

## ERTMS/ETCS – Class 1

### FFFIS Juridical Recorder-Downloading tool

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## **3. INTRODUCTION**

### **3.1 Scope**

- 3.1.1.1 This document is the Form Fit Function Interface Specification for the Juridical Recorder-Downloading tool.
- 3.1.1.2 It contains the interface between the function charged to perform the juridical recorder function and the Downloading tool for the ERTMS/ETCS system.
- 3.1.1.3 It defines the format and content of the messages exchanged, the communication protocol and the physical interface.
- 3.1.1.4 This document is inside the ERTMS/ETCS project scope. It's based on the document [1], [2] and [3].

### **3.2 General aspects**

- 3.2.1.1 This section is only a general description of the main principles of the juridical recording function.
- 3.2.1.2 The purpose of this document is to define the interface, the way this function is implemented (with an specific Juridical Recording Unit or within the ERTMS/ETCS on-board equipment) is out of the scope and it's not necessary for interoperability.
- 3.2.1.3 The juridical recording function is performed on-board.
- 3.2.1.4 The juridical recording function is performed through a temporary storage device. The flow of information goes from the ERTMS/ETCS on-board to the Downloading tool, through the Juridical Recorder device without being altered.
- 3.2.1.5 All the information recorded comes from the ERTMS/ETCS kernel.
- 3.2.1.6 It shall be possible for the ERTMS/ETCS on-board to give access to the juridical recorder function to other devices out of the ERTMS equipment, such as the STM.
- 3.2.1.7 The juridical recorder device shall be able to store the complete set of data for at least the last 24 hours in service.
- 3.2.1.8 The juridical recorder device shall be able to store a reduce set of data for at least the last 8 days in service.
- 3.2.1.9 The juridical recorder retention time (time the storage device is able to retain the stored data available after the equipment stops being powered) shall be at least 7 days.



- 3.2.1.10 The temporary storage device shall be extractable to allow the recovering and transport of data after an accident.
- 3.2.1.11 The traction/brake parameters are still under discussion and might be subject of a future change due to EEIG Brake Model.
- 3.2.1.12 The messages stored in the Juridical Recorder come from different sources which might imply non-sequential time stamps (different delays regarding the physical interface with the unit transmitting the message).

### **3.3 References**

- [1] UNISIG Subset 026 System Requirements Specification ERTMS/ETCS Class 1, Version 2.3.0
- [2] UNISIG Subset 058 FFFIS STM Application Layer , Version 2.1.1
- [3] UNISIG Subset 108 Interoperability-related consolidation on TSI annex A documents (mainly SUBSET-026 v2.2.2), Version 1.2.0

### **3.4 Abbreviations**

<b>ACK</b>	Acknowledgement
<b>DMI</b>	Driver Machine Interface
<b>JRU</b>	Juridical Recorder Unit

## 4. FUNCTIONAL INTERFACE DEFINITION

### 4.1 Data exchange (Juridical Recorder - Downloading tool)

#### 4.1.1 Dialogue definition

4.1.1.1 A dialogue is set up between the Downloading tool and the Juridical Recorder. This dialogue is charted here below (figure 1):

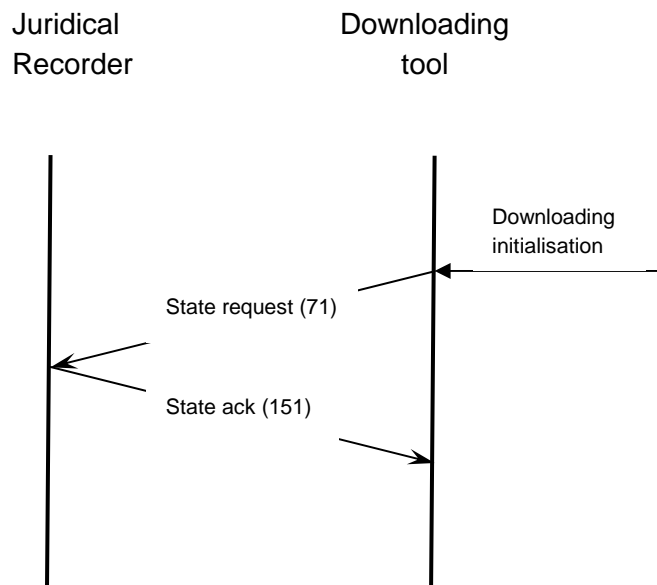


Figure 1. Start up communication dialogue

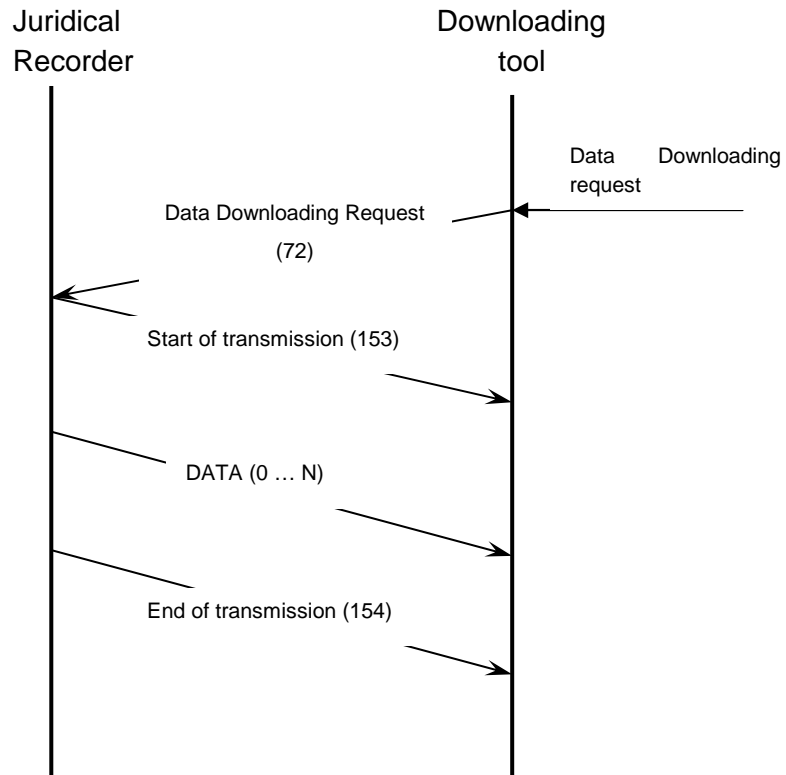
4.1.1.2 During the Downloading tool initialisation, it requests the Juridical Recorder state in order to start the communication with this equipment. If the Juridical Recorder device does not answer to this message with “state ack”, the Downloading tool considers the juridical recording function as not available.

4.1.1.3 When the Downloading tool receives “JRU failure”, it shall display that the Juridical Recorder is failed.

4.1.1.4 The state request message is sent periodically (every second) until the communication is established. After a minute without establishing the communication, the Downloading tool will raise a “Communication failure” message. When getting the “State ack” message, it shall display a “Communication established” message.

4.1.1.5 A further explanation of these control messages is included in sections 4.1.2 and 4.1.3 of this document. The numbers in brackets that appear close to the message name refer to the NID\_MESSAGE in Table 1 and Table 2.

4.1.1.6 After the initialisation process the following dialogue shall be carried out(Figure 2):



**Figure 2. Data Downloading communication dialogue**

4.1.1.7 Data downloading (Figure 2) shall be carried out through the Downloading tool physically connected to the Juridical Recorder device. The downloading tool communication above provides the management of stored data downloading.



## 4.1.2 JRU Output information (Messages / Variables)

### 4.1.2.1 Messages list

4.1.2.2 Each message has a variable in its header that contains a number to have a way to distinguish the messages. The list of all the messages (data and control messages) is shown in Table 1:

NID_MESSAGE	TYPE OF MESSAGE	MESSAGE	PAGE
0	DATA MESSAGE	Intentionally removed	
1	“	GENERAL MESSAGE	36
2	“	DATA ENTRY COMPLETED	37
3	“	EMERGENCY BRAKE ORDER	49
4	“	SERVICE BRAKE ORDER	49
5	“	EVENTS	50
6	“	TELEGRAM FROM BALISE	53
7	“	MESSAGE FROM EUROLOOP	53
8	“	MESSAGE FROM RADIO INFILL UNIT	53
9	“	MESSAGE FROM RBC	54
10	“	MESSAGE TO RBC	55
11	“	DRIVER'S ACTION	55
12	“	BALISE GROUP ERROR	59
13	“	RADIO ERROR	62
14	“	STM INFORMATION	62
15	“	DATA FROM EXTERNAL SOURCES	63
16	“	START DISPLAYING FIXED TEXT MESSAGE	63
17	“	STOP DISPLAYING FIXED TEXT MESSAGE	64

18	“	START DISPLAYING PLAIN TEXT MESSAGE	65
19	“	STOP DISPLAYING PLAIN TEXT MESSAGE	65
20	“	CURRENT VALUE OF MOST RESTRICTIVE SPEED PROFILE	66
21	“	TARGET SPEED	67
22	“	TARGET DISTANCE	67
23	“	RELEASE SPEED	69
24	“	WARNING	70
25	“	SR SPEED/DISTANCE	71
26	“	STM SELECTED	72
27	“	PERMITTED SPEED	73
28-150	“	SPARE	
151	CONTROL MESSAGE	STATE ACK	76
152	“	JRU FAILURE	76
153	"	START OF TRANSMISSION	76
154	"	END OF TRANSMISSION	76
155-255	“	SPARE	

**Table 1. Juridical Recorder-Downloading tool messages list**

### 4.1.2.3 Messages data to be downloaded: general structure

4.1.2.3.1 All the messages have the same structure with a common header and a set of variables depending on the message sent.

4.1.2.3.2 A message shall be composed of:

1. A header (fields 1 and 2).
2. Set of common variables to all the messages (fields 3-10). These variables must be recorded with each event produced: the date and time (UTC), train position, train speed, driver ID, ETCS equipment ID, the ETCS level and the active mode of the on-board system.
3. Complementary variables as needed by application (fields 11-N).

Field No	FIELDS	Remarks
1	NID_MESSAGE	Message identification number
2	L_MESSAGE	Message length including fields 1 to N
3	DATE	Current date
4	TIME	Current time
5	TRAIN_POSITION	Current train position
6	V_TRAIN	Current train speed
7	NID_DRIVER	Driver identifier
8	NID_ENGINE	On-board ETCS identity
9	LEVEL	Current level
10	MODE	Current mode
...	Variables	Data associated to the message. Its length depends on the message content, but it's always rounded up to a bytes unit.

Note : To be coherent the length of the variables defined in other documents is not included in the following description.



#### 4.1.2.4 Common Fields Description

##### 4.1.2.4.1 NID\_MESSAGE

<b>Description</b>	This field contains the message identifier.		
<b>Content</b>	<b>Variable</b>	<b>Length</b>	<b>Comment</b>
	NID_MESSAGE	8	Defined below

##### NID\_MESSAGE

<b>Name</b>	Message identifier		
<b>Description</b>	Identifier of the message		
<b>Length of variable</b>	<b>Minimum Value</b>	<b>Maximum Value</b>	<b>Resolution/formula</b>
8 bits	0	255	Numbers
<b>Special/Reserved Values</b>			

##### 4.1.2.4.2 L\_MESSAGE

<b>Description</b>	This field contains the message length.		
<b>Content</b>	<b>Variable</b>	<b>Length</b>	<b>Comment</b>
	L_MESSAGE	11	Defined below.

##### L\_MESSAGE

<b>Name</b>	Message length		
<b>Description</b>	L_MESSAGE indicates the length of the message in bytes, including all variables defined in the message header (L_MESSAGE also).		
<b>Length of variable</b>	<b>Minimum Value</b>	<b>Maximum Value</b>	<b>Resolution/formula</b>
11 bits	0	2047	1 Byte
<b>Special/Reserved Values</b>			

##### 4.1.2.4.3 DATE

<b>Description</b>	It contains the date the event recorded has occurred.		
<b>Content</b>	<b>Variable</b>	<b>Length</b>	<b>Comment</b>
	YEAR	7	Defined below.
	MONTH	4	Defined below.
	DAY	5	Defined below.

## YEAR

<b>Name</b>	Official year		
<b>Description</b>	It's used to label data recorded. Only the last two figures of the year are recorded (unit and ten).		
<b>Length of variable</b>	<b>Minimum Value</b>	<b>Maximum Value</b>	<b>Resolution/formula</b>
7 bits	00	99	1 year
<b>Special/Reserved Values</b>	110 0100	100	not used
	...	...	...
	111 1110	126	not used
	111 1111	127	year unknown

## MONTH

<b>Name</b>	Official month		
<b>Description</b>	It's used to label data recorded.		
<b>Length of variable</b>	<b>Minimum Value</b>	<b>Maximum Value</b>	<b>Resolution/formula</b>
4 bits	01	12	1 month
<b>Special/Reserved Values</b>	0000	0	not used
	1101	13	not used
	1110	14	not used
	1111	15	month unknown

## DAY

<b>Name</b>	Official day		
<b>Description</b>	It's used to label data recorded.		
<b>Length of variable</b>	<b>Minimum Value</b>	<b>Maximum Value</b>	<b>Resolution/formula</b>
5 bits	01	31	1 day
<b>Special/Reserved Values</b>	0 0000	0	day unknown

#### 4.1.2.4.4 TIME

<b>Description</b>	It contains the time in Universal Time Co-ordinated (UTC) the event recorded has occurred.		
<b>Content</b>	<b>Variable</b>	<b>Length</b>	<b>Comment</b>
	HOUR	5	Defined below.
	MINUTES	6	Defined below.
	SECONDS	6	Defined below.
	TTS	5	Defined below.

#### HOUR

<b>Name</b>	Official hour		
<b>Description</b>	It's used to label data recorded.		
<b>Length of variable</b>	<b>Minimum Value</b>	<b>Maximum Value</b>	<b>Resolution/formula</b>
5 bits	00	23	1 hour
<b>Special/Reserved Values</b>	1 1000	24	not used
	...	...	...
	1 1110	30	not used
	1 1111	31	hour unknown

#### MINUTES

<b>Name</b>	Official minutes		
<b>Description</b>	It's used to label data recorded.		
<b>Length of variable</b>	<b>Minimum Value</b>	<b>Maximum Value</b>	<b>Resolution/formula</b>
6 bits	00	59	1 minute
<b>Special/Reserved Values</b>	11 1100	60	not used
	11 1101	61	not used
	11 1110	62	not used
	11 1111	63	minutes unknown

#### SECONDS

<b>Name</b>	Official seconds		
<b>Description</b>	It's used to label data recorded.		
<b>Length of variable</b>	<b>Minimum Value</b>	<b>Maximum Value</b>	<b>Resolution/formula</b>
6 bits	00	59	1 second
<b>Special/Reserved Values</b>	11 1100	60	not used
	11 1101	61	not used
	11 1110	62	not used
	11 1111	63	seconds unknown

## TTS

<b>Name</b>	Official hundredth of second		
<b>Description</b>	It's used to label data recorded. Used only in conjunction with HOUR, MINUTES and SECONDS.		
<b>Length of variable</b>	<b>Minimum Value</b>	<b>Maximum Value</b>	<b>Resolution/formula</b>
5 bits	000 ms	950 ms	050 ms
<b>Special/Reserved Values</b>	10100 to 11110 11111		not used hundredth of second unknown

### 4.1.2.4.5 TRAIN\_POSITION

<b>Description</b>	This field contains the position of the train when the event recorded has occurred. This position is calculated with the distance to the last LRBG (Identity of Last Relevant Balise Group).		
<b>Content</b>	<b>Variable</b>	<b>Length</b>	<b>Comment</b>
	Q_SCALE		Defined in Chapter 7 of [1]
	NID_LRBG		Defined in Chapter 7 of [1]
	D_LRBG		Defined in Chapter 7 of [1]
	Q_DIRLRBG		Defined in Chapter 7 of [1]
	Q_DLRBG		Defined in Chapter 7 of [1]
	L_DOUBTOVER		Defined in Chapter 7 of [1]
	L_DOUBTUNDER		Defined in Chapter 7 of [1]

### 4.1.2.4.6 V\_TRAIN

<b>Description</b>	This field contains the current speed of the train when the event recorded has occurred.		
<b>Content</b>	<b>Variable</b>	<b>Length</b>	<b>Comment</b>
	V_TRAIN		Defined in Chapter 7 of [1]

### 4.1.2.4.7 DRIVER\_ID

<b>Description</b>	This field contains the driver identifier number.		
<b>Content</b>	<b>Variable</b>	<b>Length</b>	<b>Comment</b>
	DRIVER_ID	384 bits	48 alphanumeric characters (ISO 8859-1, also known as Latin Alphabet #1)

#### 4.1.2.4.8 NID\_ENGINE

<b>Description</b>	This field contains the onboard ETCS identity.		
<b>Content</b>	<b>Variable</b>	<b>Length</b>	<b>Comment</b>
	NID_ENGINE		Defined in Chapter 7 of [1]

#### 4.1.2.4.9 LEVEL

<b>Description</b>	This field contains the current level when the event recorded has occurred.		
<b>Content</b>	<b>Variable</b>	<b>Length</b>	<b>Comment</b>
	M_LEVEL		Defined in Chapter 7 of [1]

#### 4.1.2.4.10 MODE

<b>Description</b>	This field contains the current mode when the event recorded has occurred.		
<b>Content</b>	<b>Variable</b>	<b>Length</b>	<b>Comment</b>
	M_MODE		Defined in Chapter 7 of [1]

### 4.1.2.5 Message Description

#### 4.1.2.5.1 MESSAGE GENERAL MESSAGE

<b>Description</b>	This messages is sent each time any of the header's variables needs to be recorded (defined in Chapter 3 of [1]).		
<b>Content</b>	<b>Variable</b>	<b>Length</b>	<b>Comment</b>
	null		



#### 4.1.2.5.2 MESSAGE DATA ENTRY COMPLETED

<b>Description</b>	This message contains the train and additional data.		
<b>Content</b>	<b>Variable</b>	<b>Length</b>	<b>Comment</b>
	V_MAXTRAIN		Maximum permitted speed for the train. Defined in Chapter 7 of [1]
	NC_TRAIN		Train category. Defined in Chapter 7 of [1]
	L_TRAIN		Train length. Defined in Chapter 7 of [1]
	N_SERVICE_SECTIONS	3	Number of sections in order to build the service brake model.
	V_SERVICEDECEL_CAP(k)	10	Speed component of the service brake deceleration capacity.
	A_SERVICEDECEL_CAP(k)	8	Acceleration component of the service brake deceleration capacity.
	N_EMERGENCY_SECTIONS	3	Number of sections in order to build the emergency brake model.
	V_EMERGENCYDECEL_CAP(k)	10	Speed component of the emergency brake deceleration capacity.
	A_EMERGENCYDECEL_CAP(k)	8	Acceleration component of the emergency brake deceleration capacity.
	T_CUT_OFF	12	Time to cut-off traction.
	T_SERVICE_DELAY	12	Service Brake delay time.
	T_EMERGENCY_DELAY	12	Emergency Brake delay time.
	M_LOADINGGAUGE		Loading gauge. Defined in Chapter 7 of [1]
	M_AXLELOAD		Axle load. Defined in Chapter 7 of [1]
	N_ITER		Number of iterations. Defined in Chapter 7 of [1]
	M_TRACTION(k)		Type of traction. Defined in Chapter 7 of [1]
	M_AIRTIGHT		Status of airtight system. Defined in Chapter 7 of [1]
	M_ADHESION		Adhesion factor. Defined in Chapter 7 of [1]
	NID_MN		Identity of Radio Network. Defined in Chapter 7 of [1]

NID_C		Identity of the country or region complementing the RBC identity number. Defined in chapter 7 of [1]
NID_RBC		RBC ETCS identity number. Defined in Chapter 7 of [1]
NID_RADIO		Radio subscriber number. Defined in Chapter 7 of [1]
NID_OPERATIONAL		Train Running Number. Defined in Chapter 7 of [1]

## N\_SERVICE\_SECTIONS

<b>Name</b>	Service Brake Number of Sections.		
<b>Description</b>	It contains the number of sections needed to build the Service Brake Model.		
<b>Length of variable</b>	<b>Minimum Value</b>	<b>Maximum Value</b>	<b>Resolution/formula</b>
3 bits	1	7	
<b>Special/reserved value</b>	0	Spare Value	

## V\_SERVICEDECEL\_CAP

<b>Name</b>	Service Brake Speed Component.		
<b>Description</b>	It contains the lowest value of the speed to which the related Service Brake Deceleration Component is applicable.		
<b>Length of variable</b>	<b>Minimum Value</b>	<b>Maximum Value</b>	<b>Resolution/formula</b>
10 bits	0 km/h	600 km/h	1 km/h
<b>Special/reserved value</b>	601 - 1023	Spare Values	

### A\_SERVICEDECEL\_CAP

<b>Name</b>	Service Brake Deceleration Component.		
<b>Description</b>	It contains the lowest value of the current deceleration to which the related Service Brake Deceleration Component is applicable.		
<b>Length of variable</b>	<b>Minimum Value</b>	<b>Maximum Value</b>	<b>Resolution/formula</b>
8 bits	0	2,55	0,01 m/s <sup>2</sup>
<b>Special/reserved value</b>			

### N\_EMERGENCY\_SECTIONS

<b>Name</b>	Emergency brake Number of Sections.,		
<b>Description</b>	It contains the number of sections needed to build the Emergency Brake Model.		
<b>Length of variable</b>	<b>Minimum Value</b>	<b>Maximum Value</b>	<b>Resolution/formula</b>
3 bits	1	7	
<b>Special/reserved value</b>	0	Spare Value	

### V\_EMERGENCYDECEL\_CAP

<b>Name</b>	Emergency Brake Speed Component.		
<b>Description</b>	It contains the lowest value of the speed to which the related Emergency Brake Deceleration Component is applicable.		
<b>Length of variable</b>	<b>Minimum Value</b>	<b>Maximum Value</b>	<b>Resolution/formula</b>
10 bits	0 km/h	600 km/h	1 km/h
<b>Special/reserved value</b>	601 - 1023	Spare Values	

### A\_EMERGENCYDECEL\_CAP

<b>Name</b>	Emergency Brake Deceleration Component.		
<b>Description</b>	It contains the lowest value of the current deceleration to which the related Emergency Brake Deceleration Component is applicable.		
<b>Length of variable</b>	<b>Minimum Value</b>	<b>Maximum Value</b>	<b>Resolution/formula</b>
8 bits	0	2,55	0,01 m/s <sup>2</sup>
<b>Special/reserved value</b>			

### T\_CUT\_OFF

<b>Name</b>	Time to cut-off traction.		
<b>Description</b>	Idem.		
<b>Length of variable</b>	<b>Minimum Value</b>	<b>Maximum Value</b>	<b>Resolution/formula</b>
12 bits	0	4,095 s	0,001 s
<b>Special/reserved value</b>			

### T\_SERVICE\_DELAY

<b>Name</b>	Service Brake delay time.		
<b>Description</b>	Idem.		
<b>Length of variable</b>	<b>Minimum Value</b>	<b>Maximum Value</b>	<b>Resolution/formula</b>
12 bits	0	204,75 s	0,05 s
<b>Special/reserved value</b>			

### T\_EMERGENCY\_DELAY

<b>Name</b>	Emergency Brake delay time.		
<b>Description</b>	Idem.		
<b>Length of variable</b>	<b>Minimum Value</b>	<b>Maximum Value</b>	<b>Resolution/formula</b>
12 bits	0	204,75 s	0,05 s
<b>Special/reserved value</b>			

#### 4.1.2.5.3 MESSAGE EMERGENCY BRAKE ORDER

<b>Description</b>	This message shall record the emergency brake application order.		
<b>Content</b>	<b>Variable</b>	<b>Length</b>	<b>Comment</b>
	M_BRAKE_ORDER	1	Defined below

#### M\_BRAKE\_ORDER

<b>Name</b>	Brake order		
<b>Description</b>	It contains the order of application or revocation of the brakes.		
<b>Length of variable</b>	<b>Minimum Value</b>	<b>Maximum Value</b>	<b>Resolution/formula</b>
1 bit			
<b>Special/reserved value</b>	1	Application	
	0	Revocation	

#### 4.1.2.5.4 MESSAGE SERVICE BRAKE ORDER

<b>Description</b>	This message shall record the service brake application order.		
<b>Content</b>	<b>Variable</b>	<b>Length</b>	<b>Comment</b>
	M_BRAKE_ORDER	1	Defined in 4.1.2.5.3

#### 4.1.2.5.5 MESSAGE EVENTS

<b>Description</b>	This message shall record important events for train safety, which have been triggered during the normal train operation.		
<b>Content</b>	<b>Variable</b>	<b>Length</b>	<b>Comment</b>
	M_EVENTS	8	Defined below

## M\_EVENTS

<b>Name</b>	Events on board		
<b>Description</b>	Records the events for train safety which take place on board during normal train operational		
<b>Length of variable</b>	<b>Minimum Value</b>	<b>Maximum Value</b>	<b>Resolution/formula</b>
8 bit			
<b>Special/Reserved Values</b>	0000 0000	Not used	
	0000 0001	Service brake failure	
	0000 0010	Standstill supervision intervention	
	0000 0011	Roll away supervision intervention	
	0000 0100	Reverse movement supervision intervention	
	0000 0101	Override activated	
	0000 0110	Loop transmission error	
	0000 0111	Odometer failure	
	0000 1000	Passenger brake application	
	0000 1001	Version incompatibility with RBC/RIU	
	0000 1010	Override deactivated	
	0000 1011	Train enters unsuitable route	
	0000 1100	Normal adhesion used	
	0000 1101	Reduced adhesion used	
	0000 1110	Version incompatibility with balise	
	...	Future use	

### 4.1.2.5.6 TELEGRAM FROM BALISE

<b>Description</b>	This message shall be sent to the Juridical Recorder after receiving a telegram from a balise.
<b>Content</b>	The content of this message is the telegram coming from a balise as defined in Chapters 7 and 8 of [1].

### 4.1.2.5.7 MESSAGES FROM EUROLOOP

<b>Description</b>	This message shall be sent to the Juridical Recorder after receiving a message from an euroloop unit.
<b>Content</b>	The content of this message is any message coming from a euroloop as defined in Chapters 7 and 8 of [1].

#### 4.1.2.5.8 MESSAGES FROM RADIO INFILL UNIT

<b>Description</b>	This message shall be sent to the Juridical Recorder after receiving a message from a radio infill unit.
<b>Content</b>	The content of this message is any message coming from a radio infill unit as defined in Chapters 7 and 8 of [1].

#### 4.1.2.5.9 MESSAGES FROM RBC

<b>Description</b>	This message shall be sent to the Juridical Recorder after receiving a message from an RBC.		
<b>Content</b>	<b>Variable</b>	<b>Length</b>	<b>Comment</b>
	NID_C	10	Defined in Chapter 7 of [1]
	NID_RBC	14	Defined in Chapter 7 of [1]. ETCS identity (NID_C + NID_RBC) of the RBC from which the following message has been received.
	Message, as defined in Chapters 7 and 8 of [1], coming from the referenced RBC.		

#### 4.1.2.5.10 MESSAGES TO RBC

<b>Description</b>	This message shall be sent to the Juridical Recorder after sending a message to an RBC.		
<b>Content</b>	<b>Variable</b>	<b>Length</b>	<b>Comment</b>
	NID_C	10	Defined in Chapter 7 of [1]
	NID_RBC	14	Defined in Chapter 7 of [1]. ETCS identity (NID_C + NID_RBC) of the RBC to which the following message has been sent.
	Message, as defined in Chapters 7 and 8 of [1], sent to the referenced RBC.		

#### 4.1.2.5.11 DRIVER'S ACTIONS

<b>Description</b>	This message shall be sent to the Juridical Recorder whenever the driver acts on the on board system (DMI, information received from the train interface).		
<b>Content</b>	<b>Variable</b>	<b>Length</b>	<b>Comment</b>
	M_DRIVERACTIONS	8	Defined below



**M\_DRIVERACTIONS**

<b>Name</b>	Driver's actions.		
<b>Description</b>	This variable contains the driver's action.		
<b>Length of variable</b>	<b>Minimum Value</b>	<b>Maximum Value</b>	<b>Resolution/formula</b>
8 bit			
<b>Special/Reserved Values</b>	0000 0000	Ack of on sight	
	0000 0001	Ack of shunting	
	0000 0010	Ack of trip	
	0000 0011	Ack of staff responsible	
	0000 0100	Ack of unfitted	
	0000 0101	Ack of reversing	
	0000 0110	Ack level 0	
	0000 0111	Ack Level 1	
	0000 1000	Ack level 2	
	0000 1001	Ack level 3	
	0000 1010	Ack level STM	
	0000 1011	Shunting selected	
	0000 1100	Non Leading selected	
	0000 1101	Reversing requested	
	0000 1110	Override selected	
	0000 1111	Override route suitability	
	0001 0000	Brake release acknowledgement	
	0001 0001	Exit of shunting selected	
	0001 0010	Exit of Non Leading selected	
	0001 0011	Start selected	
	0001 0100	Data Entry requested	
	0001 0101	Driver confirmation of data	
	0001 0110	Confirm track ahead free	
	0001 0111	Ack of Plain Text Messages	
	0001 1000	Ack of Fixed Text Messages	
	0001 1001	Intentionally deleted	
	0001 1010	Train integrity confirmation	
	0001 1011	Request to show supervision limits	
	0001 1100	Ack of SN/SE mode	
	0001 1101	Change of Language	
	0001 1110	Request to show geographical position	
	0001 1111	Desk closed	
	0010 0000	Distance in SR changed	
	0010 0001	Speed in SR changed	
	0010 0010	Level 0 selected	
	0010 0011	Level 1 selected	



	0010 0100	Level 2 selected
	0010 0101	Level 3 selected
	0010 0110	Level STM selected
	0010 0111	Normal adhesion selected
	0010 1000	Reduced adhesion selected
	...	Future use

Note: The registration of these actions is not always mandatory, due to the technical restrictions of some trains to access them.

#### 4.1.2.5.12 BALISE GROUP ERROR

<b>Description</b>	This message contains a balise group related error as identified by M_ERROR.		
<b>Content</b>	<b>Variable</b>	<b>Length</b>	<b>Comment</b>
	NID_C		Defined in Chapter 7 of [1]
	NID_ERRORBG		Defined below
	M_ERROR		Defined in Chapter 7 of [1]

#### NID\_ERRORBG

<b>Name</b>	Identity number of the balise group to which the error is related		
<b>Description</b>	<p>It contains the identity number of the balise group to which the error is related.</p> <p>NID_ERRORBG is identical to NID_BG (defined in chapter 7 of [1]) except for the NID_ERRORBG Special Value "16383" which has the meaning "unknown" and covers the case that, due to the error, the balise group identity is unknown.</p>		
<b>Length of variable</b>	<b>Minimum Value</b>	<b>Maximum Value</b>	<b>Resolution/formula</b>
14 bits	0	16382	Numbers
<b>Special/reserved value</b>	16383	Unknown	

#### 4.1.2.5.13 RADIO ERROR

<b>Description</b>	This message contains an error related to communication with an RBC as identified by M_ERROR.		
<b>Content</b>	<b>Variable</b>	<b>Length</b>	<b>Comment</b>
	NID_C		Defined in Chapter 7 of [1]
	NID_RBC		Defined in Chapter 7 of [1]. ETCS identity (NID_C + NID_RBC) of the RBC to which the error is related
	M_ERROR		Defined in Chapter 7 of [1]

#### 4.1.2.5.14 STM INFORMATION

This message contains the information coming from the STM that must be recorded in the Juridical Recorder. The content of the message is defined in [2].

#### 4.1.2.5.15 DATA FROM EXTERNAL SOURCES

<b>Description</b>	This message has been reserved to record any information coming from external sources. Its content is not under the ERTMS/ETCS equipment control.
<b>Content</b>	The content of this message is Packet Number 44, as defined in Chapter 7 of [1].

#### 4.1.2.5.16 START DISPLAYING FIXED TEXT MESSAGES

<b>Description</b>	This message contains a fixed text message that is currently being shown to the driver.		
<b>Content</b>	<b>Variable</b>	<b>Length</b>	<b>Comment</b>
	Q_TEXT		Defined in Chapter 7 of [1]

#### 4.1.2.5.17 STOP DISPLAYING FIXED TEXT MESSAGES

<b>Description</b>	This message contains a fixed text message that is not shown to the driver any more.		
<b>Content</b>	<b>Variable</b>	<b>Length</b>	<b>Comment</b>
	Q_TEXT		Defined in Chapter 7 of [1]

#### 4.1.2.5.18 START DISPLAYING PLAIN TEXT MESSAGES

<b>Description</b>	This message contains a plain text message that is currently being shown to the driver.		
<b>Content</b>	<b>Variable</b>	<b>Length</b>	<b>Comment</b>
	L_TEXT		Defined in Chapter 7 of [1]
	X_TEXT(L_TEXT)		Defined in Chapter 7 of [1]

#### 4.1.2.5.19 STOP DISPLAYING PLAIN TEXT MESSAGES

<b>Description</b>	This message contains a plain text message that is not shown to the driver any more.		
<b>Content</b>	<b>Variable</b>	<b>Length</b>	<b>Comment</b>
	L_TEXT		Defined in Chapter 7 of [1]
	X_TEXT(L_TEXT)		Defined in Chapter 7 of [1]

#### 4.1.2.5.20 CURRENT VALUE OF MOST RESTRICTIVE SPEED PROFILE

<b>Description</b>	This message contains the current value of the most restrictive speed profile calculated on-board. It is recorded at every change of the current value of the most restrictive speed profile.		
<b>Content</b>	<b>Variable</b>	<b>Length</b>	<b>Comment</b>
	V_MRSP	7	

#### V\_MRSP

<b>Name</b>	Current value of most restrictive speed profile.		
<b>Description</b>			
<b>Length of variable</b>	<b>Minimum Value</b>	<b>Maximum Value</b>	<b>Resolution/formula</b>
7 bits	0 km/h	600 km/h	5 km/h
<b>Special/reserved value</b>	121-127	Spare	

#### 4.1.2.5.21 TARGET SPEED

<b>Description</b>	This message contains the target speed.		
<b>Content</b>	<b>Variable</b>	<b>Length</b>	<b>Comment</b>
	V_TARGET	7	Defined below.

#### V\_TARGET

<b>Name</b>	Target speed		
<b>Description</b>	Target speed indicated to the driver.		
<b>Length of variable</b>	<b>Minimum Value</b>	<b>Maximum Value</b>	<b>Resolution/formula</b>
7 bits	0 km/h	600 km/h	5 km/h
<b>Special/reserved value</b>	121-126	Spare	
	127	No target speed is indicated to the driver	

#### 4.1.2.5.22 TARGET DISTANCE

<b>Description</b>	This message contains the target distance.		
<b>Content</b>	<b>Variable</b>	<b>Length</b>	<b>Comment</b>
	Q_SCALE	2	Defined in Chapter 7 of [1].
	D_TARGET	15	Defined below.

#### D\_TARGET

<b>Name</b>	Target distance		
<b>Description</b>	Target distance indicated to the driver.		
<b>Length of variable</b>	<b>Minimum Value</b>	<b>Maximum Value</b>	<b>Resolution/formula</b>
15 bits	0 cm	327.660 km	10 cm, 1 m or 10 m depends on Q_SCALE.
<b>Special/reserved value</b>	32767	No target distance is indicated to the driver	

## 4.1.2.5.23 RELEASE SPEED

<b>Description</b>	This message contains the release speed.		
<b>Content</b>	<b>Variable</b>	<b>Length</b>	<b>Comment</b>
	V_RELEASE	7	

### V\_RELEASE

<b>Name</b>	Release speed.		
<b>Description</b>	Release speed associated to the supervised location.		
<b>Length of variable</b>	<b>Minimum Value</b>	<b>Maximum Value</b>	<b>Resolution/formula</b>
7 bits	0 km/h	600 km/h	5 km/h Note: the resolution of the release speed on the DMI is actually better (when release speed is calculated on-board). Unless the current value is a 5km/h step, the recorded value is a truncation to the nearest 5km/h step below the current value.
<b>Special/reserved value</b>	121-127	Spare	

## 4.1.2.5.24 WARNING

<b>Description</b>	Speed supervision warning limit exceeded, recorded when Warning state is entered.
<b>Content</b>	It doesn't contain any variable, only the fact that the speed supervision warning limit has been exceeded.

#### 4.1.2.5.25 SR SPEED/DISTANCE

<b>Description</b>	This message contains the change of the SR Speed or Distance entered by the driver.		
<b>Content</b>	<b>Variable</b>	<b>Length</b>	<b>Comment</b>
	Q_SCALE		Defined in Chapter 7 of [1].
	D_SR		Defined in Chapter 7 of [1].
	V_SR	7	

#### V\_SR

<b>Name</b>	Staff Responsible speed		
<b>Description</b>	Speed allowed to run in Staff Responsible, modified by the driver through the DMI.		
<b>Length of variable</b>	<b>Minimum Value</b>	<b>Maximum Value</b>	<b>Resolution/formula</b>
7 bits	0	600	5 km/h Note: the resolution of the SR speed entered by the driver is actually better. Unless the current value is a 5km/h step, the recorded value is a truncation to the nearest 5km/h step below the current value.

#### 4.1.2.5.26 STM SELECTED

<b>Description</b>	This message contains the STM selected when the selected level is STM.		
<b>Content</b>	<b>Variable</b>	<b>Length</b>	<b>Comment</b>
	NID_STM		Defined in Chapter 7 of [1].

## 4.1.2.5.27 PERMITTED SPEED

<b>Description</b>	This message contains a change on the permitted speed		
<b>Content</b>	<b>Variable</b>	<b>Length</b>	<b>Comment</b>
	V_PERMITTED	7	

### V\_PERMITTED

<b>Name</b>	Permitted speed		
<b>Description</b>	Current permitted speed		
<b>Length of variable</b>	<b>Minimum Value</b>	<b>Maximum Value</b>	<b>Resolution/formula</b>
7 bits	0	600	5 km/h Note: the resolution of the permitted speed on the DMI is actually better. Unless the current value is a 5km/h step, the recorded value is a truncation to the nearest 5km/h step below the current value.
<b>Special/reserved value</b>	121-127	Spare	

## 4.1.2.6 Control Messages General Structure

- 4.1.2.6.1 All the messages have the same structure with a common header.
- 4.1.2.6.2 They do not send any variable, because no extra information is needed. The length is 8 bits for each message.
- 4.1.2.6.3 Control messages shall not be registered in the juridical recorder device.
- 4.1.2.6.4 A message shall only be composed of a header, which description follows:

Field	VARIABLES	Remarks
No		
1	NID_MESSAGE	Message identification number

4.1.2.6.5 MESSAGE STATE ACK

4.1.2.6.5.1 This message answers to a “state request” which is sent by the Downloading tool.

4.1.2.6.6 MESSAGE JRU FAILURE

4.1.2.6.6.1 This message is sent to the Downloading tool when the juridical recording function has failed.

4.1.2.6.7 MESSAGE START OF TRANSMISSION

4.1.2.6.7.1 It indicates to the Downloading tool that the transmission of the data stored in the Juridical Recorder device will follow the reception of this message.

4.1.2.6.8 MESSAGE END OF TRANSMISSION

4.1.2.6.8.1 This message indicates to the Downloading tool that the transmission of the data stored has been completed.

**4.1.3 JRU Input information (Messages / Variables)**

4.1.3.1 General structure of messages

4.1.3.1.1.1 All the messages sent from the downloading tool to the Juridical Recorder, shall have the same structure than the control message sent from the Juridical Recorder to the downloading tool. These messages are shown in Table 2:

NID_MESSAGE	TYPE OF MESSAGE	MESSAGE
0-70		SPARE
71	CONTROL MESSAGE	STATE REQUEST
72	“	DATA DOWNLOADING REQUEST
73-255	“	SPARE

**Table 2. Downloading tool-Juridical Recorder messages list**

4.1.3.2 STATE REQUEST

4.1.3.2.1.1 It requests the state of the Juridical Recorder to set up the communication.

4.1.3.3 DATA DOWNLOADING REQUEST

It is sent from the Downloading tool to the Juridical Recorder, to allow the downloading of all the data stored in it. This message does not allow deleting the data.



## 5. COMMUNICATION PROTOCOLS

### 5.1 Juridical Recorder – Downloading tool Communication protocol

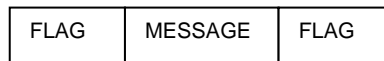
#### 5.1.1 Data Link layer

5.1.1.1 The Data Link layer will ensure the information is transmitted without any error. It receives the messages from the application layer and adds the relevant headers. The following features will be considered:

- It implements byte stuffing.
- It builds up the start and the end of the frame.

#### 5.1.2 Definition of frames

5.1.2.1 Each frame contains an application level message. The frame structure is composed of a starting byte (FLAG), an application level message field and an ending byte (FLAG).



FLAG is a byte, which value is 7EH.

The flow of several messages shall be in the following format:

**FLAG MESSAGE FLAG FLAG MESSAGE FLAG FLAG MESSAGE FLAG**

where message is either a “control message” or a data message (4.1.2.2 & 4.1.3.1.1.1)

#### 5.1.3 Definition of fields

##### 5.1.3.1 Byte stuffing

5.1.3.1.1 Its use is due to the existence of some values that coincide with fix values in fields that have a special meaning for the link layer.

5.1.3.1.2 The stuffing byte will be added to some bytes of the MESSAGE or CONTROL fields.

5.1.3.1.3 If a byte value is 7EH, it will be replaced by: 7DH, 5EH

5.1.3.1.4 If a byte value is 7DH, it will be replaced by: 7DH, 5DH



### 5.1.3.2 Character Format

5.1.3.2.1 Each byte of the message is transmitted with one start bit, eight data bits, even parity and one stop bit.

## 6. PHYSICAL INTERFACE SPECIFICATION

### 6.1 Juridical Recorder – Downloading tool Physical Interface

#### 6.1.1 Physical Layer Communication Standard.

6.1.1.1 The Physical layer is in charge of the physical message transmission/reception. The serial interface shall be implemented as an asynchronous communication.

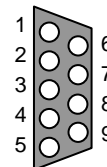
6.1.1.2 Only one physical link (without redundancy) will be implemented for the Juridical Recorder-Downloading tool interface. The Physical link will meet the following features:

- RS232 compatible with three-wire interface (Full Duplex).
- Transmission speed: 19,200 bps

#### 6.1.2 Connections.

6.1.2.1 The physical connection between Juridical Recorder and Downloading tool will be implemented through a 9 pin D sub female plug connector (using the RS232 standard).

Pin 1	spare
Pin 2	Receive Data
Pin 3	Transmit Data
Pin 4	spare
Pin 5	Signal Ground
Pin 6	spare
Pin 7	spare
Pin 8	spare
Pin 9	spare



(Female)