.1.1
	The driver selects ETCS Level = NTC x (not in look-up table), the ETCS mode is SB and Train Data is valid and validated by the driver. The driver then changes language and selects Start and acknowledges SN mode. ETCS orders STM to DA and the STM reports DA state in time. SoM finished.
ERTMS/ETCS on-board Requirements Tested	Subset-035 10.1.1.1; 10.1.1.2; 10.1.1.3; 10.2.1.1; 10.2.1.2 c1; 10.5.1.1a; 10.6.1.1a; 10.3.2.2, 10.3.2.4 B6 CS to HS, A9 HS to DA; 10.3.2.6; Subset-26 <u>4.7.2 table: ack of SN mode</u>
STM Requirements Tested	Subset-035 9.2.1.1, 9.2.1.2 9 CS to DA ; 9.3.1.4 c;
Packets Transmitted via FFFIS STM	STM-5; STM-14; STM-15; STM-30
ERTMS/ETCS on-board Configuration	-
Comments and constraints	The driver has already entered the driver id and train data and the level selection is displayed to the driver



Starting Conditions	Value	Comments
STM State	CS	
ETCS Mode	SB	
ETCS Level	Not NTC X	
Train State	Standstill	
ETCSTrain Data	Valid	
Active DMI channel Connection	Established	
Other DMI channel Connections	Not relevant	
TIU Connection	Established	STM test case: value depends on STM implementation
BIU Connection	Established	STM test case: value depends on STM implementation
JD Connection	Established	STM test case: value depends on STM implementation
TIU Regenerative Brake Command	Not Relevant	
TIU Magnetic Shoes Brake Command	Not Relevant	
TIU Eddy Current Brake Command for Emergency Brake	Not Relevant	
TIU Eddy Current Brake Command for Service Brake	Not Relevant	
TIU Pantograph Command	Not Relevant	
TIU Air Tightness Command	Not Relevant	
TIU Main Switch / Circuit Breaker Command	Not Relevant	
TIU Traction Cut Off Command	Not Relevant	
TIU Traction Status	Not Relevant	
TIU Direction Controller Position Status	Not Relevant	
TIU Cab Status (Desk Status)	Cab A or B active	
BIU Emergency Brake Command	Not Relevant	
BIU Service Brake Command	Not Relevant	
BIU Emergency Brake Status	Not Relevant	
BIU Service Brake Status	Not Relevant	
NTC isolation status	Not Isolated	



ERTMS/ETCS on-board Test Case

Step	Description/Comments	Input I/F	Input time	Input Action	Output I/F	Output time limit	Output action
1	ETCS displays a list of levels including the connected STMs to the driver for selecting NTC (and the corresponding STM)	DMI	T = 0	Driver selects Level NTC X	DMI	2s	Level selection window closed.
	ETCS sends new level NTC-x and order to HS				PROF	Ts3	STM Control Connection: Message 5 Sent packet STM-5 ETCS status data (level NTC-x) + packet - 14 State order HS to the STM Time = T1
2	STM reports HS	PROF	T1 + 3s	STM Control Connection: STM reports HS State Message 7 packet STM-15 STM State report			
3	Driver validates Train Data and then changes language	DMI	T1 + 10s	Driver Selects different language	PROF	Ts14	STM Control Connection: Message - 4 Sent packet STM-30 Time T2
4	ETCS sends its new technical mode to the STM	DMI	T2 + 3s	Driver selects Start and acknowledges SN mode	PROF	Ts9	STM Control Connection: Message - 2 Sent packet STM-5 ETCS status data
	ETCS sends the order to DA (no other STM in HS).				PROF	Ts8	STM Control Connection: Message - 3 Sent packet STM - 14 State order to STM Time = T3
	STM sends state report DA	PROF	T3 + 8s	STM Control Connection: STM reports DA State Message 6 packet STM-15 STM State report			<i>State report accepted, no order to FA state</i>

STM Test Case

Step	Description/Comments	Input I/F	Input time	Input Action	Output I/F	Output time limit	Output action
1	Driver changes language	DMI	T0	STM Control Connection: Message - 4 Sent packet STM-30 language			
	ETCS displays a list of levels including the connected NTCs to the driver for selecting the needed NTC	DMI					

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	(=>STM)						
2	Driver selects level NTC X, validates train data and then selects Start and acknowledges SN mode	DMI	T0 + 2s	STM Control Connection: Message – 3a Sent STM-5 ETCS status data and packet STM - 14 State order HS to STM	PROF	10s	STM Control Connection: STM reports HS State Message 7 packet STM-15 STM State report
2	ETCS sends its current technical mode to the STM	PROF	T0 + 14s	STM Control Connection: Message - 2 Sent packet STM-5 ETCS status data			
5	ETCS sends the order to DA (no other STM in HS).	PROF	T0 + 14.5s	STM Control Connection: Message – 3 Sent packet STM - 14 State order to STM			
6	STM sends state report DA <i>Check that report is sent in time</i>				PROF	5s	STM Control Connection: STM reports DA State Message 6 packet STM-15 STM State report. State report shall also be sent on all other open connections.

Message 2: ETCS → STM (Packet STM-5)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	5	ETCS Status data
L_PACKET	13	COMPUTED	
M_LEVEL	3	1	Level NTC
NID_NTC	8	FINITE VALUE	The NID_NTC selected by the driver
M_MODE	4	13	National System
PADDING_BITS	COMPUTED	NOT RELEVANT	

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Message 3: ETCS → STM(Packet STM-14)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	14	State order to STM
L_PACKET	13	COMPUTED	
NID_STMSTATEORDER	4	7	Data available
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message 3a: ETCS → STM(Packet STM-14)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	5	ETCS Status data
L_PACKET	13	COMPUTED	
M_LEVEL	3	1	Level NTC
NID_NTC	8	FINITE VALUE	The NID_NTC selected by the driver
M_MODE	4	6	StandBy
NID_PACKET	8	14	State order to STM
L_PACKET	13	COMPUTED	
NID_STMSTATEORDER	4	6	Hot Standby

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PADDING_BITS	COMPUTED	NOT RELEVANT	
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Message 4 ETCS → STM (STM-30)			
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	30	Driver language
L_PACKET	13	COMPUTED	Packet length
NID_DRV_LANG	16	FINITE VALUE	Driver language ID
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message 5: ETCS → STM (packet STM-5)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	5	ETCS Status data
L_PACKET	13	COMPUTED	
M_LEVEL	3	1	Level NTC
NID_NTC	8	FINITE VALUE	The NID_NTC selected by the driver
M_MODE	4	13	National System
NID_PACKET	8	14	State order to STM

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L_PACKET	13	COMPUTED	
NID_STMSTATEORDER	4	6	HS
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message 6: STM → ETCS (Packet STM-15)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	15	State report from STM
L_PACKET	13	COMPUTED	
NID_STMSTATE	4	7	Data available
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message 7: STM → ETCS (Packet STM-15)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	15	State report from STM
L_PACKET	13	COMPUTED	
NID_STMSTATE	4	6	HS



PADDING_BITS	COMPUTED	NOT RELEVANT	
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End Conditions	Value	Comments
STM State	DA	
ETCS Mode	SN	
ETCS Level	NTC	
Train State	Standstill	
ETCS Train Data	unchanged	
Active DMI channel Connection	Not relevant	
Other DMI channel Connections	Not relevant	
TIU Connection	Not relevant	
BIU Connection	Not relevant	
JD Connection	Not relevant	
TIU Regenerative Brake Command	unchanged	
TIU Magnetic Shoes Brake Command	unchanged	
TIU Eddy Current Brake Command for Emergency Brake	unchanged	
TIU Eddy Current Brake Command for Service Brake	unchanged	
TIU Pantograph Command	unchanged	
TIU Air Tightness Command	unchanged	
TIU Main Switch / Circuit Breaker Command	unchanged	
TIU Traction Cut Off Command	unchanged	
TIU Traction Status	unchanged	
TIU Direction Controller Position Status	unchanged	
TIU Cab Status (Desk Status)	unchanged	
BIU Emergency Brake Command	unchanged	
BIU Service Brake Command	unchanged	
BIU Emergency Brake Status	unchanged	
BIU Service Brake Status	Unchanged	
NTC isolation status	Not Isolated	



Test case 1a.5

TEST CASE HEADER	
Test case Identification	Start of mission
	1a.0.1.0.2.1.2
	The driver selects NL and then ETCS Level = NTC X, not in the look-up table. The ETCS sends the order to DA but the STM does not report DA.
ERTMS/ETCS on-board Requirements Tested	Subset-035 10.1.1.1; 10.1.1.2; 10.1.1.3; 10.2.1.1; 10.2.1.2 c1; 10.5.1.1a; 10.3.2.2, 10.3.2.4 A9 CS to DA; D16 CS to FA; 10.3.2.6;
STM Requirements Tested	Subset-035 None
Packets Transmitted via FFFIS STM	STM-5; STM-14; STM-15;
ERTMS/ETCS on-board Configuration	-
Comments and constraints	This is an ETCS test case for applying the safe action in the case an STM does not follow a state transition order The driver has already entered the driver id and the level selection is displayed to the driver. The non-leading input is active.



Starting Conditions	Value	Comments
STM State	CS	
ETCS Mode	SB	
ETCS Level	1	
Train State	Standstill	
ETCS Train Data	Not relevant	
Active DMI channel Connection	Not relevant	
Other DMI channel Connections	Not relevant	
TIU Connection	Not relevant	
BIU Connection	Not relevant	
JD Connection	Not relevant	
TIU Regenerative Brake Command	Not Relevant	
TIU Magnetic Shoes Brake Command	Not Relevant	
TIU Eddy Current Brake Command for Emergency Brake	Not Relevant	
TIU Eddy Current Brake Command for Service Brake	Not Relevant	
TIU Pantograph Command	Not Relevant	
TIU Air Tightness Command	Not Relevant	
TIU Main Switch / Circuit Breaker Command	Not Relevant	
TIU Traction Cut Off Command	Not Relevant	
TIU Traction Status	Not Relevant	
TIU Direction Controller Position Status	Not Relevant	
TIU Cab Status (Desk Status)	Cab A or B active	
BIU Emergency Brake Command	Not Relevant	
BIU Service Brake Command	Not Relevant	
BIU Emergency Brake Status	Not Relevant	
BIU Service Brake Status	Not Relevant	
NTC isolation status	Not Isolated	



ERTMS/ETCS on-board Test Case

Step	Description/Comments	Input I/F	Input time	Input Action	Output I/F	Output time limit	Output action
1	Driver selects NL, ETCS sends its current technical mode to the STM	DMI	T0	Driver selects NL	PROF	Ts4	STM Control Connection: Message – 5b Sent packet STM-5 ETCS status data
2	ETCS displays a list of levels including the connected STMs to the driver for selecting NTC (and the corresponding STM)	DMI	T0 + 3	Driver selects Level NTC X	DMI		Level selection window closed.
					PROF	Ts3	STM Control Connection: Message 1 Sent packet STM-5 ETCS status data + packet STM-14 State order DA to STM. Time = T1.
3	ETCS sends the order to FA	PROF	T1 + 5s	Timeout, no state report from STM	PROF	Ts10	STM Control Connection: Message – 6 Sent packet STM - 14 State order FA to STM
					DMI	Ts11	Information about the failed STM is displayed on the DMI
					JD	Ts12	Information about the failed STM is recorded in the JRU
					PROF	Ts13	STM Control Connection: Connection is closed



Message 1: ETCS → STM (packet STM-5)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	5	ETCS Status data
L_PACKET	13	COMPUTED	
M_LEVEL	3	1	Level NTC
NID_NTC	8	FINITE VALUE	The NID_NTC selected by the driver
M_MODE	4	13	National System
NID_PACKET	8	14	State order to STM
L_PACKET	13	COMPUTED	
NID_STMSTATEORDER	4	7	Order DA State
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message 2: ETCS → STM (packet STM-5)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	5	ETCS Status data
L_PACKET	13	COMPUTED	
M_LEVEL	3	1	Level NTC

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NID_NTC	8	FINITE VALUE	The NID_NTC selected by the driver
M_MODE	4	11	Non-Leading
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message 4: ETCS → STM (packet STM-14)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	14	State order to STM
L_PACKET	13	COMPUTED	
NID_STMSTATEORDER	4	6	Order HS State
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message 5: ETCS → STM (packet STM-14)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	14	State order to STM
L_PACKET	13	COMPUTED	
NID_STMSTATEORDER	4	7	Order DA State
PADDING_BITS	COMPUTED	NOT RELEVANT	



Message 5b: ETCS → STM(Packet STM-5)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	5	ETCS Status data
L_PACKET	13	COMPUTED	
M_LEVEL	3	2	Level 1
M_MODE	4	11	Non-leading
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message 6: ETCS → STM (packet STM-14)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	14	State order to STM
L_PACKET	13	COMPUTED	
NID_STMSTATEORDER	4	8	Order FA State
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message 8: STM → ETCS (Packet STM-15)			
VARIABLE	Length	VALUE	COMMENTS



NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	15	State report from the STM
L_PACKET	13	COMPUTED	
NID_STMSTATE	4	6	Hot StandBy
PADDING_BITS	COMPUTED	NOT RELEVANT	



End Conditions	Value	Comments
STM State	FA	
ETCS Mode	NL	
ETCS Level	NTC	
Train State	Standstill	
ETCS Train Data	unchanged	
Active DMI channel Connection	closed	
Other DMI channel Connections	closed	
TIU Connection	closed	
BIU Connection	closed	
JD Connection	closed	
TIU Regenerative Brake Command	Not Relevant	
TIU Magnetic Shoes Brake Command	Not Relevant	
TIU Eddy Current Brake Command for Emergency Brake	Not Relevant	
TIU Eddy Current Brake Command for Service Brake	Not Relevant	
TIU Pantograph Command	Not Relevant	
TIU Air Tightness Command	Not Relevant	
TIU Main Switch / Circuit Breaker Command	Not Relevant	
TIU Traction Cut Off Command	Not Relevant	
TIU Traction Status	Not Relevant	
TIU Direction Controller Position Status	Not Relevant	
TIU Cab Status (Desk Status)	Not Relevant	
BIU Emergency Brake Command	Not Relevant	
BIU Service Brake Command	Not Relevant	
BIU Emergency Brake Status	Not Relevant	
BIU Service Brake Status	Not Relevant	
NTC isolation status	Not Isolated	



Test case 1a.6

TEST CASE HEADER	
Test case Identification	Start of mission
	1a.0.1.0.3.0
	“Stored position” is not valid. STM in CS. The driver selects ETCS Level = NTC x (not in look-up table). STM sent to HS, the driver closes the desk, ETCS sends the STM to CS state, STM x reports CS.
ERTMS/ETCS on-board Requirements Tested	Subset-035 10.1.1.1; 10.1.1.2; 10.1.1.3; 10.2.1.1; 10.5.1.1a; 10.2.1.2 c1; 10.3.2.2 CS to HS, HS to CS, 10.3.2.4 B6, H4a; 10.3.2.6; 10.3.2.7;
STM Requirements Tested	None.
Packets Transmitted via FFFIS STM	STM-5; STM-14; STM-15;
ERTMS/ETCS on-board Configuration	STM x is not in the look-up table.
Comments and constraints	“Stored position” is not valid.



Starting Conditions	Value	Comments
STM State	CS	
ETCS Mode	SB	
ETCS Level	Not NTC X	
Train State	Standstill	
ETCS Train Data	Not relevant	
Active DMI channel Connection	Not relevant	
Other DMI channel Connections	Not relevant	
TIU Connection	Not relevant	
BIU Connection	Not relevant	
JD Connection	Not relevant	
TIU Regenerative Brake Command	Not Relevant	
TIU Magnetic Shoes brake Command	Not Relevant	
TIU Eddy Current Brake Command for Emergency Brake	Not Relevant	
TIU Eddy Current Brake Command for Service Brake	Not Relevant	
TIU Pantograph Command	Not Relevant	
TIU Air Tightness Command	Not Relevant	
TIU Main Switch / Circuit Breaker Command	Not Relevant	
TIU Traction Cut Off Command	Not Relevant	
TIU Traction Status	Not Relevant	
TIU Direction Controller Position Status	Not Relevant	
TIU Cab Status (Desk Status)	Cab A or B active	
BIU Emergency Brake Command	Not Relevant	
BIU Service Brake Command	Not Relevant	
BIU Emergency Brake Status	Not Relevant	
BIU Service Brake Status	Not Relevant	
NTC isolation status	Not Isolated	



ERTMS/ETCS on-board Test Case

Step	Description/Comments	Input I/F	Input time	Input Action	Output I/F	Output time limit	Output action
1	ETCS displays a list of levels including the connected STMs to the driver for selecting level	DMI	T0	Driver chooses to change level to select Level NTC X (=>STM X)	DMI	2s	Level selection window closed.
					PROF	Ts3	STM Control Connection: Message - 2 Sent packet STM-5 ETCS status data
2	No other STM in HS, ETCS sends the order to HS				PROF	Ts6	STM Control Connection: Message - 4 Sent packet STM-14 State order HS to STM Time = T1
3	STM reports HS state	PROF	T1 + 2s	STM Control Connection STM reports HS State Message 8 received packet STM-15 State report from STM			
4	Driver closes the desk	TIU	T1 + 8s	Close desk	PROF	Ts16	STM Control Connection: Message – 3 Sent packet STM - 14 State order U-CS to STM Time = T2
5	STM reports CS state	PROF	T2 + 2s	STM Control Connection STM reports CS State Message 6 received packet STM-15 State report from STM			STM Control Connection: no state order FA sent.

Message 2: ETCS → STM (Packet STM-5)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	

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NID_PACKET	8	5	ETCS Status data
L_PACKET	13	COMPUTED	
M_LEVEL	3	1	Level NTC
NID_NTC	8	FINITE VALUE	The NID_NTC selected by the driver
M_MODE	4	13	National System
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message 3: ETCS → STM(Packet STM-14)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	14	State order to STM
L_PACKET	13	COMPUTED	
NID_STMSTATEORDER	4	4	U-CS
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message 4: ETCS → STM (packet STM-14)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	14	State order to STM
L_PACKET	13	COMPUTED	



NID_STMSTATEORDER	4	6	Order HS State
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message 6: STM → ETCS (Packet STM-15)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	15	State report from STM
L_PACKET	13	COMPUTED	
NID_STMSTATE	4	4	CS
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message 8: STM → ETCS (Packet STM-15)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	15	State report from the STM
L_PACKET	13	COMPUTED	
NID_STMSTATE	4	6	Hot StandBy
PADDING_BITS	COMPUTED	NOT RELEVANT	



End Conditions	Value	Comments
STM State	CS	
ETCS Mode	SB	
ETCS Level	NTC	
Train State	Standstill	
ETCS Train Data	Not Relevant	
Active DMI channel Connection	Not Relevant	
Other DMI channel Connections	Not Relevant	
TIU Connection	Not Relevant	
BIU Connection	Not Relevant	
JD Connection	Not Relevant	
TIU Regenerative Brake Command	Not Relevant	
TIU Magnetic Shoes brake Command	Not Relevant	
TIU Eddy Current Brake Command for emergency brake	Not Relevant	
TIU Eddy Current Brake Command for service brake	Not Relevant	
TIU Pantograph Command	Not Relevant	
TIU Air Tightness Command	Not Relevant	
TIU Main Switch / Circuit Breaker Command	Not Relevant	
TIU Traction Cut Off Command	Not Relevant	
TIU Traction Status	Not Relevant	
TIU Direction Controller Position Status	Not Relevant	
TIU Cab Status (Desk Status)	Closed	
BIU Emergency Brake Command	Not Relevant	
BIU Service Brake Command	Not Relevant	
BIU Emergency Brake Status	Not Relevant	
BIU Service Brake Status	Not Relevant	
NTC isolation status	Not Isolated	



Test case 1a.7

TEST CASE HEADER	
Test case Identification	Start of mission
	1a.0.2.0.2.2.0.1
	“Stored position” and level are not valid. The driver selects ETCS Level = NTC x, the ETCS mode is SB and the driver selects NL in mode SB, STM state is CO, the ETCS sends the order to CS and then DA, STM reports DA late but in time.
ERTMS/ETCS on-board Requirements Tested	Subset-035 10.1.1.1; 10.1.1.2; 10.1.1.3; 10.2.1.1; 10.2.1.2 c2; 10.5.1.1a; 10.3.3.1; 10.3.2.2, 10.3.2.4 A4a; CO to CS; A9; CS to DA; 10.3.2.6; 10.3.2.7
STM Requirements Tested	Subset-035; 8.3.1.4; 9.2.1.1 CO to CS; CS to DA; 9.2.1.2 4a, 9; 9.3.1.4c;
Packets Transmitted via FFFIS STM	STM-5; STM-13; STM-14; STM-15; STM-32; STM-35;
ERTMS/ETCS on-board Configuration	STM x is in the look-up table. No DMI configuration data.
Comments and constraints	“Stored position” and level are not valid. All status changes for the STM are in due time. The final STM status is DA. The driver has already entered the driver id and the level selection is displayed to the driver. There is no other STM for the NTC.



Starting Conditions	Value	Comments
STM State	CO	
ETCS Mode	SB	
ETCS Level	Not NTC X	
Train State	Standstill	
ETCS Train Data	Not relevant	
Active DMI channel Connection	Not relevant	
Other DMI channel Connections	Not relevant	
TIU Connection	Not relevant	
BIU Connection	Not relevant	
JD Connection	Not relevant	
TIU Regenerative Brake Command	Not Relevant	
TIU Magnetic Shoes brake Command	Not Relevant	
TIU Eddy Current Brake Command for Emergency Brake	Not Relevant	
TIU Eddy Current Brake Command for Service Brake	Not Relevant	
TIU Pantograph Command	Not Relevant	
TIU Air Tightness Command	Not Relevant	
TIU Main Switch / Circuit Breaker Command	Not Relevant	
TIU Traction Cut Off Command	Not Relevant	
TIU Traction Status	Not Relevant	
TIU Direction Controller Position Status	Not Relevant	
TIU Cab Status (Desk Status)	Cab A or B active	
BIU Emergency Brake Command	Not Relevant	
BIU Service Brake Command	Not Relevant	
BIU Emergency Brake Status	Not Relevant	
BIU Service Brake Status	Not Relevant	
NTC isolation status	Not Isolated	



ERTMS/ETCS on-board Test Case

Step	Description/Comments	Input I/F	Input time	Input Action	Output I/F	Output time limit	Output action
1	ETCS displays a list of levels including the connected STMs to the driver for selecting level	DMI	T = 0	Driver chooses to change level to select Level NTC X	DMI	2s	Level selection window closed.
2					PROF	Ts3	STM Control Connection: Message – 5A Sent packet STM-5 ETCS status data
3	Driver selects NL, ETCS sends its current technical mode to the STM	DMI	10s	Driver selects NL	PROF	Ts3	STM Control Connection: Message - 5 Sent packet STM-5 ETCS status data Time T0.
4	STM requests CS, ETCS sends the order to CS	PROF	T0 + 1s	STM Control Connection: STM request CS State Message 1 received packet STM-13 STM State request	PROF	Ts17	STM Control Connection: Message – 6 Sent packet STM - 14 State order to STM Time T1.
5	STM reports CS state, ETCS sends the order to DA	PROF	T1 + 8s	STM Control Connection STM reports CS State Message 2 received packet STM-15 State report from STM	PROF	Ts15	STM Control Connection Message – 8 Sent packet STM - 14 State order to STM. Time T2.
6	STM reports DA late but in time	PROF	T2 + 4s	STM Control Connection: STM reports DA State Message 4 received packet STM-15 State report from STM 4s after receiving state order			-
7	STM opens the communication	PROF	T2 + 4.5s	STM opens the connection with the DMI function if closed		-	-
8	STM sends DMI requests	PROF	T2 + 6s	DMI Connection: Message 9 received. (STM-15 - state report from STM, STM-32 - button request, STM-35 - indicator request)	DMI	1.5s	ETCS shows STM information on DMI



STM Test case

Step	Description/Comments	Input I/F	Input time	Input Action	Output I/F	Output time limit	Output action
1	STM request CS State when NL mode is reported by the ETCS	PROF	T = 0	STM Control Connection ETCS mode report (NL mode) Message 5 received. Packet STM-5 ETCS Status data	PROF	Ts7	STM Control Connection Message - 1 Sent packet STM-13 State request from STM. Time T0.
2	STM Control orders STM to CS State. STM switches to CS state and reports its new state	PROF	T0 + 1s	STM Control Connection ETCS orders CS, Message 6 received packet STM-14 State Order to STM	PROF	10s	STM Control Connection Message - 2 Sent packet STM 15 State report from STM. Time T1.
3	STM Control orders STM to DA State. STM switches to DA and reports its new state	PROF	T1 + 0.5s	STM Control Connection ETCS orders DA Message 8 received packet STM-14 State order to STM	PROF	5s	STM Control Connection Message - 4 Sent packet STM – 15 State report from STM in time.



Message 1: STM → ETCS (Packet STM-13)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	13	STM State request
L_PACKET	13	COMPUTED	Packet length
NID_STMSTATEREQUEST	4	4	Request CS
NID_PACKET	8	15	State report from the STM
L_PACKET	13	COMPUTED	
NID_STMSTATE	4	2	Configuration
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message 2: STM → ETCS (Packet STM-15)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	15	State report from the STM
L_PACKET	13	COMPUTED	
NID_STMSTATE	4	4	Cold StandBy
PADDING_BITS	COMPUTED	NOT RELEVANT	



Message 4: STM → ETCS (Packet STM-15)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	15	State report from the STM
L_PACKET	13	COMPUTED	
NID_STMSTATE	4	7	Data Available
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message 5a: ETCS → STM(Packet STM-5)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	5	ETCS Status data
L_PACKET	13	COMPUTED	
M_LEVEL	3	1	Level NTC
NID_NTC	8	FINITE VALUE	The NID_NTC selected by the driver
M_MODE	4	6	Stand by
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message 5: ETCS → STM(Packet STM-5)



VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	5	ETCS Status data
L_PACKET	13	COMPUTED	
M_LEVEL	3	1	Level NTC
NID_NTC	8	FINITE VALUE	The NID_NTC selected by the driver
M_MODE	4	11	Non-Leading
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message 6: ETCS → STM(Packet STM-14)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	14	State order to STM
L_PACKET	13	COMPUTED	
NID_STMSTATEORDER	4	4	Order Unconditional CS State
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message 8: ETCS → STM(Packet STM-14)			
VARIABLE	Length	VALUE	COMMENTS



NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	14	State order to STM
L_PACKET	13	COMPUTED	
NID_STMSTATEORDER	4	7	Order DA State
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message-9: STM → ETCS DMI Function (Packet STM-15, STM-32, STM-35)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	message length
NID_PACKET	8	15	State report from STM (STM-15)
L_PACKET	13	COMPUTED	packet length
NID_STMSTATE	4	7	state DA
NID_PACKET	8	32	Button Request (STM-32)
L_PACKET	13	COMPUTED	packet length
N_ITER	5	2	request for 2 buttons
NID_BUTTON(1)	8	1	
NID_BUTPOS(1)	5	1	
NID_ICON(1)	8	0	
M_BUT_ATTRIB(1)	10	1000000001B	white text on dark blue (black is not supported) background, not flashing
L_CAPTION(1)	6	9	
X_CAPTION(1,1)	8	'A'	
X_CAPTION(1,2)	8	'T'	
X_CAPTION(1,3)	8	'T'	
X_CAPTION(1,4)	8	'E'	
X_CAPTION(1,5)	8	'N'	
X_CAPTION(1,6)	8	'T'	

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Message-9: STM → ETCS DMI Function (Packet STM-15, STM-32, STM-35)

VARIABLE	Length	VALUE	COMMENTS
X_CAPTION(1,7)	8	'I'	
X_CAPTION(1,8)	8	'O'	
X_CAPTION(1,9)	8	'N'	
NID_BUTTON(2)	8	2	
NID_BUTPOS(2)	5	3	
NID_ICON(2)	8	0	
M_BUT_ATTRIB(2)	10	1000000001B	white text on dark blue (black is not supported) background, not flashing
L_CAPTION(2)	6	4	
X_CAPTION(2,1)	8	'H'	
X_CAPTION(2,2)	8	'E'	
X_CAPTION(2,3)	8	'L'	
X_CAPTION(2,4)	8	'P'	
NID_PACKET	8	35	Indicator Request (STM-35)
L_PACKET	13	COMPUTED	packet length
N_ITER	5	3	request for 3 indicators
NID_INDICATOR(1)	8	1	
NID_INDPOS(1)	5	1	
NID_ICON(1)	8	0	
M_IND_ATTRIB(1)	10	1000000001B	white text on dark blue (black is not supported) background, not flashing
L_CAPTION(1)	6	1	
X_CAPTION(1,1)	8	'A'	
NID_INDICATOR(2)	8	2	
NID_INDPOS(2)	5	2	
NID_ICON(2)	8	0	
M_IND_ATTRIB(2)	10	1000000001B	white text on dark blue (black is not supported) background, not flashing
L_CAPTION(2)	6	1	
X_CAPTION(2,1)	8	'B'	
NID_INDICATOR(3)	8	3	
NID_INDPOS(3)	5	3	

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Message-9: STM → ETCS DMI Function (Packet STM-15, STM-32, STM-35)

VARIABLE	Length	VALUE	COMMENTS
NID_ICON(3)	8	0	
M_IND_ATTRIB(3)	10	1000000001B	white text on dark blue (black is not supported) background, not flashing
L_CAPTION(3)	6	1	
X_CAPTION(3,1)	8	'C'	
PADDING_BITS	COMPUTED	NOT RELEVANT	



End Conditions	Value	Comments
STM State	DA	
ETCS Mode	NL	
ETCS Level	NTC	
Train State	Standstill	
ETCS Train Data	Not Relevant	
Active DMI channel Connection	ETCS test: established; STM test: Not relevant	ETCS test: 2 buttons and 3 indicators shown on DMI STM test: Not relevant
Other DMI channel Connections	Not Established	
TIU Connection	Not Relevant	
BIU Connection	Not Relevant	
JD Connection	Not Relevant	
TIU Regenerative Brake Command	Not Relevant	
TIU Magnetic Shoes brake Command	Not Relevant	
TIU Eddy Current Brake Command for emergency brake	Not Relevant	
TIU Eddy Current Brake Command for service brake	Not Relevant	
TIU Pantograph Command	Not Relevant	
TIU Air Tightness Command	Not Relevant	
TIU Main Switch / Circuit Breaker Command	Not Relevant	
TIU Traction Cut Off Command	Not Relevant	
TIU Traction Status	Not Relevant	
TIU Direction Controller Position Status	Not Relevant	
TIU Cab Status (Desk Status)	Not Relevant	
BIU Emergency Brake Command	Not Relevant	
BIU Service Brake Command	Not Relevant	
BIU Emergency Brake Status	Not Relevant	
BIU Service Brake Status	Not Relevant	
NTC isolation status	Not Isolated	



Test case 1a.8

TEST CASE HEADER	
Test case Identification	Start of mission
	1a.0.1.0.1.0.0.2
	The driver selects ETCS Level = NTC x (not in look-up table), the ETCS mode is SB. The driver selects Train Data Entry, test continues in another TC (from FID 10) , driver validates train data and this other TC ends. The driver then selects Start and acknowledges SN mode. The STM is still in CO and ETCS displays “STM X not available” to the driver. When the STM requests CS mode, it is ordered to CS and the message “STM X not available” is removed.
ERTMS/ETCS on-board Requirements Tested	Subset-035 10.1.1.1; 10.1.1.2; 10.1.1.3; 10.2.1.1; 10.2.1.2c; 10.3.3.8;
STM Requirements Tested	-
Packets Transmitted via FFFIS STM	STM-5; STM-13; STM-14; STM-15;
ERTMS/ETCS on-board Configuration	-
Comments and constraints	The driver has already entered the driver id and train data is valid. Stored position and level are “valid”.



Starting Conditions	Value	Comments
STM State	CO	
ETCS Mode	SB	
ETCS Level	Not NTC X	
Train State	Standstill	
ETCS Train Data	Valid	To be re-validated
Active DMI channel Connection	Established	
Other DMI channel Connections	Not relevant	
TIU Connection	Established	
BIU Connection	Established	
JD Connection	Established	
TIU Regenerative Brake Command	Not Relevant	
TIU Magnetic Shoes Brake Command	Not Relevant	
TIU Eddy Current Brake Command for Emergency Brake	Not Relevant	
TIU Eddy Current Brake Command for Service Brake	Not Relevant	
TIU Pantograph Command	Not Relevant	
TIU Air Tightness Command	Not Relevant	
TIU Main Switch / Circuit Breaker Command	Not Relevant	
TIU Traction Cut Off Command	Not Relevant	
TIU Traction Status	Not Relevant	
TIU Direction Controller Position Status	Not Relevant	
TIU Cab Status (Desk Status)	Cab A or B active	
BIU Emergency Brake Command	Not Relevant	
BIU Service Brake Command	Not Relevant	
BIU Emergency Brake Status	Not Relevant	
BIU Service Brake Status	Not Relevant	
NTC isolation status	Not Isolated	



ERTMS/ETCS on-board Test Case

Step	Description/Comments	Input I/F	Input time	Input Action	Output I/F	Output time limit	Output action
1	ETCS displays a list of levels including the connected STMs to the driver for selecting/revalidating Level/ NTC (and the corresponding STM)	DMI	T = 0	Driver selects Level NTC X	DMI	2s	Level selection window closed.
					PROF	Ts3	STM Control Connection: Message 3 Sent packet STM-5 ETCS status data
	<i>Driver selects Train Data Entry and re-validates Train Data in FID 10 TC</i>						
2	Driver selects Start and acknowledges SN mode,	DMI	5s	Driver acknowledges SN mode	PROF	Ts9	STM Control Connection: Message 5 Sent packet STM-5 ETCS status data
	ETCS displays warning to driver				DMI	Ts24	ETCS displays "STM X not available"
3	STM requests CS	PROF	15s	STM sent message 1 Packet STM-13 state request CS	PROF	Ts17	ETCS sends message 6 Packet STM-14 state order CS. Time T1
4	STM reports CS, ETCS removes warning	PROF	T1 + 3s	STM sends message 2 Packet STM-15 state report CS	DMI	Ts25	ETCS no longer displays "STM X not available"

Message 1: STM → ETCS (Packet STM-13)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	13	STM State request
L_PACKET	13	COMPUTED	Packet length
NID_STMSTATEREQUEST	4	4	Request CS
NID_PACKET	8	15	State report from the STM

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L_PACKET	13	COMPUTED	
NID_STMSTATE	4	2	Configuration
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message 2: STM → ETCS (Packet STM-15)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	15	State report from the STM
L_PACKET	13	COMPUTED	
NID_STMSTATE	4	4	Cold StandBy
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message 3 ETCS → STM(Packet STM-5)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	5	ETCS Status data
L_PACKET	13	COMPUTED	
M_LEVEL	3	1	Level NTC
NID_NTC	8	FINITE VALUE	The NID_NTC selected by the driver
M_MODE	4	6	SB

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PADDING_BITS	COMPUTED	NOT RELEVANT	
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Message 5: ETCS → STM(Packet STM-5)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	5	ETCS Status data
L_PACKET	13	COMPUTED	
M_LEVEL	3	1	Level NTC
NID_NTC	8	FINITE VALUE	The NID_NTC selected by the driver
M_MODE	4	13	SN
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message 6: ETCS → STM(Packet STM-14)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	14	State order to STM
L_PACKET	13	COMPUTED	
NID_STMSTATEORDER	4	4	Order Unconditional CS State
PADDING_BITS	COMPUTED	NOT RELEVANT	



End Conditions	Value	Comments
STM State	CS	
ETCS Mode	SN	
ETCS Level	NTC X	
Train State	Standstill	
ETCS Train Data	Valid	
Active DMI channel Connection	Not relevant	
Other DMI channel Connections	Not relevant	
TIU Connection	Not relevant	
BIU Connection	Not relevant	
JD Connection	Not relevant	
TIU Regenerative Brake Command	unchanged	
TIU Magnetic Shoes Brake Command	unchanged	
TIU Eddy Current Brake Command for Emergency Brake	unchanged	
TIU Eddy Current Brake Command for Service Brake	unchanged	
TIU Pantograph Command	unchanged	
TIU Air Tightness Command	unchanged	
TIU Main Switch / Circuit Breaker Command	unchanged	
TIU Traction Cut Off Command	unchanged	
TIU Traction Status	unchanged	
TIU Direction Controller Position Status	unchanged	
TIU Cab Status (Desk Status)	unchanged	
BIU Emergency Brake Command	unchanged	
BIU Service Brake Command	unchanged	
BIU Emergency Brake Status	unchanged	
BIU Service Brake Status	Unchanged	
NTC isolation status	Not Isolated	



Test case 1b.1

TEST CASE HEADER	
Test case Identification	Start of mission (technically, sleeping does not cause a Start-of-mission as the desk is not opened, but it is handled here anyway as some other desk in the train is being opened)
	1b.0.1
	The ETCS Level is NTC X, the ETCS technical mode is SB and the sleeping signal is active. The ETCS sends the order to DA State.
ERTMS/ETCS on-board Requirements Tested	Subset-035 10.5.1.1a; 10.3.2.2, 10.3.2.4 A9; CS to DA; 10.3.2.6;
STM Requirements Tested	Subset-035 9.2.1.1, 9.2.1.2 9 CS to DA; 9.3.1.4c
Packets Transmitted via FFFIS STM	STM-5; STM-14; STM-15;
ERTMS/ETCS on-board Configuration	-
Comments and constraints	All status changes for the STM are in due time. The final STM status is DA The stored ETCS level is STM.



Starting Conditions	Value	Comments
STM State	CS	
ETCS Mode	SB	
ETCS Level	NTC X	
Train State	Standstill	
ETCS Train Data	Invalid	
Active DMI channel Connection	Not relevant	
Other DMI channel Connections	Not relevant	
TIU Connection	Established /STM test-case: if needed	
BIU Connection	Established /STM test-case: if needed	
JD Connection	Established /STM test-case: if needed	
TIU Regenerative Brake Command	Not Relevant	
TIU Magnetic Shoes Brake Command	Not Relevant	
TIU Eddy Current Brake Command for Emergency Brake	Not Relevant	
TIU Eddy Current Brake Command for Service Brake	Not Relevant	
TIU Pantograph Command	Not Relevant	
TIU Air Tightness Command	Not Relevant	
TIU Main Switch / Circuit Breaker Command	Not Relevant	
TIU Traction Cut Off Command	Not Relevant	
TIU Traction Status	Not Relevant	
TIU Direction Controller Position Status	Not Relevant	
TIU Cab Status (Desk Status)	closed	
BIU Emergency Brake Command	Not Relevant	
BIU Service Brake Command	Not Relevant	
BIU Emergency Brake Status	Not Relevant	
BIU Service Brake Status	Not Relevant	
NTC isolation status	Not Isolated	



ERTMS/ETCS on-board Test Case

Step	Description/Comments	Input I/F	Input time	Input Action	Output I/F	Output time limit	Output action
1	ETCS sends its current technical mode to the STM X when the mode changes to SL	TIU	T0	Mode is changed	PROF	Ts21	STM Control Connection: Message - 5 Sent packet STM-5 ETCS status data
	ETCS sends the order to DA				PROF	Ts22	STM Control Connection: Message – 8 Sent packet STM - 14 State order to STM. Time T1.
2	STM reports DA state	PROF	T1 + 3s	STM Control Connection: STM reports DA in due time. Message 4 received packet STM-15 STM State report	PROF		Nothing to do, no state order FA.

STM Test case

Step	Description/Comments	Input I/F	Input time	Input Action	Output I/F	Output time limit	Output action
1	SL mode is reported by the ETCS	PROF	T = 0	STM Control Connection: ETCS mode report (SL mode) Message 5 received packet STM-5 ETCS status data			
	ETCS orders STM to DA, STM reports its new state in due time	PROF		STM Control Connection: ETCS orders DA Message 8 received packet STM-14 State order to STM	PROF	5s	STM Control Connection: Message - 4 Sent packet STM – 15 State report
				<i>Also to be tested with Messages 5 and 8 combined into one message, i.e. Message 5 with added packet STM-14 from message 8.</i>			



Message 4: STM → ETCS (packet STM-15)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	15	State report from the STM
L_PACKET	13	COMPUTED	
NID_STMSTATE	4	7	Data Available
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message 5: ETCS → STM (packet STM-5)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	5	ETCS Status data
L_PACKET	13	COMPUTED	
M_LEVEL	3	1	Level NTC
NID_NTC	8	FINITE VALUE	The NID_NTC stored
M_MODE	4	5	Sleeping
PADDING_BITS	COMPUTED	NOT RELEVANT	



Message 8: ETCS → STM (packet STM-14)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	14	State order to STM
L_PACKET	13	COMPUTED	
NID_STMSTATEORDER	4	7	Order DA State
PADDING_BITS	COMPUTED	NOT RELEVANT	



End Conditions	Value	Comments
STM State	DA	
ETCS Mode	SL	
ETCS Level	unchanged	
Train State	Standstill	
ETCS Train Data	unchanged	
Active DMI channel Connection	Not relevant	
Other DMI channel Connections	Not relevant	
TIU Connection	unchanged	
BIU Connection	unchanged	
JD Connection	unchanged	
TIU Regenerative Brake Command	unchanged	
TIU Magnetic Shoes Brake Command	unchanged	
TIU Eddy Current Brake Command for Emergency Brake	unchanged	
TIU Eddy Current Brake Command for Service Brake	unchanged	
TIU Pantograph Command	unchanged	
TIU Air Tightness Command	unchanged	
TIU Main Switch / Circuit Breaker Command	unchanged	
TIU Traction Cut Off Command	unchanged	
TIU Traction Status	unchanged	
TIU Direction Controller Position Status	unchanged	
TIU Cab Status (Desk Status)	unchanged	
BIU Emergency Brake Command	unchanged	
BIU Service Brake Command	unchanged	
BIU Emergency Brake Status	unchanged	
BIU Service Brake Status	Unchanged	
NTC isolation status	Not Isolated	



Test case 1b.2

TEST CASE HEADER	
Test case Identification	Start of mission
	1b.0.2
	The ETCS Level is STM X, the ETCS technical mode is SB and the sleeping signal is active. The ETCS sends the order to DA State but the STM does not follow the DA State order
ERTMS/ETCS on-board Requirements Tested	Subset-035 10.3.2.2, 10.3.2.4 A9; CS to DA; D16 CS to FA; 10.3.2.6; 10.5.1.1a;
STM Requirements Tested	Subset-035 None
Packets Transmitted via FFFIS STM	STM-5; STM-14;
ERTMS/ETCS on-board Configuration	-
Comments and constraints	<p>This test case is just for checking the behaviour of the ETCS when an STM does not follow the state transition order</p> <p>The driver has already entered the driver id and the level selection is displayed to the driver.</p> <p>(technically, sleeping does not cause a Start-of-mission as the desk is not opened, but it is handled here anyway as some other desk in the train is being opened)</p>



Starting Conditions	Value	Comments
STM State	CS	
ETCS Mode	SB	
ETCS Level	NTC X	
Train State	Standstill	
ETCS Train Data	Invalid	
Active DMI channel Connection	Not relevant	
Other DMI channel Connections	Not relevant	
TIU Connection	Not relevant	
BIU Connection	Not relevant	
JD Connection	Not relevant	
TIU Regenerative Brake Command	Not Relevant	
TIU Magnetic Shoes Brake Command	Not Relevant	
TIU Eddy Current Brake Command for Emergency Brake	Not Relevant	
TIU Eddy Current Brake Command for Service Brake	Not Relevant	
TIU Pantograph Command	Not Relevant	
TIU Air Tightness Command	Not Relevant	
TIU Main Switch / Circuit Breaker Command	Not Relevant	
TIU Traction Cut Off Command	Not Relevant	
TIU Traction Status	Not Relevant	
TIU Direction Controller Position Status	Not Relevant	
TIU Cab Status (Desk Status)	Closed	
BIU Emergency Brake Command	Not Relevant	
BIU Service Brake Command	Not Relevant	
BIU Emergency Brake Status	Not Relevant	
BIU Service Brake Status	Not Relevant	
NTC isolation status	Not Isolated	



ERTMS/ETCS on-board Test Case

Step	Description/Comments	Input I/F	Input time	Input Action	Output I/F	Output time limit	Output action
1	ETCS sends its current technical mode to the STM when the mode changes to SL	TIU	T= 0	Sleeping signal is detected	PROF	Ts21	STM Control Connection: Message - 1 Sent packet STM-5 ETCS status data
2	ETCS sends the order to DA		0 + 0.25s		PROF	Ts22	STM Control Connection: Message – 5 Sent packet STM - 14 State order to STM. Time T0.
3	STM does not answer in time, ETCS sends the order to FA	PROF	T0	Time-out, no response	PROF	Ts10	STM Control Connection: Message - 6 Sent packet STM - 14 State order to STM.
					DMI	Ts11	Information about the failed STM is displayed on the DMI

Message 1: ETCS → STM (packet STM-5)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	5	ETCS Status data
L_PACKET	13	COMPUTED	
M_LEVEL	3	1	Level NTC
NID_NTC	8	FINITE VALUE	The NID_NTC stored
M_MODE	4	5	Sleeping

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PADDING_BITS	COMPUTED	NOT RELEVANT	
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Message 5: ETCS → STM (packet STM-14)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	14	State order to STM
L_PACKET	13	COMPUTED	
NID_STMSTATEORDER	4	7	Order DA State
PADDING_BITS	COMPUTED	NOT RELEVANT	

Message 6: ETCS → STM (Packet STM-14)			
VARIABLE	Length	VALUE	COMMENTS
NID_STM	8	FINITE VALUE	The NID_STM selected by the driver
L_MESSAGE	8	COMPUTED	
NID_PACKET	8	14	State order to STM
L_PACKET	13	COMPUTED	
NID_STMSTATEORDER	4	8	Order FA State
PADDING_BITS	COMPUTED	NOT RELEVANT	



End Conditions	Value	Comments
STM State	FA	
ETCS Mode	SL	
ETCS Level	NTC X	
Train State	Standstill	
ETCS Train Data	Invalid	
Active DMI channel Connection	Not relevant	
Other DMI channel Connections	Not relevant	
TIU Connection	Not relevant	
BIU Connection	Not relevant	
JD Connection	Not relevant	
TIU Regenerative Brake Command	Not relevant	
TIU Magnetic Shoes Brake Command	Not relevant	
TIU Eddy Current Brake Command for Emergency Brake	Not relevant	
TIU Eddy Current Brake Command for Service Brake	Not relevant	
TIU Pantograph Command	Not relevant	
TIU Air Tightness Command	Not relevant	
TIU Main Switch / Circuit Breaker Command	Not relevant	
TIU Traction Cut Off Command	Not relevant	
TIU Traction Status	Not relevant	
TIU Direction Controller Position Status	Not relevant	
TIU Cab Status (Desk Status)	Closed	
BIU Emergency Brake Command	Not relevant	
BIU Service Brake Command	Not relevant	
BIU Emergency Brake Status	Not relevant	
BIU Service Brake Status	Not relevant	
NTC isolation status	Not Isolated	



Test case 1c.1

TEST CASE HEADER	
Test case Identification	Start of mission
	1.C
	When at Start of Mission just after validation of ETCS Train Data an STM known by ERTMS/ETCS on-board configuration to be installed is not in CO, CS, HS or DA state and this STM is not known to be isolated by TIU “NTC isolation status” input data, ERTMS/ETCS on-board shall inform the driver about the failed status of the national system supported by this STM.
ERTMS/ETCS on-board Requirements Tested	Subset-035 10.14.1.2
STM Requirements Tested	Subset-035 None
Packets Transmitted via FFFIS STM	None
ERTMS/ETCS on-board Configuration	ETCS shall be configured with a list of STMs installed on-board with at least one item.
Comments and constraints	This test case is just for checking the behaviour of the ETCS when an STM does not connect to STM control. It consists of two tests, one with the isolation switch in “STM isolated” and one in “STM not isolated” position.



Starting Conditions	Value	Comments
STM State	FA	
ETCS Mode	SB	
ETCS Level	1	
Train State	Standstill	
ETCS Train Data	Valid	
STM Control Function Connection	Not Established	
Active DMI channel Connection	Not Established	
Other DMI channel Connections	Not Established	
TIU Connection	Not Established	
BIU Connection	Not Established	
JD Connection	Not Established	
Other connections	Not Relevant	
TIU Regenerative Brake Command	Not Relevant	
TIU Magnetic Shoes Command	Not Relevant	
TIU Eddy current brake Command for Emergency Brake	Not Relevant	
TIU Eddy current brake Command for Service Brake	Not Relevant	
TIU Pantograph Command	Not Relevant	
TIU Air Tightness Command	Not Relevant	
TIU Main Switch / Circuit Breaker Command	Not Relevant	
TIU Traction Cut Off Command	Not Relevant	
TIU Traction Status	Not Sleeping	
TIU Direction Controller Position Status	Not Relevant	
TIU Cab Status (Desk Status)	Not Relevant	
BIU Emergency Brake Command	Not Relevant	
BIU Service Brake Command	Not Relevant	
BIU Emergency Brake Status	Not Relevant	
BIU Service Brake Status	Not Relevant	
NTC isolation status	Test A: Isolated, B: Not Isolated	



ERTMS/ETCS on-board Test Case

Step	Description/Comments	Input I/F	Input time	Input Action	Output I/F	Output time limit	Output action
1	Just after validation of ETCS Train Data, ETCS informs the driver via the DMI about a missing STM (known by configuration information to be installed) or not, depending on Isolation Status for this STM	TIU: NTC Isolation status input	T = 0	Test case A: status = isolated Test case B: status = not isolated	DMI	B: Ts23 A: Ts23+10 s	Test case A: ETCS does not inform the driver about the failure of the specific national system Test case B: ETCS informs the driver about the failure of the specific national system

End Conditions are not relevant. Only the ETCS DMI driver interaction is relevant for this test case.