

RAE SYSTEMS(SHANGHAI) INC

CE TEST REPORT

SCOPE OF WORK:

EMC directive (2014/30/EU) – EMC report

Model:

FGM-6X00(X=1,2,3), FGM-6X00S (X=1,2,3)

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201815

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Manufacturing site : RAE SYSTEMS(SHANGHAI) INC
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201815

Summary

The equipment complies with the requirements according to the following standard(s) or Specification:

EN 50270:2015: Electromagnetic compatibility - Electrical apparatus for the detection and measurement of combustible gases, toxic gases or oxygen

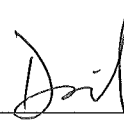
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Contents

REVISION HISTORY.....	6
MEASUREMENT RESULT SUMMARY	7
1 GENERAL INFORMATION	8
1.1 DESCRIPTION OF EQUIPMENT UNDER TEST (EUT)	8
1.2 DESCRIPTION OF TEST FACILITY	9
2 TEST SPECIFICATIONS.....	10
2.1 NORMATIVE REFERENCES	10
2.2 MODE OF OPERATION DURING THE TEST.....	11
2.3 TEST PERIPHERALS USED	11
2.4 RECORD OF CLIMATIC CONDITIONS	11
2.5 INSTRUMENT LIST	12
2.6 MEASUREMENT UNCERTAINTY	15
3 CONDUCTED EMISSION ON AC MAINS PORT	16
3.1 LIMITS.....	16
3.1.1 <i>Limits for type 1 apparatus.....</i>	<i>16</i>
3.1.2 <i>Limits for type 2 apparatus.....</i>	<i>16</i>
3.2 TEST SETUP	17
3.3 TEST PROCEDURE	18
3.4 TEST RESULT.....	18
4 CONDUCTED EMISSION ON DC POWER PORT	19
4.1 LIMITS.....	19
4.2 TEST SETUP	19
4.3 TEST PROCEDURE	20
4.4 TEST RESULT.....	21
5 CONDUCTED EMISSION ON TELECOMMUNICATIONS/NETWORK PORT	24
5.1 LIMITS.....	24
5.1.1 <i>Limits for type 1 apparatus.....</i>	<i>24</i>
5.1.2 <i>Limits for type 2 apparatus.....</i>	<i>24</i>
5.2 TEST SETUP	25
5.3 TEST PROCEDURE	26
5.4 TEST RESULT.....	26
6 RADIATED EMISSION	27
6.1 LIMITS.....	27
6.1.1 <i>Limits for type 1 apparatus.....</i>	<i>27</i>
6.1.2 <i>Limits for type 2 apparatus.....</i>	<i>27</i>
6.2 BLOCK DIAGRAM OF TEST SET UP	28
6.3 TEST PROCEDURE	29
6.4 TEST RESULT.....	29
7 HARMONIC CURRENT EMISSION	31
7.1 LIMITS.....	31
7.1.1 <i>Limits for Class A equipment.....</i>	<i>31</i>
7.1.2 <i>Limits for Class B equipment.....</i>	<i>31</i>
7.1.3 <i>Limits for Class C equipment.....</i>	<i>31</i>
7.1.4 <i>Limits for Class D equipment.....</i>	<i>32</i>
7.2 TEST SETUP.....	33

TEST REPORT

7.3	TEST PROCEDURE	33
7.4	TEST RESULT.....	33
8	VOLTAGE FLUCTUATIONS AND FLICKER.....	34
8.1	LIMITS.....	34
8.2	TEST SETUP.....	34
8.3	TEST PROCEDURE	34
8.4	TEST RESULT.....	34
	IMMUNITY TEST	35
9	ELECTROSTATIC DISCHARGE.....	36
9.1	SEVERITY LEVEL AND PERFORMANCE CRITERION	36
9.1.1	Test level	36
9.1.2	Performance Criterion.....	36
9.2	TEST SETUP.....	37
9.3	TEST PROCEDURE	38
9.4	TEST RESULT.....	38
10	RADIO-FREQUENCY ELECTROMAGNETIC FIELD	39
10.1	SEVERITY LEVEL AND PERFORMANCE CRITERION	39
10.1.1	Test level.....	39
10.1.2	Performance Criterion	39
10.2	TEST SETUP	40
10.3	TEST PROCEDURE	41
10.4	TEST RESULT.....	41
11	FAST TRANSIENTS / BURSTS.....	42
11.1	SEVERITY LEVEL AND PERFORMANCE CRITERION	42
11.1.1	Test level.....	42
11.1.2	Performance Criterion	42
11.2	TEST SETUP	43
11.3	TEST PROCEDURE	43
11.4	TEST RESULT.....	43
12	SURGES.....	44
12.1	SEVERITY LEVEL AND PERFORMANCE CRITERION	44
12.1.1	Test level.....	44
12.1.2	Performance Criterion	44
12.2	TEST SETUP	45
12.3	TEST PROCEDURE	45
12.4	TEST RESULT.....	45
13	RADIO-FREQUENCY COMMON MODE	46
13.1	SEVERITY LEVEL AND PERFORMANCE CRITERION	46
13.1.1	Test level.....	46
13.1.2	Performance Criterion	46
13.2	BLOCK DIAGRAM OF TEST SETUP	47
13.3	TEST PROCEDURE	47
13.4	TEST RESULT	48
14	POWER-FREQUENCY MAGNETIC FIELD	49
14.1	SEVERITY LEVEL AND PERFORMANCE CRITERION	49
14.1.1	Test level.....	49
14.1.2	Performance Criterion	49
14.2	TEST SETUP	50

TEST REPORT

14.3	TEST PROCEDURE	50
14.4	TEST RESULT	50
15	VOLTAGE DIPS AND SHORT INTERRUPTIONS.....	51
15.1	SEVERITY LEVEL AND PERFORMANCE CRITERION	51
15.1.1	<i>Test level.....</i>	<i>51</i>
15.1.2	<i>Performance Criterion</i>	<i>51</i>
15.2	TEST SETUP	52
15.3	TEST PROCEDURE	52
15.4	TEST RESULT	52
APPENDIX I: PHOTOGRAPH OF TEST SETUP		53
APPENDIX II: PHOTOGRAPH OF EQUIPMENT UNDER TEST		57

Revision History

Report No.	Version	Description	Issued Date
190101911SHA-001	Rev. 01	Initial issue of report	Mar 26, 2019

Measurement result summary

TEST ITEM	TEST RESULT	NOTE
Conducted Emission on AC mains port	NA	
Conducted Emission on DC mains port	Pass	
Conducted Emission on Telecommunications/network port	NA	
Radiated Emission	Pass	
Harmonic current emission	NA	
Voltage fluctuations and flicker	NA	
Electrostatic Discharge	Pass	
Radio-frequency electromagnetic field	Pass	
Fast transients / bursts	Pass	
Surges	Pass	
Radio-frequency common mode	Pass	
Power-frequency magnetic field	Pass	
Voltage dips and short interruptions	Pass	

Notes: 1: NA =Not Applicable

1 GENERAL INFORMATION

1.1 Description of Equipment Under Test (EUT)

Product name	: RAEGuard3
Type/Model	: FGM-6X00 (X=1,2,3), FGM-6X00S (X=1,2,3)
Description of EUT	: The EUT have six models, because all of the models have the same electrical characteristics, so all of the tests are performed on the sample FGM-6200.
Rating	: DC 15V-25V
EUT type	: ☒ Table-top ☐ Floor standing
Apparatus type	: ☐ Type 1 ☒ Type 2
Hardware version	: /
Software version	: /
Port identification	: Refer to the user's manual
Cable supplied	: Refer to the user's manual
Sample received date	: Feb 06,2019
Date of test	: Feb 07,2019- Mar 13,2019

1.2 Description of Test Facility

Name : Intertek Testing Services Shanghai
Address : Building 86, No. 1198 Qinzhou Road(North), Shanghai 200233, P.R. China
Telephone : 86 21 61278200
Telefax : 86 21 54262353

The test facility is : CNAS Accreditation Lab
recognized, certified, Registration No. CNAS L0139
or accredited by these FCC Accredited Lab
organizations Designation Number: CN1175
IC Registration Lab
Registration code No.: CN0051
VCCI Registration Lab
Registration No.: R-14243, G-10845, C-14723, T-12252
A2LA Accreditation Lab
Certificate Number: 3309.02

2 TEST SPECIFICATIONS

2.1 Normative references

EN 61000-6-1, Electromagnetic compatibility (EMC) - Part 6-1: Generic standards - Immunity for residential, commercial and light-industrial environments (IEC 61000-6-1)

EN 61000-6-2, Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments (IEC 61000-6-2)

EN 61000-6-3, Electromagnetic compatibility (EMC) - Part 6-3: Generic standards - Emission standard for residential, commercial and light-industrial environments (IEC 61000-6-3)

EN 61000-6-4, Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments (IEC 61000-6-4)

EN 61000-4-2: Electromagnetic Compatibility (EMC) – Part 4: testing and measurement techniques – section 2: electrostatic discharge immunity test

EN 61000-4-3:2006/+A1:2008/+A2:2010: Electromagnetic Compatibility (EMC) – Part 4: testing and measurement techniques – section 3: radiated, radio frequency, electromagnetic field immunity test

EN 61000-4-4: Electromagnetic Compatibility (EMC) – Part 4: testing and measurement techniques – section 4: electric fast transient/burst immunity test

EN 61000-4-5:2006: Electromagnetic Compatibility (EMC) – Part 4: testing and measurement techniques – section 5: surge immunity test

EN 61000-4-6: Electromagnetic Compatibility (EMC) – Part 4: testing and measurement techniques – section 6: immunity to conducted disturbance, induced by radio frequency field

EN 61000-4-8: Electromagnetic compatibility (EMC) - Part 4-8: Testing and measuring techniques -: Power-frequency magnetic field immunity test

EN 61000-4-11: Electromagnetic Compatibility (EMC) – Part 4: testing and measurement techniques – section 11: voltage dips, short interruption and voltage variations immunity test

EN 61000-4-29, Electromagnetic compatibility (EMC) - Part 4-29: Testing and measurement techniques - Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests

2.2 Mode of operation during the test

Within this test report, EUT was tested under all available operation modes and tested under its rating voltage and frequency. Other voltage and frequency is specified if used.

2.3 Test peripherals used

Item No	Description	Band and Model	S/No
1	Laptop computer	HP, 5480	NA

2.4 Record of climatic conditions

Test Item	Temperature (°C)	Relative Humidity (%)	Pressure (kPa)
Conducted Emission on AC mains port	/	/	/
Conducted emission on DC power port	22.5	45.0	/
Conducted Emission on Telecommunications/network port	/	/	/
Radiated Emission	23.0	46.0	/
Harmonic current emission	/	/	/
Voltage fluctuations and flicker	/	/	/
Electrostatic Discharge	23.5	47.0	100.7
Radio-frequency electromagnetic field	23.5	46.0	/
Fast transients / bursts	23.0	47.0	/
Surges	24.0	46.0	/
Radio-frequency common mode	24.0	56.0	/
Power-frequency magnetic field	/	/	/
Voltage dips and short interruptions	/	/	/

Notes: NA =Not Applicable

2.5 Instrument list

Conducted Emission / Disturbance Power / Tri-loop Test / CDN method					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☒	Test Receiver	R&S	ESCS 30	EC 2107	2019-07-15
☒	A.M.N.	R&S	ESH2-Z5	EC 3119	2019-11-30
☐	A.M.N.	R&S	ENV 216	EC 3393	2019-07-04
☐	A.M.N.	R&S	ENV4200	EC 3558	2019-06-10
☐	Absorbing clamp	R&S	MDS 21	EC 2108	2019-06-19
☐	CDN	Frankonia	CDN M2M316	EC 5969	2019-03-15
☐	CDN	Schaffner	CDN M316	EC 2113-1	2019-07-16
☐	Attenuator	Weinschel	68-6-44	EC 3043-9	2020-02-11
☐	Tri-loop	Schwarzbeck	HXYZ 9170	EC 3384	2019-10-10
☐	Voltage Probe	Schwarzbeck	TK9420	EC 4888	2019-09-12
☐	Current probe	R&S	EZ-17	EC 3221	2019-03-15
☐	I.S.N.	FCC	FCC-TLISN-T2-02	EC 3754	2020-02-11
☐	I.S.N.	FCC	FCC-TLISN-T4-02	EC 3755	2020-02-11
☐	I.S.N.	FCC	FCC-TLISN-T8-02	EC 3756	2020-02-11
Discontinuous Disturbance Voltage					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☐	Click meter	AFJ	DDA55	EC 5320	2019-03-08
☐	A.M.N.	AFJ	LS16C	EC 5220-1	2019-11-30
Radiated Emission					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☒	Test Receiver	R&S	ESIB 26	EC 3045	2019-09-12
☒	Bilog Antenna	TESEQ	CBL 6112D	EC 4206	2019-06-10
☐	Pre-amplifier	R&S	Pre-amp 18	EC5262	2019-06-10
☐	Horn antenna	R&S	HF 906	EC 3049	2018-11-17
☐	Horn antenna	ETS	3117	EC 4792-1	2019-01-09
☐	Horn antenna	TOYO	HAP18-26W	EC 4792-3	2020-07-09
☐	Pre-amplifier	R&S	Pre-amp 18	EC5262	2019-06-19
☐	Active loop antenna	Schwarzbeck	FMZB1519	EC 5345	2019-03-07
Harmonics / Flicker / Low-frequency immunity test					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☐	Harmonic-flicker	CI	5001ix-PACS-1	EC 2110	2019-12-11
☐	Three phase Harmonic-flicker system	EM TEST	DPA503N	EC 5383	2019-01-31
		EM TEST	NETWAVE-30-400	EC 5383-2	2019-06-19
ESD					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☒	ESD generator	EM TEST	ditto	EC 2956	2019-06-19
☒	ESD generator	TESEQ	NSG 437	EC 4792-4	2019-03-22
EFT / Surge / Voltage Dips					

TEST REPORT

Used	Equipment	Manufacturer	Type	Internal no.	Due date
☒	Conduct immunity system	EM TEST	UCS 500M6B	EC 2958	2019-04-07
☒	Automatic transformer	EM TEST	MV2616	EC 2957	2019-04-07
☐	Capacity clamp	EM TEST	HFK	EC 2959	2020-02-12
☐	Surge generator	EM TEST	TSS 500M2F	EC 2960	2019-08-15
☐	Surge generator	EM TEST	TSS 500M4	EC 2961	2020-01-03
☐	Surge Coupling network	EM TEST	CNV 504M	EC 2958-2	2020-02-11
☐	Surge Coupling network	EM TEST	CNV 504S1	EC 2958-1	2020-02-11
☐	DIPs generator	SANKI	SKS-1130GT	EC 5033	2020-01-03
☐	Ring wave generator	SANKI	SKS-1206GB	EC 5033-1	2020-01-03
☐	EFT generator	SANKI	SKS-0404IB	EC 5033-2	2019-03-08
☐	Surge generator	SANKI	SKS-0506GB-30	EC 5033-3	2019-03-08
Conducted Immunity					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☒	Signal generator	R&S	SML 01	EC 2338	2019-09-12
☒	Power amplifier	AR	75A250	EC 3043-1	2019-07-15
☒	Attenuator	EM TEST	ATT6/75	EC 3043-3	2020-02-11
☒	CDN	Frankonia	CDN M2M316	EC 5969	2019-03-15
☐	CDN	Schaffner	CDN M316	EC 2113-1	2019-07-16
☐	CDN	EM TEST	CDN T2	EC 4970	2019-09-11
☐	CDN	EM TEST	CDN T4	EC 3043-4	2020-02-11
☐	CDN	EM TEST	CDN M1/16A	EC 4792-6	2019-10-08
☐	CDN	EM TEST	CDN M1/16A	EC 4792-7	2019-09-11
☐	CDN	EM TEST	CDN M1/32A	EC4792-10	2020-02-11
☐	CDN	EM TEST	CDNM3N/16A	EC 4792-12	2020-02-11
☐	CDN	EM TEST	CDNM3N/32A	EC 4792-13	2020-02-11
☐	CDN	EM TEST	CDN T8-RJ45	EC 4792-15	2019-09-11
☐	DDC	AR	DC 2600	EC 3043-5	2019-11-29
☐	EM clamp	EM TEST	EM 101	EC 3043-6	2020-02-11
Radiated Immunity					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☒	Signal generator	R&S	SMR 20	EC 3044-1	2020-01-14
☒	Power amplifier	AR	250W1000B	EC 5818-2	2019-04-19
☒	Power amplifier	BONN	BLMA1060-100	EC 5818-4	2019-04-19
☒	DDC	WERLATONE	C5982-10	EC 5818-7	2019-04-19
☒	DDC	PULSAR	CCS30-B26	EC 5818-8	2019-04-19
☒	Power meter	Keysight	N1914A	EC 5818-3	2019-01-02
☒	Log-period antenna	AR	AT 1080	EC 3044-7	2020-08-15
☒	Horn antenna	Schwarzbeck	STLP 9149	EC 5881	2019-04-19

TEST REPORT

☐	Horn antenna	AR	AT 4002	EC 3044-8	2019-08-22
☒	Field meter	AR	FL17000	EC 5818-1	2019-05-11
RF test					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☐	PXA Signal Analyzer	Keysight	N9030A	EC 5338	2019-03-05
☐	Power sensor	Agilent	U2021XA	EC 5338-1	2019-03-05
☐	MXG Analog Signal Generator	Agilent	N5181A	EC 5338-2	2019-03-05
☐	Vector Signal Generator	Agilent	N5182B	EC 5175	2019-03-05
☐	Power meter	Keysight	N1911A	EC 4318	2019-05-11
☐	Wideband Radio Communication Tester	R&S	CMW500	EC 5944	2019-12-22
☐	Mobile Test System	LitePoint	IQxel	EC 5176	2020-01-08
☐	Test Receiver	R&S	ESCI 7	EC 4501	2019-09-12
☐	Spectrum analyzer	Agilent	E7402A	EC 2254	2019-07-15
Additional instrument					
Used	Equipment	Manufacturer	Type	Internal no.	Due date
☒	Spectrum analyzer	Agilent	E7402A	EC 2254	2019-07-15
☒	Therom-Hygrograph	ZJ1-2A	S.M.I.F.	EC 3783	2019-02-28
☒	Therom-Hygrograph	ZJ1-2A	S.M.I.F.	EC 2122	2019-03-11
☒	Therom-Hygrograph	ZJ1-2A	S.M.I.F.	EC 3326	2019-03-28
☐	Pressure meter	YM3	Shanghai Mengde	EC 3320	2019-07-01

2.6 Measurement Uncertainty

Measurement	Frequency	Expanded Uncertainty (k=2) ($\pm$)
Conducted emission at mains ports	9kHz ~ 150kHz	3.52 dB
	150kHz ~ 30MHz	3.19 dB
Continuous disturbance voltage at telecom ports	150kHz ~ 30MHz	3.64 dB
Continuous disturbance current at telecom ports	150kHz ~ 30MHz	2.62 dB
Radiated Emissions up to 1 GHz	30MHz ~ 1GHz	4.90 dB
Radiated Emissions above 1 GHz	1GHz ~ 6GHz	5.02 dB
	6GHz ~ 18GHz	5.28 dB
Harmonic current emission	-	3.90%
Voltage fluctuations and flicker	-	10.34%

3 Conducted emission on AC mains port

Test result: NA

3.1 Limits

3.1.1 Limits for type 1 apparatus

Frequency range (MHz)	Quasi-peak (dBuV)	Average (dBuV)
0.15 ~ 0.5	66 ~ 56 *	56 ~ 46 *
0.5 ~ 5	56	46
5 ~ 30	60	50

Note: 1. * Means the limit decreasing linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz
2. At transitional frequencies the lower limit applies.

3.1.2 Limits for type 2 apparatus

Frequency range (MHz)	Quasi-peak (dBuV)	Average (dBuV)
0.15 ~ 0.5	79	66
0.5 ~ 30	73	60

Note: If the limit for the measurement with the average detector is met when using a receiver with a quasi-peak detector, the equipment under test shall be deemed to meet both limits and the measurement using the receiver with an average detector need not be carried out.

4 Conducted emission on DC power port

Test result: Pass

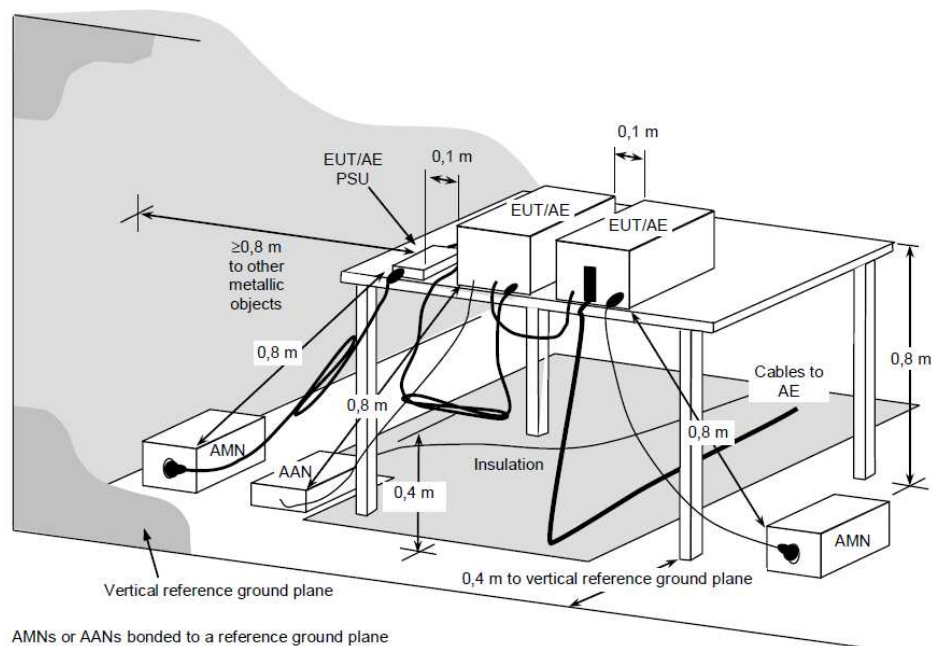
4.1 Limits

Frequency range (MHz)	Quasi-peak (dBuV)	Average (dBuV)
0.15 ~ 0.5	79	66
0.5 ~ 30	73	60

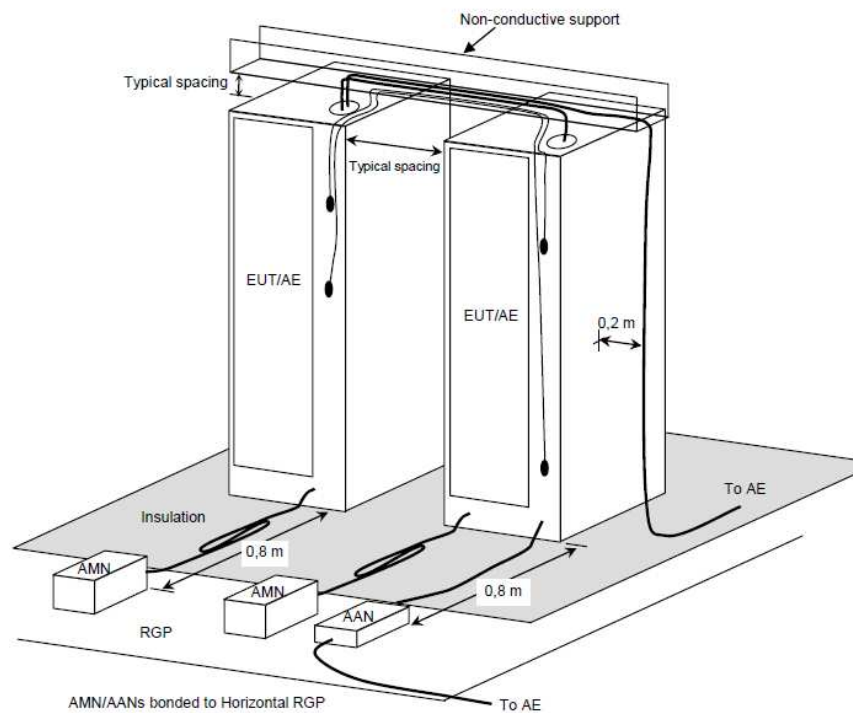
Note: If the limit for the measurement with the average detector is met when using a receiver with a quasi-peak detector, the equipment under test shall be deemed to meet both limits and the measurement using the receiver with an average detector need not be carried out.

4.2 Test setup

For table-top equipment



For floor standing equipment



4.3 Test Procedure

Measurement was performed in shielded room, and instruments used were followed EN 50270.

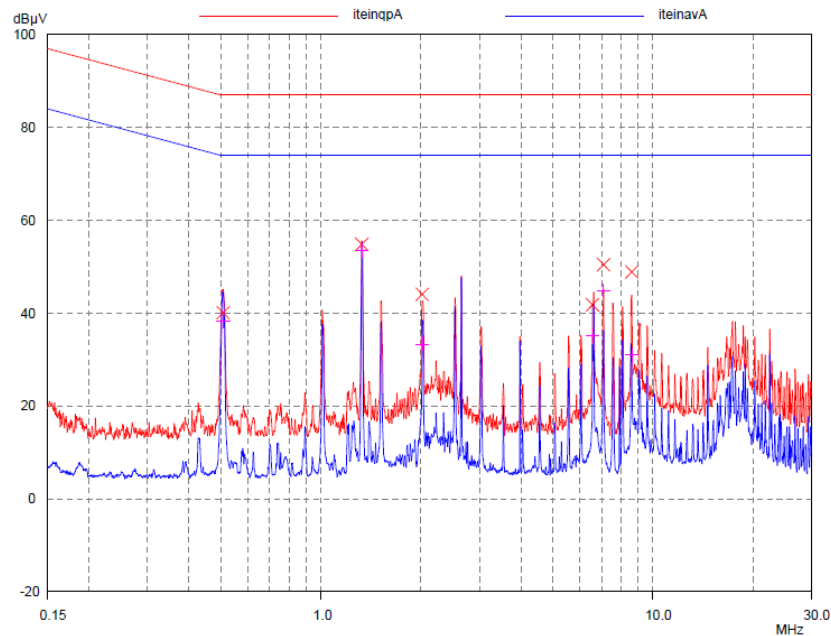
Detailed test procedure and arrangement was followed EN 50270.

Frequency range 150kHz - 30MHz was checked and EMI receiver measurement bandwidth was set to 9kHz.

4.4 Test Result

Line L

Test Curve:



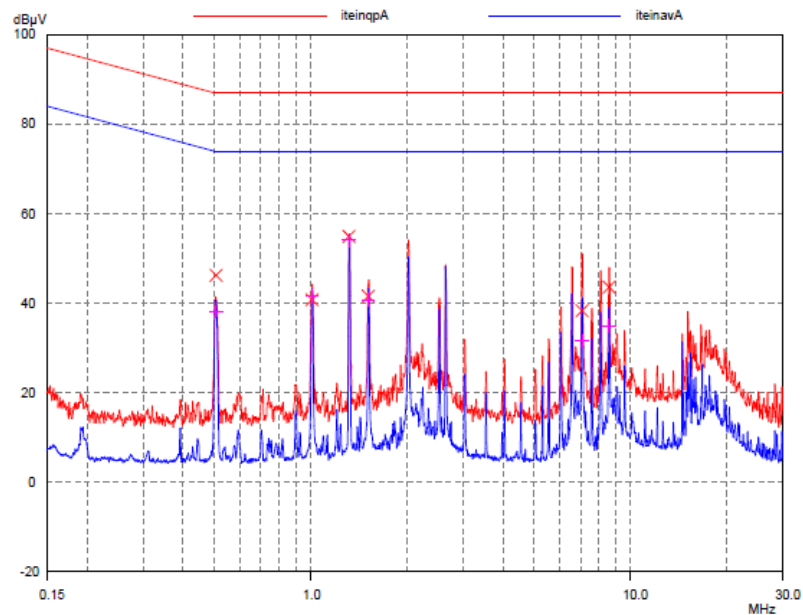
Test Data:

Frequency (MHz)	Quasi-peak			Average			Line
	Corrected Reading (dBuV)	Limit (dBuV)	Margin (dB)	Corrected Reading (dBuV)	Limit (dBuV)	Margin (dB)	
0.51	40.10	87.00	46.90	38.32	74.00	35.93	L
1.33	54.83	87.00	32.17	53.38	74.00	21.43	L
2.02	44.08	87.00	42.92	33.30	74.00	41.31	L
6.58	41.83	87.00	45.17	35.20	74.00	34.71	L
7.09	50.46	87.00	36.54	44.94	74.00	30.17	L
8.63	48.88	87.00	38.12	30.95	74.00	41.87	L
0.51	40.10	87.00	46.90	38.32	74.00	35.93	L
1.33	54.83	87.00	32.17	53.38	74.00	21.43	L

Note: * means the emission level 20dB below the relevant limit.

Line N

Test Curve:



Test Data:

Frequency (MHz)	Quasi-peak			Average			Line
	Corrected Reading (dBuV)	Limit (dBuV)	Margin (dB)	Corrected Reading (dBuV)	Limit (dBuV)	Margin (dB)	
0.51	46.22	87.00	40.78	38.15	74.00	35.85	N
1.01	40.83	87.00	46.17	41.49	74.00	32.51	N
1.32	54.91	87.00	32.09	54.06	74.00	19.94	N
1.52	41.55	87.00	45.45	40.75	74.00	33.25	N
7.07	38.34	87.00	48.66	31.66	74.00	42.34	N
8.59	43.60	87.00	43.40	35.01	74.00	38.99	N
0.51	46.22	87.00	40.78	38.15	74.00	35.85	N
1.01	40.83	87.00	46.17	41.49	74.00	32.51	N

Note: * means the emission level 20dB below the relevant limit.

TEST REPORT

Remark: 1. Correct Factor = LISN Factor + Cable Loss, the value was added to Original Receiver Reading by the software automatically.
2. Corrected Reading = Original Receiver Reading + Correct Factor
3. Margin = Limit - Corrected Reading
4. If the PK Corrected Reading is lower than AV limit, the AV test can be elided.

Example: Assuming LISN Factor = 10.00dB, Cable Loss = 2.00dB,
Original Receiver Reading = 10.00dBuV, Limit = 66.00dBuV.
Then Correct Factor = 10.00 + 2.00 = 12.00dB;
Corrected Reading = 10dBuV + 12.00dB = 22.00dBuV;
Margin = 66.00dBuV – 22.00dBuV = 44.00dB.

5 Conducted Emission on Telecommunications/network port

Test result: NA

5.1 Limits

5.1.1 Limits for type 1 apparatus

Frequency range (MHz)	Voltage Limits (dBuV)		Current limits (dBuA)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 ~ 0.5	84 ~ 74	74 ~ 64	40 ~ 30	30 ~ 20
0.5 ~ 30	74	64	30	20
Note: 1. * Means the limit decreasing linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz				

5.1.2 Limits for type 2 apparatus

Frequency range (MHz)	Voltage Limits (dBuV)		Current limits (dBuA)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 ~ 0.5	97 ~ 87	84 ~ 74	53 ~ 43	40 ~ 30
0.5 ~ 30	87	74	43	30
Note: 1. * Means the limit decreasing linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz				

5.3 Test Procedure

Measurement was performed in shielded room, and instruments used were followed EN 61000-6-3.

Detailed test procedure and arrangement was followed EN 61000-6-3.

Frequency range 150kHz - 30MHz was checked and EMI receiver measurement bandwidth was set to 9kHz.

5.4 Test Result

Test Curve:

Test Data:

Frequency (MHz)	Quasi-peak			Average		
	Corrected Reading (dBuV)	Limit (dBuV)	Margin (dB)	Corrected Reading (dBuV)	Limit (dBuV)	Margin (dB)

Remark: 1. Correct Factor = AAN Factor + Cable Loss, the value was added to Original Receiver Reading by the software automatically.

2. Corrected Reading = Original Receiver Reading + Correct Factor

3. Margin = Limit - Corrected Reading

4. If the PK Corrected Reading is lower than AV limit, the AV test can be elided.

Example: Assuming AAN Factor = 10.00dB, Cable Loss = 2.00dB,

Original Receiver Reading = 10.00dBuV, Limit = 74.00dBuV.

Then Correct Factor = 10.00 + 2.00 = 12.00dB;

Corrected Reading = 10dBuV + 12.00dB = 22.00dBuV;

Margin = 74.00dBuV – 22.00dBuV = 52.00dB.

6 Radiated emission

Test result: Pass

6.1 Limits

6.1.1 Limits for type 1 apparatus

Frequency (MHz)	Quasi-peak limit in Measurement Distance 3m (dBuV/m)	Quasi-peak limit in Measurement Distance 10m (dBuV/m)
30-230	40	30
230-1000	47	37
Note: for the measurement distance other than 3m and 10m, the limit is varied according to 20dB/10 decades.		

Frequency range GHz	Average limit in Measurement Distance 3m (dBuV/m)	Peak limit in Measurement Distance 3m (dBuV/m)
1 to 3	50	70
3 to 6	54	74
NOTE The lower limit applies at the transition frequency.		

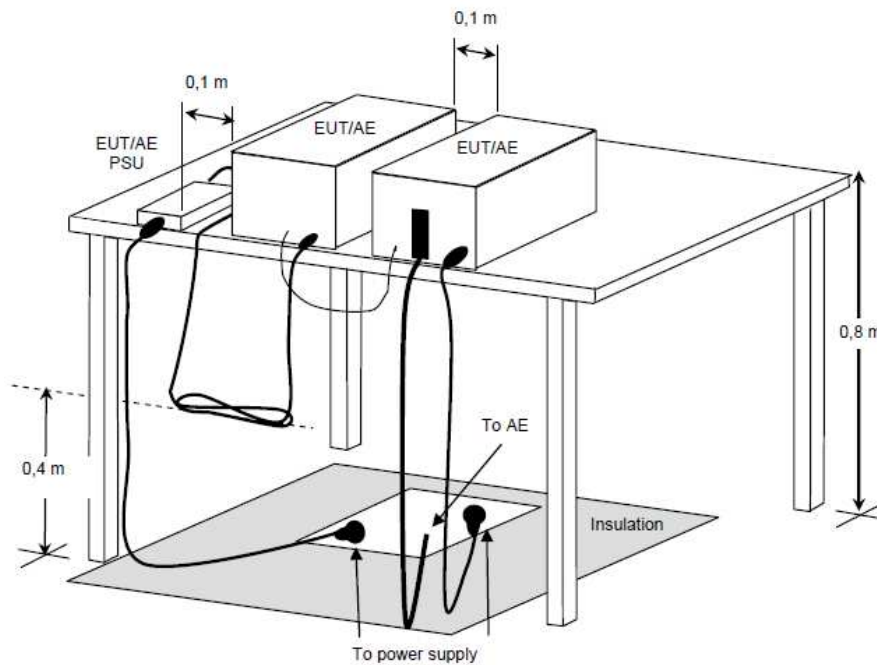
6.1.2 Limits for type 2 apparatus

Frequency (MHz)	Quasi-peak limit in Measurement Distance 3m (dBuV/m)	Quasi-peak limit in Measurement Distance 10m (dBuV/m)
30-230	50	40
230-1000	57	47
Note: for the measurement distance other than 3m and 10m, the limit is varied according to 20dB/10 decades.		

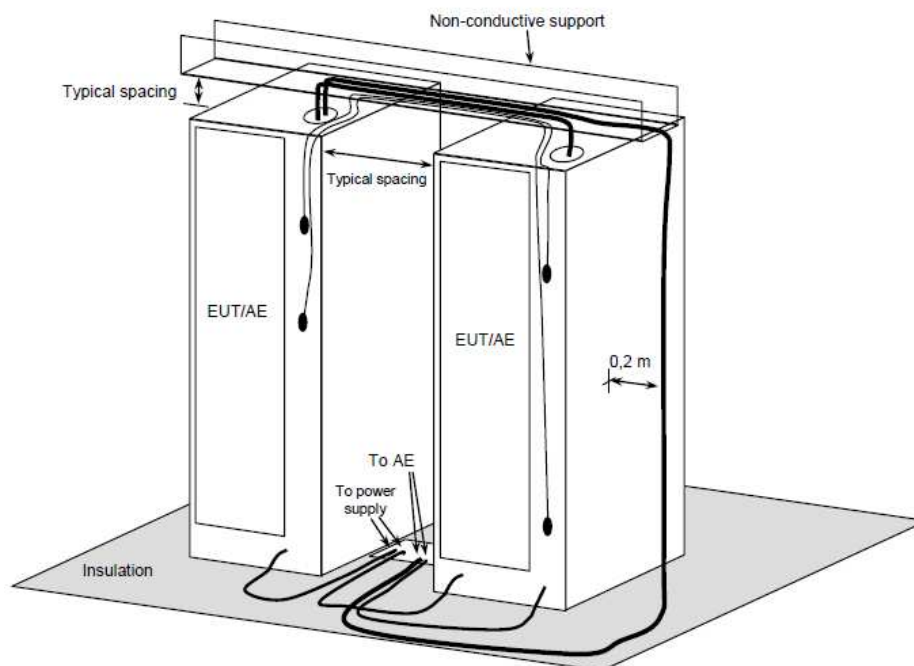
Frequency range GHz	Average limit in Measurement Distance 3m (dBuV/m)	Peak limit in Measurement Distance 3m (dBuV/m)
1 to 3	56	76
3 to 6	60	80
NOTE The lower limit applies at the transition frequency.		

6.2 Block diagram of test set up

For table-top equipment



For floor standing equipment



6.3 Test Procedure

The measurement was performed in a semi-anechoic chamber.

The distance from EUT to receiving antenna is 3 meters.

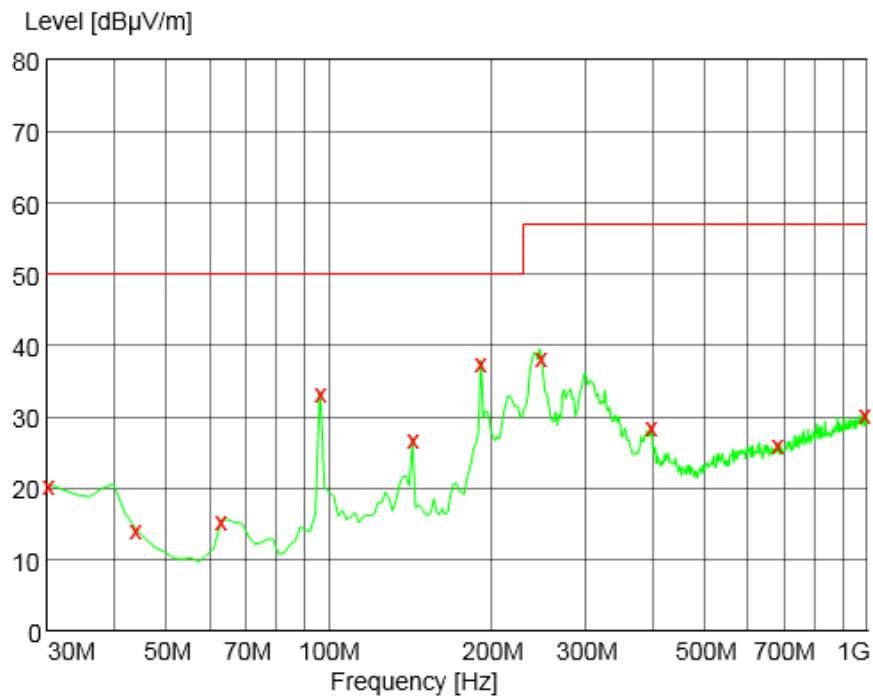
Measurement was performed according to EN 61000-6-3.

EUT arrangement and operate conditions were performed according to EN 61000-6-3.

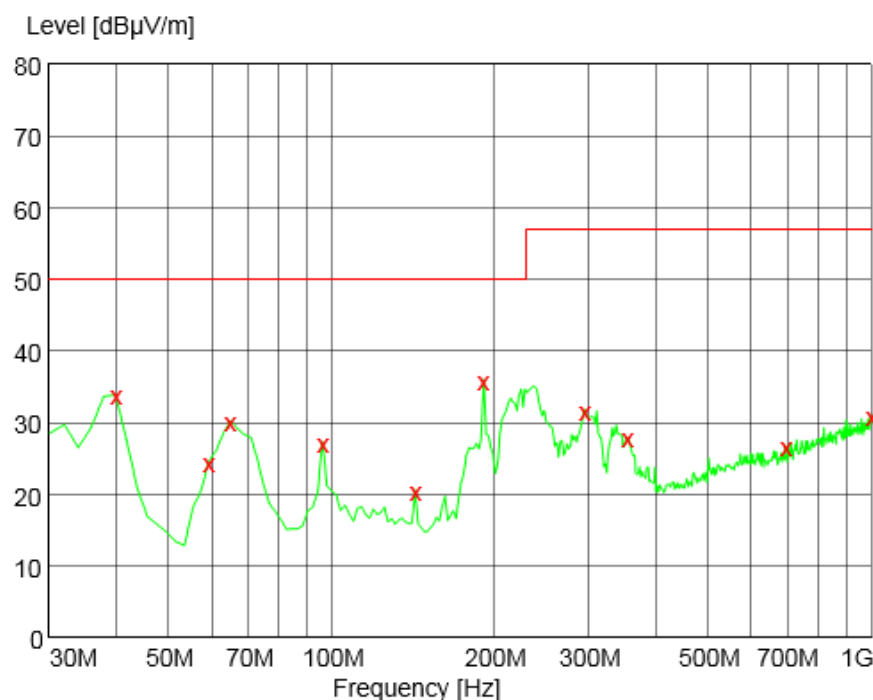
6.4 Test Result

Test Curve:

Horizontal



Vertical



Test data:

Polarization	Frequency (MHz)	Corrected Reading (dBuV/m)	Corrected Factor (dB/m)	Limits (dBuV/m)	Margin (dBuV/m)
Horizontal	63.05	15.60	7.00	50.00	34.40
	96.09	33.60	11.10	50.00	16.40
	142.75	27.10	12.20	50.00	22.90
	191.34	37.90	10.80	50.00	12.10
	247.72	38.60	13.80	57.00	18.40
	397.39	28.80	17.50	57.00	28.20
Vertical	64.99	30.30	7.10	50.00	19.70
	96.09	27.40	11.10	50.00	22.60
	142.75	20.60	12.20	50.00	29.40
	191.34	36.10	10.80	50.00	13.90
	294.37	31.90	14.60	57.00	25.10
	352.69	28.00	16.30	57.00	29.00

Remark: 1. Correct Factor = Antenna Factor + Cable Loss (+ Amplifier, for higher than 1GHz), the value was added to Original Receiver Reading by the software automatically.

2. Corrected Reading = Original Receiver Reading + Correct Factor

3. Margin = Limit - Corrected Reading

4. If the PK Corrected Reading is lower than AV limit, the AV test can be elided.

Example: Assuming Antenna Factor = 30.20dB/m, Cable Loss = 2.00dB,
Gain of Preamplifier = 32.00dB, Original Receiver Reading = 10.00dBuV,
Limit = 40.00dBuV/m.

Then Correct Factor = 30.20 + 2.00 – 32.00 = 0.20dB/m;

Corrected Reading = 10dBuV + 0.20dB/m = 10.20dBuV/m;

Margin = 40.00dBuV/m - 10.20dBuV/m = 29.80dB.

7 Harmonic current emission

Test result: NA

7.1 Limits

7.1.1 Limits for Class A equipment

Harmonic order n	Maximum permissible harmonic current A
Odd harmonics	
3	2,30
5	1,14
7	0,77
9	0,40
11	0,33
13	0,21
$15 \leq n \leq 39$	$0,15 \frac{15}{n}$
Even harmonics	
2	1,08
4	0,43
6	0,30
$8 \leq n \leq 40$	$0,23 \frac{8}{n}$

7.1.2 Limits for Class B equipment

For Class B equipment, the harmonics of the input current shall not exceed the values given in Class A limits multiplied by a factor of 1,5

7.1.3 Limits for Class C equipment

a) Active input power > 25 W

Harmonic order n	Maximum permissible harmonic current expressed as a percentage of the input current at the fundamental frequency %
2	2
3	$30 \cdot \lambda^a$
5	10
7	7
9	5
$11 \leq n \leq 39$ (odd harmonics only)	3
^a λ is the circuit power factor.	

b) Active input power ≤ 25 W

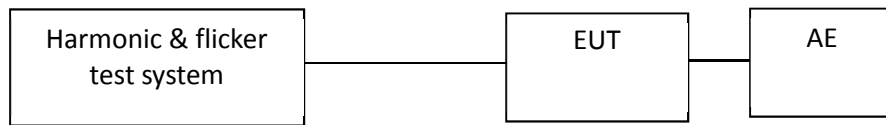
Discharge lighting equipment having an active input power smaller than or equal to 25 W shall comply with one of the following two sets of requirements:

- the harmonic currents shall not exceed the power-related limits of Class D equipment, column 2, or;
- the third harmonic current, expressed as a percentage of the fundamental current, shall not exceed 86 % and the fifth harmonic current shall not exceed 61 %.

7.1.4 Limits for Class D equipment

Harmonic order n	Maximum permissible harmonic current per watt mA/W	Maximum permissible harmonic current A
3	3,4	2,30
5	1,9	1,14
7	1,0	0,77
9	0,5	0,40
11	0,35	0,33
$13 \leq n \leq 39$ (odd harmonics only)	$\frac{3,85}{n}$	See Table 1

7.2 Test Setup



7.3 Test Procedure

Harmonics of the fundamental current were measured up to 40 order harmonics using a digital power meter with an analogue output and frequency analyzer which was integrated in the harmonic & flicker test system. The measurements were carried out under steady conditions.

For the following categories of equipment, limits are not specified in this standard:

- ☐ Equipment with a rated power of 75 W or less, other than lighting equipment.
- ☐ Professional equipment with a total rated power greater than 1 kW.
- ☐ Symmetrically controlled heating elements with a rated power less than or equal to 200 W.
- ☐ Independent dimmers for incandescent lamps with a rated power less than or equal to 1 kW.

7.4 Test Result

None

8 Voltage fluctuations and flicker

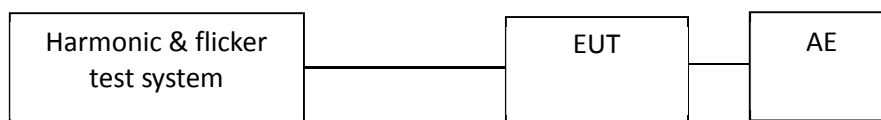
Test result: NA

8.1 Limits

- The value of P_{st} shall not be greater than 1,0;
- The value of P_{lt} shall not be greater than 0,65;
- T_{max} , the accumulated time value of $d(t)$ with a deviation exceeding 3,3 % during a single voltage change at the EUT terminals, shall not exceed 500 ms;
- The maximum relative steady-state voltage change, dc , shall not exceed 3,3 %;
- The maximum relative voltage change d_{max} , shall not exceed:
 - a) 4 % without additional conditions;
 - b) 6 % for equipment which is:
 - switched manually, or
 - switched automatically more frequently than twice per day, and also has either a delayed restart (the delay being not less than a few tens of seconds), or manual restart, after a power supply interruption.
 - c) 7 % for equipment which is:
 - attended whilst in use (for example: hair dryers, vacuum cleaners, kitchen equipment such as mixers, garden equipment such as lawn mowers, portable tools such as electric drills), or
 - switched on automatically, or is intended to be switched on manually, no more than twice per day, and also has either a delayed restart (the delay being not less than a few tens of seconds) or manual restart, after a power supply interruption.

P_{st} and P_{lt} requirements shall not be applied to voltage changes caused by manual switching.

8.2 Test Setup



8.3 Test Procedure

Voltage fluctuations and flicker were measured by a digital power meter with an analogue output and frequency analyzer which was integrated in the harmonic & flicker test system.

- ☐ The EUT is unlikely to produce significant voltage fluctuations or flicker by technical analysis and evaluation. So it is deemed to fulfil the requirements without testing.

8.4 Test Result

None

Immunity Test

Performance criteria

Performance criterion A: The apparatus shall continue to operate as intended both during and after the test. For those functions specified by the manufacturer as being safety functions, when the apparatus is used as intended no loss of function is allowed and the performance requirements given in Table 5 shall be complied with.

Performance criterion B: During the test

- degradation of performance is allowed but the performance requirements given in table 5 shall not be exceeded by more than a factor of 2, or
- the apparatus shall show a specified fault indication and/or output.

After the test any degradation in performance shall be self-recoverable and the apparatus shall continue to operate as intended. No permanent change of actual operating state or stored data or continuous deactivation of alarm is allowed.

Performance criterion C: Temporary loss of function is allowed during the test, provided the loss of function is self recoverable or can be easily restored by the operation of the controls. The apparatus shall operate as intended after the test. No change of stored data is allowed.

9 Electrostatic Discharge

Test result Pass

9.1 Severity Level and Performance Criterion

9.1.1 Test level

Contact discharge		Air discharge	
Level	Test voltage (kV)	Level	Test voltage (Kv)
1	2	1	2
2	4	2	4
3	6	3	8
4	8	4	15
X	Special	X	Special
Notes: 1. "X" is an open level. The level has to be specified in the dedicated equipment specification. If higher voltages than those shown are specified, special test equipment may be needed. 2. The gray rows were the selected test level.			

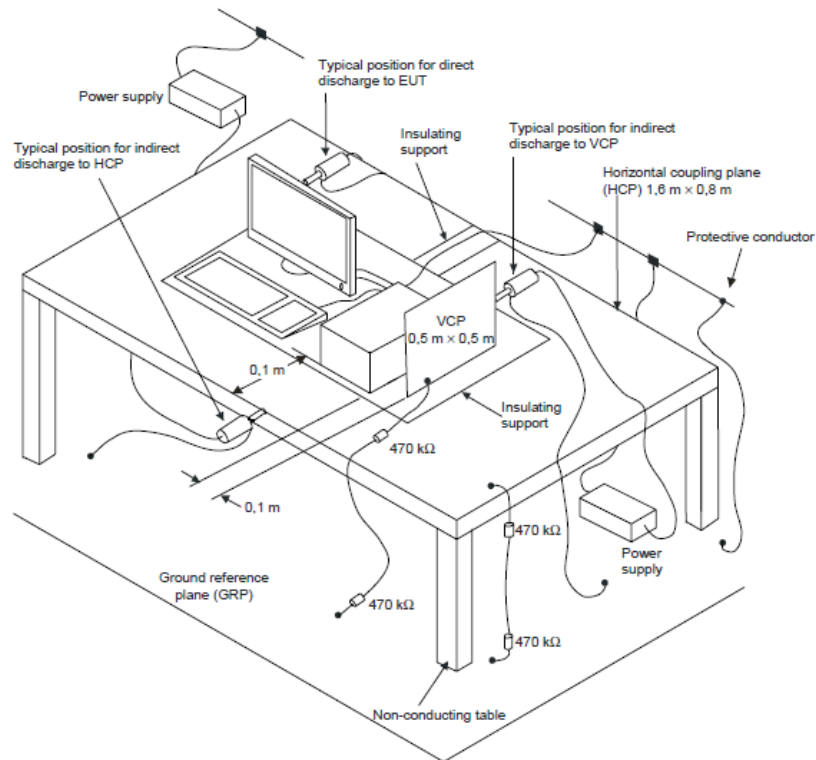
9.1.2 Performance Criterion

Criterion B for type 1 apparatus

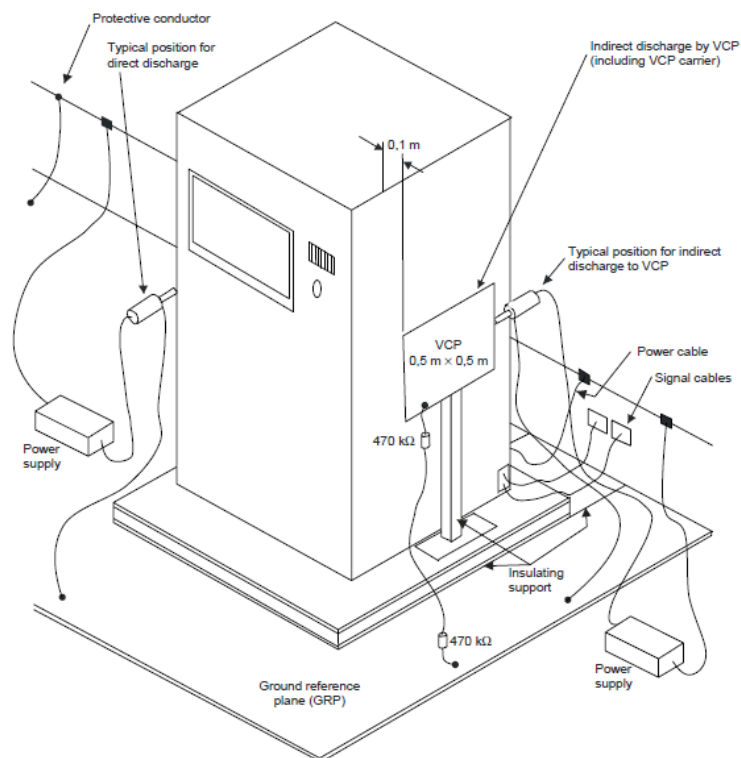
Criterion A for type 2 apparatus

9.2 Test Setup

For table-top equipment



For floor standing equipment



9.3 Test Procedure

Measurement was performed in shielded room.
Measurement procedure was applied according to EN 61000-4-2.

9.4 Test Result

Direct discharges were applied at the following selected points:

Test level [kV]	Air/Contact	Polarity (+/-)	Pass/Fail/NA	Comment
6	Contact	+/-	Pass	Accessible metal parts of the EUT
6	Contact	+/-	Pass	All touchable screws of enclosure
2/4/8	Air	+/-	Pass	Air gap of the switch, button
2/4/8	Air	+/-	Pass	Slots around the EUT

Indirect contact discharges were applied to the VCP and the HCP at the following selected points:

For table-top equipment

Position	Description	Point	Pass/Fail/NA
HCP front	0,1m from the front of the EUT	Edge of centre on HCP	Pass
HCP back	0,1m from the back of the EUT	Edge of centre on HCP	Pass
HCP right	0,1m from the right side of the EUT	Edge of centre on HCP	Pass
HCP left	0,1m from the left side of the EUT	Edge of centre on HCP	Pass
VCP front	0,1m from the front of the EUT	Edge of centre on VCP	Pass
VCP back	0,1m from the back of the EUT	Edge of centre on VCP	Pass
VCP right	0,1m from the right of the EUT	Edge of centre on VCP	Pass
VCP left	0,1m from the left of the EUT	Edge of centre on VCP	Pass

For floor standing equipment

Position	Description	Point	Pass/Fail/NA
VCP front	0,1m from the front of the EUT	Edge of centre on VCP	NA
VCP back	0,1m from the back of the EUT	Edge of centre on VCP	NA
VCP right	0,1m from the right of the EUT	Edge of centre on VCP	NA
VCP left	0,1m from the left of the EUT	Edge of centre on VCP	NA

Observation: All the functions were operated as normal after the test.

Conclusion: The EUT can meet the requirement of Performance Criterion A.

10 Radio-frequency electromagnetic field

Test result Pass

10.1 Severity Level and Performance Criterion

10.1.1 Test level

Level	Test field strength V/m
1	1
2	3
3	10
X	Special
Note: 1. X is an open test level. This level may be given in the product specification. 2. The yellow row is the selected test level.	

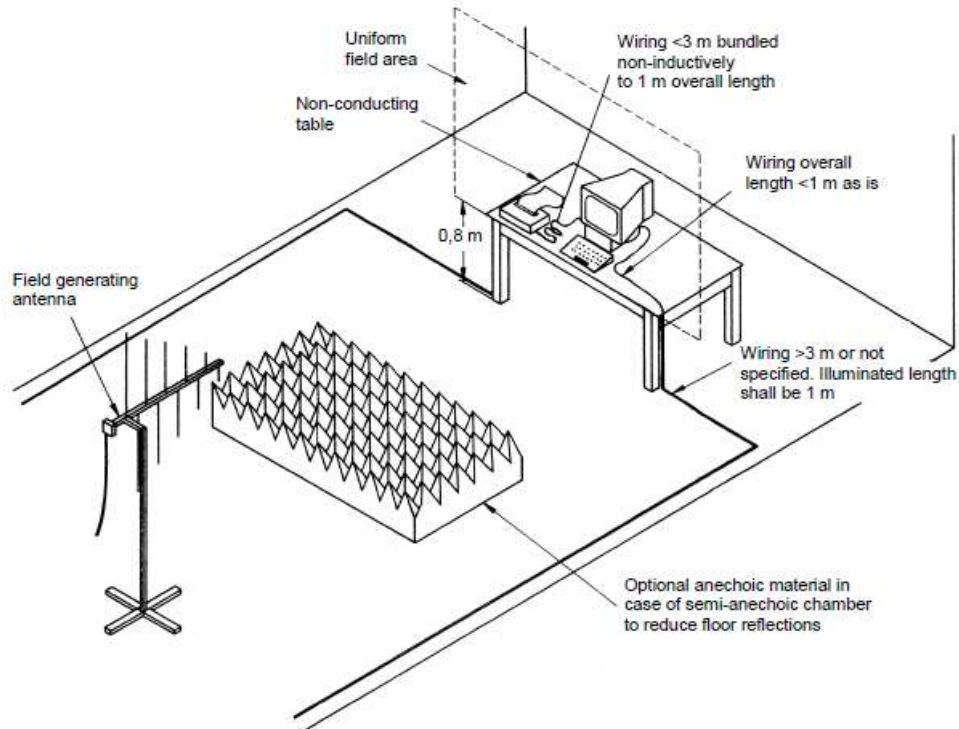
10.1.2 Performance Criterion

Criterion A for type 1 apparatus

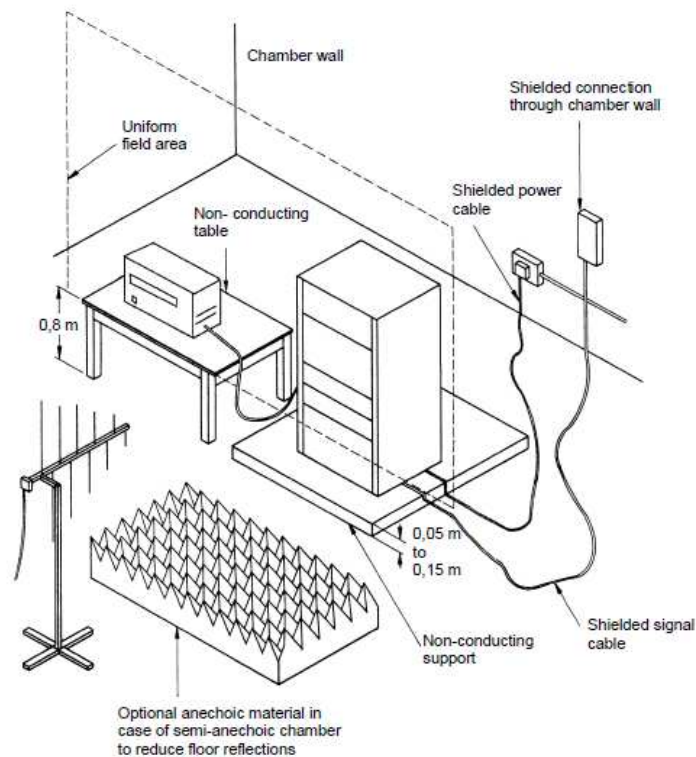
Criterion A for type 2 apparatus

10.2 Test Setup

For table-top equipment



For floor standing equipment



10.3 Test Procedure

Measurement was performed in full-anechoic chamber.

Measurement procedure was applied according to EN 61000-4-3 clause 8.

10.4 Test Result

Test no.	Frequency (MHz)	Polarization	Test level (V/m)	Modulation	Exposed location	Pass/Fail/NA
1	80-1000	H & V	10	1 kHz, 80% AM 1 % increment	All sides	Pass
2	1400-2000	H & V	10	1 kHz, 80% AM 1 % increment	All sides	Pass
3	2000-2700	H & V	3	1 kHz, 80% AM 1 % increment	All sides	Pass

Observation: All the functions were operated as normal during and after test.

Conclusion: The EUT can meet the requirement of Performance Criterion A.

11 Fast transients / bursts

Test result Pass

11.1 Severity Level and Performance Criterion

11.1.1 Test level

Open circuit output test voltage and repetition rate of the impulses				
Level	DC power ports		Signal ports	
	Voltage peak (kV)	Repetition rate (kHz)	Voltage peak (kV)	Repetition rate (kHz)
1	0.5	5	0.25	5 / 100
2	1	5	0.5	5 / 100
3	2	5	1	5 / 100
4	4	5	2	5 / 100
X	Special	Special	Special	Special
Notes: 1. "X" is an open level. The level has to be specified in the dedicated equipment specification. 2. The yellow rows were the selected test level.				

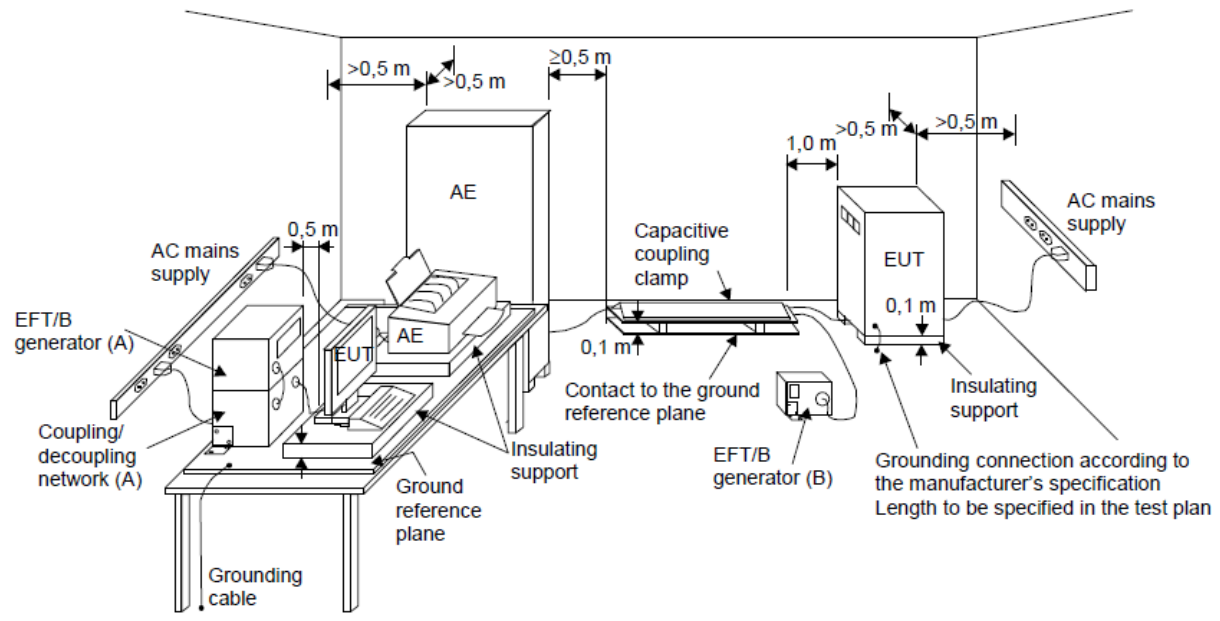
11.1.2 Performance Criterion

Criterion B for type 1 apparatus

Criterion A for type 2 apparatus

TEST REPORT

11.2 Test Setup



(A) location for supply line coupling

(B) location for signal lines coupling

11.3 Test Procedure

Measurement was performed in shielded room.

Measurement procedure was applied according to EN 61000-4-4.

11.4 Test Result

Test No.	Level (kV)	Polarity (+/-)	Port for test	Pass/Fail/NA
1	2	+/-	AC power ports	NA
2	2	+/-	DC power ports	Pass
3	1	+/-	Signal Ports	NA

Observation: All the functions were operated as normal after the test.

Conclusion: The EUT can meet the requirement of Performance Criterion A.

12 Surges

Test result Pass

12.1 Severity Level and Performance Criterion

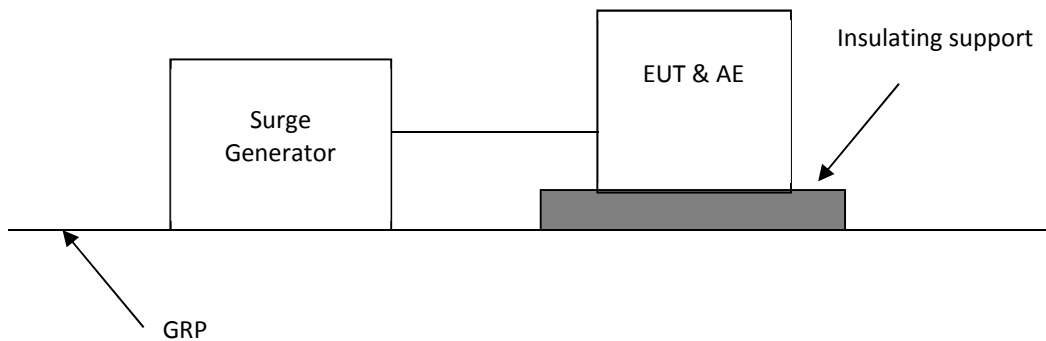
12.1.1 Test level

Level	Open-circuit test voltage (kV)
1	0.5
2	1.0
3	2.0
4	4.0
X*	Special
Notes: 1."X" is an open class. This level can be specified in the product specification 2. The yellow rows are the selected level.	

12.1.2 Performance Criterion

Criterion B for type 1 apparatus
Criterion A for type 2 apparatus

12.2 Test Setup



12.3 Test Procedure

Measurement was performed in shielded room.

Measurement procedure was applied according to EN 61000-4-5.

12.4 Test Result

Test No.	Level [kV]	Polarity +/-	Port for test	Pass/Fail/NA
1	0.5/1	+/-	AC power ports (line to line)	NA
2	0.5/1/2	+/-	AC power ports (line to earth)	NA
3	0.5/1	+/-	DC power ports (line to line)	Pass
4	0.5/1/2	+/-	DC power ports (line to earth)	Pass
5	0.5/1	+/-	Signal ports (line to line)	NA
6	0.5/1	+/-	Signal ports (line to earth)	NA

Observation: All the functions were operated as normal after the test.

Conclusion: The EUT can meet the requirement of Performance Criterion A.

13 Radio-frequency common mode

Test result **Pass**

13.1 Severity Level and Performance Criterion

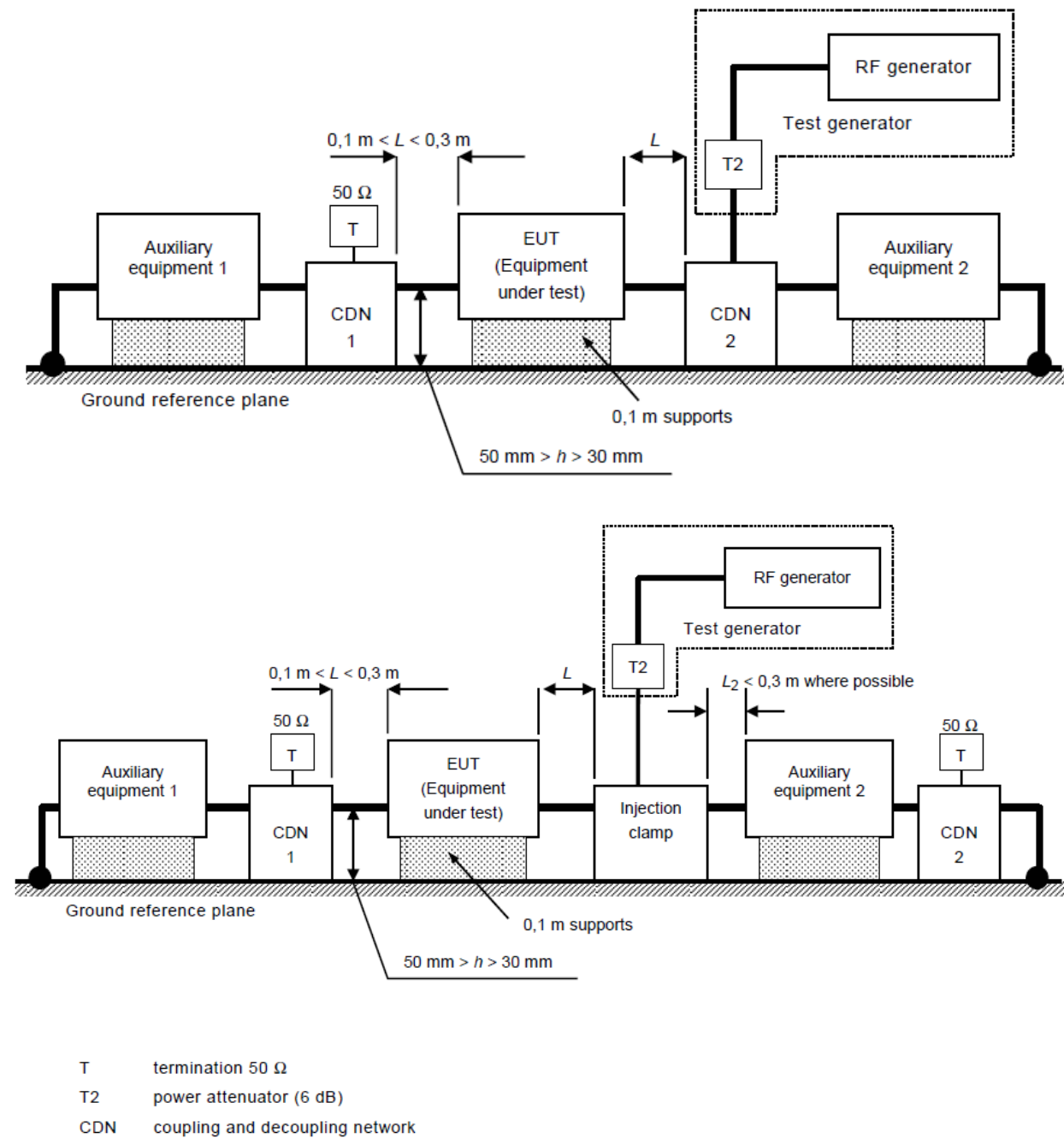
13.1.1 Test level

Frequency range 150kHz – 100MHz		
Level	Voltage level	
	U ₀ (dBuV)	U ₀ (V)
1	120	1
2	130	3
3	140	10
X	Special	Special
Notes: 1. "X" is an open level 2. The yellow row is the selected test level.		

13.1.2 Performance Criterion

Criterion A for type 1 apparatus
 Criterion A for type 2 apparatus

13.2 Block Diagram of Test Setup



13.3 Test Procedure

Measurement procedure was applied according to EN 61000-4-6.

13.4 Test Result

Test No.	Frequency (MHz)	Level (V)	Modulation	Injected point	Pass/Fail/NA
1	0.15~80	10	80%, 1 kHz, AM	AC power ports	NA
2	0.15~80	10	80%, 1 kHz, AM	DC power ports	NA
3	0.15~80	10	80%, 1 kHz, AM	Signal ports	NA

Observation: All the functions were operated as normal during and after test.

Conclusion: The EUT can meet the requirements of Performance Criterion A

14 Power-frequency magnetic field

Test result Pass

14.1 Severity Level and Performance Criterion

14.1.1 Test level

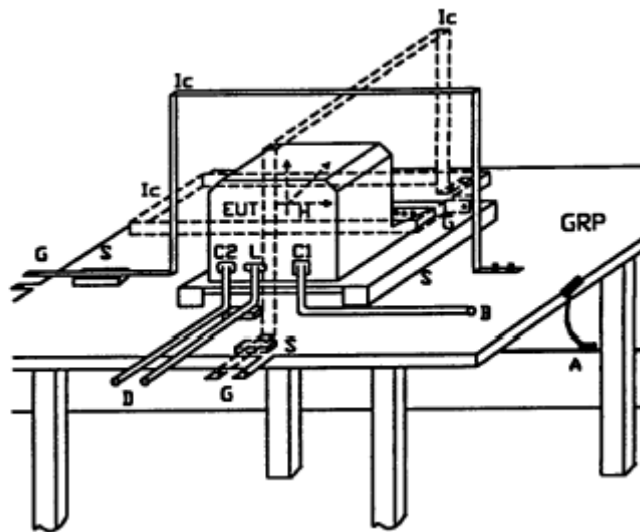
Level	Magnetic field strength (A/m)
1	1
2	3
3	10
4	30
5	100
X	Special
Note: 1. X is an open test level; this level may be given in the product specification. 2. The yellow row is the selected test level.	

14.1.2 Performance Criterion

Criterion A for type 1 apparatus

Criterion A for type 2 apparatus

14.2 Test Setup



14.3 Test Procedure

Measurement was performed in shielded room.

Measurement procedure was applied according to EN 61000-4-8.

The test method and equipment was specified by EN 61000-4-8

14.4 Test Result

Test No.	Level (A/m)	Axis	Result
1	1	X	Pass
2	1	Y	Pass
3	1	Z	Pass

Observation: All the functions were operated as normal after test.

Conclusion: The EUT can meet the requirements of Performance Criterion A

15 Voltage dips and short interruptions

Test result **Pass**

15.1 Severity Level and Performance Criterion

15.1.1 Test level

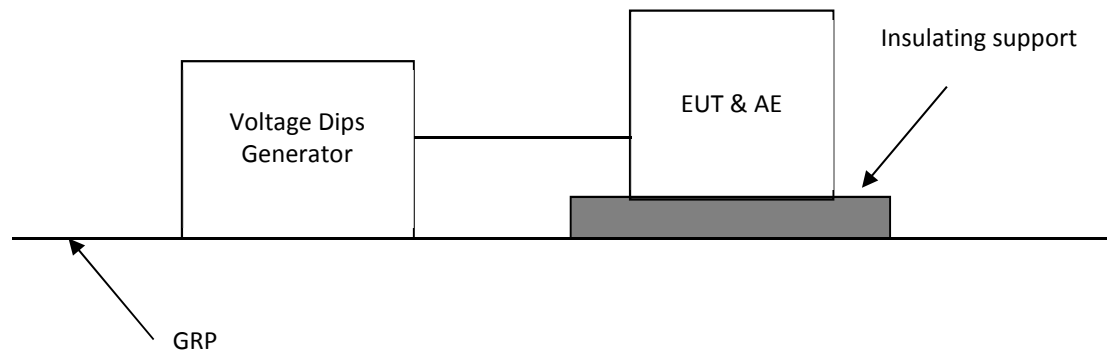
Power Port	Test level (% Ut)	Voltage dip and short interruptions (% Ut)	Duration
AC	0	100	1 cycle
AC	40	60	10 cycles for 50Hz 12 cycles for 60Hz
AC	70	30	25 cycles for 50Hz 30 cycles for 60Hz
AC	0	0	250 cycles for 50Hz 300 cycles for 60Hz
DC	100	0	1000 ms
DC	60	40	1000 ms
DC	100	0	20 ms

Notes: The yellow is the selected test level.

15.1.2 Performance Criterion

Criterion C for type 1 apparatus
Criterion C for type 2 apparatus

15.2 Test Setup



15.3 Test Procedure

Measurement was performed in shielded room.

Measurement procedure was applied according to EN 61000-4-11.

15.4 Test Result

Test no.	Dips to (% Ut)	Voltage dip and short interruptions (% Ut)	Duration (ms)	Pass/Fail/NA
1	100	0	1000	Pass
2	60	40	1000	Pass
3	100	0	20	Pass

Observation: All the functions were operated as normal after test.

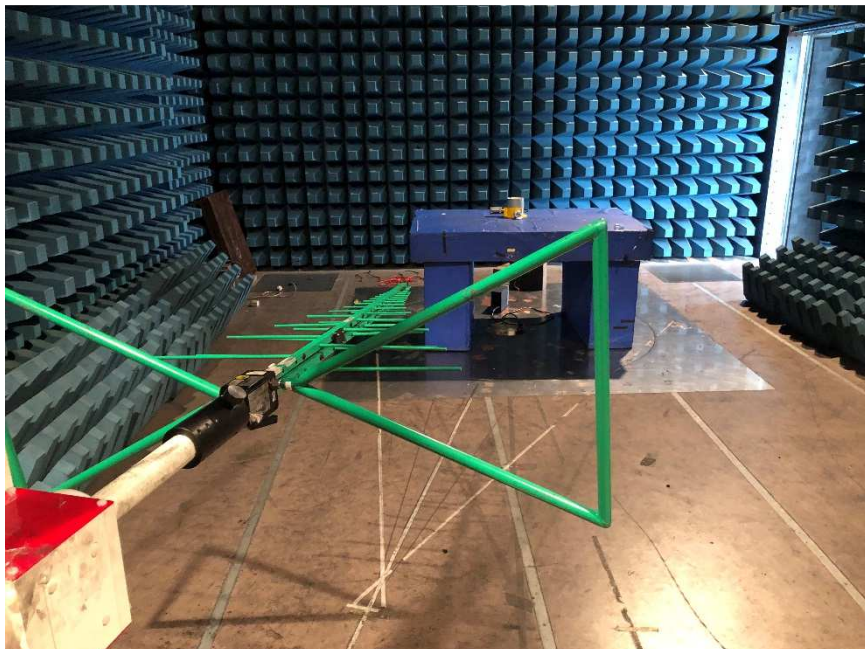
Conclusion: The EUT can meet the requirements of Performance Criterion C

Appendix I: Photograph of Test setup

Conducted emission
DC Port



Radiation emission

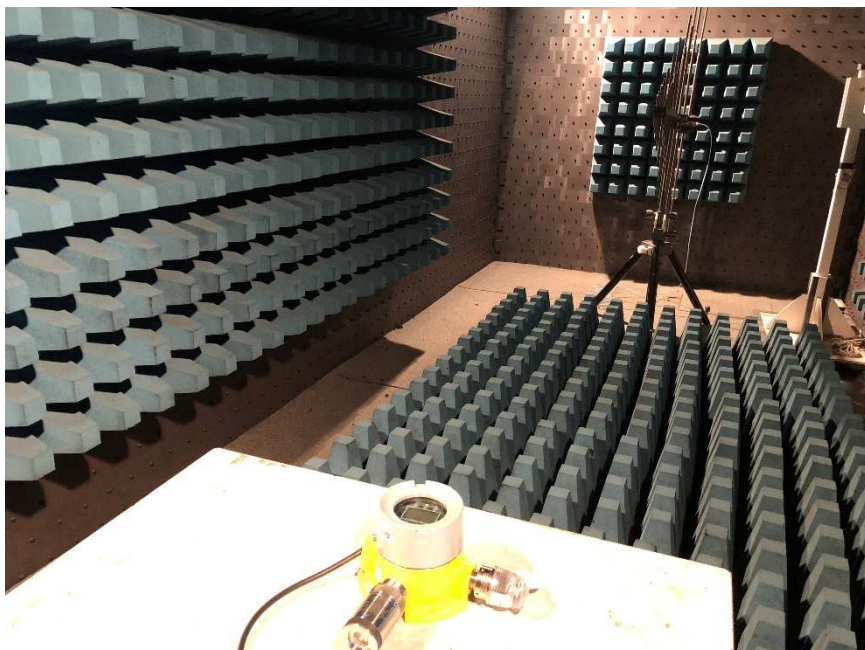


Electrostatic discharge

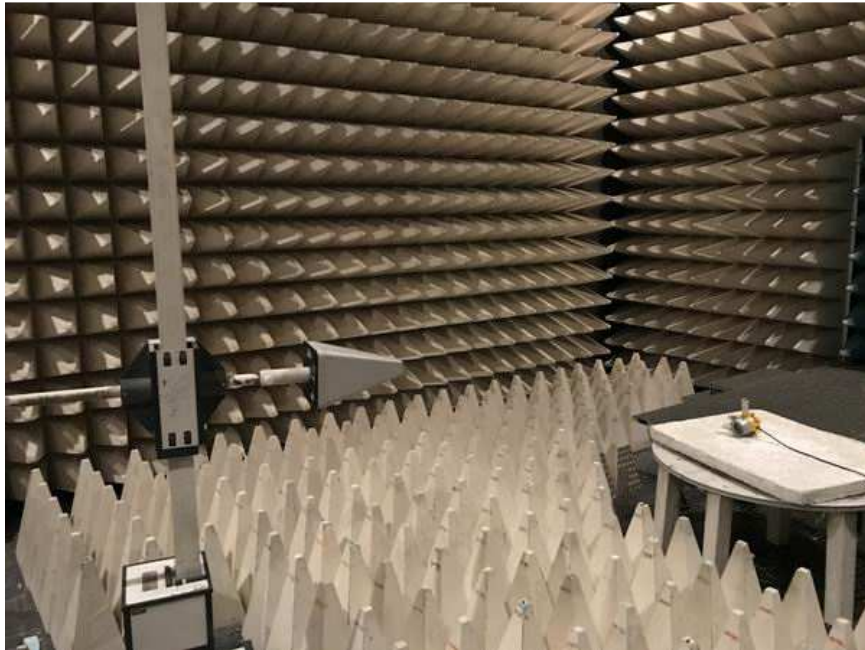


Radio frequency electromagnetic field

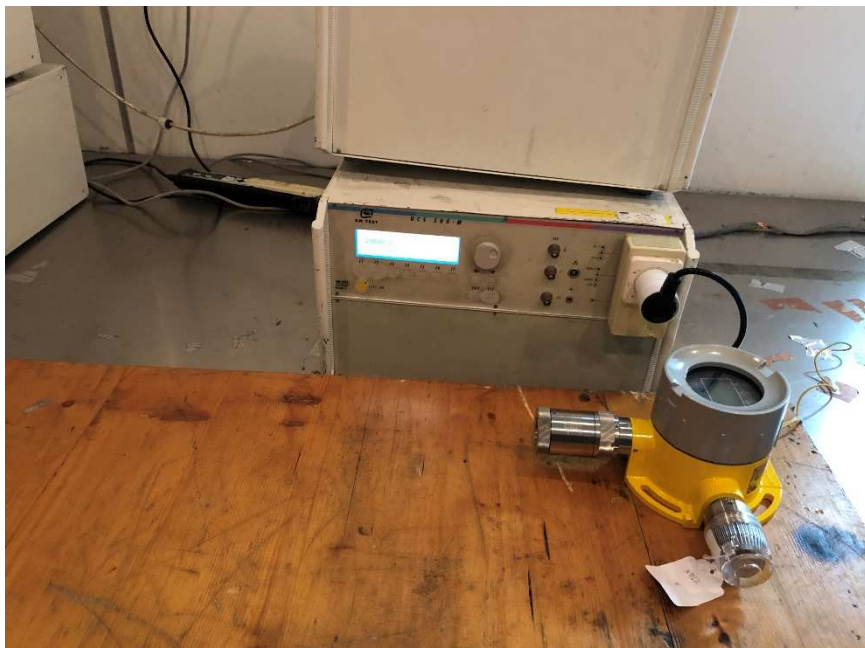
(80MHz-1GHz)



(1GHz-2.7GHz)



fast transients, common mode and surge



Power frequency magnetic field



Appendix II: Photograph of equipment under test



Appendix III: Photograph of Photograph of PCB

Main board







***** END *****