Draft ETSI EN 300 019-2-4 V2.3.7 (2015-09)

Environmental Engineering (EE);
Environmental conditions and environmental tests for telecommunications equipment;
Part 2-4: Specification of environmental tests;
Stationary use at non-weatherprotected locations

Reference
REN/EE-0161

Keywords
environment, testing

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Sous-Préfecture de Grasse (06) N° 7803/88

Contents

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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 2, sub-part 4 of a multi-part deliverable. Full details of the entire series can be found in part 2, sub-part 0 [i.1].

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

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

1 Scope

The present document specifies test methods and severities for verification of the required resistibility of equipment according to the relevant environmental class.

The tests defined in the present document apply to stationary use of equipment at non-weatherprotected locations covering the environmental conditions stated in ETSI EN 300 019-1-4 [1].

2 References

2.1 Normative 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.

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

[1] ETSI EN 300 019-1-4: "Environmental Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment; Part 1-4: Classification of environmental conditions; Stationary use at non-weatherprotected locations".

[2] IEC 60068-2-1 (03-2007): "Environmental testing - Part 2-1: Tests - Test A: Cold".

[3] Void.

[4] Void.

[5] ANSI T1.0600329 (2008): "Network Equipment - Earthquake Resistance Standard".

[6] Void.

[7] IEC 60068-2-2 (07-2007): "Environmental testing - Part 2-2: Tests - Test B: Dry heat".

[8] IEC 60068-2-14 (01-2009): "Environmental testing - Part 2-14: Tests - Test N: Change of temperature".

[9] IEC 60068-2-30 (08-2005): "Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)".

[10] IEC 60068-2-64 (04-2008): "Environmental testing - Part 2-64: Tests - Test Fh: Vibration, broadband random and guidance".

[11] IEC 60068-2-27 (02-2008): "Environmental testing - Part 2-27: Tests - Test Ea and guidance: Shock".

[12] IEC 60068-2-6 (12-2007): "Environmental testing - Part 2-6: Tests - Test Fc: Vibration (sinusoidal)".

[13] IEC 60068-2-57 (11-1999): "Environmental testing - Part 2-57: Tests - Test Ff: Vibration - Time history method".

[14] Void.

[15] IEC 60068-2-18 (10-2000): "Environmental testing - Part 2-18: Tests - Test R and guidance: Water".

[16] IEC 60068-2-78 (08-2001): "Environmental testing - Part 2-78: Tests - Test Cab: Damp heat, steady state".

[17] IEC 60068-2-11 (01-1981): "Basic environmental testing procedures - Part 2-11: Tests - Test Ka: Salt mist".

2.2 Informative 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.

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

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

[i.2] IEC 60068-2-68 (8-1994): "Environmental testing - Part 2: Tests - Test L: Dust and sand".

[i.3] IEC 60068-2 (all parts): "Environmental testing".

3 Environmental test specifications

The detailed descriptions of the environmental conditions are given in clauses 4 and 5 of ETSI EN 300 019-1-4 [1].

ETSI EN 300 019-2-0 [i.1] forms a general overview of part 2 of this multi-part deliverable.

The equipment under test is assumed to be in its operational state throughout the test conditions described in the present document unless otherwise stated. The required performance before, during and after the test need to be specified in the product specification. Input and load conditions of the equipment shall be chosen to obtain full utilization of the equipment under test. The heat dissipation shall be maximized, except for the steady state, low temperature test, where it shall be minimized.

3.1 Specification T 4.1: Non-weatherprotected locations, climatic tests

The specification in table 1 shall apply to Non-weatherprotected locations described in ETSI EN 300 019-1-4 [1].

Table 1: Test specification T 4.1: Stationary use at non-weatherprotected locations - climatic tests

Environmental parameter			Environmental Class 4.1	Environmental test specification T 4.1: Stationary use, Non-weatherprotected locations				
Type	**Parameter**	**Detail parameter**	**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Notes**
Air temperature	Low	(°C)	-33	-33 or -45	16 h	IEC 60068-2-1 [2]	Ab/Ad/Ae: Cold	1
	High	(°C)	+40	+40 or +55	16 h	IEC 60068-2-2 [7]	Bb/Bd/Be: Dry heat	2
	Change	(°C) (°C/min)	 0,5	-10/+40 0,5	2 cycles t_1 = 3 h	IEC 60068-2-14 [8]	Nb: Change of temperature	3
Humidity	Relative	Low (%)	15	none				8
		high (%) (°C)	100	93 +30	10 d	IEC 60068-2-78 [16]	Cab: Damp heat steady state	4
		condensation (%) (°C)	yes	 90-100 +30	2 cycles	IEC 60068-2-30 [9]	Db: Damp heat, cyclic Variant 1	5
	Absolute	Low (g/m^3)	0,26	none				
		high (g/m^3)	25					6
Air	Pressure	Low (kPa) high (kPa)	70 106	none none				7 7
	Speed	(m/s)	50	none				8
Water	Rain	Intensity	6 mm/min	0,01 m^3/min 90 kPa	3 min/m^2 or 15 min	IEC 60068-2-18 [15]	Rb: Impacting water Method 1	9
		low temperature (°C)	+5	none				
	Other sources		splashing water					10
	Icing & frosting		yes	none				8
Radiation	Solar	(W/m^2)	1 120					11
	Heat	(W/m^2)	negligible					

Environmental parameter			Environmental Class 4.1	Environmental test specification T 4.1: Stationary use, Non-weatherprotected locations				
Type	**Parameter**	**Detail parameter**	**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Notes**
Chemically active substances	Sulphur	SO_2 (mg/m^3)	0,3/1,0	none				12
		H_2S (mg/m^3)	0,1/0,5	none				12
	Chlorine	salt mist	sea and road salt	35 °C, 5 %NaCl solution	10d	IEC 60068-2-11 [17]	Ka: Salt mist	12
		Cl (mg/m^3)	0,1/0,3	none				12
		HCl (mg/m^3)	0,1/0,5	none				12
	Nitrogen	NO_x (mg/m^3)	0,5/1,0	none				12
		NH_3 (mg/m^3)	1,0/3,0	none				12
	Hydrogen fluoride HF	(mg/m^3)	0,01/0,03	none				12
	Ozone O_3	(mg/m^3)	0,05/0,1	none				12
Mechanically active substances	Dust	sedimentation ($mg/(m^2h)$)	20					13
		suspension (mg/m^3)	5					13
	Sand	(mg/m^3)	300					13
Flora and fauna	Micro organisms		mould, fungus, etc.	none				14
	Rodents, insects		rodents, etc.	none				14

Environmental parameter			Environmental Class 4.1	Environmental test specification T 4.1: Stationary use, Non-weatherprotected locations				
Type	**Parameter**	**Detail parameter**	**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Notes**
NOTE 1: (Air temperature, low). The equipment under test shall remain operational throughout this test (without any damage or deterioration of performance, according to product specification). Two test temperatures are given, the lower test temperature applies if the equipment is protected against solar irradiation. The higher test temperature includes heat irradiation emitted from the equipment. If a cold start up test is performed, the characteristic severity should be used as a cold start up temperature, but it may be modified (within the class characteristic severity range) by the product specification. In this case, the cold start up test shall commence once low temperature stability is achieved.								
NOTE 2: (Air temperature, high). The equipment under test shall remain operational throughout this test (without any damage or deterioration of performance, according to product specification). Two test temperatures are given, the lower test temperature applies if the equipment is protected against solar radiation or the equipment is ventilated (natural or forced). The higher test temperature includes the heating effects of solar radiation. If a high temperature start up test is performed, the characteristic severity should be used as a high start up temperature, but it may be modified (within the class characteristic severity range) by the product specification. In this case, the high temperature start up test shall commence once high temperature stability is achieved.								
NOTE 3: (Air temperature, change). This test is intended for specimen with large thermal time constant. For equipment where the rapid change of temperature of the surface has a significant effect on internal components, the values of the change of temperature up to 5 °C/min can be applied (e.g. heat sinks).								
NOTE 4: (Humidity, relative high). IEC 60068-2-78 [16] Test Cab shall be used with test severities not higher than climatogram limits for this class.								
NOTE 5: (Condensation). IEC 60068-2-30 [9] Test Db shall be used with test severities not higher than climatogram limits for this class.								
NOTE 6: (Humidity, absolute, high). This effect is considered to be partly included in the damp heat test IEC 60068-2-78 [16] Test Cab.								
NOTE 7: (Air pressure, low and high). No test shall be used for normal applications, because the effect of air pressure is evaluated at the component level.								
NOTE 8: There is no IEC 60068-2 [i.3] series test for this parameter.								
NOTE 9: (Water, rain). IEC 60068-2-18 [15] Test Rb method 1 has been chosen even if it does not imitate normal rain. It is a simple hand held shower test, easy to perform and can demonstrate that the specimen design is adequately toleranced to survive this condition. The cooling effect of the low temperature of the rain is included in IEC 60068-2-14 [8] Test Nb. Two durations are given, whichever is the greatest should be chosen.								
NOTE 10: (Water, other sources). No test is recommended because the effect is already included in IEC 60068-2-18 [15] Test Rb.								
NOTE 11: (Radiation). The heating effect of solar radiation is included in the higher test temperature in IEC 60068-2-2 [7] Test Bb as described in note 2. Photochemical tests can be made separately for component and materials.								
NOTE 12: (Chemically active substances). Characteristic severities are mean/maximum values. The characteristic severities should be considered when designing the equipment and when choosing components and materials. No test is recommended in the present document, except for the mechanical enclosures, where the salt mist test is required to be performed. The execution of this test can be performed on the entire enclosure or subparts of the enclosure if the results are not affected.								
NOTE 13: (Mechanically active substances). The characteristic severities are much lower than the lowest test severity in IEC 60068-2-68 [i.2] Test L and therefore no test is recommended. This condition should be considered when designing the equipment and choosing components and materials.								
NOTE 14: (Flora and fauna). The characteristic severities should be considered when choosing components and materials.								

3.2 Specification T 4.1E: Non-weatherprotected locations - extended, climatic tests

The specification in table 2 shall apply to Non-weatherprotected locations - extended as described in ETSI EN 300 019-1-4 [1].

Table 2: Test specification T 4.1E: Stationary use at non-weatherprotected locations, extended - climatic tests

Environmental parameter			Environmental Class 4.1E	Environmental test specification T 4.1E: Stationary use Non-weatherprotected locations - extended				
Type	**Parameter**	**Detail parameter**	**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Notes**
Air temperature	Low	(°C)	-45	-45 or -55	16 h	IEC 60068-2-1 [2]	Ab/Ad/Ae: Cold	1
	High	(°C)	+45	+45 or +60	16 h	IEC 60068-2-2 [7]	Bb/Bd/Be: Dry heat	2
	Change	(°C) (°C/min)	0,5	-10/+45 0,5	2 cycles t1 = 3 h	IEC 60068-2-14 [8]	Nb: Change of temperature	3
Humidity	Relative	low (%)	8	none				8
		high (%) (°C)	100	93 +30	10 d	IEC 60068-2-78 [16]	Cab: Damp heat steady state	4
		condensation (%) (°C)	yes	90-100 +30	2 cycles	IEC 60068-2-30 [9]	Db: Damp heat cyclic Variant 1	5
	Absolute	low (g/m^3)	0,03	none				6
		high (g/m^3)	30					
Air	Pressure	low (kPa)	70	none				7
		high (kPa)	106	none				7
	Speed	(m/s)	50	none				8
Water	Rain	intensity	15 mm/min	0,01 m^3/min 90 kPa	6 min/m^2 or 30 min	IEC 60068-2-18 [15]	Rb: Impacting water, method 1	9
		low temperature (°C)	+5	none				
	Other sources		splashing water					10
	Icing & frosting		yes	none				8
Radiation	Solar	(W/m^2)	1 120					11
	Heat	(W/m^2)	negligible					

Environmental parameter			Environmental Class 4.1E	Environmental test specification T 4.1E: Stationary use Non-weatherprotected locations - extended				
Type	**Parameter**	**Detail parameter**	**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Notes**
Chemically active substances	Sulphur	SO_2 (mg/m^3)	0,3/1,0	none				12
		H_2S (mg/m^3)	0,1/0,5	none				12
	Chlorine	salt mist	sea and road salt	35 °C, 5 % NaCl solution	10d	IEC 60068-2-11 [17]	Ka: Salt mist	12
		Cl (mg/m^3)	0,1/0,3	none				12
		HCl (mg/m^3)	0,1/0,5	none				12
	Nitrogen	NO_x (mg/m^3)	0,5/1,0	none				12
		NH_3 (mg/m^3)	1,0/3,0	none				12
	Hydrogen fluoride HF	(mg/m^3)	0,01/0,03	none				12
	Ozone O_3	(mg/m^3)	0,05/0,1	none				12
Mechanically active substances	Dust	sedimentation ($mg/(m^2h)$)	20					13
		suspension (mg/m^3)	5					13
	Sand	(mg/m^3)	300					13
Flora and fauna	Micro organisms		mould, fungus, etc.	none				14
	Rodents, insects		rodents, etc.	none				14

Environmental parameter			Environmental Class 4.1E	Environmental test specification T 4.1E: Stationary use Non-weatherprotected locations - extended				
Type	**Parameter**	**Detail parameter**	**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Notes**

NOTE 1: (Air temperature, low). The equipment under test shall remain operational throughout this test (without any damage or deterioration of performance, according to product specification). Two test temperatures are given, the lower test temperature applies if the equipment is protected against solar irradiation. The higher test temperature includes heat irradiation emitted from the equipment. If a cold start up test is performed, the characteristic severity should be used as a cold start up temperature, but it may be modified (within the class characteristic severity range) by the product specification. In this case, the cold start up test shall commence once low temperature stability is achieved.

NOTE 2: (Air temperature, high). The equipment under test shall remain operational throughout this test (without any damage or deterioration of performance, according to product specification). Two test temperatures are given, the lower test temperature applies if the equipment is protected against solar radiation or the equipment is ventilated (natural or forced). The higher test temperature includes the heating effects of solar radiation. If a high temperature start up test is performed, the characteristic severity should be used as a high start up temperature, but it may be modified (within the class characteristic severity range) by the product specification. In this case, the high temperature start up test shall commence once high temperature stability is achieved.

NOTE 3: (Air temperature, change). This test is intended for specimen with large thermal time constant. For equipment where the rapid change of temperature of the surface has a significant effect on internal components, the values of the change of temperature up to 5 °C/min can be applied (e.g. heat sinks).

NOTE 4: (Humidity, relative high). IEC 60068-2-78 [16] Test Cab is shall be used with test severities not higher than climatogram limits for this class.

NOTE 5: (Condensation). IEC 60068-2-30 [9] Test Db shall be used with test severities not higher than climatogram limits for this class.

NOTE 6: (Humidity, absolute, high). This effect is considered to be partly included in the damp heat test IEC 60068-2-78 [16] Test Cab.

NOTE 7: (Air pressure, low and high). No test shall be used for normal applications, because the effect of air pressure is evaluated at the component level.

NOTE 8: There is no IEC 60068-2 [i.3] series test for this parameter.

NOTE 9: (Water, rain). IEC 60068-2-18 [15] Test Rb method 1 has been chosen even if it does not imitate normal rain. It is a simple hand held shower test, easy to perform and can demonstrate that the specimen design is adequately toleranced to survive this condition. The cooling effect of the low temperature of the rain is included in IEC 60068-2-14 [8] Test Nb. Two durations are given, whichever is the greatest should be chosen.

NOTE 10: (Water, other sources). No test is recommended because the effect is already included in IEC 60068-2-18 [15] Test Rb.

NOTE 11: (Radiation). The heating effect of solar radiation is included in the higher test temperature in IEC 60068-2-2 [7] Test Bb as described in note 2. Photochemical tests can be made separately for component and materials.

NOTE 12: (Chemically active substances). Characteristic severities are mean/maximum values. The characteristic severities should be considered when designing the equipment and when choosing components and materials. No test is recommended in the present document, except for the mechanical enclosures, where the salt mist test is required to be performed. The execution of this test can be performed on the entire enclosure or subparts of the enclosure if the results are not affected.

NOTE 13: (Mechanically active substances). The characteristic severities are much lower than the lowest test severity in IEC 60068-2-68 [i.2] Test L and therefore no test is recommended. This condition should be considered when designing the equipment and choosing components and materials.

NOTE 14: (Flora and fauna). The characteristic severities should be considered when choosing components and materials.

3.3 Specification T 4.2L: Non-weatherprotected locations - extremely cold, climatic tests

The specification in table 3 shall apply to Non-weatherprotected locations - extremely cold as described in ETSI EN 300 019-1-4 [1] (see table 3).

Table 3: Test specification T 4.2L: Stationary use at non-weatherprotected locations, extremely cold - climatic tests

Environmental parameter			Environmental Class 4.2L	Environmental test specification T 4.2L: Stationary use Non-weatherprotected locations - extremely cold				
Type	**Parameter**	**Detail parameter**	**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Notes**
Air temperature	Low	(°C)	-65	-65 or -75	16 h	IEC 60068-2-1 [2]	Ab/Ad/Ae: Cold	1
	High	(°C)	+35	+35 or +50	16 h	IEC 60068-2-2 [7]	Bb/Bd/Be: Dry heat	2
	Change	(°C) (°C/min)	 0,5	-10/+45 0,5	2 cycles t1 = 3 h	IEC 60068-2-14 [8]	Nb: Change of temperature	3
Humidity	Relative	low (%)	20	none				8
		high (%) (°C)	100	93 +30	10 d	IEC 60068-2-78 [16]	Cab: Damp heat steady state	4
		condensation (%) (°C)	yes	 90 -100 +30	2 cycles	IEC 60068-2-30 [9]	Db: Damp heat cyclic Variant 1	5
	Absolute	low (g/m^3)	0,003	none				6
		high (g/m^3)	22					
Air	Pressure	low (kPa)	70	none				7
		high (kPa)	106	none				7
	Speed	(m/s)	50	none				8
Water	Rain	intensity	15 mm/min	0,01 m^3/min 90 kPa	6 min/m^2 or 30 min	IEC 60068-2-18 [15]	Rb: Impacting water, method 1	9
		low temperature (°C)	+5	none				
	Other sources		splashing water					10
	Icing & frosting		yes	none				8

Environmental parameter			Environmental Class 4.2L	Environmental test specification T 4.2L: Stationary use Non-weatherprotected locations - extremely cold				
Type	**Parameter**	**Detail parameter**	**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Notes**
Radiation	Solar	(W/m^2)	1 120					11
	Heat	(W/m^2)	negligible					
Chemically active substances	Sulphur	SO_2 (mg/m^3)	0,3/1,0	none				12
		H_2S (mg/m^3)	0,1/0,5	none				12
	Chlorine	salt mist	sea and road salt	35 °C, 5 % Nacl solution	10d	IEC 60068-2-11 [17]	Ka: Salt mist	12
		Cl (mg/m^3)	0,1/0,3	none				12
		HCl (mg/m^3)	0,1/0,5	none				12
	Nitrogen	NO_x (mg/m^3)	0,5/1,0	none				12
		NH_3 (mg/m^3)	1,0/3,0	none				12
	Hydrogen fluoride HF	(mg/m^3)	0,01/0,03	none				12
	Ozone O_3	(mg/m^3)	0,05/0,1	none				12
Mechanically active substances	Dust	sedimentation ($mg/(m^2h)$)	20					13
		suspension (mg/m^3)	5					13
	Sand	(mg/m^3)	300					13
Flora and fauna	Micro organisms		mould, fungus, etc.	none				14
	Rodents, insects		rodents, etc.	none				14

Environmental parameter			Environmental Class 4.2L	Environmental test specification T 4.2L: Stationary use Non-weatherprotected locations - extremely cold				
Type	**Parameter**	**Detail parameter**	**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Notes**
NOTE 1: (Air temperature, low). The equipment under test shall remain operational throughout this test (without any damage or deterioration of performance, according to product specification). Two test temperatures are given, the lower test temperature applies if the equipment is protected against solar irradiation. The higher test temperature includes heat irradiation emitted from the equipment. If a cold start up test is performed, the characteristic severity should be used as a cold start up temperature, but it may be modified (within the class characteristic severity range) by the product specification. In this case, the cold start up test shall commence once low temperature stability is achieved.								
NOTE 2: (Air temperature, high). The equipment under test shall remain operational throughout this test (without any damage or deterioration of performance, according to product specification). Two test temperatures are given, the lower test temperature applies if the equipment is protected against solar radiation or the equipment is ventilated (natural or forced). The higher test temperature includes the heating effects of solar radiation. If a high temperature start up test is performed, the characteristic severity should be used as a high start up temperature, but it may be modified (within the class characteristic severity range) by the product specification. In this case, the high temperature start up test shall commence once high temperature stability is achieved.								
NOTE 3: (Air temperature, change). This test is intended for specimen with large thermal time constant. For equipment where the rapid change of temperature of the surface has a significant effect on internal components, the values of the change of temperature up to 5 °C/min can be applied (e.g. heat sinks).								
NOTE 4: (Humidity, relative high). IEC 60068-2-78 [16] Test Cab shall be used with test severities not higher than climatogram limits for this class.								
NOTE 5: (Condensation). IEC 60068-2-30 [9] Test Db shall be used with test severities not higher than climatogram limits for this class.								
NOTE 6: (Humidity, absolute, high). This effect is considered to be partly included in the damp heat test IEC 60068-2-78 [16] Test Cab.								
NOTE 7: (Air pressure, low and high). No test is recommended for normal applications, because the effect of air pressure is evaluated at the component level.								
NOTE 8: There is no IEC 60068-2 [i.3] series test for this parameter.								
NOTE 9: (Water, rain). IEC 60068-2-18 [15] Test Rb method 1 has been chosen even if it does not imitate normal rain. It is a simple hand held shower test, easy to perform and can demonstrate that the specimen design is adequately toleranced to survive this condition. The cooling effect of the low temperature of the rain is included in IEC 60068-2-14 [8] Test Nb. Two durations are given, whichever is the greatest should be chosen.								
NOTE 10: (Water, other sources). No test is recommended because the effect is already included in IEC 60068-2-18 [15] Test Rb.								
NOTE 11: (Radiation). The heating effect of solar radiation is included in the higher test temperature in IEC 60068-2-2 [7] Test Bb as described in note 2. Photochemical tests can be made separately for component and materials.								
NOTE 12: (Chemically active substances). Characteristic severities are mean/maximum values. The characteristic severities should be considered when designing the equipment and when choosing components and materials. No test is recommended in the present document, except for the mechanical enclosures, where the salt mist test is required to be performed. The execution of this test can be performed on the entire enclosure or subparts of the enclosure if the results are not affected.								
NOTE 13: (Mechanically active substances). The characteristic severities are much lower than the lowest test severity in IEC 60068-2-68 [i.2] Test L and therefore no test is recommended. This condition should be considered when designing the equipment and choosing components and materials.								
NOTE 14: (Flora and fauna). The characteristic severities should be considered when choosing components and materials.								

3.4 Specification T 4.2H: Non-weatherprotected locations - extremely warm dry, climatic tests

The specification in table 4 shall apply to Non-weatherprotected locations - extremely warm dry described in ETSI EN 300 019-1-4 [1].

Table 4: Test specification T 4.2H: Stationary use at non-weatherprotected locations, extremely warm dry - climatic tests

Environmental parameter			Environmental Class 4.2H	Environmental test specification T 4.2H: Stationary use Non-weatherprotected locations - extremely warm dry				
Type	**Parameter**	**Detail parameter**	**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Notes**
Air temperature	Low	(°C)	-20	-20 or -30	16 h	IEC 60068-2-1 [2]	Ab/Ad: Cold	1
	High	(°C)	+55	+55 or +70	16 h	IEC 60068-2-2 [7]	Bb/Bd: Dry heat	2
	Change	(°C) (°C/min)	0,5	-10/+45 0,5	2 cycles t1 = 3 h	IEC 60068-2-14 [8]	Nb: Change of temperature	3
Humidity	Relative	low (%)	4	none				8
		high (%) (°C)	100	93 +40	10 d	IEC 60068-2-78 [16]	Cab: Damp heat steady state	4
		condensation (%) (°C)	yes	90-100 +30	2 cycles	IEC 60068-2-30 [9]	Db: Damp heat cyclic Variant 1	5
	Absolute	low (g/m^3)	0,9	none				6
		high (g/m^3)	36					
Air	Pressure	low (kPa)	70	none				7
		high (kPa)	106	none				7
	Speed	(m/s)	50	none				8
Water	Rain	intensity	15 mm/min	0,01 m^3/min 90 kPa	6 min/m^2 or 30 min	IEC 60068-2-18 [15]	Rb: Impacting water, method 1	9
		low temperature (°C)	+5	none				
	Other sources		splashing water					10
	Icing & frosting		yes	none				8
Radiation	Solar	(W/m^2)	1 120					11
	Heat	(W/m^2)	negligible					
Chemically active substances	Sulphur	SO_2 (mg/m^3)	0,3/1,0	none				12
		H_2S (mg/m^3)	0,1/0,5	none				12
	Chlorine	salt mist	sea and road salt	35 ºC, 5 % Nacl solution	10d	IEC 60068-2-11 [17]	Ka:Salt mist	12
		Cl (mg/m^3)	0,1/0,3	none				12

Environmental parameter			Environmental Class 4.2H	Environmental test specification T 4.2H: Stationary use Non-weatherprotected locations - extremely warm dry				
Type	**Parameter**	**Detail parameter**	**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Notes**
		HCl (mg/m^3)	0,1/0,5	none				12
	Nitrogen	NO_x (mg/m^3)	0,5/1,0	none				12
		NH_3 (mg/m^3)	1,0/3,0	none				12
	Hydrogen fluoride HF	(mg/m^3)	0,01/0,03	none				12
	Ozone O_3	(mg/m^3)	0,05/0,1	none				12
Mechanically active substances	Dust	sedimentation ($mg/(m^2h)$)	20					13
		suspension (mg/m^3)	5					13
	Sand	(mg/m^3)	300					13
Flora and fauna	Micro organisms		mould, fungus, etc.	none				14
	Rodents, insects		rodents, etc.	none				14

Environmental parameter			Environmental Class 4.2H	Environmental test specification T 4.2H: Stationary use Non-weatherprotected locations - extremely warm dry				
Type	**Parameter**	**Detail parameter**	**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Notes**
NOTE 1: (Air temperature, low). The equipment under test shall remain operational throughout this test (without any damage or deterioration of performance, according to product specification). Two test temperatures are given, the lower test temperature applies if the equipment is protected against solar irradiation. The higher test temperature includes heat irradiation emitted from the equipment. If a cold start up test is performed, the characteristic severity should be used as a cold start up temperature, but it may be modified (within the class characteristic severity range) by the product specification. In this case, the cold start up test shall commence once low temperature stability is achieved.								
NOTE 2: (Air temperature, high). The equipment under test shall remain operational throughout this test (without any damage or deterioration of performance, according to product specification). Two test temperatures are given, the lower test temperature applies if the equipment is protected against solar radiation or the equipment is ventilated (natural or forced). The higher test temperature includes the heating effects of solar radiation. If a high temperature start up test is performed, the characteristic severity should be used as a high start up temperature, but it may be modified (within the class characteristic severity range) by the product specification. In this case, the high temperature start up test shall commence once high temperature stability is achieved.								
NOTE 3: (Air temperature, change). This test is intended for specimen with large thermal time constant. For equipment where the rapid change of temperature of the surface has a significant effect on internal components, the values of the change of temperature up to 5°C/min can be applied (e.g. heat sinks).								
NOTE 4: (Humidity, relative high). IEC 60068-2-78 [16] Test Cab shall be used with test severities not higher than climatogram limits for this class.								
NOTE 5: (Condensation). IEC 60068-2-30 [9] Test Db shall be used with test severities not higher than climatogram limits for this class.								
NOTE 6: (Humidity, absolute, high). This effect is considered to be partly included in the damp heat test IEC 60068-2-78 [16] Test Cab.								
NOTE 7: (Air pressure, low and high). No test shall be used for normal applications, because the effect of air pressure is evaluated at the component level.								
NOTE 8: There is no IEC 60068-2 [i.3] series test for this parameter.								
NOTE 9: (Water, rain). IEC 60068-2-18 [15] Test Rb method 1 has been chosen even if it does not imitate normal rain. It is a simple hand held shower test, easy to perform and can demonstrate that the specimen design is adequately toleranced to survive this condition. The cooling effect of the low temperature of the rain is included in IEC 60068-2-14 [8] Test Nb. Two durations are given, whichever is the greatest should be chosen.								
NOTE 10: (Water, other sources). No test is recommended because the effect is already included in IEC 60068-2-18 [15] Test Rb.								
NOTE 11: (Radiation). The heating effect of solar radiation is included in the higher test temperature in IEC 60068-2-2 [7] Test Bb as described in note 2. Photochemical tests can be made separately for component and materials.								
NOTE 12: (Chemically active substances). Characteristic severities are mean/maximum values. The characteristic severities should be considered when designing the equipment and when choosing components and materials. No test is recommended in the present document, except for the mechanical enclosures, where the salt mist test is required to be performed. The execution of this test can be performed on the entire enclosure or subparts of the enclosure if the results are not affected.								
NOTE 13: (Mechanically active substances). The characteristic severities are much lower than the lowest test severity in IEC 60068-2-68 [i.2] Test L and therefore no test is recommended. This condition should be considered when designing the equipment and choosing components and materials.								
NOTE 14: (Flora and fauna). The characteristic severities should be considered when choosing components and materials.								

3.5 Specification T 4.1, 4.1E, 4.2L and 4.2H: Non-weatherprotected locations - mechanical tests

The specification in table 5 shall apply to all locations.

Table 5: Test specification T 4.1: Non-weatherprotected locations - mechanical tests
Test specification T 4.1E: Non-weatherprotected locations, extended - mechanical tests
Test specification T 4.2L: Non-weatherprotected locations, extremely cold - mechanical tests
Test specification T 4.2H: Non-weatherprotected locations, extremely warm dry - mechanical tests

Environmental parameter			Environmental Class 4.X	Environmental test specification T 4.X: Stationary use, Non-weatherprotected locations				
Type	**Parameter**	**Detail parameter**	**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Notes**
Vibration	Sinusoidal	displacement (mm) acceleration (m/s^2) frequency range (Hz) axes of vibration	3,0 10 2-9 9-200	1,2 4 5-9 9-200 3	3 x 5 sweep cycles	IEC 60068-2-6 [12]	Fc: Vibration (sinusoidal)	1
	Random	ASD (m^2/s^3) (dB/oct) frequency range (Hz) axes of vibration	no	0,04 +12 -12 5-10 10-50 50-100 3	3 x 30 minutes	IEC 60068-2-64 [10]	Fh: Vibration, broad-band (digital control)	2
Shocks	Shocks	shock spectrum duration (ms) acceleration (m/s^2) number of shocks directions of shocks	Type II 6 250	half sine 11 50 6	100 in each direction	IEC 60068-2-27 [11]	Ea: Shock	3
Vibration	Sinusoidal	velocity (mm/s) displacement (mm) acceleration (m/s^2) frequency range (Hz) axes of vibration	1,5 5 2-9 9-200	5 2 5-62 62-200 3	3 x 5 sweep cycles	IEC 60068-2-6 [12]	Fc: Vibration (sinusoidal)	1
	Random	ASD (m^2/s^3) (dB/oct) frequency range (Hz) axes of vibration	no	0,02 +12 -12 5-10 10-50 50-100 3	3 x 30 minutes	IEC 60068-2-64 [10]	Fh: Vibration, broad-band (digital control)	2
Shocks	Shocks	shock spectrum duration (ms) acceleration (m/s^2) number of shocks directions of shocks	Type L 22 70	half sine 11 30 6	3 in each direction	IEC 60068-2-27 [11]	Ea: Shock	3

<table>
<tr><th colspan="3">Environmental parameter</th><th>Environmental Class 4.X</th><th colspan="5">Environmental test specification T 4.X: Stationary use, Non-weatherprotected locations</th></tr>
<tr><th>Type</th><th>Parameter</th><th>Detail parameter</th><th>Characteristic severity</th><th>Test severity</th><th>Duration</th><th>Reference</th><th>Method</th><th>Notes</th></tr>
<tr><td colspan="9">NOTE 1: (Vibration, sinusoidal). The severities are given as peak values. Test severity values not specified in IEC 60068-2 [i.3] series. The test severity is lower than the characteristic severity which is considered to be too severe for this class. Equipment under test shall be mounted in the "in-use" position. The equipment function shall be monitored throughout the test.
NOTE 2: (Vibration, random). ASD (Acceleration Spectral Density) random vibration testing method may be used instead of the sinusoidal vibration test. The test severity values are not specified in IEC 60068-2 [i.3] series. The maximum test frequency has been reduced to 100 Hz because between 100 Hz and 200 Hz the contribution is insignificant. Also at low and high frequency ends the ASD is reduced by 12 dB/oct.
<table>
<tr><td></td><td>IEC class 4M3</td><td>IEC class 4M5</td></tr>
<tr><td>Acceleration RMS (for information only)</td><td>1,06 m/s^2</td><td>1,5 m/s^2</td></tr>
</table>
Equipment under test shall be mounted in the "in-use" position. The equipment function shall be monitored throughout the test.
NOTE 3: (Shocks). The severities are given as peak values. The Energy content and the SRS of the shock given as test severity have been considered more appropriate than that given by the characteristic severity. Equipment under test shall be mounted in the "in-use" position. The equipment function shall be monitored throughout the test.</td></tr>
</table>

4 Earthquake test specification

If earthquake conditions are specified by the customer, the earthquake test requirements stated below shall be applied.

The test specification is applicable to classes 4.1, 4.1E, 4.2L and 4.2H.

4.1 Vibration response investigation

A preliminary vibration response investigation shall be carried out to determine the lowest resonant frequency of the mounted test specimen.

The vibration response investigation can be carried out by means of *sine sweep testing* or *random testing*.

When using the *sine sweep testing*, the vibration response investigation shall be carried out in a manner based on that of IEC 60068-2-6 [12] (test Fc), with the following parameter severities:

Frequency range:	1 Hz to 35 Hz
Vibration amplitude:	2 m/s^2
Sweep rate:	≤ 1 octave/min

NOTE 1: The vibration amplitude may be reduced to 1 m/s^2 or less in case of sharp resonances.

If a *random test* is used this shall be performed in accordance with the requirements of IEC 60068-2-64 [10], using the following severities:

Frequency range:	1 Hz to 20 Hz	20 Hz to 35 Hz
ASD:	0,5 m^2/s^3	-3 dB/octave
Duration:	3 minutes	

NOTE 2: The Acceleration Spectral Density (ASD) value may be reduced to 0,3 m^2/s^3 or less in case of sharp resonances.

- The time-history stated in table 6 can be omitted if, after the vibration response investigation, the equipment does not exhibit any resonance below 5 Hz and has passed the sinusoidal vibration test reported in table 5 for class 4M5. This test is sufficient to prove compliance with the earthquake conditions given in ETSI EN 300 019-1-4 [1].

4.2 Test conditioning

See table 6.

The extent to which the equipment under test has to function during tests or merely to survive conditions of test shall be stated in the product specification.

Table 6: Test specification T 4.X: Earthquake test

Environmental parameter			Environmental Class 4.X	Environmental test specification T 4.X: Earthquake test				
Type	**Parameter**	**Detail parameter**	**Characteristic severity**	**Test severity**	**Duration**	**Reference**	**Method**	**Notes**
Earthquake	Time-history	RRS	fig.1, tab.7	fig.1, tab.7		IEC 60068-2-57 [13]	Ff: time-history method	(see note)
		frequency range (Hz)	0,3 - 50	1 - 35				
		ZPA (m/s^2)	5	5				
		axes		3	30 s			
		damping ratio (%)		2				

NOTE: (Earthquake). Time history signal Verteq II specified in ANSI T1.0600329 [5] shall be used.
RRS (Required Response Spectrum). ZPA (Zero Period Acceleration).
The equipment under test mounted in the "in use" position. The testing configuration shall be worst case in terms of weight and stiffness. The influence of connections, piping, cables, etc. shall be taken into account when mounting the specimen. The normal "in service" mounting structure of the specimen should be included in the test.
Single-axis excitation shall be used; simultaneous multi-axis excitation is also acceptable, but it is not recommended since, in general, multi-axis testing gives less reproducible test results.
The three testing axes can be reduced to two horizontal axes if the equipment, after the vibration response investigation in the vertical axis, does not exhibit any resonance below 20 Hz.
The strong part of the time-history should be at least 15 s. The duration of each time-history signal shall be 30 s. One time-history shall be applied along each axis.

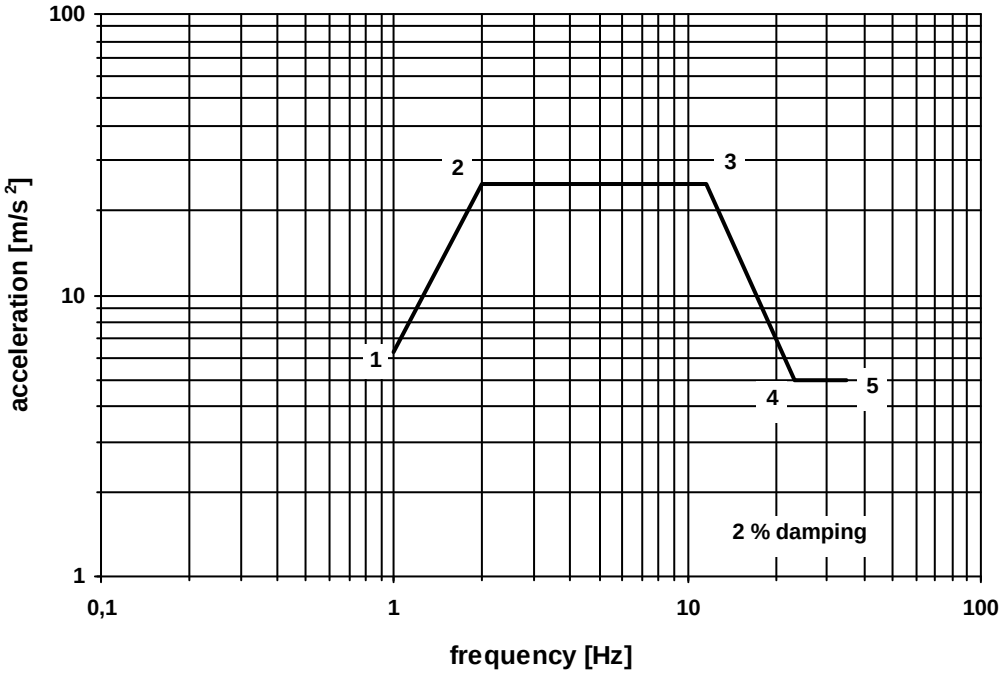

Figure 1: Earthquake Required Response Spectrum

Table 7: Acceleration co-ordinates for the Required Response Spectrum in figure 1

Co-ordinate point	Frequency [Hz]	Ground acceleration [m/s^2]
1	1,0	6,3
2	2,0	25
3	11,6	25
4	23,0	5
5	35,0	5

Annex A (informative): Bibliography

IEC 60068-1: "Environmental testing - Part 1: General and guidance".

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

History

Document history		
Edition 1	May 1994	Publication as ETSI ETS 300 019-2-4
Amendment 1	July 1997	Amendment 1 to 1st Edition of ETSI ETS 300 019-2-4
V2.1.2	September 1999	Publication
V2.2.1	March 2003	Publication
V2.2.2	April 2003	Publication
V2.3.1	August 2013	Publication
V2.3.7	September 2015	EN Approval Procedure AP 20160119: 2015-09-21 to 2016-01-19