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Foreword

This draft European Standard (EN) has been produced by ETSI Technical Committee Environmental Engineering (EE), and is now submitted for the combined Public Enquiry and Vote phase of the ETSI standards EN Approval Procedure.

The present document is part 1, sub-part 2 of a multi-part deliverable covering the classification of environmental conditions and environmental tests for telecommunications equipment, as identified below:

Part 1: "Classification of environmental conditions": (see note 1)

Sub-part 0: "Introduction";

Sub-part 1: "Storage";

Sub-part 2: "Transportation";

Sub-part 3: "Stationary use at weatherprotected locations";

Sub-part 4: "Stationary use at non-weatherprotected locations";

Sub-part 5: "Ground vehicle installations";

Sub-part 6: "Ship environments";

Sub-part 7: "Portable and non-stationary use";

Sub-part 8: "Stationary use at underground locations";

Part 2: "Specification of environmental tests" (see note 2).

NOTE 1: Specifies different standardized environmental classes covering climatic and biological conditions, chemically and mechanically active substances and mechanical conditions during storage, transportation and in use. Sub-part 1-0 forms a general overview of part 1.

NOTE 2: Specifies the recommended test severities and test methods for the different environmental classes.

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

1 Scope

The present document defines classes of environmental conditions and their severities to which telecommunication equipment may be exposed. The severities specified are those which will have a low probability of being exceeded; generally less than 1 %.

The present document applies to equipment being transported from one place to another after being made ready for dispatch from the manufacturer's works. The most commonly used methods of transportation have been taken into account, i.e. ground, water and air transport. Loading and unloading as well as temporary storage, have been included. Where the equipment is packaged the environmental conditions apply to the packaged equipment.

NOTE: Normal transportation time is considered to be 30 days or less. Where the total transportation time exceeds 30 days then additional storage or packaging precautions should be considered.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

2.1 Normative references

The following referenced documents are necessary for the application of the present document.

Not applicable.

2.2 Informative references

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] Void.

[i.2] IEC 60721-3-2:1997: "Classification of environmental conditions - Part 3: Classification of groups of environmental parameters and their severities - Section 2: Transportation".

[i.3] IEC 60721-2-1:2013: "Classification of environmental conditions. Part 2: Environmental conditions appearing in nature. Temperature and humidity".

[i.4] IEC 60068-2-27:2008: "Environmental testing. Part 2: Tests. Test Ea and guidance: Shock".

[i.5] ETSI EN 300 019-2-2 (2012): "Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 2-2: Specification of environmental tests; Transportation".

3 Definitions

For the purposes of the present document, the following terms and definitions apply:

absolute humidity: mass of water vapour in grammes which is associated with one cubic metre of dry air in an air/water vapour mixture

non-weatherprotected location: equipment, packaged or unpackaged, is not protected in any way from the environment

relative humidity: ratio of the partial pressure of the water vapour in moist air at a given temperature, to the partial pressure of the water vapour in saturated air at the same temperature

weatherprotected location: location at which the equipment is protected from direct weather influences

NOTE: Totally weatherprotected location: the equipment, packaged or unpackaged, is contained within an enclosure which affords some protection from the environment, ranging from a temperature controlled container to a waterproof cover placed over the equipment. Ventilation ranges from controlled air flow to the raising of part of a waterproof cover to allow for natural air flow.

4 Environmental classes

Three different environmental classes have been defined. Classes 2.1 and 2.2 are special classes relating to low temperature and less severe mechanical conditions. Class 2.3 is the normal class for transportation of equipment.

4.1 Class 2.1: Very careful transportation

Class 2.1 is a combination of classes 2K3/2B2/2C2/2S2/2M1 in IEC 60721-3-2 [i.2].

This class shall apply to transportation where special care has been taken e.g. with respect to low temperature and handling.

The conditions covered include transportation in unventilated enclosures and in non-weatherprotected conditions with restrictions on the general open-air climates, excluding cold and cold temperate climates. transportation by air only covers equipment carried in heated, pressurised holds.

NOTE: A survey of applications in different climates is shown at annex A. Climatic conditions for different areas are defined in IEC 60721-2-1 [i.3].

This class shall apply to transportation:

- where the equipment may be moved between cold, non-weatherprotected and warm, weatherprotected conditions. It may for short periods be exposed to direct solar radiation, precipitation and splashing water. The equipment may be placed on a wet floor and inside an enclosure which is subjected to sunshine and rain etc. Non-weatherprotected exposure does not include exposure to sea waves. The equipment may be placed close to heating elements;
- in areas and conditions where mould growth, attacks by animals, except termites, may occur;
- which is non-weatherprotected (but including transport by sea where the equipment is protected against sea waves) in areas with normal industrial activities excluding those where large quantities of chemical pollutants are emitted;
- which is non-weatherprotected, as well as weatherprotected and where sweeping of dusty floors is taken into account. Transportation in sand desert areas is not included;
- in aircraft, lorries and air-cushioned trucks and trailers in areas with well-developed road systems. Only mechanical loading and unloading is included. No risk of dropping is taken into account. The mechanical conditions given apply to equipment placed on the floor of the compartment in which it is transported.

4.2 Class 2.2: Careful transportation

Class 2.2 is a combination of classes 2K3/2B2/2C2/2S2/2M1 in IEC 60721-3-2 [i.2].

This class shall apply to transportation where special care has been taken e.g. with respect to low temperature and handling.

Class 2.2 covers the conditions of class 2.1. In addition class 2.2 includes transportation in all types of lorries and trailers in areas with well-developed road systems. It also includes transportation by ship and by train with specially designed, shock-reducing buffers. Manual loading and unloading of up to 20 kg is included.

4.3 Class 2.3: Public transportation

Class 2.3 is a combination of classes 2K4/2B2/2C2/2S2/2M2 in IEC 60721-3-2 [i.2].

This class shall apply to transportation, where no special precautions have been taken.

The conditions covered include transportation in unventilated enclosures and in non-weatherprotected conditions with restrictions on the general open-air climates, excluding cold climates. Transportation by air covers equipment carried in heated, pressurised holds.

NOTE: A survey of applications in different climates is shown in annex A. Climatic conditions for different areas are defined in IEC 60721-2-1 [i.3].

Class 2.3 covers the conditions of classes 2.1 and 2.2. In addition class 2.3 has a lower cold-temperature limit. Continuous or repeated solar radiation, precipitation and splashing of water may occur. Class 2.3 also includes all types of transport in areas without well-developed road systems. Rough handling is included.

5 Environmental conditions

5.1 Climatic conditions

Table 1: Climate parameters for environmental classes 2.1, 2.2 and 2.3

		Class		
	Environmental parameter	**Unit**	**2.1 and 2.2**	**2.3**
a)	Low temperature air	°C	-25	-40
b)	High temperature, air, in unventilated enclosures (see note 1)	°C	+70	+70
c)	High temperature, air, in ventilated enclosures or outdoor air (see note 2)	°C	+40	+40
d)	Change of temperature: air/air (see note 3)	°C	-25/+30	-40/+30
e)	Change of temperature: air/ water (see note 3)	°C	+40/+5	+40/+5
f)	Relative humidity, not combined with rapid temperature changes	% °C	95 + 40	95 +45
g)	Relative humidity, combined with rapid temperature changes air/air, at high relative humidity (see notes 3, 6)	% °C	95 -25/+30	95 -40/+30
h)	Absolute humidity, combined with rapid temperature changes: air/air, at high water content (see note 4)	g/m^3 °C	60 +70/+15	60 +70/+15
i)	Low air pressure	kPa	70	70
j)	Change of air pressure	kPa/min	no	no
k)	Movement of the surrounding medium, air	m/s	20	20
l)	Precipitation, rain	mm/min	6 (see note 7)	6
m)	Radiation, solar	W/m^2	1 120	1 120
n)	Radiation, heat	W/m^2	600	600
o)	Water from sources other than rain (see note 5)	m/s	1 (see note 7)	1
p)	Wetness	none	conditions of wet surfaces	

NOTE 1: The high temperature of the surface of a product may be influenced by both the surrounding air temperature, given here, and the solar radiation through a window or another opening.
NOTE 2: The high temperature of the surface of a product is influenced by the surrounding air temperature, given here, and the solar radiation defined below.
NOTE 3: A direct transfer of the product between the two given temperatures is presumed.
NOTE 4: The product is assumed to be subjected to a rapid decrease of temperature only (no rapid increase). The figures of water content apply to temperatures down to the dew-point; at lower temperatures the relative humidity is assumed to be approximately 100 %.
NOTE 5: The figure indicates the velocity of water and not the height of water accumulated.
NOTE 6: Occurrence of condensation.
NOTE 7: For short duration only.

5.2 Biological conditions

Table 2: Biological conditions for environmental classes 3.1 to 3.6

	Environmental parameter	**Unit**	**Classes 2.1 to 2.3**
a)	Flora	none	Presence of mould, fungus, etc.
b)	Fauna	none	Presence of rodents or other animals harmful to products but excluding termites

5.3 Chemically active substances

Table 3: Chemically active substances for environmental classes 2.1, 2.2 and 2.3

	Environmental parameter	Unit (see note 1)	Class 2.1, 2.2 and 2.3 (see note 2)
a)	Salt mist	none	sea and road salt mist
b)	Sulphur dioxide (SO_2)	mg/m^3 cm^3/m^3	1,0 0,37
c)	Hydrogen sulphide (H_2S)	mg/m^3 cm^3/m^3	0,5 0,36
d)	Nitrogen oxides (expressed as equivalent values of nitrogen dioxides) (NO_X)	mg/m^3 cm^3/m^3	1,0 0,52
e)	Ozone (O_3)	mg/m^3 cm^3/m^3	0,1 0,05
f)	Hydrogen chloride (HCl)	mg/m^3 cm^3/m^3	0,5 0,33
g)	Hydrogen fluoride (HF)	mg/m^3 cm^3/m^3	0,03 0,036
h)	Ammonia (NH_3)	mg/m^3 cm^3/m^3	3,0 4,2
NOTE 1: The values given in cm^3/m^3 have been calculated from the values given in mg/m^3 and refer to 20°C and 101,3 kPa. The table uses rounded values. NOTE 2: The figures given are limit or peak values, occurring over a period of time of not more than 30 minutes per day.			

5.4 Mechanically active substances

Table 4: Mechanically active substances for environmental classes 2.1, 2.2 and 2.3

	Environmental parameter	Unit	Class 2.1, 2.2 and 2.3
a)	Sand in air	g/m^3	0,1
b)	Dust sedimentation	$mg/(m^2h)$	3,0

5.5 Mechanical conditions

Table 5: Mechanical conditions for the environmental classes 2.1, 2.2 and 2.3 (see note 1)

	Environmental parameter	Unit	Class								
			2.1			2.2			2.3		
a)	Stationary vibration, sinusoidal. (note 5)										
	displacement amplitude (note 2)	mm	3,5			3,5			3,5		
	acceleration amplitude (note 2)	m/s^2		10	15		10	15		10	15
	frequency range (notes 3 and 4)	Hz	2 to 9	9 to 200	200 to 500	2 to 9	9 to 200	200 to 500	2 to 9	9 to 200	200 to 500
b)	Stationary vibration, random. (see note 5)										
	acceleration spectral density	m^2/s^3	1	0,3		1	0,3		1	0,3	
	frequency range (see note 3)	Hz	10 to 200	200 to 2 000		10 to 200	200 to 2 000		10 to 200	200 to 2 000	
c)	Non-stationary vibration, including shock (see note 6)										
	shock response spectrum type I, peak acceleration (â) (note 6)	m/s^2	no			100			100		
	duration	ms				11			11		
	shock response spectrum type II, peak acceleration (â) (note 6)	m/s^2							300		
	duration	ms	no			no			6		
d)	Free fall:		see note 8								
	mass < 20 kg	m	no			0,25			1,2		
	mass 20 kg to 100 kg	m	no			0,25			1,0		
	mass > 100 kg	m	no			0,1			0,25		
e)	Toppling										
	mass < 20 kg	none	no			Toppling around any of the edges					
	mass 20 kg to 100 kg	none	no			no			Toppling around any of the edges		
	mass > 100 kg	none	no			no			no		
f)	Rolling, pitching:										
	angle	degree	no			no			± 35 (see note 7)		
	period	s	no			no			8		
g)	Steady state acceleration	m/s^2	20			20			20		
h)	Static load	kPa	5			5			10		

NOTE 1: The mechanical conditions given apply to items placed on the floor of the transport compartments.
NOTE 2: Units are peak displacement amplitude (mm), peak acceleration amplitude (m/s^2) and frequency range (Hz).
NOTE 3: The frequency range may be limited to 200 Hz for transportation on parts of the vehicle with high internal damping.
NOTE 4: The cross-over frequency is a rounded value.
NOTE 5: Random vibration is often a more realistic vibration characteristic compared with sinusoidal. Test severities for random vibration are given in EN 300 019-2-2 [i.5] and these represent all types of vibration found in practice. Random vibration is therefore recommended to be used as an environmental parameter unless significant sinusoidal vibration is known to be present in a particular application.
NOTE 6: For definition of Model Shock Response Spectra (First Order Maximax Shock Response Spectra) see IEC 60721-3-2 [i.2], and Maximax see IEC 60068-2-27 [i.4].
NOTE 7: An angle of 35° only occurs temporarily, but angles up to 22,5° can be reached for long periods of time.
NOTE 8: For class 2.1 the IEC conditions of free fall and shock have very low probability of occurrence and therefore are not applicable.

Annex A (informative): Summary of applications of classes 2.1, 2.2 and 2.3 applied to the climatic conditions for different areas as defined in IEC 60721-2-1

Table A.1

IEC 60721-2-1 [i.3] Open-air climates (note 1)					
Application	**Polar**	**Cold**	**Temperate**	**Arid**	**Tropical**
Weather protected ventilated location					
temperature controlled	2.1, 2.2, 2.3	2.1, 2.2, 2.3	2.1, 2.2, 2.3	2.1, 2.2, 2.3	2.1, 2.2, 2.3
- heated	2.1, 2.2, 2.3	2.1, 2.2, 2.3	2.1, 2.2, 2.3	2.1, 2.2, 2.3	2.1, 2.2, 2.3
- not heated	----,----, ----	----,----, ----	2.1, 2.2, 2.3	2.1, 2.2, 2.3	2.1, 2.2, 2.3
not ventilated					
- heated	2.1, 2.2, 2.3	2.1, 2.2, 2.3	2.1, 2.2, 2.3	2.1, 2.2, 2.3	2.1, 2.2, 2.3
- not heated	---, ---, ---	---, ---, ---	2.1, 2.2, 2.3	2.1, 2.2, 2.3	2.1, 2.2, 2.3
Non-weather protected location (note 2)	---, ---, ---	---, ---, ---	2.1, 2.2, 2.3	2.1, 2.2, 2.3	2.1, 2.2, 2.3
NOTE 1: Absolute extreme values NOTE 2: Normal rain up to 6 mm/minute is included.					

Tropical: Warm damp and Warm damp Equable.

Arid: Mild Warm dry and extremely warm dry.

Temperate: Warm temperate and warm dry.

Cold: Cold temperate.

Polar: Extremely cold and cold.

Annex B (informative): Bibliography

ETSI TR 100 035 (2004): "Equipment Engineering (EE); Environmental engineering; Guidance and terminology".

History

Document history		
Edition 1	February 1992	Publication as ETS 300 019-1-2
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