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of 18 March 2016

implementing Regulation (EU) No 165/2014 of the European Parliament and of the Council laying down the requirements for the construction, testing, installation, operation and repair of tachographs and their components

ANNEX I C

Requirements for construction, testing, installation, and inspection

Appendix 9

TYPE APPROVAL LIST OF MINIMUM REQUIRED TESTS

1.INTRODUCTION

1.1. **Type approval**

The EC type approval for a recording equipment (or component) or a tachograph card is based on:

a security certification , based on Common Criteria specifications, against a security target fully compliant with Appendix 10 to this Annex,

a **functional certification** performed by a Member State authority certifying that the item tested fulfils the requirements of this Annex in terms of functions performed, measurement accuracy and environmental characteristics,

an **interoperability certification** performed by the competent body certifying that the recording equipment (or tachograph card) is fully interoperable with the necessary tachograph card (or recording equipment) models (see Chapter 8 of this Annex).

This Appendix specifies which tests, as a minimum, must be performed by a Member State authority during the functional tests, and which tests, as a minimum, must be performed by the competent body during the interoperability tests. Procedures to follow to carry out the tests or the type of tests are not specified further.

The security certification aspects are not covered by this Appendix. If some tests requested for type approval are performed during the security evaluation and certification process, then these tests do not need to be performed again. In this case, only the results of these security tests may be inspected. For information, the requirements expected to be tested (or closely related to tests expected to be performed) during the security certification, are marked with a '*' in this Appendix.

The numbered requirements refer to the Annex corpus, while the other requirements refer to the other appendixes (e.g. PIC_001 refers to requirement PIC_001 of Appendix 3 Pictograms).

This Appendix considers separately the type approval of the motion sensor, of the vehicle unit, and of the external GNSS facility as components of the recording equipment. Each component will get its own type approval certificate in which the other compatible components will be indicated. The functional test of the motion sensor (or external GNSS facility) is done together with the vehicle unit and vice versa.

Interoperability between every model of motion sensor (resp. external GNSS facility) and every model of vehicle unit is not required. In that case the type approval for a motion sensor (resp. external GNSS facility) can be granted only in combination with the type approval of the relevant vehicle unit and vice versa.

1.2. **References**

The following references are used in this Appendix:

IEC 60068-2-1:

Environmental testing — Part 2-1: Tests — Test A: Cold

IEC 60068-2-2:

Basic environmental testing procedures; part 2: tests; tests B: dry heat (sinusoidal).

IEC 60068-2-6:

Environmental testing — Part 2: Tests — Test Fc: Vibration

IEC 60068-2-14:

Environmental testing; Part 2-14: Tests; Test N: Change of temperature

IEC 60068-2-27:

Environmental testing. Part 2: Tests. Test Ea and guidance: Shock

IEC 60068-2-30:

Environmental testing — Part 2-30: Tests — Test Db: Damp heat, cyclic (12 h + 12 h cycle)

IEC 60068-2-64:

Environmental testing — Part 2-64: Tests — Test Fh: Vibration, broadband random and guidance

IEC 60068-2-78

Environmental testing — Part 2-78: Tests — Test Cab: Damp heat, steady state

ISO 16750-3 —

Mechanical loads (2012-12)

ISO 16750-4 —

Climatic loads(2010-04).

ISO 20653:

Road vehicles — Degree of protection (IP code) — Protection of electrical equipment against foreign objects, water and access

ISO 10605:2008 + Technical Corrigendum:2010 + AMD1:2014

Road vehicles — Test methods for electrical disturbances from electrostatic discharge

ISO 7637-1:2002 + AMD1: 2008

Road vehicles — Electrical disturbances from conduction and coupling — Part 1: Definitions and general considerations.

ISO 7637-2

Road vehicles — Electrical disturbances from conduction and coupling — Part 2: Electrical transient conduction along supply lines only.

ISO 7637-3

Road vehicles — Electrical disturbances from conduction and coupling — Part 3: Electrical transient transmission by capacitive and inductive coupling via lines other than supply lines.

ISO/IEC 7816-1

Identification cards — Integrated circuit(s) cards with contacts — Part 1: Physical characteristics..

ISO/IEC 7816-2

Information technology — Identification cards — Integrated circuit(s) cards with contacts — Part 2: Dimensions and location of the contacts.

ISO/IEC 7816-3

Information technology — Identification cards — Integrated circuit(s) cards with contacts — Part 3: Electronic signals and transmission protocol.

ISO/IEC 10373-1:2006 + AMD1:2012

Identification cards — Test methods — Part 1: General characteristics

ISO/IEC 10373-3:2010 + Technical Corrigendum:2013

Identification cards — Test methods — Part 3: Integrated circuit cards with contacts and related interface devices

ISO 16844-3:2004, Cor 1:2006

Road vehicles — Tachograph systems — Part 3: Motion sensor interface (with vehicle units).

ISO 16844-4

Road vehicles — Tachograph systems — Part 4: CAN interface

ISO 16844-6

Road vehicles — Tachograph systems — Part 6: Diagnostics

ISO 16844-7

Road vehicles — Tachograph systems — Part 7: Parameters

ISO 534

Paper and board — Determination of thickness, density and specific volume

UN ECE R10

Uniform provisions concerning the approval of vehicles with regard to electromagnetic compatibility (United Nation Economic Commission for Europe)

2.VEHICLE UNIT FUNCTIONAL TESTS

No	Test	Description	Related requirements
1.	Administrative examination		
1.1	Documentation	Correctness of documentation	
1.2	Manufacturer test results	Results of manufacturer test performed during integration. Paper demonstrations.	88, 89,91
2.	Visual inspection		
2,1	Compliance with documentation		
2.2	Identification / markings		224 to 226
2.3	Materials		219 to 223
2.4	Sealing		398, 401 to 405
2.5	External interfaces		
3.	Functional tests		
3.1	Functions provided		02, 03, 04, 05, 07, 382
3.2	Modes of operation		09 to 11*, 134, 135
3.3	Functions and data access rights		12* 13*, 382, 383, 386 to 389
3.4	Monitoring cards insertion and withdrawal		15, 16, 17, 18, 19*, 20*, 134
3.5	Speed and distance measurement		21 to 31
3.6	Time measurement (test performed at 20 °C)		38 to 43
3.7	Monitoring driver activities		44 to 53, 134
3.8	Monitoring driving status		54, 55, 134
3.9	Manual entries		56 to 62
3.10	Company locks management		63 to 68
3.11	Monitoring control activities		69, 70
3.12	Detection of events and/or faults		71 to 88, 134

3.13	Equipment identification data	93*, 94*, 97, 100
3.14	Driver card insertion and withdrawal data	102* to 104*
3.15	Driver activity data	105* to 107*
3.16	Places and positions data	108* to 112*
3.17	Odometer data	113* to 115*
3.18	Detailed speed data	116*
3.19	Events data	117*
3.20	Faults data	118*
3.21	Calibration data	119* to 121*
3.22	Time adjustment data	124*, 125*
3.23	Control activity data	126*, 127*
3.24	Company locks data	128*
3.25	Download activity data	129*
3.26	Specific conditions data	130*, 131*
3.27	Recording and storing on tachographs cards	136, 137, 138*, 139*, 141*, 142, 143 144, 145, 146*, 147*, 148*, 149, 150
3.28	Displaying	90, 134, 151 to 168, PIC_001, DIS_001
3.29	Printing	90, 134, 169 to 181, PIC_001, PRT_001 to PRT_014
3.30	Warning	134, 182 to 191, PIC_001

3.31	Data downloading to external media		90, 134, 192 to 196
3.32	Remote communication for targeted roadside checks		197 to 199
3.33	Output data to additional external devices		200, 201
3.34	Calibration		202 to 206*, 383, 384, 386 to 391
3.35	Roadside calibration checking		207 to 209
3.36	Time adjustment		210 to 212*
3.37	Non-interference of additional functions		06, 425
3.38	Motion sensor interface		02, 122
3.39	External GNSS facility		03, 123
3.40	Verify that the VU detects, records and stores the event(s) and/or fault(s) defined by the VU manufacturer when a paired motion sensor reacts to magnetic fields disturbing vehicle motion detection.		217
3.41	Cypher suite and standardized domain parameters		CSM_48, CSM_50
4.	Environmental tests		
4.1	Temperature	Verify functionality through: Test according to ISO 16750-4, Chapter 5.1.1.2: Low temperature operation test (72 h @ – 20 °C) This test refers to IEC 60068-2-1: Environmental testing - Part 2-1: Tests - Test A: Cold Test according to ISO 16750-4: Chapter 5.1.2.2: High temperature operation test (72 h at 70 °C) This test refers to IEC 60068-2-2: Basic environmental testing procedures; part 2: tests; tests B: dry heat Test according to ISO 16750-4: Chapter 5.3.2: Rapid change of temperature with specified transition duration (– 20 °C/70 °C, 20 cycles, dwell time 2h at each temperature) A reduced set of tests (among those defined in section 3 of this table) can be carried out at the lower temperature, the higher temperature and during the temperature cycles	213
4.2	Humidity	Verify that the vehicle unit can withstand a cyclic damp (heat test) through IEC 60068-2-30, test Db, six 24 hours cycles, each temperature varying from +25 °C to + 55 °C and a relative humidity of 97 % at + 25 °C and equal to 93 % at +55 °C	214

4.3	Mechanical	1. Sinusoidal vibrations. verify that the vehicle unit can withstand sinusoidal vibrations with the following characteristics: constant displacement between 5 and 11 Hz: 10mm peak constant acceleration between 11 and 300 Hz: 5g This requirement is verified through IEC 60068-2-6, test Fc, with a minimum test duration of 3 × 12 hours (12 hours per axis) ISO 16750-3 does not require a sinusoidal vibration test for devices located in the decoupled vehicle cab. 2. Random vibrations: Test according to ISO 16750-3: Chapter 4.1.2.8: Test VIII: Commercial vehicle, decoupled vehicle cab Random vibration test, 10…2000 Hz, RMS vertical 21,3 m/s ^{2} , RMS longitudinal 11,8 m/s ^{2} , RMS lateral 13,1 m/s ^{2} , 3 axes, 32 h per axis, including temperature cycle – 20…70 °C. This test refers to IEC 60068-2-64: Environmental testing - Part 2-64: Tests - Test Fh: Vibration, broadband random and guidance 3. Shocks: mechanical shock with 3 g half sinus according ISO 16750. The tests described above are performed on different samples of the equipment type being tested.	219
4.4	Protection against water and foreign bodies	Test according to ISO 20653: Road vehicles – Degree of protection (IP code) – Protection of electrical equipment against foreign objects, water and access (No change in parameters); Minimum value IP 40	220, 221

4.5	Over-voltage protection	Verify that the vehicle unit can withstand a power supply of: 24 V versions : 34V at + 40 °C 1 hour 12V versions : 17V at + 40 °C 1 hour (ISO 16750-2)	216
4.6	Reverse polarity protection	Verify that the vehicle unit can withstand an inversion of its power supply (ISO 16750-2)	216
4.7	Short-circuit protection	Verify that input output signals are protected against short circuits to power supply and ground (ISO 16750-2)	216
5.	EMC tests		
5.1	Radiated emissions and susceptibility	Compliance with Regulation ECE R10	218
5.2	Electrostatic discharge	Compliance with ISO 10605:2008 + Technical Corrigendum:2010 + AMD1:2014: +/– 4 kV for contact and +/– 8 kV for air discharge	218

5.3	Conducted transient susceptibility on power supply	For 24V versions: compliance with ISO 7637-2 + ECE Regulation No. 10 Rev. 3: pulse 1a: Vs=450V Ri=50 ohms pulse 2a: Vs=+37V Ri=2 ohms pulse 2b: Vs=+20V Ri=0,05 ohms pulse 3a: Vs=– 150V Ri=50 ohms pulse 3b: Vs=+150V Ri=50 ohms pulse 4: Vs=– 16V Va=– 12V t6=100ms pulse 5: Vs=+120V Ri=2,2 ohms td=250ms For 12V versions: compliance with ISO 7637– 1 + ECE Regulation No. 10 Rev. 3: pulse 1: Vs=– 75V Ri=10 ohms pulse 2a: Vs=+37V Ri=2 ohms pulse 2b: Vs=+10V Ri=0,05 ohms pulse 3a: Vs=– 112V Ri=50 ohms pulse 3b: Vs=+75V Ri=50 ohms pulse 4: Vs=– 6V Va=– 5V t6=15ms pulse 5: Vs=+65V Ri=3ohms td=100ms Pulse 5 shall be tested only for vehicle units designed to be installed in vehicles for which no external common protection against load dump is implemented For load dump proposal, refer to ISO 16750-2, 4th edition, chapter 4.6.4.	218

3.MOTION SENSOR FUNCTIONAL TESTS

No	Test	Description	Related requirements
1.	**Administrative examination**		
1.1	Documentation	Correctness of documentation	
2.	**Visual inspection**		

2.1.	Compliance with documentation	
2.2.	Identification/markings	225, 226,
2.3	Materials	219 to 223
2.4.	Sealing	398, 401 to 405
3.	**Functional tests**	
3.1	Sensor identification data	95 to 97*
3.2	Motion sensor — vehicle unit pairing	122*, 204
3.3	Motion detection Motion measurement accuracy	30 to 35
3.4	Vehicle unit interface	02
3.5	Check that the motion sensor is immune to constant magnetic field. Alternatively, verify that the motion sensor reacts to constant magnetic fields disturbing vehicle motion detection so that a connected VU can detect, record and store sensor faults	217
4.	**Environmental tests**	
4.1	Operating temperature Verify functionality (as defined in test No 3.3) in temperature range [– 40°C; + 135°C through: IEC 60068-2-1 test Ad, with a test duration of 96 hours at the lowest temperature To_{min}, IEC 60068-2-2 test Bd, with a test duration of 96 hours at the highest temperature To_{max} Test according to ISO 16750-4: Chapter 5.1.1.2: Low temperature operation test (24 h @ – 40 °C) This test refers to IEC 60068-2-1: Environmental testing — Part 2-1: Tests — Test A: Cold IEC 68-2-2 test Bd, with a test duration of 96 hours at the lowest temperature of – 40°C. Test according to ISO 16750-4: Chapter 5.1.2.2: High temperature operation test (96 h @ 135 °C) This test refers to IEC 60068-2-2: Basic environmental testing procedures; part 2: tests; tests B: dry heat	213

4.2	Temperature cycles	Test according to ISO 16750-4: Chapter 5.3.2: Rapid change of temperature with specified transition duration (– 40°C/135 °C, 20 cycles, dwell time 30 min at each temperature) IEC 60068-2-14: Environmental testing; Part 2-14: Tests; Test N: Change of temperature	213
4.3	Humidity cycles	Verify functionality (as defined in test No. 3.3) through IEC 60068-2-30, test Db, six 24 hours cycles, each temperature varying from + 25°C to + 55°C and a relative humidity of 97 % at + 25°C and equal to 93 % at + 55°C	214
4.4	Vibration	ISO 16750-3: Chapter 4.1.2.6: Test VI: Commercial vehicle, engine, gearbox Mixed mode vibration test including a) Sinusoidal vibration test, 20…520 Hz, 11,4 … 120 m/s^2, <= 0,5 oct/min b) Random vibration test, 10…2 000 Hz, RMS 177 m/s^2 94 h per axis, including temperature cycle – 20…70°C) This test refers to IEC 60068-2-80: Environmental testing — Part 2-80: Tests — Test Fi: Vibration — Mixed mode	219
4.5	Mechanical shock	ISO 16750-3: Chapter 4.2.3: Test VI: Test for devices in or on the gearbox half-sinusoidal shock, acceleration to be agreed in the range 3 000…15 000 m/s^2, pulse duration to be agreed, however < 1 ms, number of shocks: to be agreed This test refers to IEC 60068-2-27: Environmental testing. Part 2: Tests. Test Ea and guidance: Shock	219

4.6	Protection against water and foreign bodies	Test according to ISO 20653: Road vehicles — Degree of protection (IP code) — Protection of electrical equipment against foreign objects, water and access (Target value IP 64)	220, 221
4.7	Reverse polarity protection	Verify that the motion sensor can withstand an inversion of its power supply	216
4.8	Short circuit protection	Verify that input output signals are protected against short circuits to power supply and ground	216
5.	**EMC**		
5.1	radiated emissions and susceptibility	Verify compliance with Regulation ECE R10	218
5.2	Electrostatic discharge	Compliance with ISO 10605:2008 + Technical Corrigendum:2010 + AMD1:2014: +/– 4kV for contact and +/– 8kV for air discharge	218

5.3	Conducted transient susceptibility on data lines)	For 24V versions: compliance with ISO 7637-2 + ECE Regulation No. 10 Rev. 3: pulse 1a: Vs = – 450 V Ri = 50 ohms pulse 2a: Vs = + 37 V Ri = 2 ohms pulse 2b: Vs = + 20 V Ri = 0,05 ohms pulse 3a: Vs = – 150 V Ri = 50 ohms pulse 3b: Vs = + 150 V Ri = 50 ohms pulse 4: Vs= – 16 V Va = – 12 V t6 = 100ms pulse 5: Vs = + 120 V Ri = 2,2 ohms td = 250ms For 12V versions: compliance with ISO 7637-1 + ECE Regulation No. 10 Rev. 3: pulse 1: Vs = – 75 V Ri = 10 ohms pulse 2a: Vs = + 37 V Ri = 2 ohms pulse 2b: Vs = + 10 V Ri = 0,05 ohms pulse 3a: Vs = – 112 V Ri = 50 ohms pulse 3b: Vs = + 75 V Ri = 50 ohms pulse 4: Vs= – 6 V Va=-5 V t6 = 15 ms pulse 5: Vs = + 65 V Ri = 3 ohms td = 100 ms Pulse 5 shall be tested only for vehicle units designed to be installed in vehicles for which no external common protection against load dump is implemented For load dump proposal, refer to ISO 16750-2, 4th edition, chapter 4.6.4	218

4.TACHOGRAPH CARDS FUNCTIONAL TESTS

Tests according to this Section 4,

no. 5 ‘Protocol tests’,

no. 6 ‘Card structure’ and

no. 7 ‘Functional tests’

can be performed by the evaluator or certifier during the Common Criteria (CC) security certification process for the chip module.

Tests number 2.3 and 4.2 are the same. These are the mechanical tests of the combination card body and chip module. If one of these components (card body, chip module) is changed, then these tests are necessary.

No	Test	Description	Related requirements
1.	**Administrative examination**		
1.1	Documentation	Correctness of documentation	
2	**Card Body**		

2.1 Printed Design	Make sure that all features for protection and visible data are correctly printed on the card and compliant. [Designator Annex 1C, chapter 4.1 ‘Visible data’, 227) The front page shall contain: the words ‘Driver card’ or ‘Control card’ or ‘Workshop card’ or ‘Company card’ printed in capital letters in the official language or languages of the Member State issuing the card, according to the type of the card. [Member State name Annex 1C, chapter 4.1 ‘Visible data’, 228) The front page shall contain: the name of the Member State issuing the card (optional). [Sign Annex 1C, chapter 4.1 ‘Visible data’, 229) The front page shall contain: the distinguishing sign of the Member State issuing the card, printed in negative in a blue rectangle and encircled by 12 yellow stars. [Enumeration Annex 1C, chapter 4.1 ‘Visible data’, 232) The reverse page shall contain: an explanation of the numbered items which appear on the front page of the card. [Colour Annex 1C, chapter 4.1 ‘Visible data’, 234) Tachograph cards shall be printed with the following background predominant colours: driver card: white, workshop card: red, control card: blue, company card: yellow. [Security Annex 1C, chapter 4.1 ‘Visible data’, 235)	227 to 229, 232, 234 to 236

2.2 Mechanical Tests

[Card size 240, 243

Tachograph cards must conform to standard ISO/IEC 7810

ISO/IEC 7810, Identification cards — Physical characteristics,

[5 Dimension of card,

[5.1 Card size,

[5.1.1 Card dimensions and tolererances,

card type ID-1 Unused card

[Card edges

Tachograph cards must conform to standard

ISO/IEC 7810, Identification cards — Physical characteristics,

[5 Dimension of card,

[5.1 Card size,

[5.1.2 Card edges

[Card construction

Tachograph cards must conform to standard

ISO/IEC 7810, Identification cards — Physical characteristics,

[6 Card construction

[Card materials

Tachograph cards must conform to standard

ISO/IEC 7810, Identification cards — Physical characteristics,

[7 Card materials

[Bending stiffness

Tachograph cards must conform to standard

ISO/IEC 7810, Identification cards — Physical characteristics,

[8 Card characteristics,

[8.1 Bending stiffness

[Toxicity

Tachograph cards must conform to standard

2.3	Mechanical tests with chip module embedded	[Bending Tachograph cards must conform to standard ISO/IEC 7810:2003/Amd. 1:2009, Identification cards — Physical characteristics, Amendment 1: Criteria for cards containing integrated circuits [9.2 Dynamic bending stress Total number of bending cycles: 4 000. [Torsion Tachograph cards must conform to standard ISO/IEC 7810:2003/Amd. 1:2009, Identification cards — Physical characteristics, Amendment 1: Criteria for cards containing integrated circuits [9.3 Dynamic torsional stress Total number of torsion cycles: 4 000.	ISO/IEC 7810

3 **Module**

3.1 Module ISO/IEC 7816

Module is the chip encapsulation and the contact plate.

[Surface profile

Tachograph cards must conform to standard

ISO/IEC 7816-1:2011, Identification cards — Integrated circuit cards — Part 1: Cards with contacts — Physical characteristics

[4.2 Surface profile of contacts

[Mechanical strength

Tachograph cards must conform to standard

ISO/IEC 7816-1:2011, Identification cards — Integrated circuit cards — Part 1: Cards with contacts — Physical characteristics

[4.3 Mechanical strength (of a card and contacts)

[Electrical resistance

Tachograph cards must conform to standard

ISO/IEC 7816-1:2011, Identification cards — Integrated circuit cards — Part 1: Cards with contacts — Physical characteristics

[4.4 Electrical resistance (of contacts)

[Dimension

Tachograph cards must conform to standard

ISO/IEC 7816-2:2007, Identification cards — Integrated circuit cards — Part 2: Cards with contacts — Dimension and location of the contacts

[3 Dimension of the contacts

[Location

Tachograph cards must conform to standard

ISO/IEC 7816-2:2007, Identification cards — Integrated circuit cards — Part 2: Cards with contacts — Dimension and location of the contacts

[4 Number and location of the contacts

In case of modules with six contacts, contact ‘C4’ and ‘C8’ are not part of this test requirement.

4.1 Chip

[Operating temperature

241 to 244

The Tachograph card chip shall operate in an ambient temperature range between – 25 °C and + 85 °C.

ECE R10

ISO/IEC 7810

[Temperature and humidity

ISO/IEC 10373

Annex 1C, chapter 4.4 ‘Environmental and electrical specifications’, 241)

Tachograph cards shall be capable of operating correctly in all the climatic conditions normally encountered in Community territory and at least in the temperature range – 25°C to + 70°C with occasional peaks of up to + 85°C, ‘occasional’ meaning not more than 4 hours each time and not over 100 times during the life time of the card.

The Tachograph cards are exposed in consecutive steps to the following temperatures and humidities for the given time. After each step the Tachograph cards are tested for electrical functionality.

1.

Temperature of – 20 °C for 2 h.

2.

Temperature of +/– 0 °C for 2 h.

3.

Temperature of + 20 °C, 50 % RH, for 2 h.

4.

Temperature of + 50 °C, 50 % RH, for 2 h.

5.

Temperature of + 70 °C, 50 % RH, for 2 h.

The temperature is increased intermittently to + 85 °C, 50 % RH, for 60 min.

6.

Temperature of + 70 °C, 85 % RH, for 2 h.

The temperature is increased intermittently to + 85 °C, 85 % RH, for 30 min.

[Humidity

Annex 1C, chapter 4.4 ‘Environmental and electrical specifications’, 242)

Tachograph cards shall be capable of operating correctly in the humidity range 10 % to 90 %.

[Electromagnetic compatibility — EMC

4.2	Mechanical tests chip module embedded in the card body-> same as 2.3	[Bending Tachograph cards must conform to standard ISO/IEC 7810:2003/Amd. 1:2009, Identification cards — Physical characteristics, Amendment 1: Criteria for cards containing integrated circuits [9.2 Dynamic bending stress Total number of bending cycles: 4 000. [Torsion Tachograph cards must conform to standard ISO/IEC 7810:2003/Amd. 1:2009, Identification cards — Physical characteristics, Amendment 1: Criteria for cards containing integrated circuits [9.3 Dynamic torsional stress Total number of torsion cycles: 4 000.	ISO/IEC 7810
5	**Protocol tests**		
5.1	ATR	Check that the ATR is compliant	ISO/IEC 7816-3 TCS_14, TCS_17, TCS_18
5.2	T=0	Check that T=0 protocol is compliant	ISO/IEC 7816-3 TCS_11, TCS_12, TCS_13, TCS_15
5.3	PTS	Check that the PTS command is compliant by setting T=1 from T=0.	ISO/IEC 7816-3 TCS_12, TCS_19, TCS_20, TCS_21

5.4	T=1	Check that T=1 protocol is compliant	ISO/IEC 7816-3 TCS_11, TCS_13, TCS_16
6	**Card structure**		
6.1		Test that the file structure of the card is compliant by checking the presence of the mandatory files in the card and their access conditions	TCS_22 to TCS_28 TCS_140 to TCS_179
7	**Functional tests**		
7.1	Normal processing	Test at least once each allowed usage of each command (ex: test the UPDATE BINARY command with CLA = ‘00’, CLA = ‘0C’ and with different P1,P2 and Lc parameters) Check that the operations have actually been performed in the card (ex: by reading the file the command has been performed on)	TCS_29 to TCS_139
7.2	Error messages	Test at least once each error message (as specified in Appendix 2) for each command Test at least once every generic error (except ‘**6400**’ integrity errors checked during security certification)	
7.3	Cypher suite and standardized domain parameters		CSM_48, CSM_50
8	**Personalisation**		

8.1	Optical personalisation	Annex 1C, chapter 4.1 ‘Visible data’, 230) The front page shall contain: information specific to the card issued. Annex 1C, chapter 4.1 ‘Visible data’, 231) The front page shall contain: dates using a ‘dd/mm/yyyy’ or ‘dd.mm.yyyy’ format (day, month, year). Annex 1C, chapter 4.1 ‘Visible data’, 235) Tachograph cards shall bear at least the following features for protection of the card body against counterfeiting and tampering: in the area of the photograph, the security design background and the photograph shall overlap.	230, 231, 235

5.EXTERNAL GNSS FACILITY TESTS

No	Test	Description	Related requirements
1.	**Administrative examination**		
1.1	Documentation	Correctness of documentation	
2.	**Visual inspection for external GNSS facility**		
2.1.	Compliance with documentation		
2.2.	Identification/markings		224 to 226
2.3	Materials		219 to 223
3.	**Functional tests**		
3.1	Sensor identification data		98,99
3.2	External GNSS module — vehicle unit coupling		123, 205
3.3	GNSS position		36, 37
3.4	Vehicle unit interface when the GNSS receiver is external to the Vehicle Unit		03
3.5	Cypher suite and standardized domain parameters		CSM_48, CSM_50
4.	**Environmental tests**		

4.1	Temperature	Verify functionality through: Test according to ISO 16750-4, Chapter 5.1.1.2: Low temperature operation test (72 h @ – 20 °C) This test refers to IEC 60068-2-1: Environmental testing — Part 2-1: Tests — Test A: Cold Test according to ISO 16750-4: Chapter 5.1.2.2: High temperature operation test (72 h @ 70 °C) This test refers to IEC 60068-2-2: Basic environmental testing procedures; part 2: tests; tests B: dry heat Test according to ISO 16750-4: Chapter 5.3.2: Rapid change of temperature with specified transition duration (– 20 °C/70 °C, 20 cycles, dwell time 1 h at each temperature) A reduced set of tests (among those defined in section 3 of this table) can be carried out at the lower temperature, the higher temperature and during the temperature cycles	213
4.2	Humidity	Verify that the vehicle unit can withstand a cyclic damp (heat test) through IEC 60068-2-30, test Db, six 24 hours cycles, each temperature varying from + 25 °C to + 55 °C and a relative humidity of 97 % at + 25 °C and equal to 93 % at + 55 °C	214

4.3	Mechanical	1. Sinusoidal vibrations. verify that the vehicle unit can withstand sinusoidal vibrations with the following characteristics: constant displacement between 5 and 11 Hz: 10 mm peak constant acceleration between 11 and 300 Hz: 5g This requirement is verified through IEC 60068-2-6, test Fc, with a minimum test duration of 3 × 12 hours (12 hours per axis) ISO 16750-3 does not require a sinusoidal vibration test for devices located in the decoupled vehicle cab. 2. Random vibrations: Test according to ISO 16750-3: Chapter 4.1.2.8: Test VIII: Commercial vehicle, decoupled vehicle cab Random vibration test, 10…2 000 Hz, RMS vertical 21,3 m/s^2, RMS longitudinal 11,8 m/s^2, RMS lateral 13,1 m/s^2, 3 axes, 32 h per axis, including temperature cycle – 20…70°C. This test refers to IEC 60068-2-64: Environmental testing — Part 2-64: Tests — Test Fh: Vibration, broadband random and guidance 3. Shocks: mechanical shock with 3g half sinus according ISO 16750. The tests described above are performed on different samples of the equipment type being tested.	219
4.4	Protection against water and foreign bodies	Test according to ISO 20653: Road vehicles — Degree of protection (IP code) — Protection of electrical equipment against foreign objects, water and access (No change in parameters)	220, 221
4.5	Over-voltage protection	Verify that the vehicle unit can withstand a power supply of: 24 V versions: 34 V at + 40 °C 1 hour 12V versions: 17 V at + 40 °C 1 hour (ISO 16750-2, chapter 4.3)	216

4.6	Reverse polarity protection	Verify that the vehicle unit can withstand an inversion of its power supply (ISO 16750-2, chapter 4.7)	216
4.7	Short-circuit protection	Verify that input output signals are protected against short circuits to power supply and ground (ISO 16750-2, chapter 4.10)	216
5	**EMC tests**		
5.1	Radiated emissions and susceptibility	Compliance with Regulation ECE R10	218
5.2	Electrostatic discharge	Compliance with ISO 10605:2008 + Technical Corrigendum: 2010 + AMD1:2014: +/– 4kV for contact and +/– 8kV for air discharge	218

5.3	Conducted transient susceptibility on power supply	For 24V versions: compliance with ISO 7637-2 + ECE Regulation No. 10 Rev. 3: pulse 1a: Vs = – 450V Ri = 50 ohms pulse 2a: Vs= + 37V Ri = 2 ohms pulse 2b: Vs= + 20V Ri = 0,05 ohms pulse 3a: Vs= – 150V Ri = 50 ohms pulse 3b: Vs=+ 150V Ri = 50 ohms pulse 4: Vs = – 16 V Va = – 12V t6 = 100 ms pulse 5: Vs= + 120 V Ri = 2,2 ohms td = 250 ms For 12V versions: compliance with ISO 7637-1 + ECE Regulation No. 10 Rev. 3: pulse 1: Vs= – 75V Ri=10 ohms pulse 2a: Vs= + 37V Ri=2 ohms pulse 2b: Vs= + 10V Ri=0,05 ohms pulse 3a: Vs= – 112V Ri=50 ohms pulse 3b: Vs= + 75V Ri=50 ohms pulse 4: Vs= – 6V Va=-5V t6=15ms pulse 5: Vs= + 65V Ri=3ohms td=100ms Pulse 5 shall be tested only for vehicle units designed to be installed in vehicles for which no external common protection against load dump is implemented For load dump proposal, refer to ISO 16750-2, 4th edition, chapter 4.6.4.	218

6. EXTERNAL REMOTE COMMUNICATION FACILITY TEST

No	Test	Description	Related requirements
1.	Administrative examination		
1.1	Documentation	Correctness of documentation	
2.	Visual inspection		
2.1.	Compliance with documentation		

2.2.	Identification / markings		225, 226
2.3	Materials		219 to 223
3.	Functional tests		
3.1	Remote communication for targeted roadside checks		4, 197 to 199
3.2	Recording and storing in data memory		91
3.3	Communication with Vehicle Unit		Appendix 14 DSC_66 to DSC_70, DSC_71 to DSC_76
4.	Environmental tests		
4.1	Temperature	Verify functionality through: Test according to ISO 16750-4, Chapter 5.1.1.2: Low temperature operation test (72 h @ – 20 °C) This test refers to IEC 60068-2-1: Environmental testing - Part 2-1: Tests - Test A: Cold Test according to ISO 16750-4: Chapter 5.1.2.2: High temperature operation test (72 h @ 70 °C) This test refers to IEC 60068-2-2: Basic environmental testing procedures; part 2: tests; tests B: dry heat Test according to ISO 16750-4: Chapter 5.3.2: Rapid change of temperature with specified transition duration (– 20 °C/70 °C, 20 cycles, dwell time 1 h at each temperature) A reduced set of tests (among those defined in section 3 of this table) can be carried out at the lower temperature, the higher temperature and during the temperature cycles	213
4.2	Protection against water and foreign bodies	Test according to ISO 20653: Road vehicles – Degree of protection (IP code) – Protection of electrical equipment against foreign objects, water and access (targeted value IP40)	220, 221
5	EMC tests		
5.1	Radiated emissions and susceptibility	Compliance with Regulation ECE R10	218
5.2	Electrostatic discharge	Compliance with ISO 10605:2008 + Technical Corrigendum:2010 + AMD1:2014: +/– 4 kV for contact and +/– 8 kV for air discharge	218

5.3	Conducted transient susceptibility on power supply	For 24V versions: compliance with ISO 7637-2 + ECE Regulation No. 10 Rev. 3: pulse 1a: Vs=– 450V Ri=50 ohms pulse 2a: Vs=+37V Ri=2 ohms pulse 2b: Vs=+20V Ri=0,05 ohms pulse 3a: Vs=– 150V Ri=50 ohms pulse 3b: Vs=+150V Ri=50 ohms pulse 4: Vs=– 16V Va=-12V t6=100ms pulse 5: Vs=+120V Ri=2,2 ohms td=250ms For 12V versions: compliance with ISO 7637-1 + ECE Regulation No. 10 Rev. 3: pulse 1: Vs=-75V Ri=10 ohms pulse 2a: Vs=+37V Ri=2 ohms pulse 2b: Vs=+10V Ri=0,05 ohms pulse 3a: Vs=– 112V Ri=50 ohms pulse 3b: Vs=+75V Ri=50 ohms pulse 4: Vs=– 6V Va=– 5V t6=15ms pulse 5: Vs=+65V Ri=3ohms td=100ms Pulse 5 shall be tested only for vehicle units designed to be installed in vehicles for which no external common protection against load dump is implemented For load dump proposal, refer to ISO 16750-2, 4th edition, chapter 4.6.4.	218

7.PAPER FUNCTIONAL TESTS

No	Test	Description	Related requirements
1.	**Administrative examination**		
1.1	Documentation	Correctness of documentation	
2	**General Tests**		

2.1	Number of characters per line	Visual inspection of printouts.	172
2.2	Minimum character size	Visual inspection of printout and character inspection.	173
2.3	Supported character sets	The printer shall support characters specified in Appendix 1 Chapter 4 ‘Character sets’.	174
2.4	Printouts definition	Check of tachograph type approval and visual inspection of printouts	174
2.5	Legibility and identification of printouts	Inspection of printouts Demonstrated by test reports and test protocols by manufacturer. All homologation number(s) of tachographs with which the printer paper may be used are imprinted on the paper.	175, 177, 178
2.6	Addition of handwritten notes	Visual inspection: Field for signature of the driver is available. Fields for additional other handwritten entries are available.	180
2.7	Additional details on paper faces.	Paper's face and reverse side may feature additional details and information. These additional details and information may not interfere with the legibility of the printouts. Visual inspection.	177, 178
3	**Storage Tests**		
3.1	Dry Heat	Preconditioning: 16 hours at + 23 °C ± 2 °C/55 % ± 3 % relative humidity Test environment: 72 hours at + 70 °C ± 2 °C Recovery: 16 hours at + 23 °C ± 2 °C/55 % ± 3 % relative humidity	176, 178 IEC 60068-2-2-Bb

2.2	Damp Heat	Preconditioning: 16 hours at + 23 °C ± 2 °C/55 % ±3 % relative humidity Test environment: 144 hours at + 55 °C ± 2 °C and 93 % ± 3 % r.h. Recovery: 16 hours at + 23 °C ± 2 °C/55 % ± 3 % relative humidity	176, 178 IEC 60068-2-78-Cab
4	**Paper In-Service Tests**		
4.1	Humidity resistance background (unprinted paper)	Preconditioning: 16 hours at + 23 °C ± 2 °C/55 % ±3 % relative humidity Test environment: 144 hours at + 55 °C ± 2 °C and 93 % ± 3 % r.h. Recovery: 16 hours at + 23 °C ± 2 °C/55 % ± 3 % relative humidity	176, 178 IEC 60068-2-78-Cab
4.2	Printability	Preconditioning: 24 hours at + 40 °C ± 2 °C/93 % ± 3 % relative humidity Test environment: printout produced at + 23 °C ± 2 °C Recovery: 16 hours at + 23 °C ± 2 °C/55 % ± 3 % relative humidity	176, 178
4.3	Heat resistance	Preconditioning: 16 hours at + 23 °C ± 2 °C/55 % ± 3 % relative humidity Test environment: 2 hours at + 70 °C ± 2 °C, dry heat Recovery: 16 hours at + 23 °C ± 2 °C/55 % ± 3 % relative humidity	176, 178 IEC 60068-2-2-Bb
4.4	Low temperature resistance	Preconditioning: 16 hours at + 23 °C ± 2 °C/55 % ± 3 % relative humidity Test environment: 24 hours – 20 °C ± 3 °C, dry cold Recovery: 16 hours at + 23 °C ± 2 °C/55 % ± 3 % relative humidity	176, 178 ISO 60068-2-1-Ab

4.5 Light resistance	Preconditioning: 16 hours at + 23 °C ± 2 °C/55 % ± 3 % relative humidity Test environment: 100 hours under 5 000 Lux illumination at + 23 °C ± 2 °C/55 % ± 3 % relative humidity Recovery: 16 hours at + 23 °C ± 2 °C/55 % ± 3 % relative humidity	176, 178

Legibility criteria for tests 3.x and 4.x:

Printout legibility is assured if optical densities comply with the following limits:

Printed characters: min. 1,0

Background (unprinted paper): max. 0,2

Optical densities of the resulting printouts shall be measured according to DIN EN ISO 534.

Printouts shall show no dimensional changes and remain clearly legible.

8.INTEROPERABILITY TESTS

No	Test	Description
	8.1 Interoperability tests between vehicle units and tachograph cards	
1	Mutual authentication	Check that the mutual authentication between the vehicle unit and the tachograph card runs normally
2	Write/read tests	Execute a typical activity scenario on the vehicle unit. The scenario shall be adapted to the type of card being tested and involve writings in as many EFs as possible in the card Verify through a vehicle unit downloading that all corresponding recordings have been properly made Verify through a card downloading that all corresponding recordings have been properly made Verify through daily printouts that all corresponding recordings can be properly read
	8.2 Interoperability tests between vehicle units and motion sensors	
1	Pairing	Check that the pairing between the vehicle units and the motion sensors runs normally

2	Activity tests	Execute a typical activity scenario on the motion sensor. The scenario shall involve a normal activity and creating as many events or faults as possible. Verify through a vehicle unit downloading that all corresponding recordings have been properly made Verify through a card downloading that all corresponding recordings have been properly made Verify through a daily printout that all corresponding recordings can be properly read

8.3 Interoperability tests between vehicle units and external GNSS facilities (when applicable)

1	Mutual authentication	Check that the mutual authentication (coupling) between the vehicle unit and the external GNSS module runs normally.
2	Activity tests	Execute a typical activity scenario on the external GNSS facility. The scenario shall involve a normal activity and creating as many events or faults as possible. Verify through a vehicle unit downloading that all corresponding recordings have been properly made Verify through a card downloading that all corresponding recordings have been properly made Verify through a daily printout that all corresponding recordings can be properly read