

EMC TEST REPORT

Product Name lawn mower
Trade mark /
Model No. 12V, 21V, 18V, 24V, 36V, 42V, 88V, 188V
Report No. CTB211210007EX
Applicant Yongkang champagne industry and Trade Co., Ltd
No. 89, Changsheng East Road, Xiangzhu Town, Yongkang City, Jinhua City, Zhejiang Province
Manufacturer Yongkang champagne industry and Trade Co., Ltd
No. 89, Changsheng East Road, Xiangzhu Town, Yongkang City, Jinhua City, Zhejiang Province
Prepared by Shenzhen CTB Testing Technology Co., Ltd.
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Date of Receipt 2021-12-07
Date of Test(s) 2021-12-08 to 2021-12-13
Date of Issue 2021-12-13
Test Standard(s) EN 55014-1:2017/A11:2020, EN 55014-2:2015
EN IEC 61000-3-2:2019, EN 61000-3-3:2013/A1:2019
Test Result: Pass

In the configuration tested, the EUT complied with the standards specified above.

Compiled by:

Du Fei

Du Fei

Reviewed by:

Zack Zhu

Zack Zhu

Approved by:



Note: The results shown in this test report refer only to the sample(s) tested unless otherwise stated. This test report shall not be reproduced except in full, without prior written approval of CTB. This document may be altered or revised by CTB, personnel only, and shall be noted in the revision of the document.

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1. Description of version

Report No.	Issue Date	Description	Approved
CTB211210007EX	2021-12-13	Original	Valid

2. Test summary

Emission		
Test item	Test Method	Result
Continuous disturbance	EN 55014-1	PASS
Discontinuous disturbance		N/A
Disturbance power		N/A
Radiated emission		PASS
Harmonic current emissions	EN IEC 61000-3-2	N/A ¹
voltage changes, voltage fluctuations and flicker	EN 61000-3-3	PASS
Immunity(EN 55014-2:2015)		
Test item	Test Method	Result
Electrostatic discharges	IEC 61000-4-2	PASS
Fast transients	IEC 61000-4-4	PASS
Injected currents	IEC 61000-4-6	PASS
Radio frequency electromagnetic field	IEC 61000-4-3	PASS
Surges	IEC 61000-4-5	PASS
Voltage dips	IEC 61000-4-11	PASS

Note: N/A is abbreviation for Not Applicable.

1. The Product belongs to Class A, and its power is less than 75W, so it deems to fulfil this standard without testing.

3. Measurement uncertainty

The reported uncertainty of measurement $y \pm U$, where expanded uncertainty U is based on a standard

Test item	Frequency	Expanded Uncertainty (U_{Lab})
Conducted Emission	150 kHz to 30 MHz	± 3.2 dB
Disturbance power	30 MHz to 300 MHz	± 3.7 dB
Magnetic field strength	9 kHz-30 MHz	± 2.8 dB
Radiated Emission	30 MHz to 1000 MHz	± 4.8 dB
Radiated Emission	1000 MHz to 6000 MHz	± 4.9 dB

uncertainty multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95 %

4. General information

4.1. Description of EUT

Product name	lawn mower
Trade Mark	/
Model	21V
Serial No.	12V,18V, 24V, 36V, 42V, 88V, 188V
Model Difference	All model's the function, software and electric circuit are the same, only with a product color and model named different. Test sample model: 21V,
Rated Power	650W
Normal Testing Voltage	AC230V/50Hz& DC21V
Category	<input type="checkbox"/> I <input checked="" type="checkbox"/> II <input type="checkbox"/> III <input type="checkbox"/> IV
Configuration	<input checked="" type="checkbox"/> Table-top <input type="checkbox"/> Floor-standing
Adapter Information:	Model No.:TZ-C03AE Input:100-240V 50Hz 1.0A Output:21V-98V 1000mA

Note: The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

4.2. Description of Accessory Device

No.	Device Type	Brand	Model	Specification	Note
/	/	/	/	/	/

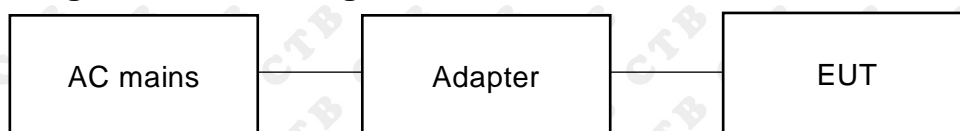
4.3. Test conditions

Temperature: 15-25°C

Relative Humidity: 30-60 %

Atmospheric pressure: 800hPa-1060hPa

4.4. Block diagram of EUT configuration



4.5. Operating condition of EUT

Operating condition	Mode 1*	Charging	Test Voltage	AC 230V/50Hz
	Mode 2	Working	Test Voltage	DC 21V

Note: This test covers all possible operating modes of the device, only the worst data are list in report. The worst data are shows (*)is the nearest standard limit which were recorded in this report.

5. List of test and measurement instruments

Continuous disturbance					
No.	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	AMN	ROHDE&SCHWARZ	ESH3-Z5	831551852	2022.08.05
2	Pulse limiter	ROHDE&SCHWARZ	ESH3Z2	357881052	2022.08.05
3	EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCS30	834115/006	2022.08.05
4	Coaxial cable	ZDECL	Z302S	18091904	2022.08.05
5	AAN	Schwarzbeck	NTFM8158	6114	2022.08.05
6	EZ-EMC	Frad	EMC-con3A1.1	/	/

Radiated emission					
No.	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	Double Ridged Broadband Horn Antenna	Schwarzbeck	BBHA 9120D	1911	2022.08.07
2	TRILOG Broadband Antenna	Schwarzbeck	VULB 9168	869	2022.08.07
3	Amplifier	Agilent	8449B	3008A01838	2022.08.05
4	Amplifier	HP	8447E	2945A02747	2022.08.05
5	EMI TEST RECEIVER	ROHDE&SCHWARZ	ESPI7	100362	2022.08.05
6	Coaxial cable	ETS	RFC-SNS-100 -NMS-80 NI	/	2022.08.05
7	Coaxial cable	ETS	RFC-SNS-100 -NMS-20 NI	/	2022.08.05
8	Coaxial cable	ETS	RFC-SNS-100 -SMS-20 NI	/	2022.08.05
9	Coaxial cable	ETS	RFC-NNS-10 0-NMS-300 NI	/	2022.08.05
10	EZ-EMC	Frad	EMC-con3A1. 1	/	/

Harmonic current emission & Voltage changes, voltage fluctuations and flicker					
No.	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	Power Analyzer	Laplace Instruments	AC2000A	311363	2022.08.05
2	AC Power source	HTEC Instruments	HPF5010	633088	2022.08.05
3	TTI HA1600	/	Ver.3.01	/	/

Electrostatic discharges					
No.	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	ESD Simulator	TESTQ	NSG437	329	2022.08.07

Surges & Fast transients					
No.	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	Surge& Burst Generator	Lioncel	LSG-545CB	180602	2022.08.05
2	Capacitive coupling clamp	Lioncel	EFTC	18071801	2022.08.05

Voltage dips					
No.	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	Voltage dip simulator	Lioncel	VDS-1102	180902	2022.08.05

Injected currents					
No.	Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	C/S Test System	SKET	CITS-150K230M-75W	2106070108	2022.08.16
2	CDN	SKET	CDN-150K230M-M2/M3-16A	2106070109	2022.08.16
3	CDN	SKET	CDN-150K80M-T8-	2106070110	2022.08.16
4	6dB 100Watt Attenuator	SKET	AP-DC01G-100W-N-6dB	2106070112	2022.08.16
5	Electromagnetic Injection Clamp	SKET	EC-150K230M	2106070111	2022.08.16
6	50Ω Load	SKET	TL-DC01G-2W-50BNC	2106070113	2022.08.16
7	Test Software	SKET	/	/	/

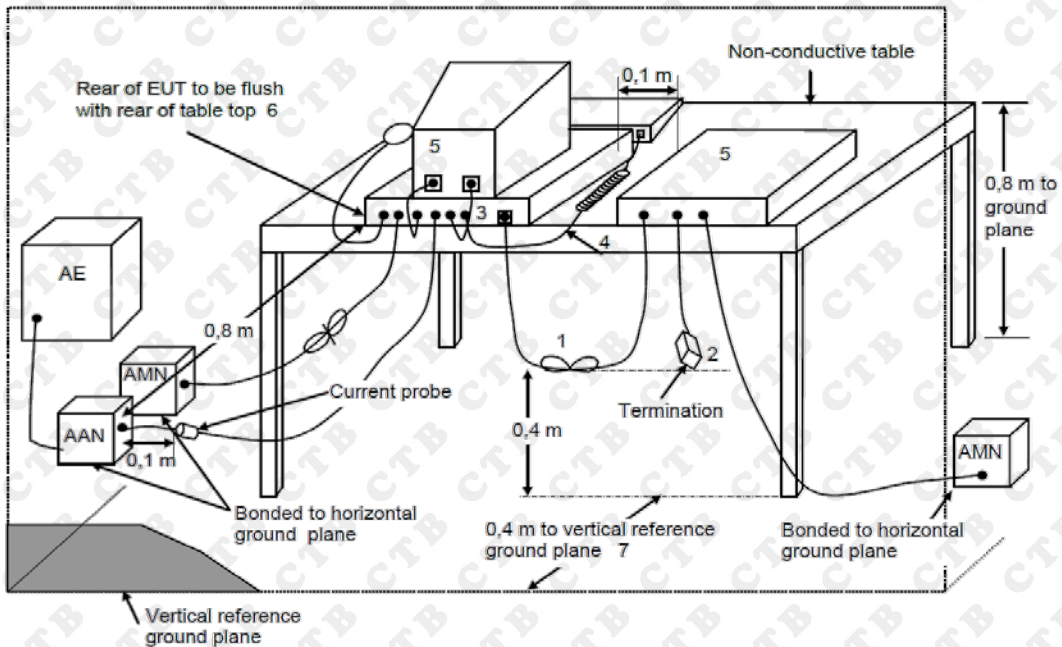
Radio frequency electromagnetic field					
No.	Equipment	Manufacturer	Type No.	Serial No.	Calibrated until
1	Signal Generator	Agilent	N5181A	2106070101	2022.08.16
2	Stacked Double Log.-Per. Antenna	SKET	STLP 9129 Plus	2106070106	2022.08.16
3	Switch Controller	SKET	RFSU-DC18 G-4C	2106070105	2022.08.16
4	RF Power Meter	Agilent	U2001	2106070102	2022.08.16
5	E-Field Probe	Narda	EP-601	2106070107	2022.08.16
6	Power Amplifier	SKET	HAP-80M01G -250W	2106070103	2022.08.16
7	Power Amplifier	SKET	HAP-01G 06G-75W	2106070104	2022.08.16
8	Audio Analysis	R&S	UPV	2106070116	2022.08.16
9	Audio Output Matching Network	SKET	RCO Network	2106070117	2022.08.16
10	Test Software	SKET	/	/	/

6. Emission

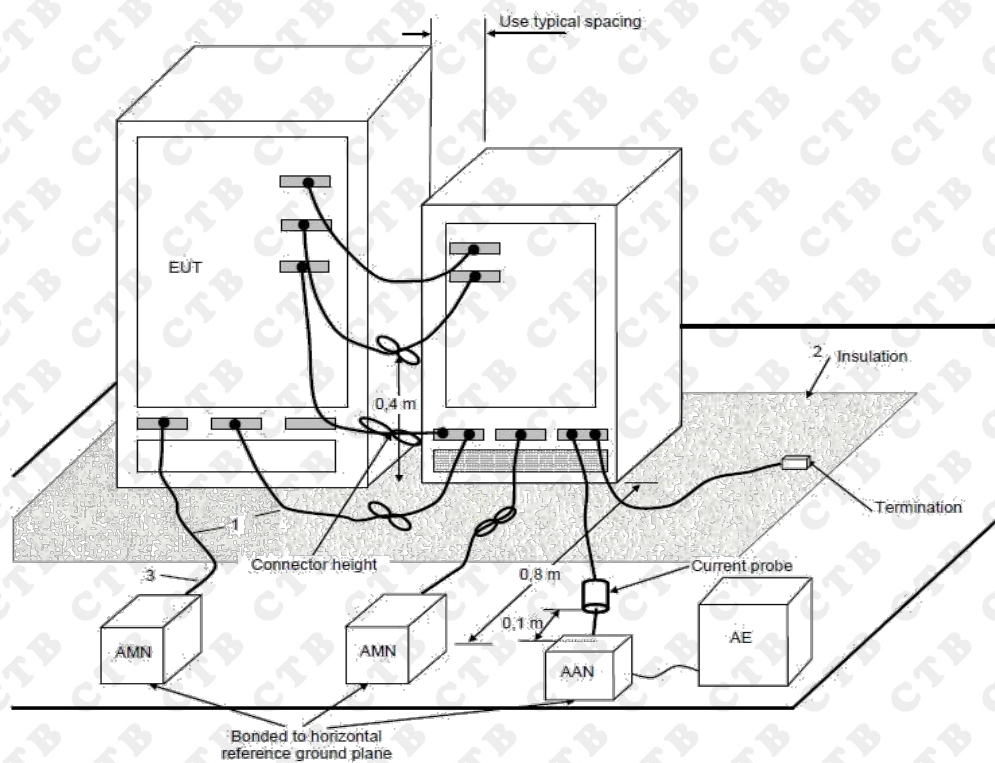
6.1. Continuous disturbance

6.1.1. Block diagram of test setup

For table-top equipment



For floor standing equipment



6.1.2. Limit

General limits						
Frequency range	Mains ports		Associated ports			
	Disturbance voltage		Disturbance voltage		Disturbance current	
MHz	Quasi-peak dB μ V	Average dB μ V	Quasi-peak dB μ V	Average dB μ V	Quasi-peak dB μ A	Average dB μ A
0,15 to 0,50	Decreasing linearly with the logarithm of the frequency from:		80	70	Decreasing linearly with the logarithm of the frequency from:	
	66 to 56	59 to 46			40 to 30	30 to 20
0,50 to 5	56	46	74	64	30	20
5 to 30	60	50	74	64		

The lower limit applies at the transition frequencies.
The test report shall state which test method was used and which limits were applied.

Limits for mains port of tools						
Frequency range	P \leq 700 W		700 W < P \leq 1 000 W		P > 1 000 W	
MHz	Quasi-peak dB μ V	Average dB μ V	Quasi-peak dB μ V	Average dB μ V	Quasi-peak dB μ V	Average dB μ V
	Decreasing linearly with the logarithm of the frequency from:					
0,15 to 0,35	66 to 59	59 to 49	70 to 63	63 to 53	76 to 69	69 to 59
0,35 to 5	59	49	63	53	69	59
5 to 30	64	54	68	58	74	64

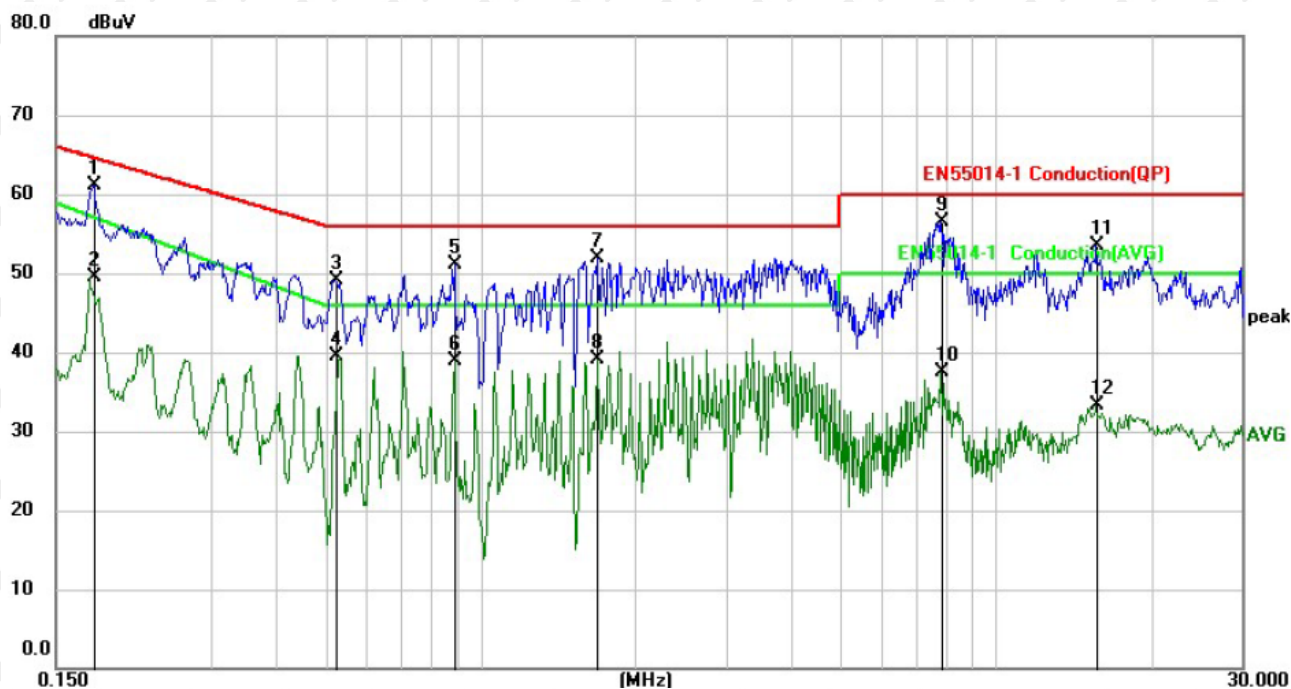
The lower limit applies at the transition frequencies.
P = rated power of the motor only.

6.1.3. Test procedure

1. The AMN placed 0,8m/0,1m from the boundary of the unit under test and bonded to a round reference plane. This distance was between the closest points of the AMN and the EUT. All other units of the EUT and associated equipment were at least 0,8 m from the AMN. All power was connected to the system through Artificial Mains Network (AMN). Conducted voltage measurements on mains lines were made at the output of the AMN.
2. Both sides of AC line are checked to find out the maximum conducted emission according to the EN 55014-1 regulations during conducted emission test. And the voltage probe had been used for the load terminals test according to the EN 55014-1 standard.
3. The bandwidth of the test receiver (R&S ESCS30) is set at 9 kHz in 150 kHz~30 MHz.
4. The frequency range from 150 kHz to 30MHz is checked.

6.1.4. Test results

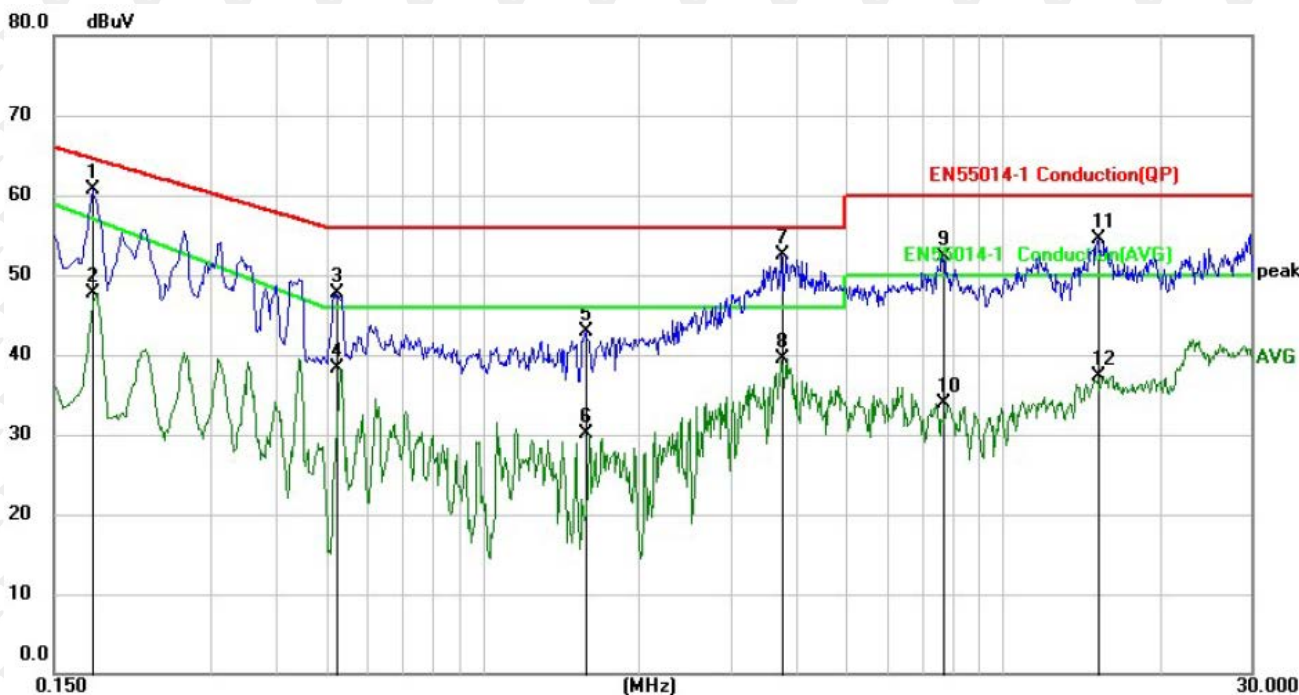
Temperature:	23°C	Relative Humidity:	54 %
Pressure:	101kPa	Phase :	Line
Test Voltage :	AC 230V/50Hz	Test Mode:	Mode 1



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Margin dB	Detector	Comment
1		0.1768	51.15	9.96	61.11	64.63	-3.52	QP	
2		0.1768	39.54	9.96	49.50	57.23	-7.73	AVG	
3		0.5220	39.18	9.96	49.14	56.00	-6.86	QP	
4		0.5220	29.50	9.96	39.46	46.00	-6.54	AVG	
5		0.8900	41.07	9.96	51.03	56.00	-4.97	QP	
6		0.8900	29.02	9.96	38.98	46.00	-7.02	AVG	
7		1.6859	41.89	10.00	51.89	56.00	-4.11	QP	
8		1.6859	29.19	10.00	39.19	46.00	-6.81	AVG	
9	*	7.8338	46.03	10.53	56.56	60.00	-3.44	QP	
10		7.8338	27.02	10.53	37.55	50.00	-12.45	AVG	
11		15.7019	42.49	10.99	53.48	60.00	-6.52	QP	
12		15.7019	22.28	10.99	33.27	50.00	-16.73	AVG	

Note: Result=Reading + Factor
Over Limit=Result - Limit

Temperature:	23°C	Relative Humidity:	54 %
Pressure:	101kPa	Phase :	Neutral
Test Voltage :	AC 230V/50Hz	Test Mode:	Mode 1



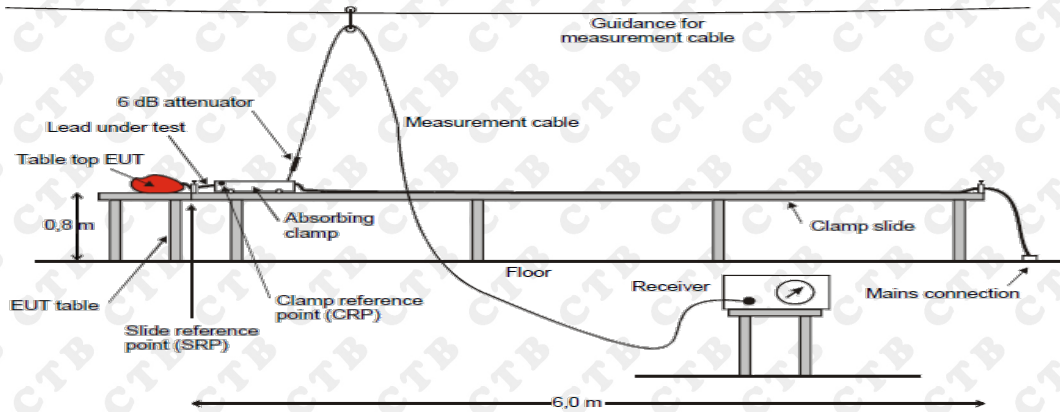
No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Margin dB	Detector	Comment
1		0.1779	50.80	9.96	60.76	64.58	-3.82	QP	
2		0.1779	37.77	9.96	47.73	57.16	-9.43	AVG	
3		0.5220	37.77	9.96	47.73	56.00	-8.27	QP	
4		0.5220	28.32	9.96	38.28	46.00	-7.72	AVG	
5		1.5780	32.87	9.99	42.86	56.00	-13.14	QP	
6		1.5780	20.07	9.99	30.06	46.00	-15.94	AVG	
7	*	3.7500	42.38	10.10	52.48	56.00	-3.52	QP	
8		3.7500	29.40	10.10	39.50	46.00	-6.50	AVG	
9		7.6539	41.81	10.50	52.31	60.00	-7.69	QP	
10		7.6539	23.36	10.50	33.86	50.00	-16.14	AVG	
11		15.3018	43.44	10.98	54.42	60.00	-5.58	QP	
12		15.3018	26.39	10.98	37.37	50.00	-12.63	AVG	

Note: Result=Reading + Factor
Over Limit=Result - Limit

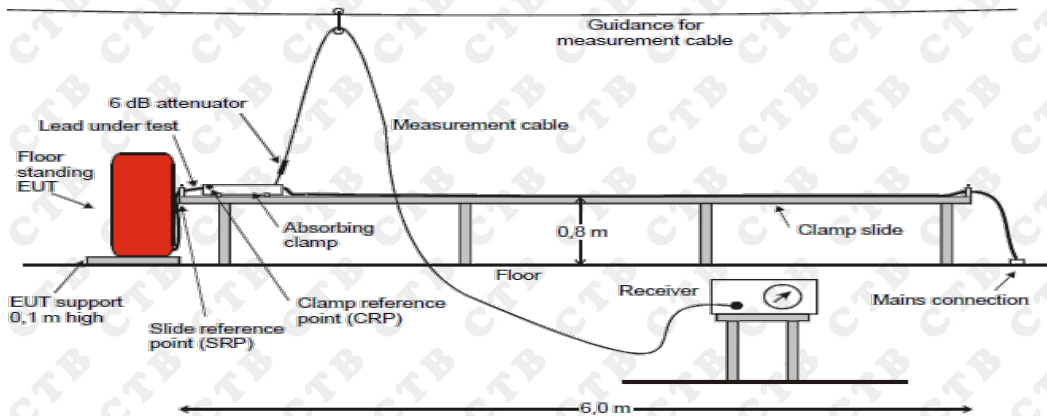
6.4. Disturbance power – 30 MHz to 300 MHz

6.4.1. Block diagram of test setup

For table-top equipment



For floor standing equipment



6.4.2. Limits

Table 1 - Disturbance power limits – 30 MHz to 300 MHz

Frequency range	General		Tools						
			$P \leq 700 \text{ W}$		$700 \text{ W} < P \leq 1\,000 \text{ W}$		$P > 1\,000 \text{ W}$		
1	2	3	4	5	6	7	8	9	
MHz	Quasi-peak dBpW	Average dBpW	Quasi-peak dBpW	Average dBpW	Quasi-peak dBpW	Average dBpW	Quasi-peak dBpW	Average dBpW	
30 to 300	Increasing linearly with the frequency from:								
	45 to 55	35 to 45	45 to 55	35 to 45	49 to 59	39 to 49	55 to 65	45 to 55	

Key
 P = rated power of the motor only.

Note:

If the quasi-peak measurements meet the average limit, the EUT shall be deemed to meet both limits and the measurements using the average detector need not be carried out.

Table 2 - Reduction applicable to Table 1 limit

Frequency range	General		Tools					
			$P \leq 700 \text{ W}$		$700 \text{ W} < P \leq 1\,000 \text{ W}$		$P > 1\,000 \text{ W}$	
1	2	3	4	5	6	7	8	9
MHz	Quasi-peak dBpW	Average dBpW	Quasi-peak dBpW	Average dBpW	Quasi-peak dBpW	Average dBpW	Quasi-peak dBpW	Average dBpW
200 to 300	Increasing linearly with the frequency from:							
	0 to 10	0	0 to 10	0	0	0 to 10	0 to 10	0
Key P = rated power of the motor only.								

6.4.3. Test procedure

1. The disturbance power is measured on the cables attached to the ports of the EUT according to Clause 7 of CISPR 16-2-2 and the methods described in this standard.

2. The measurement was performed in a shielded room.

Frequency range 30MHz – 300MHz was checked and EMI receiver measurement bandwidth was set to 120 kHz.

Note:

The EUT shall be also deemed to comply with the requirement of this standard in the frequency range from 300 MHz to 1 000 MHz without further testing if both conditions 1) and 2) below are fulfilled:

- 1) the disturbance power emission from the EUT is lower than the limits of Table 1 reduced by the values of Table 2;
- 2) the maximum clock frequency is less than 30 MHz

If either of the conditions 1) or 2) is not fulfilled, radiated measurements in the frequency range from 300 MHz to 1 000 MHz shall be performed and the limits of Table 3 for that range applied. In any case, the limits of Table 1 in the frequency range 30 MHz to 300 MHz shall be met.

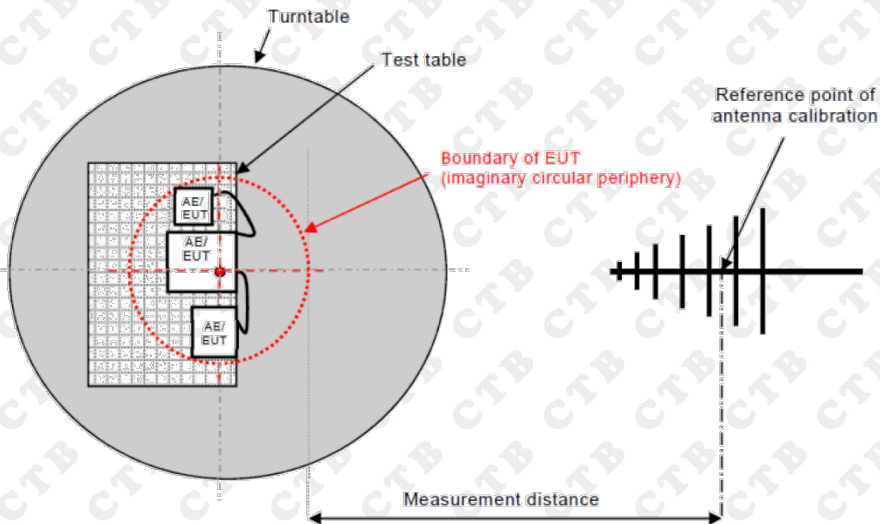
6.4.4. Test results

N/A

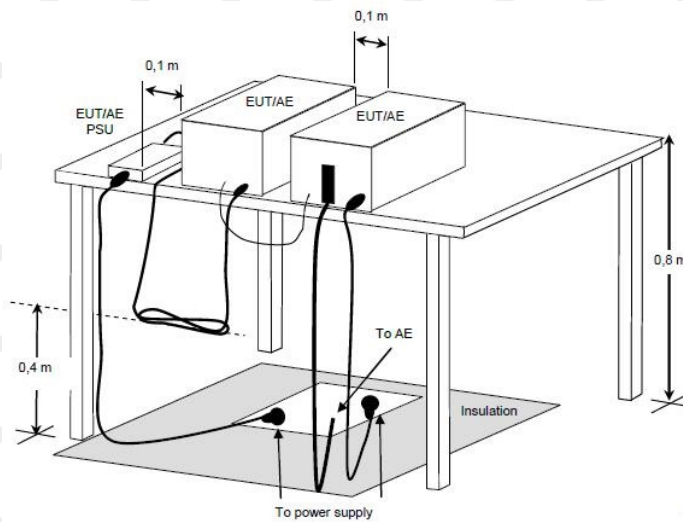
6.5. Radiated emission

6.5.1. Block diagram of test setup

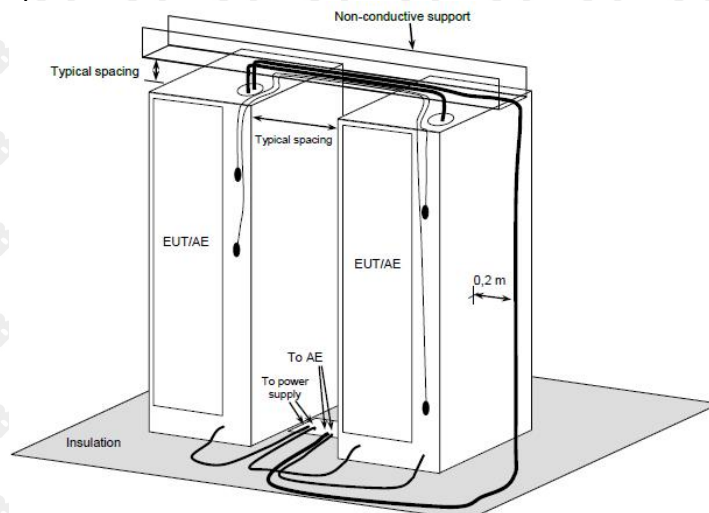
Measurement distance



For table-top equipment



For floor standing equipment



6.5.2. Limit

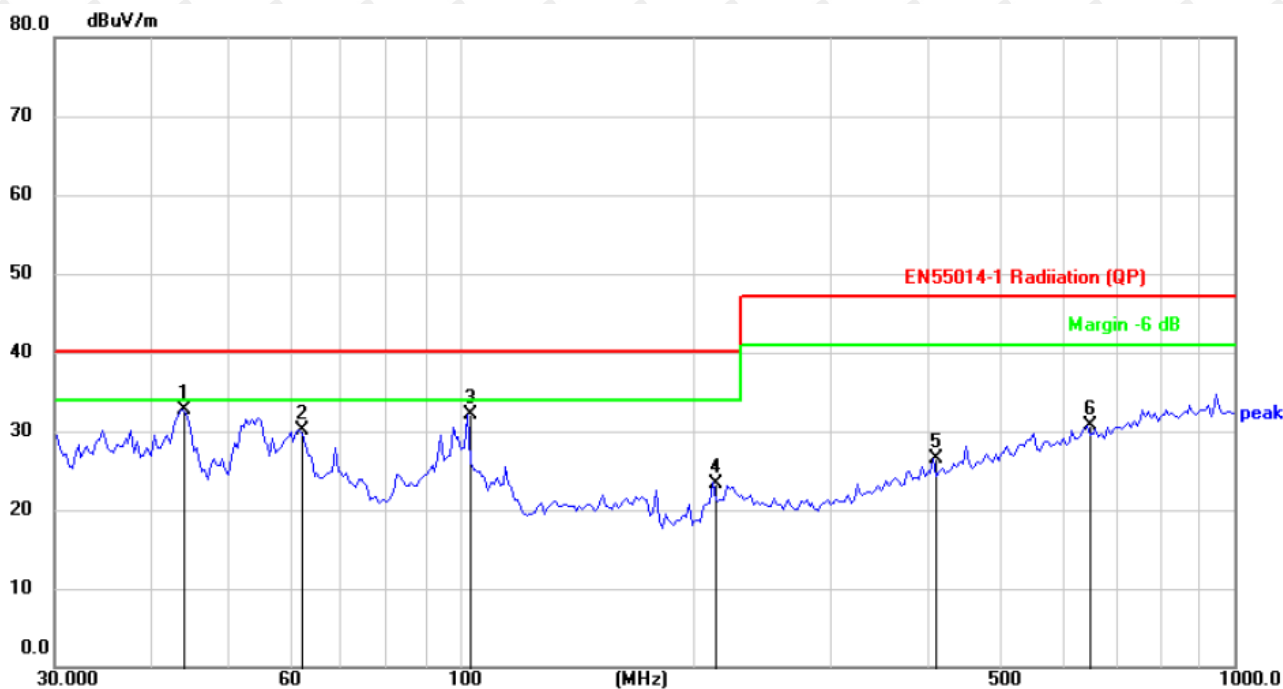
Frequency range MHz	Measurement			Limits dB(μ V/m)
	Facility	Distance m	Detector type / bandwidth	
30 to 230	SAC	3	Quasi Peak / 120 kHz	40
230 to 1 000				47

6.5.3. Test procedure

1. The EUT is placed on a turn table which is 0,8m meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The Boundary of EUT (imaginary circular periphery) is set 3 meters away from the receiving antenna (Reference point of antenna calibration) which is mounted on an antenna tower. The antenna can move up and down between 1 to 4 meters to find out the maximum emission level. Broadband antennas (calibrated by dipole antenna) are used as a receiving antenna.
2. Both horizontal and vertical polarizations of the antenna are set on test.
3. The bandwidth setting on the test receiver (R&S ESPI) reference 5.3.2.
4. The EUT is tested in Semi-Anechoic Chamber.
5. The Test results are listed in Section 5.3.4.

6.5.4. Test results

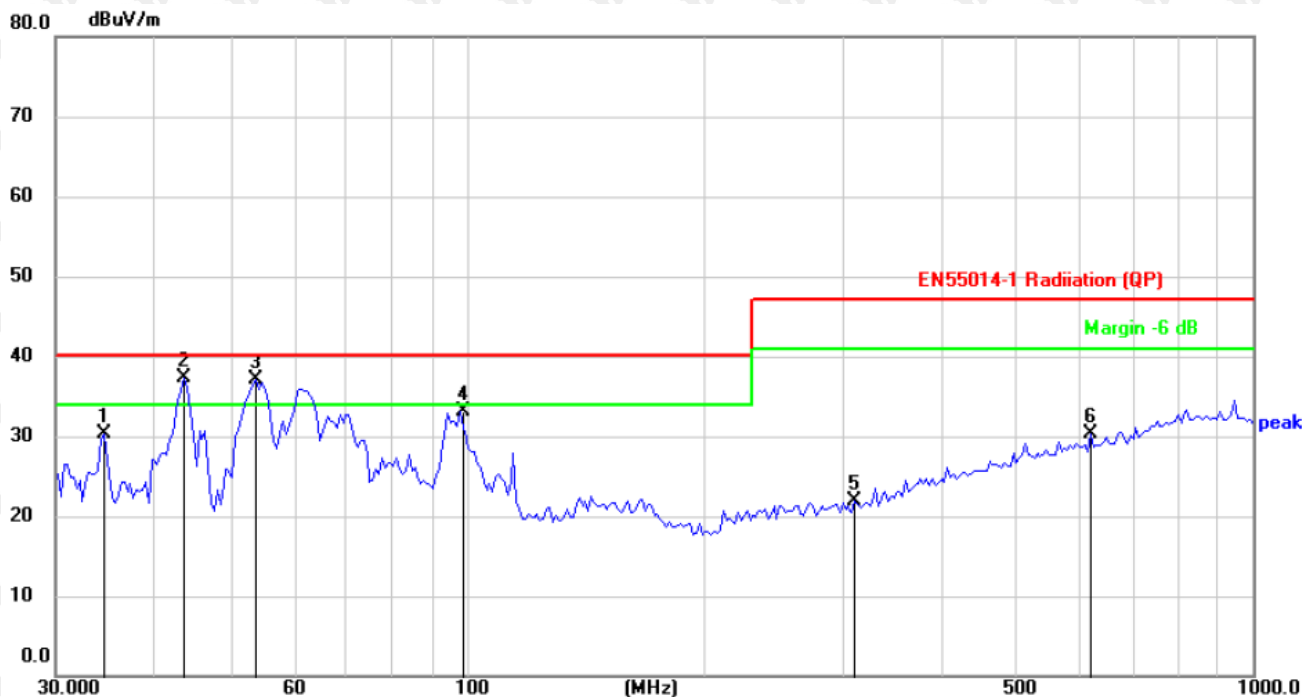
Temperature:	23°C	Relative Humidity:	54 %
Pressure:	101kPa	Polarization :	Horizontal
Test Voltage :	AC 230V/50Hz	Test Mode:	Mode 1



No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Antenna Height cm	Table Degree degree	Comment
1	*	43.7352	38.07	-5.41	32.66	40.00	-7.34	QP		
2		62.1039	36.74	-6.54	30.20	40.00	-9.80	QP		
3		102.3597	40.68	-8.49	32.19	40.00	-7.81	QP		
4		211.8977	30.73	-7.33	23.40	40.00	-16.60	QP		
5		408.9460	27.91	-1.47	26.44	47.00	-20.56	QP		
6		645.1195	27.49	3.20	30.69	47.00	-16.31	QP		

Note: Result=Reading + Factor
Over Limit=Result - Limit

Temperature:	23°C	Relative Humidity:	54 %
Pressure:	101kPa	Phase :	Neutral
Test Voltage :	AC 230V/50Hz	Test Mode:	Mode 1

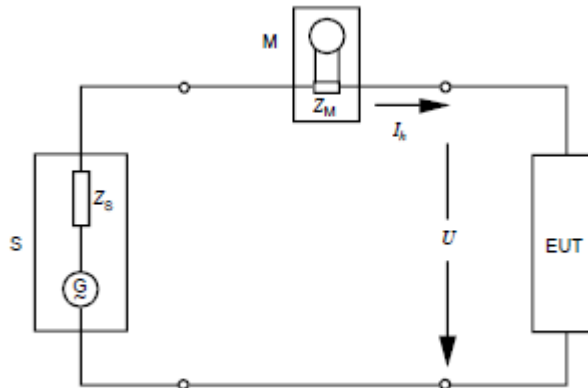


No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dB/m	Over dB	Antenna Height cm	Table Degree degree	Comment
1		34.5172	36.88	-6.58	30.30	40.00	-9.70	QP		
2	*	43.7351	42.73	-5.41	37.32	40.00	-2.68	QP		
3	!	53.9763	42.87	-5.85	37.02	40.00	-2.98	QP		
4		97.9700	41.87	-8.86	33.01	40.00	-6.99	QP		
5		311.6324	26.62	-4.81	21.81	47.00	-25.19	QP		
6		622.8900	27.50	2.89	30.39	47.00	-16.61	QP		

Note: Result=Reading + Factor
Over Limit=Result - Limit

6.6. Harmonic current emissions

6.6.1. Block diagram of test setup



S power supply source

M measurement equipment

EUT equipment under test

Z_M input impedance of measurement equipment

I_h harmonic component of order h of the line current

U test voltage

Z_s internal impedance of the supply source

G open-loop voltage of the supply source

6.6.2. Test Specification

Basic Standard(s)	:	EN IEC 61000-3-2
Measurement Equipment requirement	:	IEC 61000-4-7
Measured Harmonics	:	1 - 40
Equipment Class	:	<input checked="" type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D
Limits	:	<input checked="" type="checkbox"/> Clause 7.1 Table 1 <input type="checkbox"/> Clause 7.2 <input type="checkbox"/> Clause 7.3 Table 2 <input type="checkbox"/> Clause 7.4 Table 3

6.6.3. Test procedure

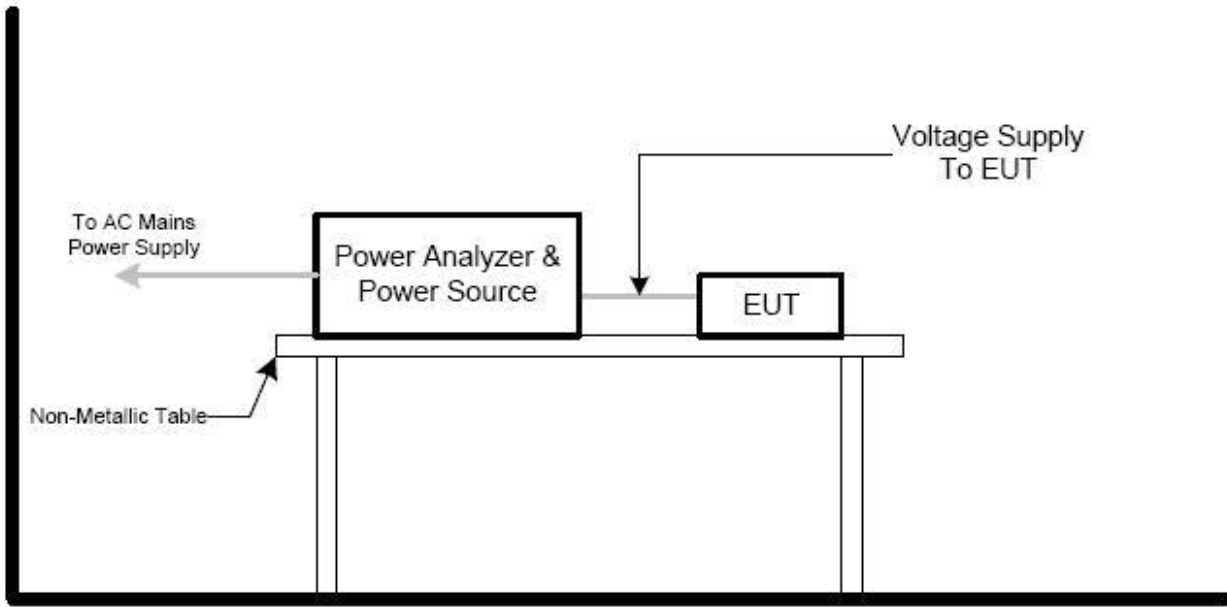
1. EUT is placed on a wooden table with a height of 0,8m/0,1m in the EMC lab.
2. Apply a 230V/50Hz rated test voltage which shall be maintained within $\pm 2.0\%$ and the frequency within $\pm 0.5\%$ of the nominal value to EUT.
3. Let EUT works as stated and through Universal Power Analyzer to measure the EUT to get the harmonic current for Odd & Even harmonics up to 40th.

6.6.4. Test results

N/A

6.7. Voltage changes, voltage fluctuations and flicker

6.7.1. Block diagram of test setup



6.7.2. Test Specification

Basic Standard(s)	:	EN 61000-3-3
Measurement Equipment requirement	:	IEC 61000-4-15
Limits	:	Clause 5

6.7.3. Test procedure

1. EUT is placed on a wooden table with a height of 0,8m/0.1m in the EMC lab.
2. Apply a 230V/50Hz rated test voltage which shall be maintained within $\pm 2.0\%$ and the frequency within $\pm 0.5\%$ of the nominal value to EUT.

6.7.4. Test results

Voltage Variations

Nominal Voltage: 230 Vrms
 Highest Half-cycle level: -1.08%
 Lowest Half-cycle level: -0.18%

d(max): -0.50% Limit: 4% PASS
 t(max): 0.00seconds Limit: 500ms PASS

Steady State definition: >1000ms within +/- 0.2%
 Largest d(c) change down: +0.03%
 Largest d(c) change up: +0.00%
 Largest d(c) change: +0.03% Limit: 3.3% PASS

Flicker

Pst Classifier		Plt Calculation	
Duration	Flicker	Interval	Pst
0.1%	0.00		
0.7%	0.00		
1.0%	0.00		
1.5%	0.00		
2.2%	0.00		
3%	0.00		
4%	0.00		
6%	0.00		
8%	0.00		
10%	0.00		
13%	0.00		
17%	0.00		
30%	0.00		
50%	0.00		
80%	0.00		

7. Immunity

7.1. Performance criterion

Performance criterion A: The apparatus shall continue to operate as intended during the test. No degradation of performance or loss of function is allowed below a performance level (or permissible loss of performance) specified by the manufacturer, when the apparatus is used as intended. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and from what the user may reasonably expect from the apparatus if used as intended.

Performance criterion B: The apparatus shall continue to operate as intended after the test. No degradation of performance or loss of function is allowed below a performance level (or permissible loss of performance) specified by the manufacturer, when the apparatus is used as intended. During the test, degradation of performance is allowed, however no change of actual operating state or stored data is allowed to persist after the test. If the minimum performance level or the permissible performance loss is not specified by the manufacturer, then either of these may be derived from the product description and documentation, and from what the user may reasonably expect from the apparatus if used as intended.

Performance criterion C: Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls, or by any operation specified in the instructions for use.

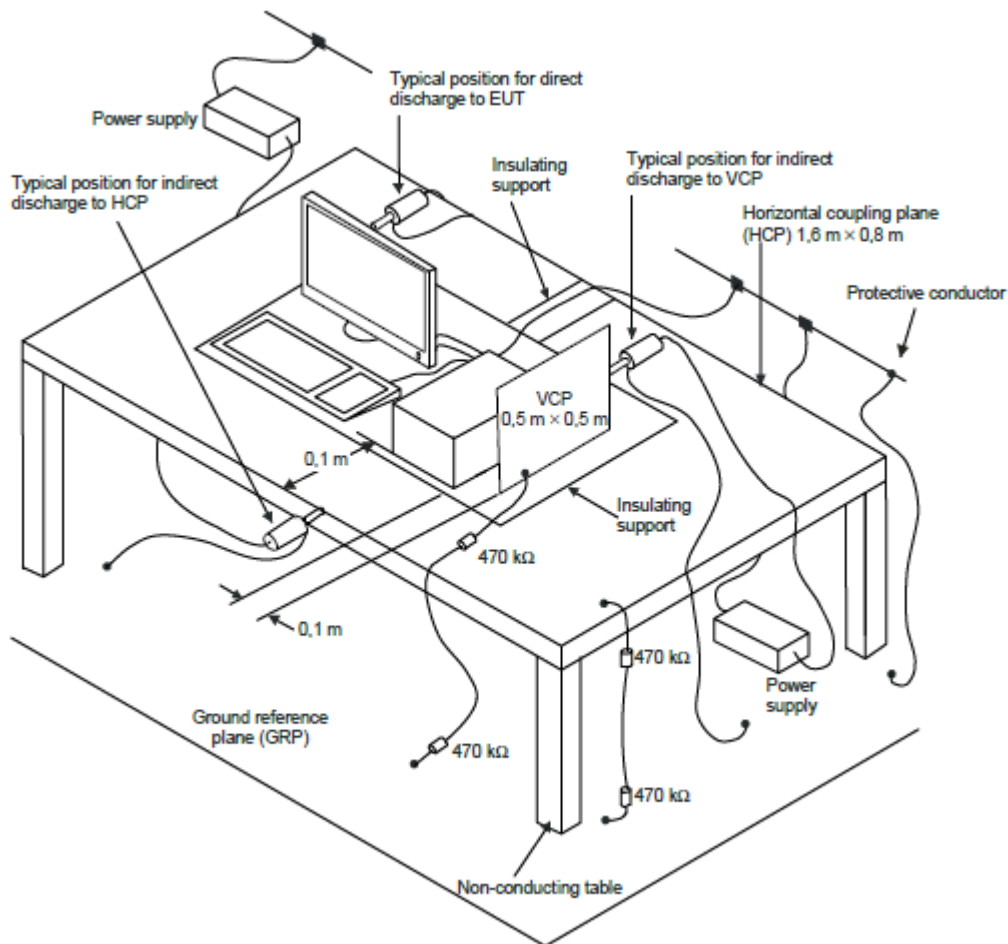
7.2. Electrostatic discharges

7.2.1. Test standard and Levels

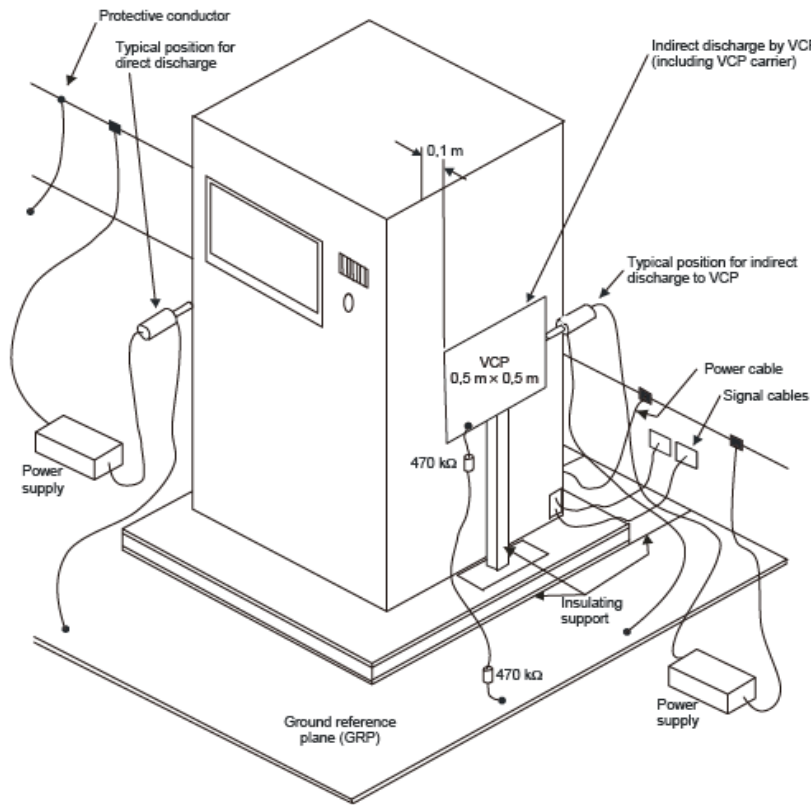
Environmental phenomenon	Test specifications	Basic Standard
Electrostatic discharge	8 kV air discharge	IEC 61000-4-2
	4 kV contact discharge	

7.2.2. Block diagram of test setup

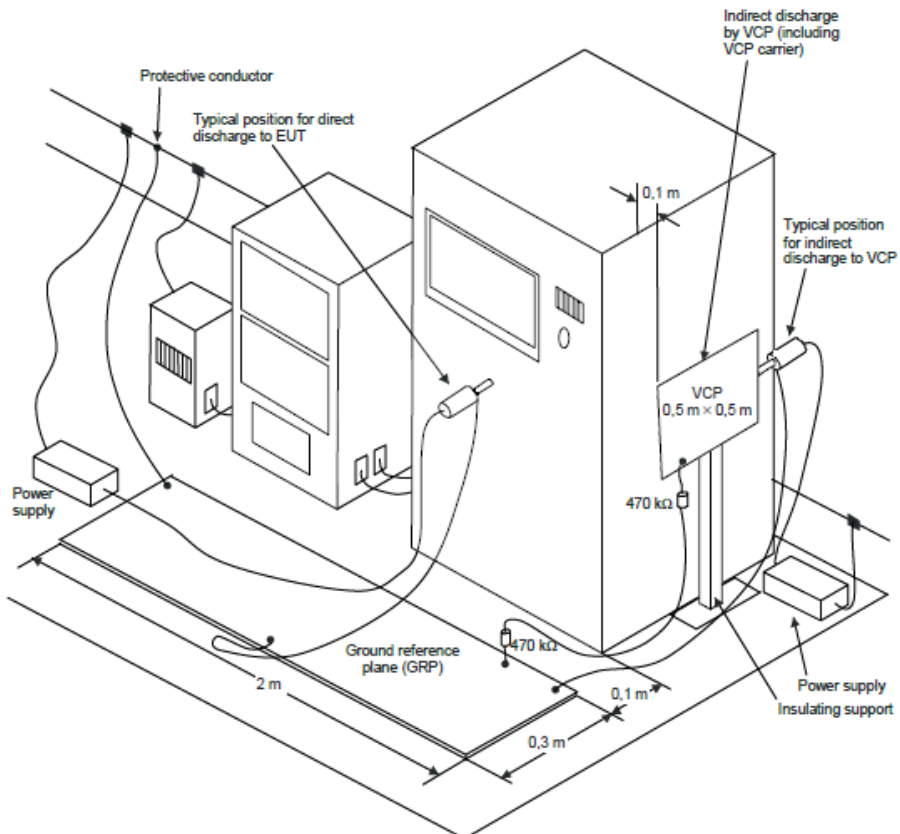
For table-top equipment



For floor standing equipment



For table-top & floor standing equipment



7.2.3. Test procedure

1. Air discharge:

This test is done on a non-conductive surface. The round discharge tip of the discharge electrode shall be approached as fast as possible to touch the EUT. After each discharge, the discharge electrode shall be removed from the EUT. The generator is then re-triggered for a new single discharge and repeated 10 times for each pre-selected test point. This procedure shall be repeated until all the air discharge completed.

2. Contact discharge:

All the procedure shall be same as Section 1. except that the tip of the discharge electrode shall touch the EUT before the discharge switch is operated.

3. Indirect discharge for horizontal coupling plane

At least 20 single discharges shall be applied to the horizontal coupling plane, at points on each side of the EUT. The discharge electrode positions vertically at a distance of 0.1m from the EUT and with the discharge electrode touching the coupling plane.

4. Indirect discharge for vertical coupling plane

At least 20 single discharge shall be applied to the center of one vertical edge of the coupling plane. The coupling plane, of dimensions 0.5m X 0.5m, is placed parallel to, and positioned at a distance of 0.1m from the EUT. Discharges shall be applied to the coupling plane, with this plane in sufficient different positions that the four faces of the EUT are completely illuminated.

7.2.4. Test results

Discharge Method	Discharge Position	Voltage (\pm kV)	Min. No. of Discharge per polarity (Each Point)	Required Criterion	Performance Criterion
Contact Discharge	Conductive Surfaces	4	10	B	A
	Indirect Discharge HCP	4	10	B	A
	Indirect Discharge VCP	4	10	B	A
Air Discharge	Slots, Apertures, and Insulating Surfaces	8	10	B	A
Note: /					

7.3. Fast transients

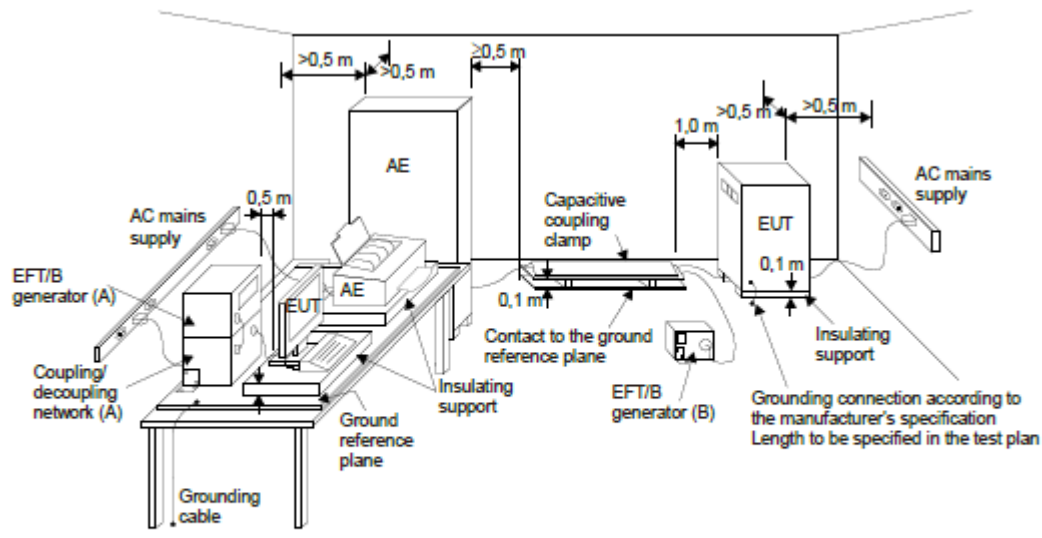
7.3.1. Test standard and Levels

Ports for signal lines and control lines		
Environmental phenomenon	Test specifications	Basic Standard
Fast transients common mode	0,5 kV (peak)	IEC 61000-4-4
	5/50 ns T_r/T_d	
	5 kHz repetition frequency	
Applicable only to ports interfacing with cables whose total length can exceed 3 m according to the manufacturer's functional specification		

Input and output d.c. power ports		
Environmental phenomenon	Test specifications	Basic Standard
Fast transients common mode	0,5 kV (peak)	IEC 61000-4-4
	5/50 ns T_r/T_d	
	5 kHz repetition frequency	
Not applicable to input ports intended for connection to a battery or a rechargeable battery which shall be removed or disconnected from the apparatus for recharging. Apparatus with a d.c. power input port intended for use with an a.c. – d.c. power adaptor shall be tested on the a.c. power input of the a.c.- d.c. power adaptor specified by the manufacturer or, where none is so specified, using a typical a.c. – d.c. power adaptor. For d.c. input and output ports intended to be connected permanently, the test is only applicable to cables longer than 3 m.		

Input and output a.c. power ports		
Environmental phenomenon	Test specifications	Basic Standard
Fast transients common mode	1 kV (peak)	IEC 61000-4-4
	5/50 ns T_r/T_d	
	5 kHz repetition frequency	
For extra low voltage a.c. ports and output a.c. ports, this testing is only applicable to ports interfacing with cables whose total length may exceed 3 m according to the manufacturer's functional specification.		

7.3.2. Block diagram of test setup



- (A) location for supply line coupling
 (B) location for signal lines coupling

7.3.3. Test procedure

The EUT is put on the table which is 0.8/0.1 meter high above the ground. This reference ground plane shall project beyond the EUT by at least 0.1 m on all sides and the minimum distance between the EUT and all other conductive structure, except the ground plane beneath the EUT, shall be more than 0.5 m.

1. For input and output AC power ports:

The EUT is connected to the power mains by using a coupling device which couples the EFT interference signal to AC power lines. Both polarities of the test voltage should be applied during compliance test and the duration of the test is 2 mins.

2. For signal lines and control lines ports:

The EUT is connected to the power mains by using a coupling device which couples the EFT interference signal to signal lines. Both polarities of the test voltage should be applied during compliance test and the duration of the test is 2 mins.

3. For DC output line ports:

The EUT is connected to the power mains by using a coupling device which couples the EFT interference signal to DC output lines. Both polarities of the test voltage should be applied during compliance test and the duration of the test is 1 min.

7.3.4. Test result

Coupling	Voltage (kV)	Polarity	Required Criterion	Performance Criterion
AC Mains L-N	1.0	±	B	A
Signal Line	0.5	±	B	/
Telec Ports	0.5	±	B	/
DC Ports	0.5	±	B	/
Note: /				

7.4. Injected currents

7.4.1. Test standard and Levels

Test frequency range: 0,15MHz to 230MHz

Ports for signal lines and control lines		
Environmental phenomenon	Test specifications	Basic Standard
RF current common mode 1 kHz, 80 % AM	0,15 MHz to 230 MHz	IEC 61000-4-6
	1 V (r.m.s.) (unmodulated)	
	150 Ω source impedance	
Applicable only to ports interfacing with cables whose total length may exceed 3 m according to the manufacturer's functional specification.		

Input and output d.c. power ports		
Environmental phenomenon	Test specifications	Basic Standard
RF current common mode 1 kHz, 80 % AM	0,15 MHz to 230 MHz	IEC 61000-4-6
	1 V (r.m.s.) (unmodulated)	
	150 Ω source impedance	
Not applicable to battery operated appliances that cannot be connected to the mains while in use. Not applicable to input ports intended for connection to a battery or a rechargeable battery which shall be removed or disconnected from the apparatus for recharging. Apparatus with a d.c. power input port intended for use with an a.c. – d.c. power adaptor shall be tested on the a.c. power input of the a.c.- d.c. power adaptor specified by the manufacturer or, where none is so specified, using a typical a.c. – d.c. power adaptor. For d.c. input and output ports intended to be connected permanently, the test is only applicable to cables longer than 3 m.		

Input and output a.c. power ports		
Environmental phenomenon	Test specifications	Basic Standard
RF current common mode 1 kHz, 80 % AM	0,15 MHz to 230 MHz	IEC 61000-4-6
	3 V (r.m.s.) (unmodulated)	
	150 Ω source impedance	
For extra low voltage a.c ports and output a.c. ports, this testing is only applicable to ports interfacing with cables whose total length may exceed 3 m according to the manufacturer's functional specification.		

Test frequency range: 0,15MHz to 80MHz

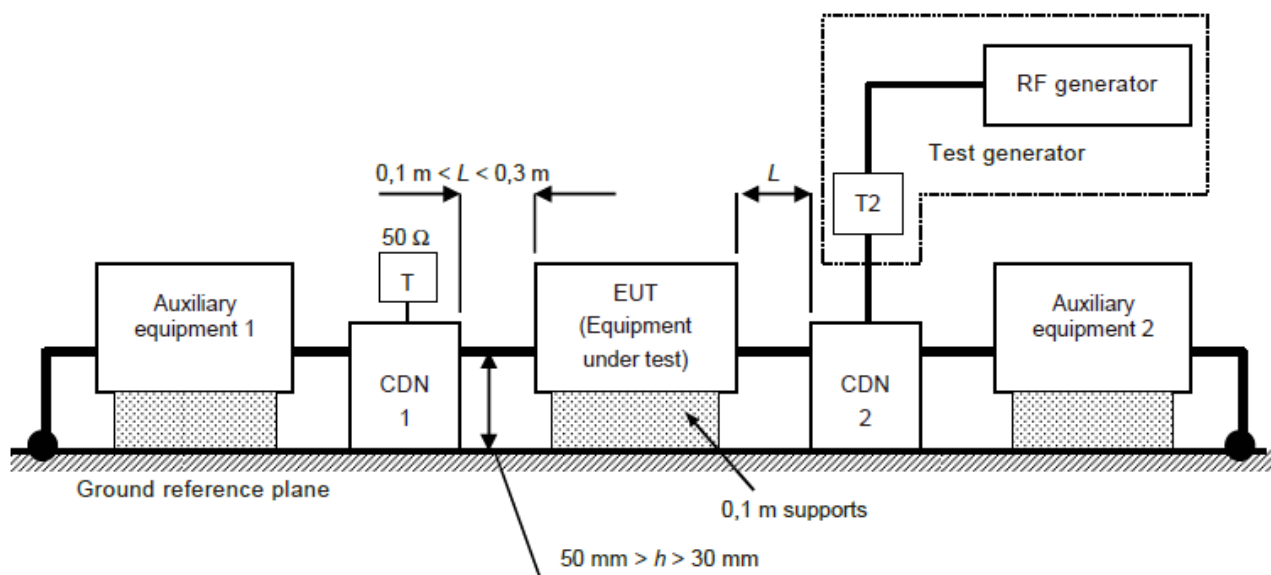
Ports for signal lines and control lines		
Environmental phenomenon	Test specifications	Basic Standard
RF current common mode 1 kHz, 80 % AM	0,15 MHz to 80 MHz	IEC 61000-4-6
	1 V (r.m.s.) (unmodulated)	
	150 Ω source impedance	
Applicable only to ports interfacing with cables whose total length may exceed 3 m according to the manufacturer's functional specification.		

Input and output a.c. power ports		
Environmental phenomenon	Test specifications	Basic Standard
RF current common mode 1 kHz, 80 % AM	0,15 MHz to 80 MHz	IEC 61000-4-6
	3 V (r.m.s.) (unmodulated)	
	150 Ω source impedance	
For extra low voltage a.c. ports and output a.c. ports, this testing is only applicable to ports interfacing with cables whose total length may exceed 3 m according to the manufacturer's functional specification.		

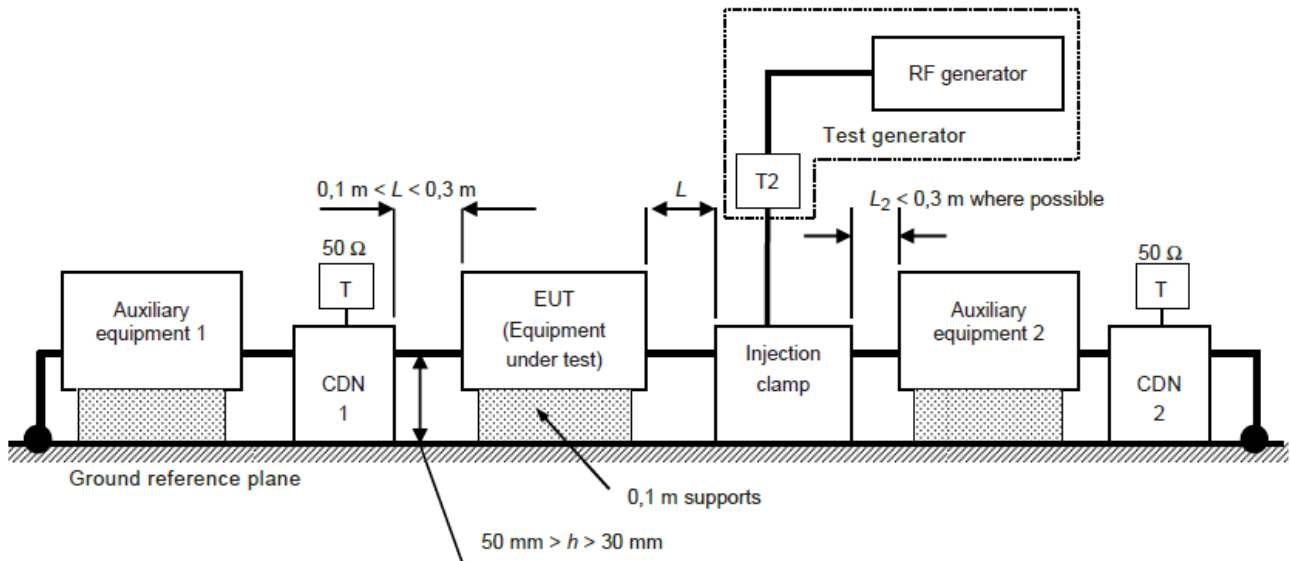
Input and output d.c. power ports		
Environmental phenomenon	Test specifications	Basic Standard
RF current common mode 1 kHz, 80 % AM	0,15 MHz to 80 MHz	IEC 61000-4-6
	1 V (r.m.s.) (unmodulated)	
	150 Ω source impedance	
Not applicable to battery operated appliances that cannot be connected to the mains while in use. Not applicable to input ports intended for connection to a battery or a rechargeable battery which shall be removed or disconnected from the apparatus for recharging. Apparatus with a d.c. power input port intended for use with an a.c. - d.c. power adaptor shall be tested on the a.c. power input of the a.c.- d.c. power adaptor specified by the manufacturer or, where none is so specified, using a typical a.c. - d.c. power adaptor. For d.c. input and output ports intended to be connected permanently, the test is only applicable to cables longer than 3 m.		

7.4.2. Block diagram of test setup

For input a.c. / d.c. power port:



For signal lines and control lines:



7.4.3. Test procedure

1. Set up the EUT, CDN and test generators as IEC 61000-4-6.
2. Let the EUT work in test mode and test it.
3. The EUT are placed on an insulating support 0.1m high above a ground reference plane. CDN (coupling and decoupling device) is placed on the ground plane about 0.3m from EUT. Cables between CDN and EUT are as short as possible, and their height above the ground reference plane shall be between 30 and 50 mm (where possible).
4. The disturbance signal described below is injected to EUT through CDN or clamp.
5. The EUT operates within its operational mode(s) under intended climatic conditions after power on.
6. The frequency range is swept from 150KHz to 80M/230MHz using 3V/1V signal level, and with the disturbance signal 80% amplitude modulated with a 1KHz sine wave.
7. The rate of sweep shall not exceed $1.5 \cdot 10^{-3}$ decades/s. Where the frequency is swept incrementally, the step size shall not exceed 1% of the start and thereafter 1% of the preceding frequency value.
8. Recording the EUT operating situation during compliance testing and decide the EUT immunity criterion.

7.4.4. Test result

Inject Line	Frequency (MHz)	Voltage Level (V r.m.s.)	Required Criterion	Performance Criterion
a.c. port	0.15 - 80	3	A	A
Signal Line	0.15 - 80	3	A	/
Telec Ports	0.15 - 80	3	A	/
DC Ports	0.15 - 80	3	A	/
Note: /				

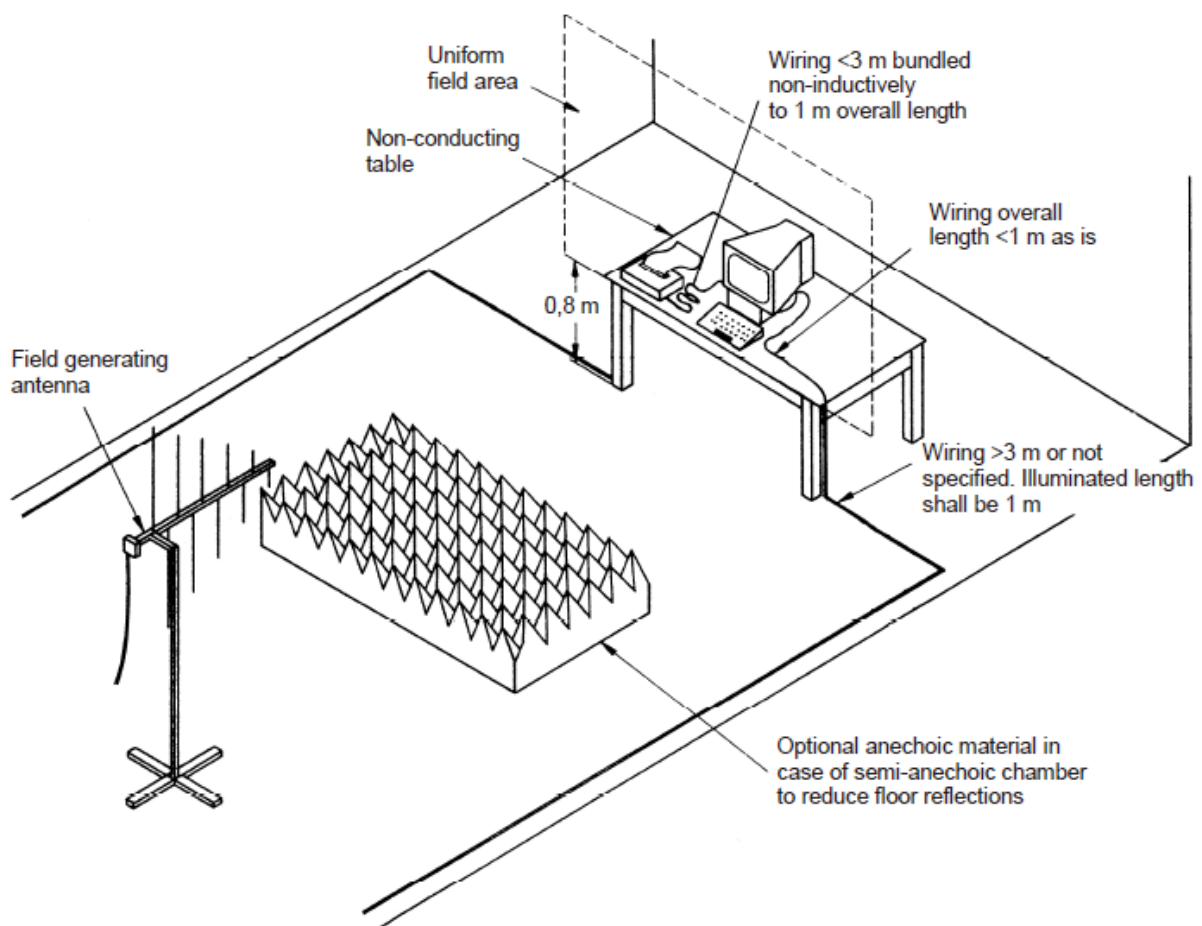
7.5. Radio frequency electromagnetic fields

7.5.1. Test standard and Levels and Performance Criterion

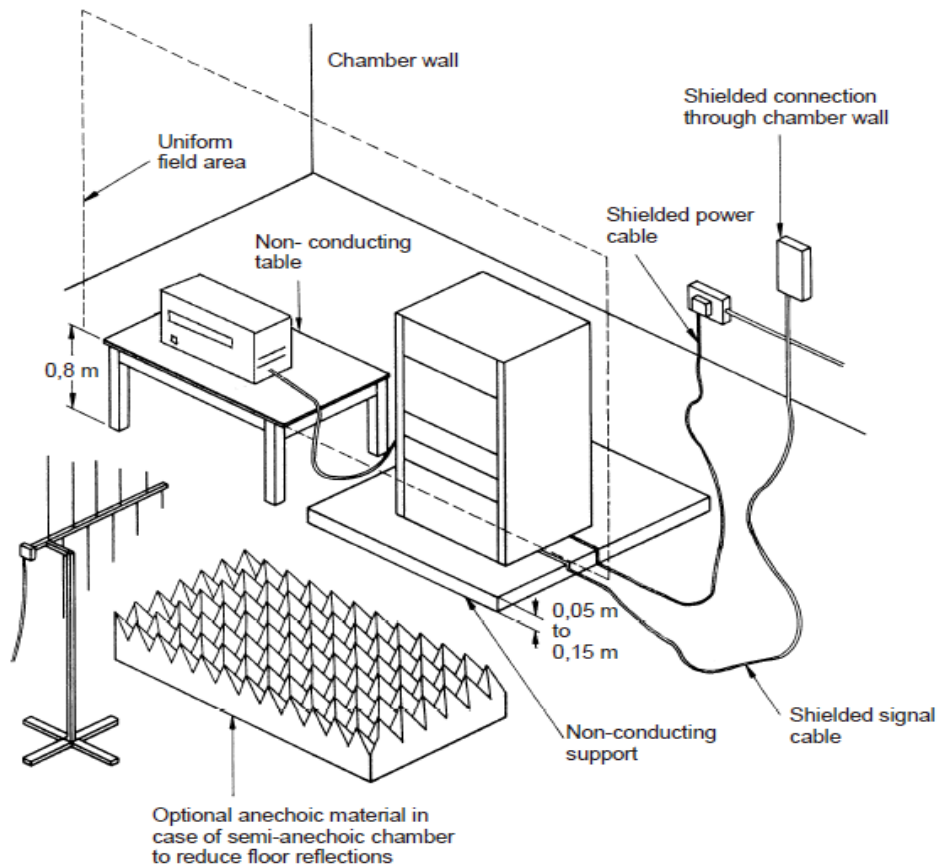
Enclosure port		
Environmental phenomenon	Test specifications	Basic Standard
Radio-frequency electromagnetic field, 1 kHz, 80% AM	80 MHz to 1 000 MHz	IEC 61000-4-3
	3 V (r.m.s.) (unmodulated)	

7.5.2. Block diagram of test setup

For table-top equipment



For floor standing equipment



7.5.3. Test procedure

1. The EUT and its simulators are placed on a turn table which is 0.8 meter above the ground. The EUT is set 3 meters away from the transmitting antenna which is mounted on an antenna tower. Both horizontal and vertical polarizations of the antenna are set on test.
2. Each of the four sides of EUT must be faced this transmitting antenna and measured individually.
3. In order to determine the performance of EUT, a CCD camera is used to monitor the EUT.

7.5.4. Test results

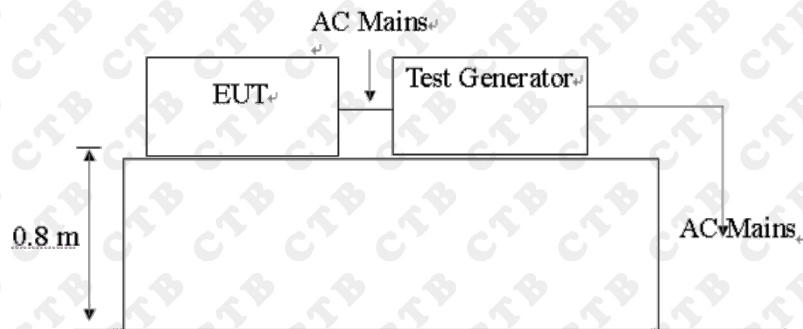
Frequency range [MHz]	Test Level [V/m]	Polarization	EUT Face	Required Criterion	Performance Criterion	Results
80 to 1000	3	Horizontal & Vertical	Front/ Rear	A	A	PASS
			Right/ Left	A	A	PASS
			Top/ Underside	A	A	PASS
Note: /						

7.6. Surges

7.6.1. Test standard and Levels

Input a.c. power ports		
Environmental phenomenon	Test specifications	Basic Standard
Surge	1,2/50 (8/20) μ s Tr/Td	IEC 61000-4-5
	2 kV line-to-earth with 12 Ω Impedance	
	1 kV line-to-line with 2 Ω Impedance	

7.6.2. Block diagram of test setup



7.6.3. Test procedure

1. Setup the EUT and test generator refer to IEC 61000-4-5.
2. For line to line coupling mode, provide a 0.5KV 1.2/50us voltage surge (at open-circuit condition) and 8/20us current surge to EUT selected points.
3. At least 5 positive and 5 negative (polarity) tests with a maximum 1/min repetition rate are conducted during test.
4. Different phase angles are done individually.
5. Record the EUT operating situation during compliance test and decide the EUT immunity criterion for above each test.

7.6.4. Test result

Coupling	Level [kV]	Polarity	Phase angles [°]	Required Criterion	Performance Criterion	Results
Line-to-line	1	\pm	0, 90, 180, 270	B	A	PASS
Line-to-earth	2	\pm	0, 90, 180, 270	B	A	PASS
Note: /						

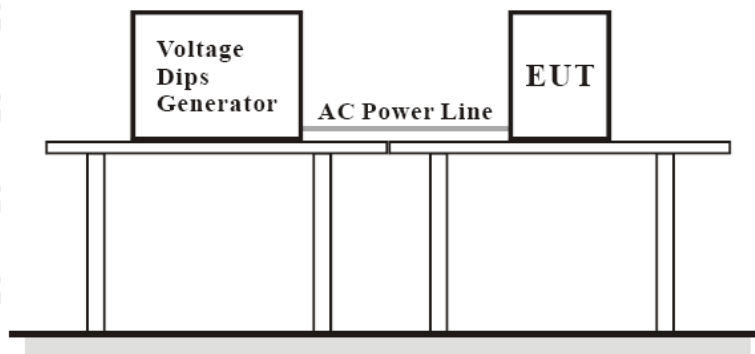
7.7. Voltage dips

7.7.1. Test standard and Levels

Input a.c. power ports					
Environmental phenomena		Test level in % U_T	Durations for voltage dips		Test set-up
			50Hz	60Hz	
Voltage dips in % U_T	100	0	0,5 cycle	0,5 cycle	IEC 61000-4-11 Voltage change shall occur at zero crossing
	60	40	10 cycle	12 cycle	
	30	70	25 cycle	30 cycle	

U_T is the rated voltage of the equipment under test.

7.7.2. Block diagram of test setup



7.7.3. Test procedure

- 1 Set up the EUT and test generator refer to IEC61000-4-11.
- 2 The interruptions are introduced at selected phase angles with specified duration.
- 3 Record any degradation of performance.

7.7.4. Test result

Test Level % U_T	Voltage dips in % U_T	Duration (cycles)		Required Criterion	Performance Criterion
		50Hz	60Hz		
0	100	0.5	0.5	C	A
40	60	10	12	C	A
70	30	25	30	C	A

Note: /

8. Photographs of test setup

Radiated Emission



Conducted disturbances

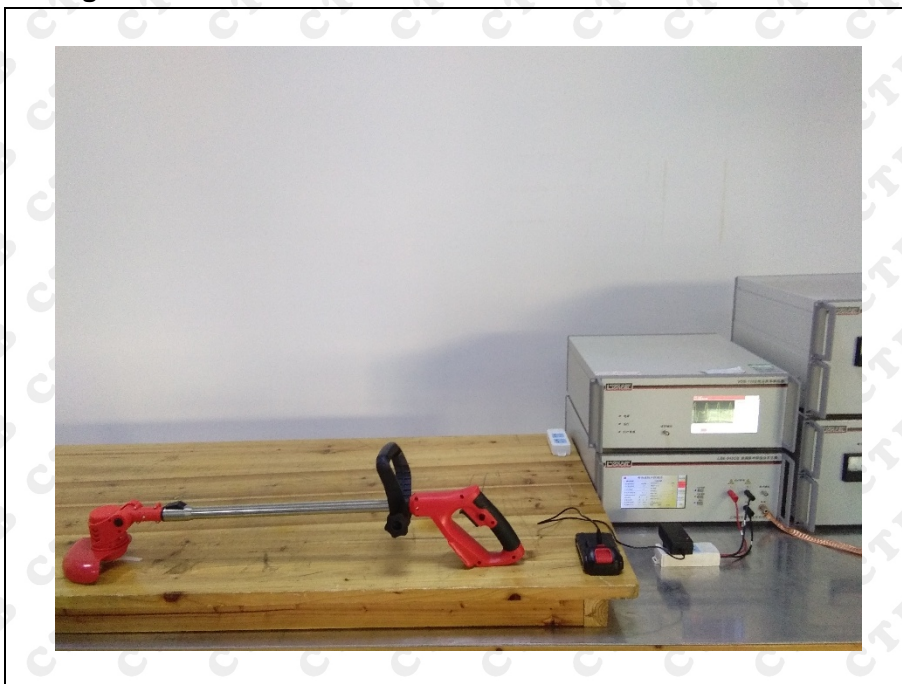
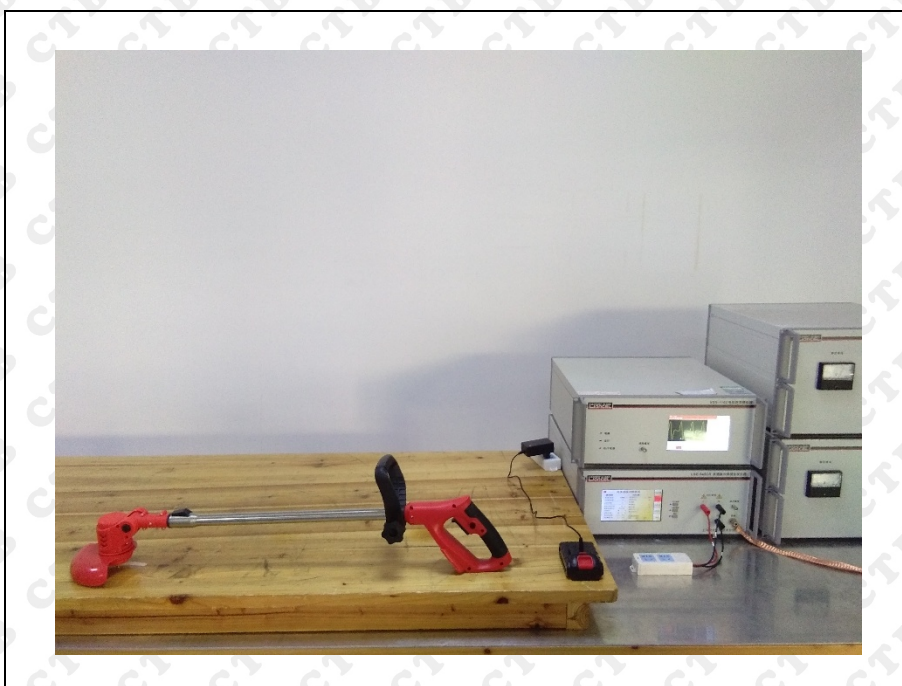


H&F



Electrostatic discharges

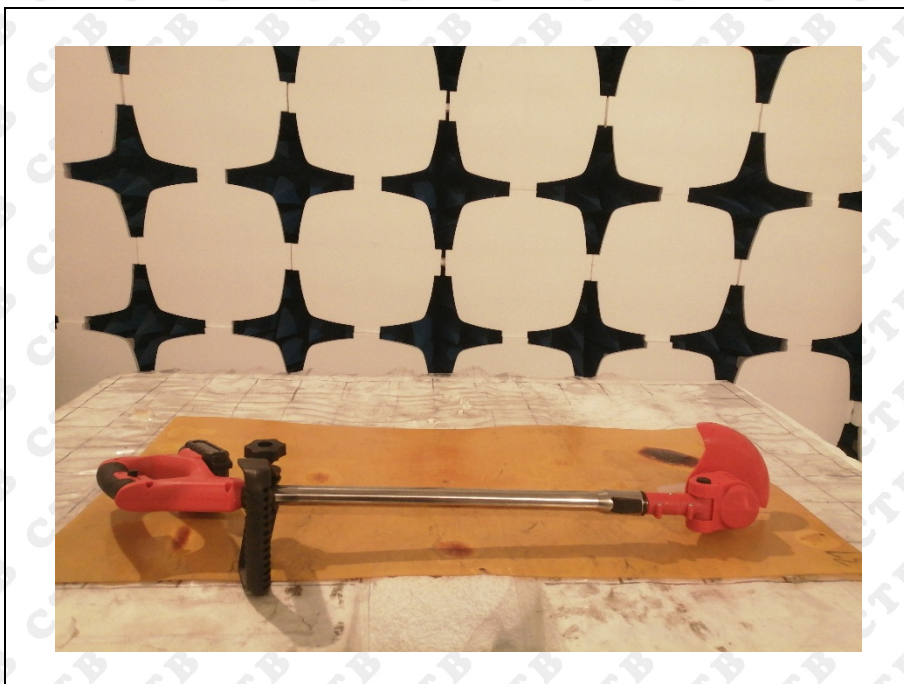


Fast transients& Surges**Voltage dips**

CS



RS

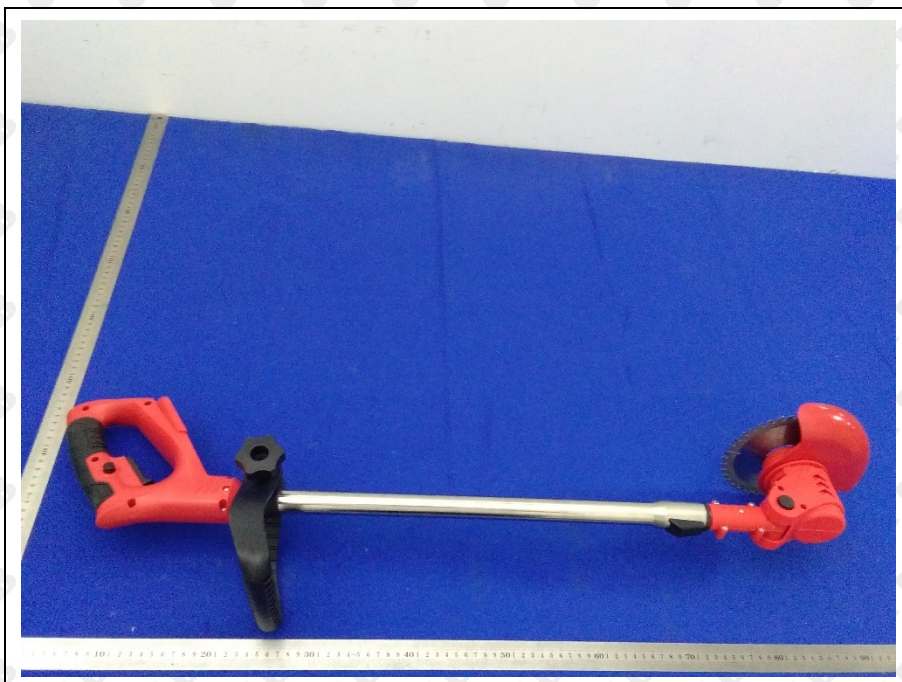


9. Photographs of EUT

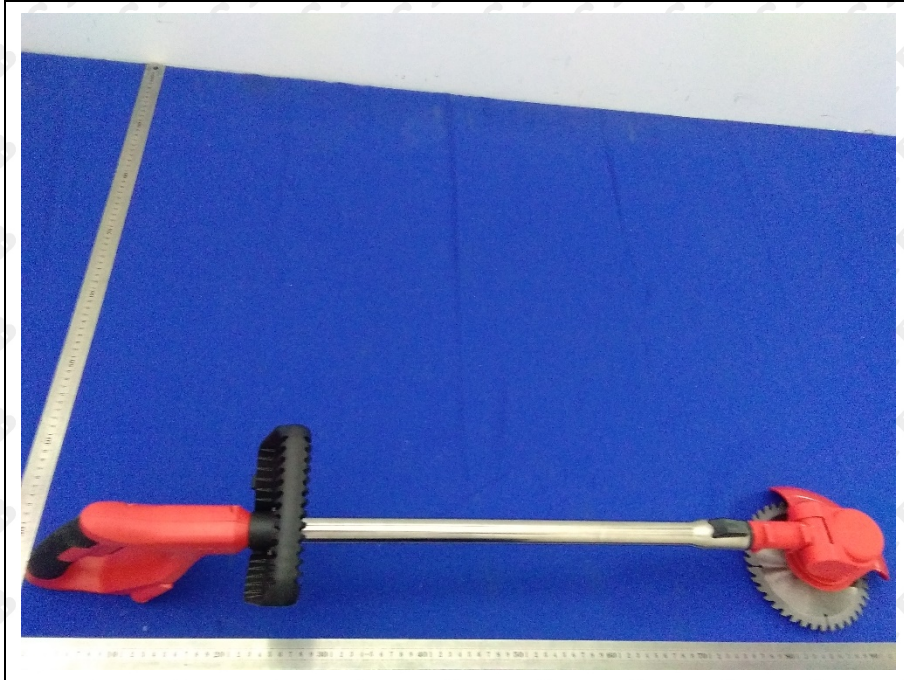
EUT photo 1



EUT photo 2



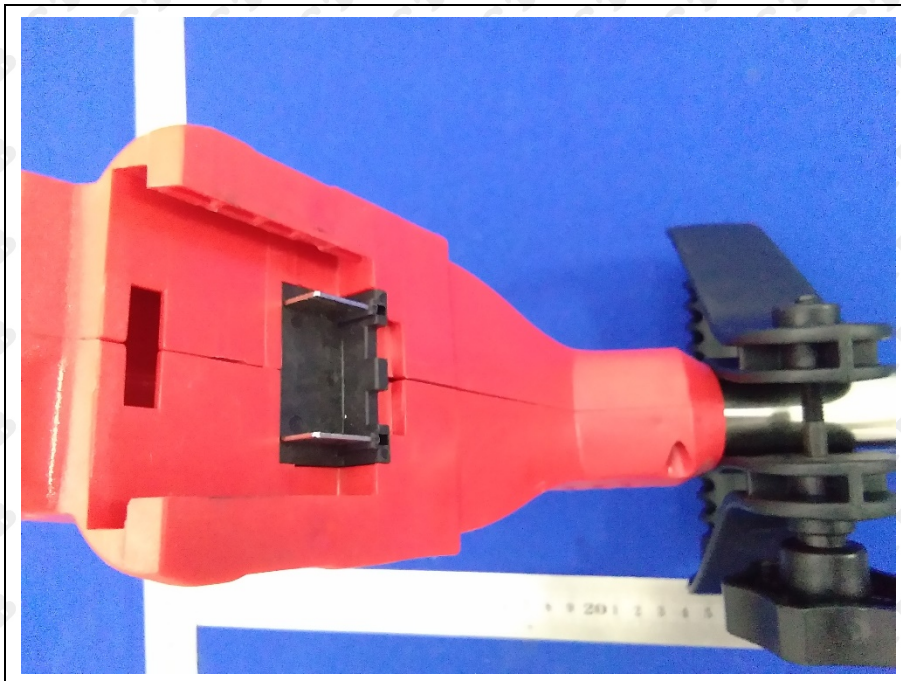
EUT photo 3



EUT photo 4



EUT photo 5



EUT photo 6



EUT photo 7



EUT photo 8



End of report