

EUROPEAN TELECOMMUNICATION STANDARD

ETS 300 019-2-2

May 1994

Source: ETSI TC-EE Reference: DE/EE-1019-2-2

ICS: 33.080

Key words: Environment, equipment

Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment Part 2-2: Specification of environmental tests Transportation

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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 p	arameter		Environmental Class 2.1		Environmental test specification T 2.1: Very careful transportation				
Туре	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method		
	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		
Air temperature		ventilated or (°C) outdoors	+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)		
	Toldave	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/m³)	+70/+15 60	none (6) (3)					
	pressure	low (kPa)		none					
Air	procedio	change	no						
	speed	(m/s)	20	none					
	rain	intensity (mm/min)	6 (1)	none					
Water	Tani	low temperature (°C)	no						
	other sources	(m/s)	1 (1)	(3)					
	wetness		wet surfaces	(3)					
Dadiation	solar	(W/m ²)	1120	(7)					
Radiation	heat	(W/m ²)	600	(7)					

(continued)

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

Environmental pa	arameter		Environmental Class 2.1	Environmental te Very careful trans	st specification T 2.1 sportation.	•	
Гуре	ype Parameter Detail pa		Characteristic severity	Test severity	Duration	Reference	Method
	sulphur	SO ₂ (mg/m ³)	1,0 (2)	none (5)			
Chemically active sub- stances	Calpital	H_2S (mg/m ³)	0,5 (2)	none (5)			
	chlorine	salts	sea and road salt mist	none (5)			
	Chionne	Cl ₂ (mg/m ³)	no				
		HCI (mg/m ³)	0,5 (2)	none (5)			
	nitrogen	NO _x (mg/m ³)	1,0 (2)	none (5)			
	Thurogen	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	dust	sedimentation (mg/(m²h))	3,0	none (8)			
active substances		suspension (mg/m ³)	no				
bubsidiiles	sand	(mg/m ³)	100	none (8)			
Flora and	micro organisr	ns	mould, fungus, etc.	none (5)			
Flora and Fauna	rodents, insec	ts	rodents, etc.	none (5)			

no = this condition does not occur in this class. none = verification is required only in special cases.

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

Environmental pa	rameter		Environmental Class 2.1	Environmental test specification T 2.1: Very careful transportation.				
Гуре	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	
Vibration	sinusoidal	displacement (13) (mm) acceleration (13) (m/s²) freq. range (Hz) axes of vibration	3,5 10 15 2-9 9- 200- 200 500	none				
VIDIATION	random	ASD (14) (m²/s³) (dB/oct) frequency range (Hz) axes of vibration		-3	3 x 10 minutes	IEC 68-2-36	Fdb: Random vibration, wide band	
Shocks	shocks	shock spectrum duration (ms) acceleration (13) (m/s²) number of shocks directions of shocks	no					
Fall	free fall	height (mm) mass (kg) attitude	no					
ı alı	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					
	pitching n does not occur in n is required only i	this class.	(n) =	 = NOTE (n = number of i	 note), see subclaus	e 3.4.		

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 p	arameter		Environmental Class 2.2	Environmental te Careful transporta		:	
Туре	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method
	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
Air emperature		ventilated or (°C) outdoors	+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/m³)	+70/+15 60	none (3) (6)			
	pressure	low (kPa)	70	none			
Air	piessuie	change	no				
	speed	(m/s)	20	none			
	rain	intensity (mm/min)	6 (1)	none			
Matar	laiii	low temperature (°C)	no				
Water	other sources	(m/s)	1 (1)	(3)			
	wetness		wet surfaces	(3)			
Dadiation	solar	(W/m ²)	1120	(7)			
Radiation	heat	(W/m ²)	600	(7)			

(continued)

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

Environmental pa	ırameter		Environmental Class 2.2	Environmental test specification T 2.2: Careful transportation.				
Гуре	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	
	sulphur	SO ₂ (mg	/m ³) 1,0 (2)	none (5)				
		H ₂ S (mg	/m³) 0,5 (2)	none (5)				
		salts	sea and road salt mist	none (5)				
	chlorine	Cl ₂ (mg	/m³) no					
Chemically active		HCI (mg	/m³) 0,5 (2)	none (5)				
sub- stances	nitrogen	NO _x (mg	/m³) 1,0 (2)	none (5)				
		NH ₃ (mg	/m³) 3,0 (2)	none (5)				
	hydrogen fluoride HF	(mç	/m³) 0,03 (2)	none (5)				
	ozone O ₃	(mg	/m ³) 0,1 (2)	none (5)				
Mechanically	dust	sedimentation (mg/(r		none (8)				
active substances		suspension (mg	/m³) no					
	sand	(mg	/m ³) 100	none (8)				
Flora and	micro organism		mould, fungus, etc.	none (5)				
-auna	rodents, insects		rodents, etc.	none (5)	r of note), see subcla			

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

Environmental pa	rameter		Environmental Class 2.2	Environmental test sp Careful transportation			
Гуре	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method
Vibration	sinusoidal	displacement (13) (mm) acceleration (13) (m/s²) freq. range (Hz) axes of vibration	3,5 10 15 2-9 9- 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/s²) mass (kg) number of bumps directions of bumps	Type I 11 100	6 6 (18) 250 100 (16) ≤ 100 >100 >500 <500	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 Miscellaneous	static load rolling and pitching	angle (deg) period (s)	5	none (6)			

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 p	parameter		Environmental Class 2.3	Environmental test specification T 2.3: Public transportation.					
Туре	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method		
	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		
Air		ventilated or (°C) outdoors	+40	none					
emperature	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					
		slow temperature (%) change (°C)	95 +45	93 +40	4 d	IEC 68-2-56	Cb: Damp heat steady state (9)		
Humidity	relative	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/m³)	+70/+15 60	none (3) (6)					
	proguro	low (kPa)	70	none					
Air	pressure	change	no						
	speed	(m/s)	20	none					
	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						
Vater	other sources	(m/s)	1	(3)					
	wetness		wet surfaces	(3)					
Padiation	solar	(W/m ²)	1120	(7)					
Radiation	heat	(W/m ²)	600	(7)					

(continued)

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

Environmental pa	arameter		Environmental Class 2.3	Environmental test specification T 2.3: Public transportation.				
Туре	Parameter	Detail parameter	Characteristic severity	Test severity	Duration	Reference	Method	
	sulphur	SO ₂ (mg/r	1,0 (2)	none (5)				
		H ₂ S (mg/r	n³) 0,5 (2)	none (5)				
Chemically active sub- stances		salts	sea and road salt mist	none (5)				
	chlorine	Cl ₂ (mg/r	n ³) no					
		HCI (mg/r	n ³) 0,5 (2)	none (5)				
	nitrogen	NO _x (mg/r	n³) 1,0 (2)	none (5)				
		NH ₃ (mg/r	n ³) 3,0 (2)	none (5)				
	hydrogen fluoride HF	(mg/r	n ³) 0,03 (2)	none (5)				
	ozone O ₃	(mg/r	n ³) 0,1 (2)	none (5)				
Mechanically	dust	sedimentation (mg/(m ²		none (8)				
active substances		suspension (mg/r	n³) no					
	sand	(mg/r	n ³) 100	none (8)				
Flore and	micro organisr		mould, fungus, etc.	none (5)				
Flora and Fauna	rodents, insec	ts	rodents, etc.	none (5)				

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

Environmental par	ameter			vironmental ass 2.3	Environmental test sp Public transportation.	ecification T 2.3:		
Туре	Parameter	Detail parameter		aracteristic verity	Test severity	Duration	Reference	Method
Vibration	sinusoidal	acceleration (13) (m	mm) 3,5 n/s ²) (Hz) 2-9	10 15	none			
	random	(dB/d	, ,	0,3 -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	acceleration (13) (m mass ((ms) 11 n/s²) 10 (kg) (kg)		6 16 400 100 (16) ≤ 100 >100 >500 <500	500 in each direction (17)	IEC 68-2-29	Eb: Bump
Fall	free fall toppling	height mass (attitude mass ((m) 1,2 (kg) <2 (kg) <2	0 20-100 >100	see table 8		IEC 68-2-32	Ed: Free fall Procedure 1
Acceleration	around steady state		an n/s²) 20	,	none			
Load Miscellaneous	static load rolling and	`	(Pa) 10 deg) +/- (s) 8	35	none (6) none			

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

Environmental parameter			Environmental Class 2.3 special			
Туре	Parameter	Detail parameter	Characteristic severity	Test severity		erence Method
Vibration	sinusoidal	displacement (13) (mm) acceleration (13) (m/s²) freq. range (Hz) axes of vibration	7,5 20 40 2-8 8- 200- 200 500	none		
ſ	random	ASD (14) (m²/s³) (dB/oct) frequency range (Hz) axes of vibration	3 1 10-200 200-2000	1,92 -3 5-20 20-500 3 axes (17)		68-2-36 Fdb: Random vibration, wide band
Shocks	shocks	shock spectrum duration (ms) acceleration (13) (m/s²) mass (kg) number of bumps directions of bumps	Type I Type II 11 6 300 1000	6 16 400 100 (16) ≤ 100 >100 >500 <500	500 in each direction (17)	68-2-29 Eb: Bump
Fall	free fall	height (m) mass (kg) attitude	1,5 1,2 0,5 <20 20- >100			68-2-32 Ed: Free fall cedure 1
	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		
	does not occur in t	his class.		NOTE (n = number of	note), see subclause 3.4.	ı

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

	Free fall test height (m)				
Mass	Class T 2.2	Class T 2.3	Special		
kg	(NOTE)	(NOTE)	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].

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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].

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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

Document history					
May 1994	First Edition				
February 1996	Converted into Adobe Acrobat Portable Document Format (PDF)				