Final draft ETSI EN 300 019-1-3 V2.1.1 (2002-11)

European Standard (Telecommunications series)

Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-3: Classification of environmental conditions; Stationary use at weatherprotected locations



Reference

REN/EE-01027-1-3

2

Keywords

environment, testing, equipment pratice

ETSI

650 Route des Lucioles F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C Association à but non lucratif enregistrée à la Sous-Préfecture de Grasse (06) N° 7803/88

Important notice

Individual copies of the present document can be downloaded from: <u>http://www.etsi.org</u>

The present document may be made available in more than one electronic version or in print. In any case of existing or perceived difference in contents between such versions, the reference version is the Portable Document Format (PDF). In case of dispute, the reference shall be the printing on ETSI printers of the PDF version kept on a specific network drive within ETSI Secretariat.

Users of the present document should be aware that the document may be subject to revision or change of status. Information on the current status of this and other ETSI documents is available at http://portal.etsi.org/tb/status/status.asp

> If you find errors in the present document, send your comment to: editor@etsi.org

Copyright Notification

No part may be reproduced except as authorized by written permission. The copyright and the foregoing restriction extend to reproduction in all media.

> © European Telecommunications Standards Institute 2002. All rights reserved.

DECTTM, **PLUGTESTS**TM and **UMTS**TM are Trade Marks of ETSI registered for the benefit of its Members. **TIPHON**TM and the **TIPHON logo** are Trade Marks currently being registered by ETSI for the benefit of its Members. **3GPP**TM is a Trade Mark of ETSI registered for the benefit of its Members and of the 3GPP Organizational Partners.

Contents

Intell	ectual Property Rights	4
Forev	word	4
1	Scope	5
2	References	5
3	Definitions	5
4	Environmental classes	6
4.1	Class 3.1: Temperature-controlled locations	6
4.2	Class 3.2: Partly temperature-controlled locations	7
4.3	Class 3.3: Not temperature-controlled locations	9
4.4	Class 3.4: Sites with heat-trap	10
4.5	Class 3.5: Sheltered locations	11
4.6	Class 3.6: Telecommunication Control Room locations	12
5	Environmental conditions	13
5.1	Climatic conditions	13
5.2	Biological conditions	14
5.3	Chemically active substances	15
5.4	Mechanically active substances	16
5.5	Mechanical conditions	17
5.6	Earthquake conditions	17
Anne	ex A (informative): Bibliography	20
Histo	۶۳y	21

3

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: "Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards", which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (http://webapp.etsi.org/IPR/home.asp).

4

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Environmental Engineering (EE), and is now submitted for the ETSI standards One-step Approval Procedure.

The present document is part 1, sub part 3 of a multi-part deliverable covering the classification of environmental conditions for telecommunications equipment, as identified below:

Part 1: "Classification of environmental conditions";

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".

Part 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.

Part 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 %.

5

The present document applies to equipment mounted for stationary use including periods of erection work, down time, maintenance and repair at weatherprotected locations defined in clause 5.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.
- [1] IEC 60721-3-3: "Classification of environmental conditions Part 3-3: Classification of groups of environmental parameters and their severities Stationary use at weatherprotected locations".
- [2] IEC 60068-2-27: "Environmental testing. Part 2: Tests. Test Ea and guidance: Shock".
- [3] IEC 60721-2-6: "Classification of environmental conditions. Part 2: Environmental conditions appearing in nature. Earthquake vibration and shock".
- [4] IEC 60068-3-3: "Environmental testing Part 3: Guidance. Seismic test methods for equipment".
- [5] ETSI EN 300 019-2-3: "Equipment Engineering (EE);Environmental conditions and environmental tests for telecommunications equipment; Part 2-3: Specification of environmental tests; Stationary use at weatherprotected locations".
- [6] IEC 60721-3-0: "Classification of environmental conditions Part 3: Classification of groups of environmental parameters and their severities Introduction".

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

air conditioning system: system that fully and automatically controls the climatic parameters air temperature and humidity by heating, cooling, humidifying and dehumidifying

climate-controlling system: system that controls or influences climate, acting at least on one climatic parameter in one direction

cooling system: system that controls or influences climate by decreasing the air temperature only

NOTE: This can decrease the absolute humidity.

forced ventilation system: system that controls or influences climate by introducing outdoor air into the room or expelling air out of the room

stationary use: The equipment is mounted firmly on the structure, or on mounting devices, or it is permanently placed at a certain site. It is not intended for portable use - but short periods of handling during erection works, down time, maintenance and repair at the location are included.

6

heating system: system that controls or influences climate by increasing the air temperature only

NOTE: This can decrease the relative humidity.

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

- totally weatherprotected location (enclosed location):
 - direct weather influences are totally excluded,
- partly weatherprotected location (sheltered location):
 - direct weather influences are not completely excluded.
- 4 Environmental classes

The classes shown in parentheses, e.g. (3C1), may be selected for special applications.

4.1 Class 3.1: Temperature-controlled locations

Class 3.1 is a combination of classes 3K3/3Z2/3Z4/3B1/3C2(3C1)/3S2/3M1 in IEC standard 60721-3-3 [1].

The climatogram is shown in figure 1 in clause 4.1.

Seismic environment: **zone 4** as defined in IEC 60721-2-6 [3]. Option zone 4 (modified Mercalli scale \geq 9): if earthquake conditions are specified by the customer, the conditions stated in clause 5.6 apply.

This class applies to a permanently temperature controlled enclosed location. Humidity is usually not controlled. The climatogram is shown in figure 1.

Heating, cooling, forced ventilation and humidification are used as necessary to maintain the required conditions - especially where there is a significant difference between the room environment and the external ambient. The climate-controlling systems could be periodically switched on or off but extremely high or low temperatures are prevented.

This class applies to locations:

- where installed equipment may be exposed to solar radiation and to heat radiation. It may also be exposed to movements of the surrounding air due to draughts in buildings. They are not subjected to condensed water, precipitation, water from sources other than rain or icing;
- without particular risks of biological attacks. This includes protective measures, e.g. special product design, or installations at locations of such construction that mould growth and attacks by animals, etc. are not probable;
- with normal levels of contaminants experienced in urban areas with industrial activities scattered over the whole area and/or with heavy traffic;
- without special precautions to minimize the presence of sand or dust, but which are not situated in proximity to sources of sand or dust;
- with insignificant vibration and shock.

The conditions of this class may be found in:

- normal living or working areas, e.g. living rooms, rooms for general use (theatres, restaurants);

7

- offices;
- shops;
- workshops for electronic assemblies and other electrotechnical products;
- telecommunication centres;
- storage rooms for valuable and sensitive products.



NOTE: Exceptional conditions may occur following the failure of the temperature controlling system. This is described as 3.1E in the tables but it should be noted that there is no separate class 3.1E.

Figure 1: Climatogram for Class 3.1: Temperature-controlled locations

4.2 Class 3.2: Partly temperature-controlled locations

This class is a combination of classes 3K5/3Z2/3Z4/3B2/3C2(3C1)/3S3/3M2 in IEC standard 60721-3-3 [1].

Seismic environment: **zone 4** as defined in IEC 60721-2-6 [3]. Option zone 4 (modified Mercalli scale \geq 9): if earthquake conditions are specified by the customer, the conditions stated in clause 5.6 apply.

This class applies to an enclosed location having neither temperature nor humidity control. The climatogram is shown in figure 2.

Heating may be used to raise low temperatures especially where there is a significant difference between the conditions of this class and the open-air climate. Building construction is designed to avoid extremely high temperatures.

This class applies to locations:

- where installed equipment may be exposed to solar radiation and heat radiation. They may also be exposed to movements of the surrounding air due to draughts in buildings, e.g. through open windows. They may be subjected to condensed water. They are not subjected to precipitation;

8

- where mould growth or attacks by animals, except termites, may occur;
- with normal levels of contaminants experienced in urban areas with industrial activities scattered over the whole area and/or with heavy traffic;
- in close proximity to sources of sand or dust;
- with vibration of low significance, e.g. for products fastened to light supporting structures subjected to negligible vibrations.

- entrances and staircases of buildings;
- garages;
- cellars;
- certain workshops;
- buildings in factories and industrial process plants;
- unattended equipment stations;
- certain telecommunication buildings;
- ordinary storage rooms for frost resistant products and farm buildings, etc.



Figure 2: Climatogram for class 3.2: Partly temperature-controlled locations

Class 3.3: Not temperature-controlled locations 4.3

This class is a combination of classes 3K6/3Z2/3Z4/3Z7/3B2/3C2(3C1)/3S3/3M2 in IEC 60721-3-3 [1].

Seismic environment: **zone 4** as defined in IEC 60721-2-6 [3], Option zone 4 (modified Mercalli scale \geq 9): if earthquake conditions are specified by the customer, the conditions stated in clause 5.6 apply.

9

This class applies to a weatherprotected location having neither temperature nor humidity control. The location may have openings directly to the open air, i.e. may be only partially-weather protected. The climatogram is shown in figure 3.

The climatic conditions of this class may be affected to a varying extent by the conditions of the open-air climate and the construction of the building.

This class applies to locations:

- where installed equipment may be exposed to solar radiation and temporarily to heat radiation. It may also be exposed to movements of the surrounding air due to draughts e.g. through doors, windows or other openings. It may be subjected to condensed water, to water from sources other than rain and to icing. It may temporarily be subjected to limited wind-driven precipitation, including snow;
- where mould growth, or attacks by animals, except termites, may occur;
- with normal levels of contaminants experienced in urban areas with industrial activities scattered over the whole area and/or with heavy traffic;
- in close proximity to sources of sand or dust;
- with vibration of low significance, e.g. for products fastened to light supporting structures subjected to negligible vibrations.

- some entrances to buildings; _
- some garages;
- some shacks:
- unattended buildings, etc.



Figure 3: Climatogram for class 3.3: Not temperature controlled locations

4.4 Class 3.4: Sites with heat-trap

This class is a combination of classes 3K7/3Z2/3Z4/3Z7/3Z8/3B2/3C2(3C3)/3S3/3M5(3M3) in IEC 60721-3-3 [1].

Seismic environment: **zone 4** as defined in IEC 60721-2-6 [3]. Option zone 4 (modified Mercalli scale \ge 9): if earthquake conditions are specified by the customer, the conditions stated in clause 5.6 apply.

This class applies to a weather protected location having neither temperature nor humidity control. The location may have openings directly to the open air, i.e. may be only partially weather protected. The effect of direct solar radiation and heat trap conditions exist. The climatogram is shown in figure 4.

This class applies to locations:

- where installed equipment may also be exposed temporarily to solar radiation and temporarily to heat radiation. They may be exposed to movements of the surrounding air due to draughts e.g. through doors, windows or other openings. They may be subjected to condensed water and to water from sources other than rain and to icing. They may be subjected to limited wind-driven precipitation including snow;
- where mould growth, or attacks by animals, except termites, may occur;
- with normal levels of contaminants experienced in urban areas with industrial activities scattered over the whole area and/or with heavy traffic;
- NOTE 1: At locations in the immediate neighbourhood of industrial sources with chemical emissions either special precautions must be taken or the special chemical class must be chosen.
- in close proximity to sources of sand or dust;
- where transmitted vibrations are experienced from machines or passing vehicles. Higher shock levels may be experienced e.g. from adjacent machines.

NOTE 2: These requirements do not cover intentional damage by vandals.

- some sheds;
- shacks;
- lofts;
- telephone booths;
- some buildings.



11

Figure 4: Climatogram for class 3.4: Sites with heat-trap

4.5 Class 3.5: Sheltered locations

This class is a combination of IEC classes 3K7 low/3Z2/3Z6/3Z7/3Z8/3B2/3C2(3C3)/3S3/3M5(3M3) in IEC 60721-3-3 [1].

Seismic environment: **zone 4** as defined in IEC 60721-2-6 [3]. Option zone 4 (modified Mercalli scale \geq 9): if earthquake conditions are specified by the customer, the conditions stated in clause 5.6 apply.

This class applies to a shelter where direct solar radiation and heat-trap conditions do not exist. The climatogram is shown in figure 5.

This class applies to locations:

- where installed equipment may be exposed to heat radiation from the roof or walls heated by the sun. They may be exposed to movement of the surrounding air through openings. They may be subjected to condensed water and to water from sources other than rain and to icing. They may be subjected to limited wind-driven precipitation including snow;
- where mould growth, or attacks by animals, except termites, may occur;
- with normal levels of contaminants experienced in urban areas with industrial activities scattered over the whole area and/or with heavy traffic;
- NOTE 1: At locations in the immediate neighbourhood of industrial sources with chemical emissions either special precautions must be taken or the special chemical class must be chosen.
- in close proximity to sources of sand or dust;
- where transmitted vibrations are experienced from machines or passing vehicles. Higher shock levels may be experienced, e.g. from adjacent machines.
- NOTE 2: For equipment intended for public use more severe mechanical conditions are expected. Special requirements should be used for such equipment. These requirements do not cover intentional damage by vandals.

- some sheds;
- open telephone booths;
- under single roofs, e.g. carports.



12

Figure 5: Climatogram for class 3.5: Sheltered locations

4.6 Class 3.6: Telecommunication Control Room locations

This class is a combination of classes 3K2/3Z2/3Z4/3B1/3C2(3C1)/3S2/3M1 in IEC standard 60721-3-3 [1].

Seismic environment: **zone 4** as defined in IEC 60721-2-6 [3]. Option zone 4 (modified Mercalli scale \ge 9): if earthquake conditions are specified by the customer, the conditions stated in clause 5.6 apply.

This class applies to a permanently temperature controlled enclosed location. Humidity is usually not controlled. The climatogram is shown in figure 6.

Heating, cooling, forced ventilation and humidification are used as necessary to maintain the required conditions - especially where there is a significant difference between the room environment and the external ambient. The climate-controlling systems could be periodically switched on or off but high or low temperatures are prevented.

This class applies to locations:

- where installed equipment may be exposed to solar radiation and to heat radiation. It may also be exposed to movements of the surrounding air due to draughts in buildings. They are not subjected to condensed water, precipitation, water from sources other than rain;
- without particular risks of biological attacks. This includes protective measures, e.g. special product design, or installations at locations of such construction that mould growth and attacks by animals, etc. are not probable;
- with normal levels of contaminants experienced in urban areas with industrial activities scattered over the whole area and/or with heavy traffic;
- without special precautions to minimize the presence of sand or dust, but which are not situated in proximity to sources of sand or dust;
- with insignificant vibration and shock.

The conditions of this class may be found in:

- dedicated control rooms within telecommunication centres intended to be used for small specialized peripheral equipment such as workstations, test equipment, storage media and printers.



Figure 6: Climatogram for Class 3.6: Telecommunication Control Rooms

5 Environmental conditions

5.1 Climatic conditions

Table 1: Climate parameters	for environmental	classes 3.1 to 3.6
-----------------------------	-------------------	--------------------

E	nvironmental parameter	Unit				C	lass		
			3.	1	3.2	3.3	3.4	3.5	3.6
			Normal	Exceptional (E)					
a)	Low air temperature	°C	+5	-5	-5	-25	-40	-40	+15
b)	High air temperature	°C	+40	+45	+45	+55	+70	+40 (see note 5)	+30
c)	Low relative humidity	%RH	5	5	5	10	10	10	10
d)	High relative humidity	%RH	85	90	95	100	100	100	75
e)	Low absolute humidity	g/m ³	1	•	1	0,5	0,1	0,1	2
f)	High absolute humidity	g/m ³	25		29	29	35	35	22
g)	Rate of change of temperature (see note 1)	°C/min	0,5		0,5	0,5	1,0	1,0	0,5
h)	Low air pressure	kPa	70	C	70	70	70	70	70
i)	High air pressure (see note 2)	kPa	10	6	106	106	106	106	106
j)	Solar radiation	W/m ²	70	0	700	1120	1120	-	700

13

E	nvironmental parameter	Unit				CI	ass		
			3.	.1	3.2	3.3	3.4	3.5	3.6
			Normal	Exceptional (E)					
k)	Heat radiation	W/m ²	60)0	600	600 see note 4	600 see note 4	600 see note 6	600
1)	Movement of the surrounding air (see note 3)	m/s	5	5	5	5	5	30	5
m)	Conditions of condensation	none	n	0	yes	yes	yes	yes	no
n)	Conditions of wind- driven rain, snow, hail, etc.	none	no		no	Yes see note 4	yes	yes	no
0)	Conditions of water from sources other than rain	none	n	0	no	dripping	dripping spraying	dripping spraying	no
p)	Conditions of icing	none	n	0	yes	yes	yes	yes	no
	Climatogram, figure		1		2	3	4	5	6
NOT NOT	E 1: Averaged over a period E 2: Conditions in mines ar	d of 5 minu e not consi	ites. idered.						

NOTE 3: A cooling system based on non-assisted convection may be disturbed by adverse movement of the surrounding air.

NOTE 4: Temporarily. NOTE 5: Direct solar radiation and heat-trap conditions do not exist.

NOTE 6: Secondary effect of solar radiation.

Biological conditions 5.2

Table 2: Biological conditions for environmental classes 3.1 to 3.6

E	Environmental U			Class		
	parameters		3.1 and 3.6	3.2 to 3.5 (see note)		
a)	Flora	none	-	presence of mould, fungus, etc		
b)	Fauna	none	-	presence of rodents and other animals harmful to products but excluding termites		
NOT	E: At non-heat encountered	ed locatio	ons (class 3.3)	only mould growth may be		

5.3 Chemically active substances

Table 3a: Chemically active substances for environmental classes 3.1 to 3.3and 3.6

Er	nvironmental	Unit	Class (see note 1)						
	parameter	(see note 2)	3.1, 3.2, 3	.3 and 3.6	special (3C1)				
			Mean	Max	Max				
			(see note 4)	(see note 5)	(see note 5)				
a)	Salt mist	none	sea salts	s, road salts, ex	cl. class 3.1 and 3.6				
				(see note 6)					
b)	Sulphur	mg/m ³	0,3	1,0	1,0				
	dioxide	cm ³ /m ³	0,11	0,37	0,37				
	(SO ₂)								
	Hudrogon	. 3	0.1	0.5	0.01				
C)	sulphide	mg/m ³	0,1	0,5	0,01				
	(HoS)	cm ^o /m ^o	0,071	0,00	0,0071				
	(120)								
d)	Chlorine	ma/m ³	0,1	0,3	0,1				
,	(Cl_2)	cm ³ /m ³	0,034	0,1	0,034				
	-								
e)	Hydrochloric	mg/m ³	0,1	0,5	0,1				
	acid	cm ³ /m ³	0,066	0,33	0,066				
f)	Hydrofluoric	ma/m ³	0,01	0,03	0,03				
	acid	cm ³ /m ³	0,012	0,036	0,036				
	(HF)								
a)	Ammonia	ma/m ³	1.0	3.0	0.3				
9)	(NH ₂)	cm ³ /m ³	1,0	4.2	0.42				
	(Citi /iti	.,.	- ;	-,				
h)	Ozone (O ₃)	mg/m ³	0,05	0,1	0,01				
	5	cm ³ /m ³	0,025	0,05	0,005				
i)	Nitrogen	mg/m ³	0,5	1,0	0,1				
	oxides (NO _X)	cm ³ /m ³	0,26	0,52	0,052				
	(see note 7)								
	Castable Ob fr								
	See table 3b for notes.								

Table 3b: Chemically active substances for environmental classes 3.4. and 3.5

	Environmental	Unit		Class (s	ee note 1)		
	parameter	(see note 2)	3.4 aı	3.4 and 3.5		al (3C3) note 3)	
			Mean (see note 4)	Max (see note 5)	Mean (see note 4)	Max (see note 5)	
a)	Salt mist	none		sea salts	, road salts		
b)	Sulphur dioxide (SO ₂)	mg/m ³ cm ³ /m ³	0,3 0,11	1,0 0,37	5,0 1,85	10 3,7	
c)	Hydrogen sulphide (H ₂ S)	mg/m ³ cm ³ /m ³	0,1 0,071	0,5 0,36	3,0 2,1	10 7,1	
d)	Chlorine (Cl ₂)	mg/m ³ cm ³ /m ³	0,1 0,034	0,3 0,1	0,3 0,1	1,0 0,34	
e)	Hydrochloric acid (HCl)	mg/m ³ cm ³ /m ³	0,1 0,066	0,5 0,33	1,0 0,66	5,0 3,3	

	Environmental	Unit	Class (see note 1)					
	parameter	(see note 2)	3.4 ar	nd 3.5	specia	al (3C3)		
					(see	note 3)		
			Mean	Max	Mean	Max		
			(see note 4)	(see note 5)	(see note 4)	(see note 5)		
f)	Hydrofluoric acid	mg/m ³	0,01	0,03	0,1	2,0		
	(HF)	cm ³ /m ³	0,012	0,036	0,12	2,4		
g)	Ammonia (NH ₃)	mg/m ³	1,0	3,0	10	35		
	5	cm ³ /m ³	1,4	4,2	14	49		
h)	Ozone (O ₃)	mg/m ³	0,05	0,1	0,1	0,3		
	-	cm ³ /m ³	0,025	0,05	0,05	0,15		
i)	Nitrogen oxides	ma/m ³	0,5	1,0	3,0	9,0		
	(NO _x)		0,26	0,52	1,56	4,68		
	(see note 7)	CIII°/III°						
NO	TE 1: Because of the	e low probability	of simultaneous	occurrence of the	nese gases at th	e levels of IEC		
	class 3C2, the	values of 3C1 a	re considered m	ore appropriate	to describe the I	ong term		
	environmental	conditions.			,	2		
NO	IE 2: The values giv	en in cm ³ /m ³ ha	ive been calcula	ted from the valu	ies given in mg/i	m ³ and refer to		
NO	20 °C. The tab	le uses rounded	values.					
NO	IE 3. It is not manda	itory to consider	the special clas	s 303 as a requi	rement for the c	ombined effect		
	or all paramete	ers stated. If app	licable, values o	r single paramet	ers may be sele	cted from this		
	special class II	t especially nam	ad		5.4 and 5.5 are			
NOTE 4. Mean values are the average values (leng term values) to be expected								
	TE 5. Maximum valu	es are limit or pa	alues (long-tern	ring over a perio	nd of not more th	an 30 minutes		
	ner dav	of are mine of pe		ining over a perio				
NOT	FE 6: Salt mist may I	be present at sh	eltered locations	of coastal area	s and offshore si	ites.		
NO	NOTE 7: Expressed as the equivalent values of nitrogen dioxide.							

5.4 Mechanically active substances

3.6
3

Env	ironmental parameters	Unit	Class		
			3.1 and 3.6	3.2.to 3.5 (see note)	
a)	Sand	mg/m ³	30	300	
b)	Dust (suspension)	mg/m ³	0,2	0,4	
c)	Dust (sedimentation)	mg/(m ² h)	1,5	15	
ΝΟΊ	FE: In locations where e.g. in unheated tel mechanically active	appropriate a lecommunica e substances	air filtering met ation centres th of class 3.1 a	hods are used, nen the pply.	

5.5 Mechanical conditions

Table 5: Mechanical conditions	for the environmental	classes 3.1	to 3.6
--------------------------------	-----------------------	-------------	--------

17

Environmental parameter		Unit	Class							
				3.1 a	nd 3.6	3.2 a	nd 3.3	3.4 a	and 3.5	
-)	01-1							(see	note 1)	
a)	Stat	onary vibration, (see note 2)								
	sinu	soidal. (see note 4)	Mm	0.3		15		3.0		
		(,	m/s ²	0,0	1	1,0	5	0,0	10	
	disp	lacement amplitude	Hz	2-9	9-200	2-9	9-200	2-9	9-200	
	acce	eleration amplitude								
	freq	uency range								
b)	Non	-stationary vibration, including			I					
	shoo	ck (see note 3)								
	chor	abade reasonable as a strum turs I			10		10			
	snock response spectrum type L,		m/s²	2	+0 22		+U 22			
	P 0 0.		ms	2			-			
	dura	tion	m/o2					2	250	
	shor	k response spectrum type II	ms						6	
	peal	c acceleration (â)								
		tion.								
	dura	tion								
NOT	E 1:	When the consequences of me	chanical	failure a	are minor	, or the p	robability c	f high		
		mechanical stresses is rare, the mechanical levels of IEC class 3M3 may be chosen.								
NOTE 2:		Units are peak displacement amplitude (mm), peak acceleration amplitude (m/s ²) and								
NOTE 2		frequency range (Hz).								
NOTE 5.		For delimition of wodel Shock Response Spectra (First Order Maximax Shock Response Spectra) see IEC 60721-3-3 [1], and Maximax see IEC 60068-2-27 [2]								
NOT	E 4:	Random vibration is often a mo	re realisti	c vibra	tion chara	acteristic	compared	with sir	iusoidal.	
		Test severities for random vibra	tion are g	given in	EN 300	019-2-3 [5] and the	se repre	esent all	
types of vibration found in practice. Random vibration is the			therefore	recommer	nded to	be used				
		as an environmental parameter unless significant sinusoidal vibration is known to be present								
		levels experienced in practice								

5.6 Earthquake conditions

The dynamic environment which an equipment experiences during an earthquake depends on several parameters including the intensity of the ground motion, the structural characteristics of the building, the elevation of the equipment in the building and the characteristics of the structures used to support and house the equipment itself.

The most common method for specifying seismic conditions taking into account all these parameters is through the definition of a Response Spectrum (RS).

A RS is the graphical representation of the maximum response (i.e. acceleration) of an array of single degree-of-freedom oscillators as a function of oscillator frequency, in response to an applied transient base motion.

In other words the RS may be used to describe the motion that equipment is expected to experience at its mounting during a postulated seismic event.

To define an RS it is necessary to define the base motion and the characteristics of the array of the single degree-of-freedom oscillators, including their damping ratio.

The high frequency asymptotic value of the acceleration of the response spectrum is normally called *Zero Period Acceleration* (ZPA) and represents the largest peak value of acceleration of the base motion.

In the absence of a detailed knowledge of the possible seismic motion, the ZPA value can be obtained by the following formula (see IEC 60068-3-3 [4]):

$$ZPA = a_f = a_g \times K \times D \times G$$

where:

 a_f floor acceleration;

- a_g ground acceleration that depends on the intensity of the earthquake;
- *K superelevation factor* that takes into account the amplification of the ground acceleration resulting from the vibrational behaviour of buildings and structures;
- *D direction factor* that takes into consideration possible intensity differences of the seismic motion between the horizontal and vertical axes;
- *G* geometric factor; normally specified among testing parameters when single axis excitation is used for testing to take into account the interaction, due to installation location, along the different axes of the equipment of simultaneous multi-directional input vibrations.

The parameter severities that shall be used for classes 3.1 to 3.5 are shown in table 6.

The severities have been chosen from those stated in IEC 60068-3-3 [4].

Parameter	Description	Severity
earthquake intensity	strong to very strong earthquakes	$a_g = 5 \text{ m/s}^2$
	(Richter scale magnitude > 7,	
	Modified Mercalli intensity scale > IX)	
superelevation factor	installations on stiff structures connected	K=2
	rigidly to buildings	
direction factor	no intensity differences among axes	<i>D_{xyz}</i> = 1
geometric factor	single-axis excitation with interaction with	G = 1,5
	the other axes	

Table 6: Earthquake parameters for classes 3.1 to 3.5

The corresponding Response Spectrum, assuming a damping ratio of the single degree-of-freedom oscillators N = 2 %, is described in figure 7 and table 7.



19

Figure 7: Earthquake Response Spectrum

Co-ordinate point	Frequency [Hz]	Values for upper floor acceleration [m/s ²]
1	0,3	2
2	0,6	20
3	2,0	50
4	5,0	50
5	15,0	15
6	50,0	15

Table 7: Acceleration co-ordinates for the Response Spectrum

Annex A (informative): Bibliography

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

20

History

Document history					
Edition 1	February 1992	Publication as ETS 300 019-1-3			
Amendment 1	June 1997	Amendment 1 to 1 st Edition of ETS 300 019-1-3			
V2.1.0	December 2001	One-step Approval Procedure (Withdrawn)	OAP 20020419: 2001-12-19 to 2002-04-19		
V2.1.1	November 2002	One-step Approval Procedure	OAP 20030321: 2002-11-20 to 2003-03-21		