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Foreword

This multi-part European Telecommunication Standard (ETS) has been produced by the Equipment Engineering (EE) Technical Committee of the European Telecommunications Standards Institute (ETSI).

ETS 300 019 is concerned with environmental conditions and environmental tests for telecommunications equipment and comprises two main parts, each with subdivisions:

- ETS 300 019-1: "Classification of environmental conditions".

  Part 1 specifies different standardised environmental classes covering climatic and biological conditions, chemically and mechanically active substances and mechanical conditions during storage, transportation and in use.

- ETS 300 019-2: "Specification of environmental tests".

  Part 2 specifies the recommended test severities and test methods for the different environmental classes.

Part 2-0 forms a general overview of Part 2. This part, (Part 2-2), deals with transportation.

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1 Scope

This European Telecommunication Standard (ETS) specifies test severities and methods for verification of the required resistibility of equipment according to the relevant environmental class.

The tests defined in Part 2-2 of this multi-part standard apply to transportation of equipment covering the environmental conditions stated in ETS 300 019-1-2 [1].

2 Normative references

This ETS incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

[1] ETS 300 019-1-2: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment Part 1-2: Classification of environmental conditions Transportation".

[2] IEC 68-2: "Environmental testing: Part 2 : Tests".

[3] ISO 4180-2 (1980): "Complete, filled transport packages - General rules for the compilation of performance test schedules - Part 2: Quantitative data".

[4] ETS 300 019-2-0: "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment Part 2-0: Specification of environmental tests Introduction".

3 Environmental test specifications

The detailed descriptions of the environmental conditions are given in Clauses 4 and 5 of ETS 300 019-1-2 [1].

ETS 300 019-2-0 [4] forms a general overview of Part 2 of this ETS.

If the equipment is normally transported in a packed state then it shall be tested in its packaging.

3.1 Specification T 2.1: Very careful transportation

This specification applies to transportation by air and by road on good quality road surfaces where special care has been taken with respect to low temperatures, handling and type of vehicle. See tables 1 and 2.

Table 1: Test specification T 2.1: Very careful transportation - climatic tests

Environmental parameter			Environmental Class 2.1	Environmental test specification T 2.1: Very careful transportation			
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method
Air temperature	low	(°C)	-25	-25	6 h	IEC 68-2-1	Ab: Cold
	high	unventilated (°C)	+70	+70	6 h	IEC 68-2-2	Bb: Dry heat
		ventilated or outdoors (°C)	+40	none			
	change	air/air (°C) (°C/min)	-25/+30	-25/+30 1	5 cycles t1 = 3 h	IEC 68-2-14	Nb: Change of temperature (4)
		air/water (°C)	+40/+5	none			
Humidity	relative	slow temperature (%) change (°C)	95 +40	93 +30	4 d	IEC 68-2-56	Cb: Damp heat steady state (9)
		rapid temperature (%) change (°C)	95 -25/+30	90-100 +40	2 cycles	IEC 68-2-30	Db: Damp heat cyclic Variant 1
	absolute	rapid temperature (°C) change (g/m^3)	+70/+15 60	none (6) (3)			
Air	pressure	low (kPa)	70	none			
		change	no				
	speed	(m/s)	20	none			
Water	rain	intensity (mm/min)	6 (1)	none			
		low temperature (°C)	no				
	other sources	(m/s)	1 (1)	(3)			
	wetness		wet surfaces	(3)			
Radiation	solar	(W/m^2)	1120	(7)			
	heat	(W/m^2)	600	(7)			

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Table 1 (concluded): Very careful transportation - climatic tests

Environmental parameter			Environmental Class 2.1	Environmental test specification T 2.1: Very careful transportation.			
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method
Chemically active sub-stances	sulphur	SO_2 (mg/m^3)	1,0 (2)	none (5)			
		H_2S (mg/m^3)	0,5 (2)	none (5)			
	chlorine	salts	sea and road salt mist	none (5)			
		Cl_2 (mg/m^3)	no				
		HCl (mg/m^3)	0,5 (2)	none (5)			
	nitrogen	NO_x (mg/m^3)	1,0 (2)	none (5)			
		NH_3 (mg/m^3)	3,0 (2)	none (5)			
	hydrogen fluoride HF	(mg/m^3)	0,03 (2)	none (5)			
	ozone O_3	(mg/m^3)	0,1 (2)	none (5)			
Mechanically active substances	dust	sedimentation ($mg/(m^2h)$)	3,0	none (8)			
		suspension (mg/m^3)	no				
	sand	(mg/m^3)	100	none (8)			
Flora and Fauna	micro organisms		mould, fungus, etc.	none (5)			
	rodents, insects		rodents, etc.	none (5)			

no = this condition does not occur in this class. (n) = NOTE (n = number of note), see subclause 3.4.
none = verification is required only in special cases.

Table 2: Test specification T 2.1: Very careful transportation - mechanical tests

Environmental parameter			Environmental Class 2.1	Environmental test specification T 2.1: Very careful transportation.			
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method
Vibration	sinusoidal	displacement (13) (mm) acceleration (13) (m/s^2) freq. range (Hz) axes of vibration	3,5 10 15 2-9 9- 200- 200 500	none			
	random	ASD (14) (m^2/s^3) (dB/oct) frequency range (Hz) axes of vibration	1 0,3 10-200 200-2000	0,96 -3 5-20 20-500 3 axes (15)	3 x 10 minutes	IEC 68-2-36	Fdb: Random vibration, wide band
Shocks	shocks	shock spectrum duration (ms) acceleration (13) (m/s^2) number of shocks directions of shocks	no				
Fall	free fall	height (mm) mass (kg) attitude	no				
	toppling around	mass (kg) edges	no				
Acceleration, steady state		(m/s^2)	20	none			
Load	static load	(kPa)	5	none (6)			
Miscellaneous	rolling and pitching	angle (deg) period (s)	no				

no = this condition does not occur in this class. (n) = NOTE (n = number of note), see subclause 3.4.
none = verification is required only in special cases.

3.2 Specification T 2.2: Careful transportation

This specification applies to transportation by air, by road on good quality road surfaces, by ship and by train with specially designed shock-reducing buffers and where special care has been taken with respect to low temperatures and handling. See tables 3, 4 and 8.

Table 3: Test specification T 2.2: Careful transportation - climatic tests

Environmental parameter			Environmental Class 2.2	Environmental test specification T 2.2: Careful transportation.			
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method
Air temperature	low	(°C)	-25	-25	72 h	IEC 68-2-1	Ab: Cold
	high	unventilated (°C)	+70	+70	72 h	IEC 68-2-2	Bb: Dry heat
		ventilated or outdoors (°C)	+40	none			
	change	air/air (°C) (°C/min)	-25/+30	-25/+30 1,0	5 cycles t1 = 3 h	IEC 68-2-14	Nb: Change of temperature (4)
		air/water (°C)	+40/+5	none			
Humidity	relative	slow temperature (%) change (°C)	95 +40	93 +40	4 d	IEC 68-2-56	Cb: Damp heat steady state (9)
		rapid temperature (%) change (°C)	95 -25/+30	90-100 +40	2 cycles	IEC 68-2-30	Db: Damp heat cyclic Variant 1
	absolute	rapid temperature (°C) change (g/m^3)	+70/+15 60	none (3) (6)			
Air	pressure	low (kPa)	70	none			
		change	no				
	speed	(m/s)	20	none			
Water	rain	intensity (mm/min)	6 (1)	none			
		low temperature (°C)	no				
	other sources	(m/s)	1 (1)	(3)			
	wetness		wet surfaces	(3)			
Radiation	solar	(W/m^2)	1120	(7)			
	heat	(W/m^2)	600	(7)			

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Table 3 (concluded): Test specification T 2.2: Careful transportation - climatic tests

Environmental parameter			Environmental Class 2.2	Environmental test specification T 2.2: Careful transportation.			
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method
Chemically active sub-stances	sulphur	SO_2 (mg/m^3)	1,0 (2)	none (5)			
		H_2S (mg/m^3)	0,5 (2)	none (5)			
	chlorine	salts	sea and road salt mist	none (5)			
		Cl_2 (mg/m^3)	no				
		HCl (mg/m^3)	0,5 (2)	none (5)			
	nitrogen	NO_x (mg/m^3)	1,0 (2)	none (5)			
		NH_3 (mg/m^3)	3,0 (2)	none (5)			
	hydrogen fluoride HF	(mg/m^3)	0,03 (2)	none (5)			
	ozone O_3	(mg/m^3)	0,1 (2)	none (5)			
Mechanically active substances	dust	sedimentation ($mg/(m^2h)$)	3,0	none (8)			
		suspension (mg/m^3)	no				
	sand	(mg/m^3)	100	none (8)			
Flora and Fauna	micro organisms		mould, fungus, etc.	none (5)			
	rodents, insects		rodents, etc.	none (5)			

no = this condition does not occur in this class. (n) = NOTE (n = number of note), see subclause 3.4.
none = verification is required only in special cases.

Table 4: Test specification T 2.2: Careful transportation - mechanical tests

Environmental parameter			Environmental Class 2.2	Environmental test specification T 2.2: Careful transportation.			
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method
Vibration	sinusoidal	displacement (13) (mm) acceleration (13) (m/s^2) freq. range (Hz) axes of vibration	3,5 10 15 2-9 9- 200- 200 500	none			
	random	ASD (14) (m^2/s^3) (dB/oct) frequency range (Hz) axes of vibration	1,0 0,3 10-200 200-2000	0,96 -3 5-20 20-500 3 axes (15)	3 x 10 minutes	IEC 68-2-36	Fdb: Random vibration, wide band
Shocks	shocks	shock spectrum duration (ms) acceleration (13) (m/s^2) mass (kg) (kg) number of bumps directions of bumps	Type I 11 100	6 6 (18) 250 100 (16) ≤ 100 >100 >500 <500 6	500 in each direction (17)	IEC 68-2-29	Eb: Bump
Fall	free fall	height (m) mass (kg) attitude	0,25 0,25 0,1 <20 20-100 >100	see table 8		IEC 68-2-32	Ed: Free fall Procedure 1
	toppling around	mass (kg) edges	<20 20-100 >100 any no no	none			
Acceleration, steady state		(m/s^2)	20	none			
Load	static load	(kPa)	5	none (6)			
Miscellaneous	rolling and pitching	angle (deg) period (s)					

no = this condition does not occur in this class.
none = verification is required only in special cases.
(n) = NOTE (n = number of note), see subclause 3.4.

3.3 Specification T 2.3: Public transportation

This specification applies to transportation by air, by road on all qualities of road surface, by ship and by train and where some care has been taken with respect to low temperatures. See tables 5 to 8.

Table 5: Test specification T 2.3: Public transportation - climatic tests

Environmental parameter			Environmental Class 2.3	Environmental test specification T 2.3: Public transportation.			
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method
Air temperature	low	(°C)	-40	-40	72 h	IEC 68-2-1	Ab: Cold
	high	unventilated (°C)	+70	+85 (10) (12) and +70	72 h	IEC 68-2-2	Bb: Dry heat
		ventilated or outdoors (°C)	+40	none			
	change	air/air (°C) (°C/min)	-40/+30	-40/+30 1,0	5 cycles t1 = 3 h	IEC 68-2-14	Nb: Change of temperature (4)
		air/water (°C)	+40/+5	none			
Humidity	relative	slow temperature (%) change (°C)	95 +45	93 +40	4 d	IEC 68-2-56	Cb: Damp heat steady state (9)
		rapid temperature (%) change (°C)	95 -40/+30	90-100 +40	2 cycles	IEC 68-2-30	Db: Damp heat cyclic Variant 1
	absolute	rapid temperature (°C) change (g/m^3)	+70/+15 60	none (3) (6)			
Air	pressure	low (kPa)	70	none			
		change	no				
	speed	(m/s)	20	none			
Water	rain	intensity	6 mm/min	0,01 m^3/min, 90kPa	3 min/m^2 or 15 min (11)	IEC68-2-18	Rb: Impacting water Method 2.2
		low temperature (°C)	no				
	other sources	(m/s)	1	(3)			
	wetness		wet surfaces	(3)			
Radiation	solar	(W/m^2)	1120	(7)			
	heat	(W/m^2)	600	(7)			

(continued)

Table 5 (concluded): Test specification T 2.3: Public transportation - climatic tests

Environmental parameter			Environmental Class 2.3	Environmental test specification T 2.3: Public transportation.			
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method
Chemically active sub-stances	sulphur	SO_2 (mg/m^3)	1,0 (2)	none (5)			
		H_2S (mg/m^3)	0,5 (2)	none (5)			
	chlorine	salts	sea and road salt mist	none (5)			
		Cl_2 (mg/m^3)	no				
		HCl (mg/m^3)	0,5 (2)	none (5)			
	nitrogen	NO_x (mg/m^3)	1,0 (2)	none (5)			
		NH_3 (mg/m^3)	3,0 (2)	none (5)			
	hydrogen fluoride HF	(mg/m^3)	0,03 (2)	none (5)			
	ozone O_3	(mg/m^3)	0,1 (2)	none (5)			
Mechanically active substances	dust	sedimentation ($mg/(m^2h)$)	3,0	none (8)			
		suspension (mg/m^3)	no				
	sand	(mg/m^3)	100	none (8)			
Flora and Fauna	micro organisms		mould, fungus, etc.	none (5)			
	rodents, insects		rodents, etc.	none (5)			

no = this condition does not occur in this class.
none = verification is required only in special cases.
(n) = NOTE (n = number of note), see subclause 3.4.

Table 6: Test specification T 2.3: Public transportation - mechanical tests

Environmental parameter			Environmental Class 2.3	Environmental test specification T 2.3: Public transportation.			
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method
Vibration	sinusoidal	displacement (13) (mm) acceleration (13) (m/s^2) freq. range (Hz) axes of vibration	3,5 10 15 2-9 9- 200- 200 500	none			
	random	ASD (14) (m^2/s^3) (dB/oct) frequency range (Hz) axes of vibration	1 0,3 10-200 200-2000	0,96 -3 5-20 20-500 3 axes (15)	3 x 10 minutes	IEC 68-2-36	Fdb: Random vibration, wide band
Shocks	shocks	shock spectrum duration (ms) acceleration (13) (m/s^2) mass (kg) (kg) number of bumps directions of bumps	Type I Type II 11 6 100 300	6 16 400 100 (16) ≤ 100 >100 >500 <500 6	500 in each direction (17)	IEC 68-2-29	Eb: Bump
Fall	free fall	height (m) mass (kg) attitude	1,2 1,0 0,25 <20 20-100 >100	see table 8		IEC 68-2-32	Ed: Free fall Procedure 1
	toppling around	mass (kg) edges	<20 20-100 >100 any any no	none			
Acceleration	steady state	(m/s^2)	20	none			
Load	static load	(kPa)	10	none (6)			
Miscellaneous	rolling and pitching	angle (deg) period (s)	+/- 35 8	none			

no = this condition does not occur in this class. (n) = NOTE (n = number of note), see subclause 3.4.
none = verification is required only in special cases.

Table 7: Test specification T 2.3: Public transportation - special mechanical conditions (IEC class 2M3)

Environmental parameter			Environmental Class 2.3 special	Environmental test specification T 2.3: Public transportation - special (IEC class 2M3)			
Type	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method
Vibration	sinusoidal	displacement (13) (mm) acceleration (13) (m/s^2) freq. range (Hz) axes of vibration	7,5 20 40 2-8 8- 200- 200 500	none			
	random	ASD (14) (m^2/s^3) (dB/oct) frequency range (Hz) axes of vibration	3 1 10-200 200-2000	1,92 -3 5-20 20-500 3 axes (17)	3 x 10 minutes	IEC 68-2-36	Fdb: Random vibration, wide band
Shocks	shocks	shock spectrum duration (ms) acceleration (13) (m/s^2) mass (kg) (kg) number of bumps directions of bumps	Type I Type II 11 6 300 1000	6 16 400 100 (16) ≤ 100 >100 >500 <500 6	500 in each direction (17)	IEC 68-2-29	Eb: Bump
Fall	free fall	height (m) mass (kg) attitude	1,5 1,2 0,5 <20 20- >100 100	see table 8		IEC 68-2-32 Procedure 1	Ed: Free fall
	toppling around	mass (kg) edges	<20 20-100 >100 any any any	none			
Acceleration,	steady state	(m/s^2)	20	none			
Load	static load	(kPa)	10	none (6)			
Miscellaneous	rolling pitching	angle (degrees) period (s)	+/- 35 8	none			

no = this condition does not occur in this class. (n) = NOTE (n = number of note), see subclause 3.4.
none = verification is required only in special cases.

Table 8: Free fall test severities for test specifications T 2.2 and T 2.3

	Free fall test height (m)		
Mass kg	Class T 2.2 (NOTE)	Class T 2.3 (NOTE)	Special IEC class 2M3
< 10	0,8	1,0	1,2
< 15	0,6	1,0	1,2
< 20	0,6	0,8	1,0
< 30	0,5	0,6	0,8
< 40	0,4	0,5	0,6
< 50	0,3	0,4	0,5
< 100	0,2	0,3	0,4
> 100	0,1	0,1	0,2
Duration: 1 fall on each face. If the mass is > 5 kg and if the normal attitude is specified, 2 falls in the specified attitude only.			
NOTE: Values specified in ISO 4180-2 [3].			

3.4 Notes to tables 1 to 7

NOTE 1: For short durations only.

NOTE 2: Maximum value.

NOTE 3: The wetting effect is included in test Db.

NOTE 4: For unpacked equipment with a mass < 5 kg test Na is applied.

NOTE 5: The characteristic severities should be considered when choosing components and materials. Therefore, no tests are required at the equipment level.

NOTE 6: Relevant parameter - packaging and/or equipment should be designed with this requirement in mind.

NOTE 7: The heating effect on equipment is covered by test Bb. Photochemical tests for materials can be made separately.

NOTE 8: No suitable tests exist in IEC 68-2 [2].

NOTE 9: Test required for unpackaged equipment only.

NOTE 10: Solar and heat radiation included.

NOTE 11: Whichever is greater.

NOTE 12: An additional test of 85 °C for 6 hours shall be conducted on unpackaged equipment only.

NOTE 13: Peak value.

NOTE 14: Acceleration Spectral Density.

NOTE 15: If normal attitude is specified then the severity for the horizontal axes ASD is reduced by a factor of 10.

NOTE 16: For masses > 500 kg no bump test is required.

NOTE 17: If the normal attitude is specified, the bumps shall be applied in one direction of one axis, duration 1 000 bumps.

NOTE 18: Value not specified in IEC 68-2 [2].

Annex A (informative): Bibliography

The following references are used for informative purposes within this ETS.

ETR 035: "Equipment Engineering (EE); Environmental engineering Guidance and terminology".

IEC 68-1: "Environmental testing Part 1: General and guidance".

History

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