EMC Test Report

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Applicant: Hunan Wisdom Technology Co.,Ltd.
Address: Room 405, Building 15 Xingsha International Enterprise Center, No.68, Luositang Road, Economic Development Zone, 410100 Changsha, Hunan, PEOPLE'S REPUBLIC OF CHINA

Product: Batteries (Li-ion Battery Pack)

Model: WD-CSC48100-A*3, WD-CSC48100-A*4, WD-CSC48100-A*5, WD-CSC48100-A*6

COMMERCIAL-IN-CONFIDENCE

Report Number: 64.771.22.60598.01

RESPONSIBLE FOR	NAME	SIGNATURE	DATE
Prepared by	Chris Liang		2023-03-13
Approved by	Matt Zhang		2023-03-13

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD Product Service control rules.

EXECUTIVE SUMMARY This product was found to be in compliance with	EN IEC 61000-6-1:2019, EN IEC 61000-6-3:2021

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1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	2023-03-13

1.2 Introduction

The information contained in this report is intended to show verification of the EMC Qualification Approval Testing of the requirements of the standards for the tests listed in Section 1.3.

Applicant	:	Hunan Wisdom Technology Co.,Ltd.
Address	:	Room 405, Building 15 Xingsha International Enterprise Center, No.68, Luositang Road, Economic Development Zone, 410100 Changsha, Hunan, PEOPLE'S REPUBLIC OF CHINA
Manufacturer	:	Same as applicant
Address	:	Same as applicant
Model Number(s)	:	WD-CSC48100-A*3 WD-CSC48100-A*4 WD-CSC48100-A*5 WD-CSC48100-A*6
Product Type	:	Batteries (Li-ion Battery Pack)
Date of Receipt of EUT	:	2023-02-07
Start of Test	:	2023-02-07
Finish of Test	:	2023-02-13
Name of Engineer(s)	:	Chris Liang

1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with EN IEC 61000-6-1:2019 and EN IEC 61000-6-3:2021 is shown below.

Specification	Test Description	Result	Comments/Base Standard
EN IEC 61000-6-3:2021	Radiated Disturbance (30MHz to 1GHz)	Pass	CISPR 16-2-3
EN IEC 61000-6-3:2021	Conducted Disturbance at AC mains port	N/A	CISPR 16-2-1 CISPR 16-1-2
EN IEC 61000-6-3:2021	Conducted Disturbance at DC power port*	Pass	CISPR 16-2-1 CISPR 16-1-2
EN IEC 61000-6-3:2021	Conducted Disturbance at Telecommunications/network port	N/A	CISPR 22
EN IEC 61000-6-3:2021	Harmonic Current Emissions	N/A	IEC 61000-3-2
EN IEC 61000-6-3:2021	Flicker	N/A	IEC 61000-3-3
EN IEC 61000-6-1:2019	Electrostatic discharge	Pass	IEC 61000-4-2
EN IEC 61000-6-1:2019	Radiated, radio-frequency, electromagnetic field immunity test	Pass	IEC 61000-4-3
EN IEC 61000-6-1:2019	Power frequency magnetic field immunity test**	Pass	IEC 61000-4-8
EN IEC 61000-6-1:2019	Fast transients*	Pass	IEC 61000-4-4
EN IEC 61000-6-1:2019	Radio-frequency common mode*	Pass	IEC 61000-4-6
EN IEC 61000-6-1:2019	Surge***	N/A	IEC 61000-4-5
EN IEC 61000-6-1:2019	Voltage dips and voltage interruptions	N/A	IEC 61000-4-11

Remark:

"*": Applicable only to ports with a connecting cable exceeding a length of 3m.

"**": Application only to equipment containing devices susceptible to magnetic fields.

"***": Applicable only to ports interfacing with long distance lines; not applicable to input ports intended for connection to a battery.

Note 1: The highest internal frequency of the EUT is less than 108 MHz, the measurement was made up to 1GHz.

1.4 Test Conditions

1.4.1 Environmental Conditions

The climatic conditions during the tests are within the limits specified by the manufacturer for the operation of the EUT and the test equipment. The climatic conditions during the tests were within the following limits:		
Temperature	**Humidity**	**Atmospheric pressure**
15 °C – 35 °C	30 % - 60 %	860 hPa – 1060 hPa
If explicitly required in the basic standard or applied product standard the climatic values are recorded and documented separately in this test report.		

1.4.2 Performance Criteria

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 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 reasonable 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 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 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 reasonable 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 instruction for use.

If, as a result of the application of the tests defined in this standard, the EUT becomes dangerous or unsafe, it shall be deemed to have failed the test.

1.5 Product Information and general remarks

1.5.1 Technical Description

Nominal voltage : 153.6VDC

Rated Capacity : 100Ah

1.5.2 Test Configuration

Configuration	Description
DC Powered	153.6VDC

1.5.3 Modes of Operation

Mode	Description
TM1	Charging mode (165VDC, 20A)
TM2	Discharging mode (153VDC, 20A)
Remark	All DC input/output line and signal line with a maximum length >3m.

1.5.4 General remark:

Refer to model list below, all models use the same module, control box and main components, except the quantity of batteries.
For evaluation, we selected model WD-CSC48100-A*3 for full tests this time.

Model list

Model Name	Rated Voltage (Vd.c)	Rated Capacity (Ah)
WD-CSC48100-A*3	153.6	100
WD-CSC48100-A*4	204.8	100
WD-CSC48100-A*5	256	100
WD-CSC48100-A*6	307.2	100

1.6 Deviations from the Standard

No deviations from the applicable test standard were made during testing.

1.7 Test Location

Test Site:
TÜV SÜD Certification and Testing (China) Co., Ltd. Guangzhou Branch

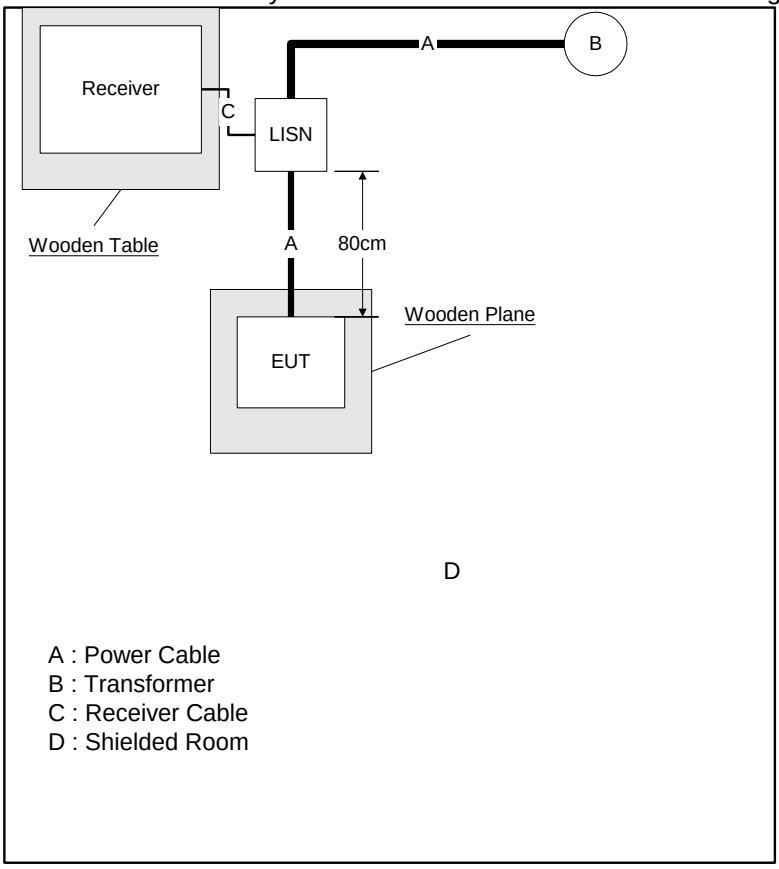
Address:
South 1/F & Unit 302, TÜV SÜD Testing Center, D1 building, No.63 Chuangqi Road, Shilou Town, Panyu District, Guangzhou, P.R. China

2 Test Details

2.1 Conducted Disturbance

2.1.1 Test Method

The EUT was placed on a 0.8 m non-conductive table for table-top equipment and on a 0.12 m insulated support for floor standing equipment above a ground reference plane all within a test laboratory.
All power was connected to the EUT through an Artificial Mains Network (AMN). Conducted disturbance voltage measurements on mains lines were made at the output of the AMN. The AMN was placed 0.8m from the boundary of the EUT and bonded to the reference ground plane.



2.1.2 Specification Limits

Disturbance voltage limits at the AC mains port		
Frequency range	Limits dB(μV)	
	Quasi-peak	Average
0.15MHz to 0.5MHz	66 to 56	56 to 46
0.5MHz to 5.0MHz	56	46
5.0MHz to 30MHz	60	50

Disturbance voltage limits at the DC power port		
Frequency range	Limits dB(μV)	
	Quasi-peak	Average
0.15MHz to 0.5MHz	79	66
0.5MHz to 30MHz	73	60

Disturbance voltage limits at the telecommunications/network port		
Frequency range	Limits dB(μV)	
	Quasi-peak	Average
0.15MHz to 0.5MHz	84 to 74	74 to 64
0.5MHz to 30MHz	74	64

Remark：
Level=Reading Level + Correction Factor
Correction Factor=Cable Loss + LISN Factor
(The Reading Level is recorded by software which is not shown in the sheet)

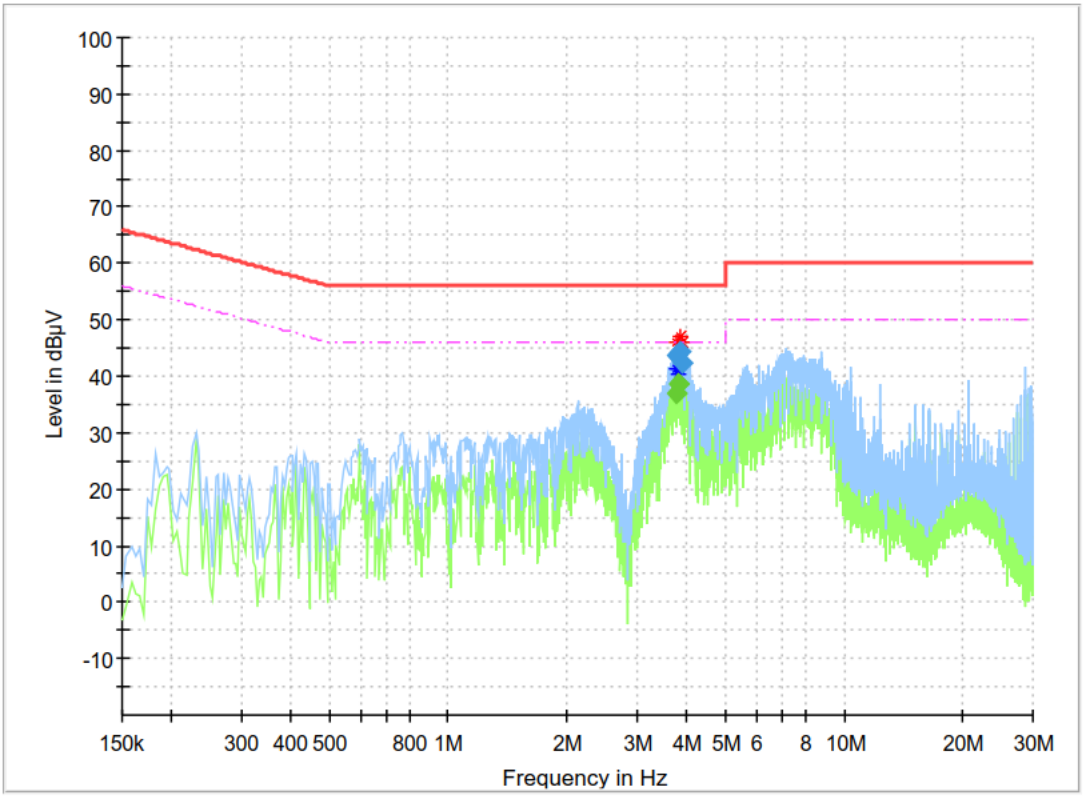
2.1.3 Test Setup



2.1.4 Test Location

This test was carried out in shielded room.

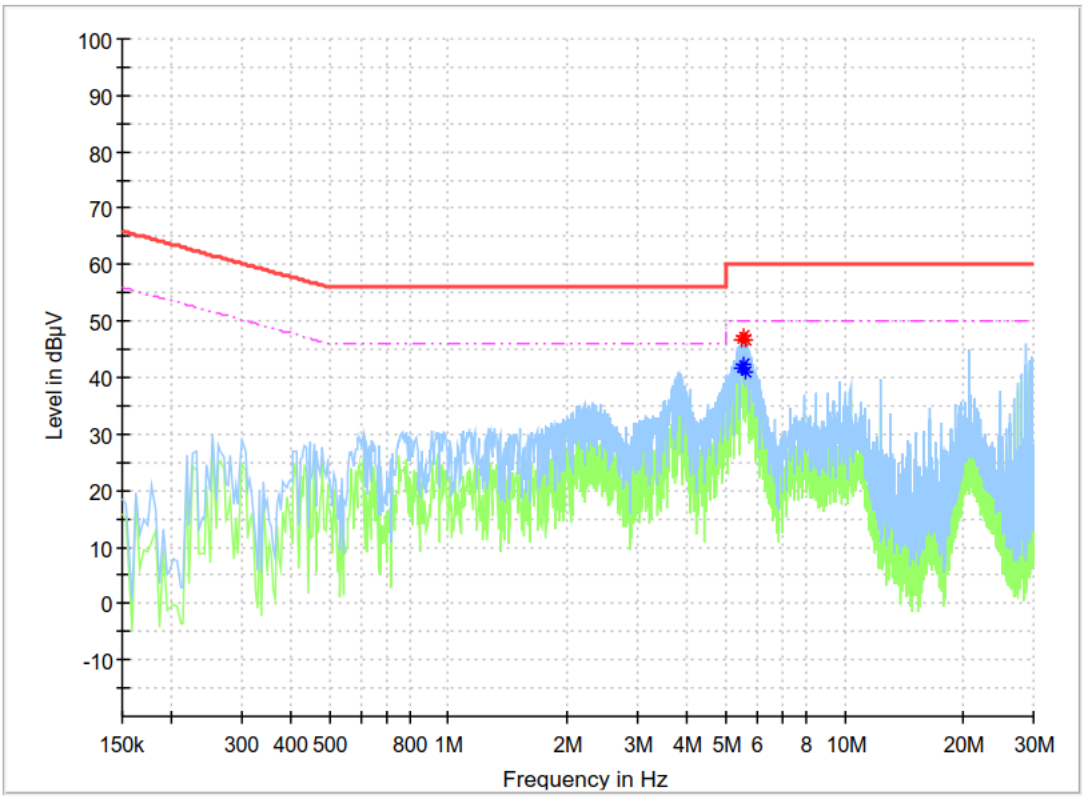
2.1.5 Test Results



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Comment
3.770000	---	36.83	46.00	9.17	D-	
3.782000	43.80	---	56.00	12.20	D-	
3.798000	---	38.65	46.00	7.35	D-	
3.818000	---	38.81	46.00	7.19	D-	
3.850000	44.36	---	56.00	11.64	D-	
3.914000	42.22	---	56.00	13.78	D-	

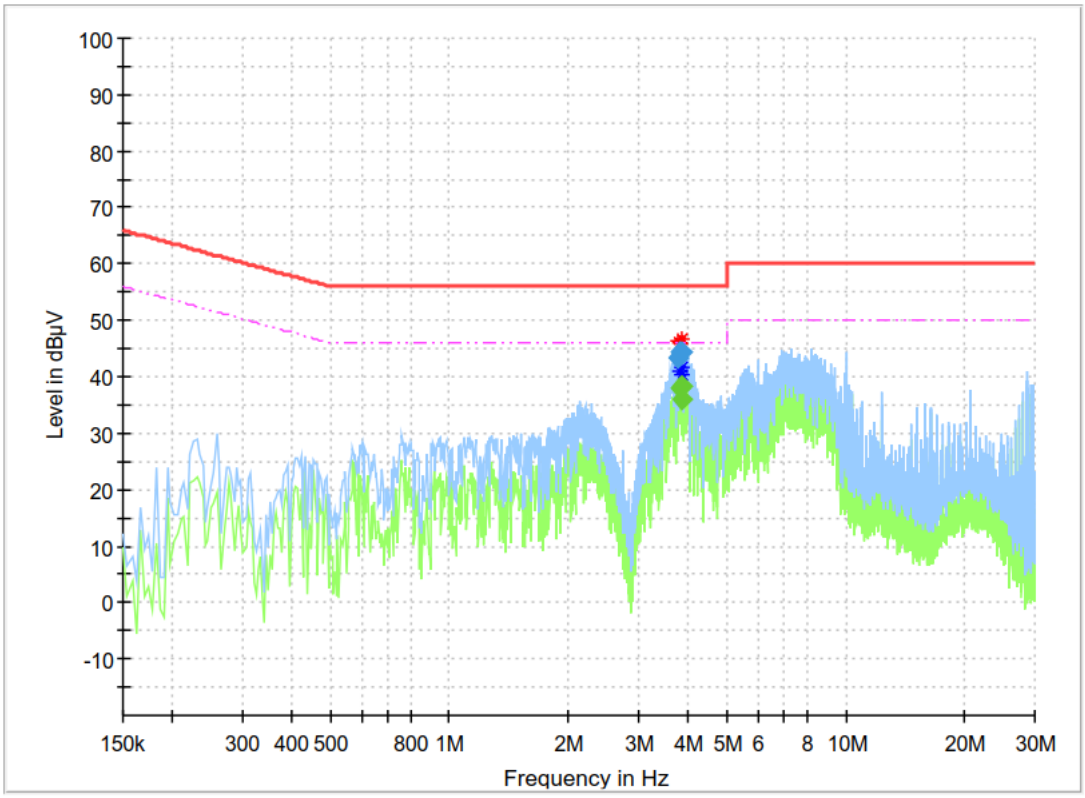
Model	:	WD-CSC48100-A
Operating Mode	:	TM1
Conduct Line/Port	:	D-
Test voltage	:	AC 230V/50Hz
Test Date	:	2023-02-08



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Comment
5.494000	46.74	---	60.00	13.26	D+	
5.510000	---	41.78	50.00	8.22	D+	
5.570000	47.34	---	60.00	12.66	D+	
5.570000	---	42.23	50.00	7.77	D+	
5.598000	46.78	---	60.00	13.22	D+	
5.602000	---	41.00	50.00	9.00	D+	

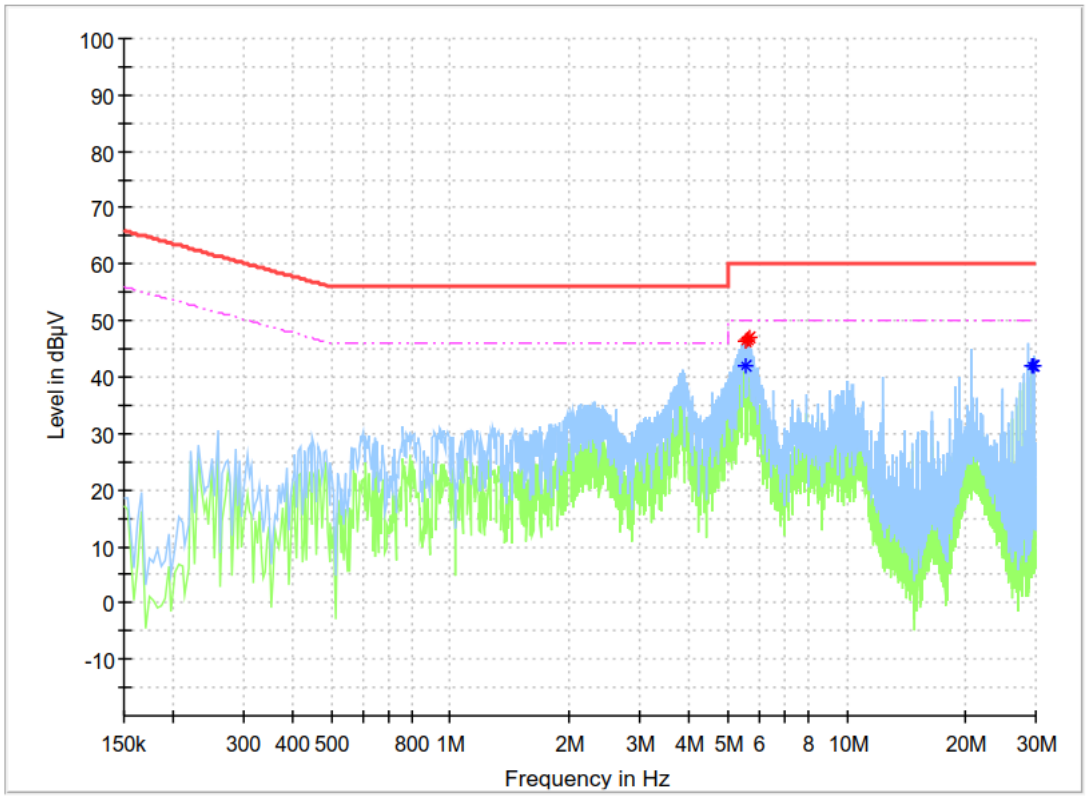
Model	:	WD-CSC48100-A
Operating Mode	:	TM1
Conduct Line/Port	:	D+
Test voltage	:	AC 230V/50Hz
Test Date	:	2023-02-08



Final_Result

Frequency (MHz)	QuasiPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Comment
3.770000	43.25	---	56.00	12.75	D-	
3.794000	---	38.08	46.00	7.92	D-	
3.806000	44.35	---	56.00	11.65	D-	
3.850000	44.34	---	56.00	11.66	D-	
3.850000	---	38.42	46.00	7.58	D-	
3.878000	---	35.99	46.00	10.01	D-	

Model	:	WD-CSC48100-A
Operating Mode	:	TM2
Conduct Line/Port	:	D-
Test voltage	:	AC 230V/50Hz
Test Date	:	2023-02-08



Critical_Freqs

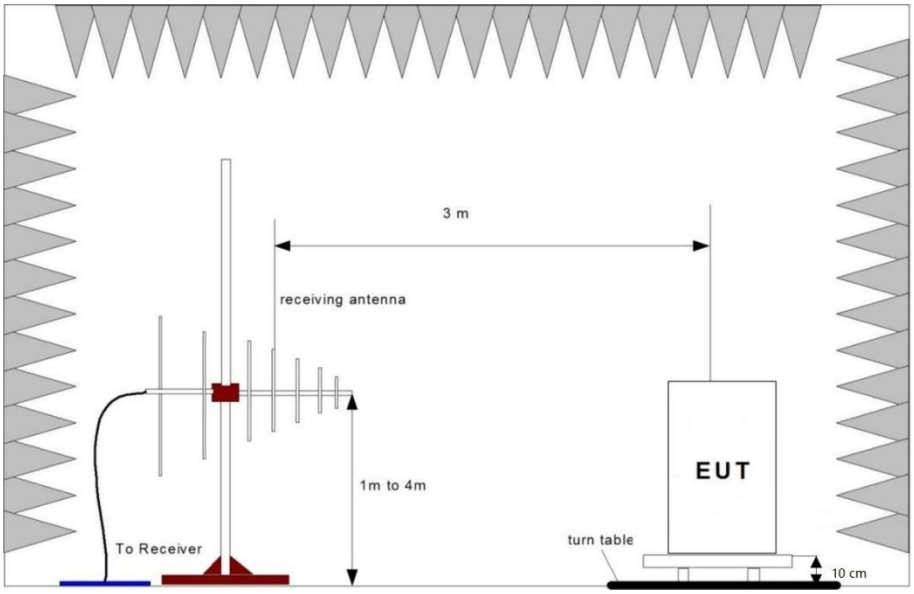
Frequency (MHz)	MaxPeak (dBµV)	Average (dBµV)	Limit (dBµV)	Margin (dB)	Line	Comment
5.554000	---	41.95	50.00	8.05	D+	
5.582000	46.46	---	60.00	13.54	D+	
5.610000	46.76	---	60.00	13.24	D+	
5.662000	46.93	---	60.00	13.07	D+	
29.190000	---	41.89	50.00	8.11	D+	
29.806000	---	42.10	50.00	7.90	D+	

Model	:	WD-CSC48100-A
Operating Mode	:	TM2
Conduct Line/Port	:	D+
Test voltage	:	AC 230V/50Hz
Test Date	:	2023-02-08

2.2 Radiated Disturbance (30MHz to 1000MHz)

2.2.1 Test Method

The EUT was set up in a semi-anechoic chamber on a remotely controlled turntable placed on a 0.8 m non-conductive table for table-top equipment and on a 0.12 m insulated support for floor standing equipment above a ground reference plane.
A prescan of the EUT emissions profile was made while varying the antennae-to-EUT azimuth and antenna-to-EUT polarization using a peak detector; measurements were taken at a 3m distance. Using the prescan list of the highest emissions detected, their bearing and associated antenna polarization, the EUT was then formally measured using Quasi-Peak and Average detectors, as appropriate. The readings were maximized by adjusting the antenna height, polarization and turntable azimuth, in accordance with the specification.



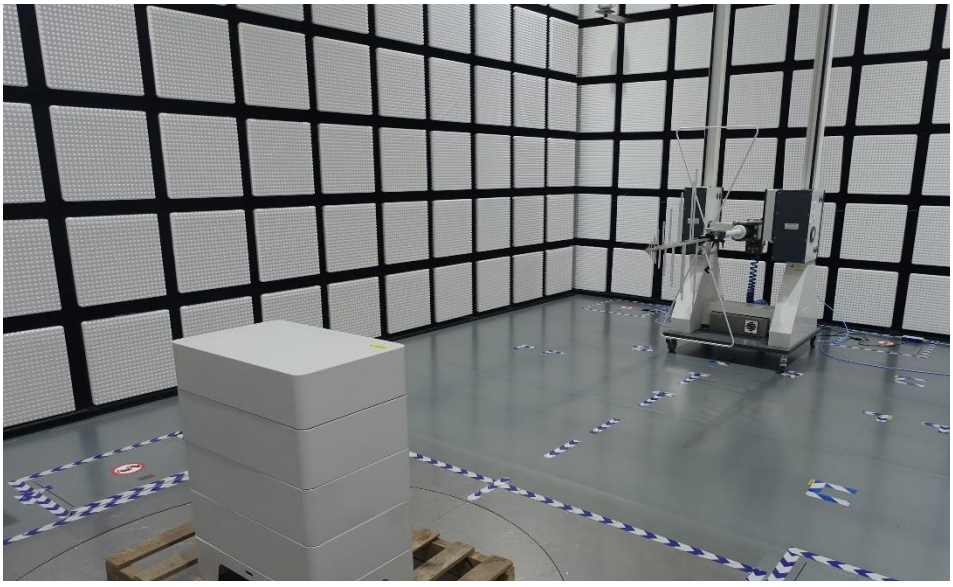
2.2.2 Specification Limits

Radiated disturbance limits in the frequency range 30MHz to 1000MHz at a measuring distance of 3 m	
Frequency range MHz	Quasi-peak limits dB(μV/m)
30 to 230	40
230 to 1000	47

Radiated disturbance limits in the frequency range 30MHz to 1000MHz at a measuring distance of 10 m	
Frequency range MHz	Quasi-peak limits dB(μV/m)
30 to 230	30
230 to 1000	37

Remark：
Level=Reading Level + Correction Factor
Correction Factor=Antenna Factor + Cable Loss
(The Reading Level is recorded by software which is not shown in the sheet)

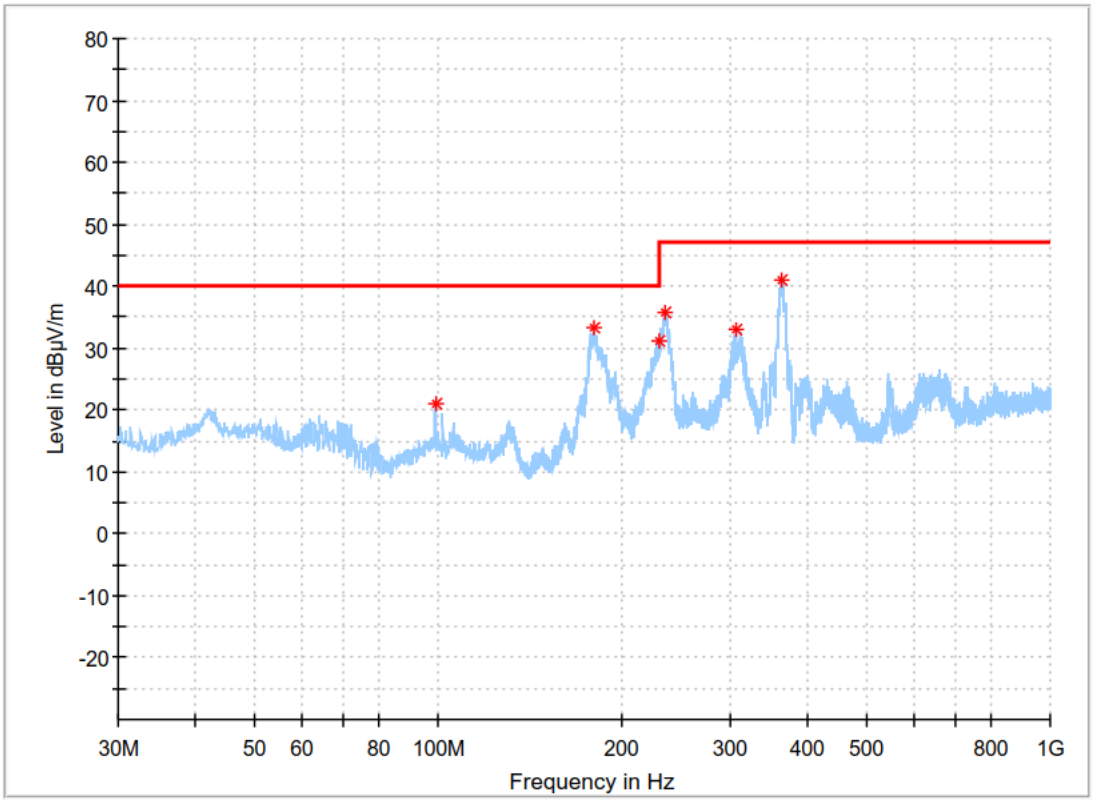
2.2.3 Test Setup



2.2.4 Test Location

This test was carried out in 3m anechoic chamber.

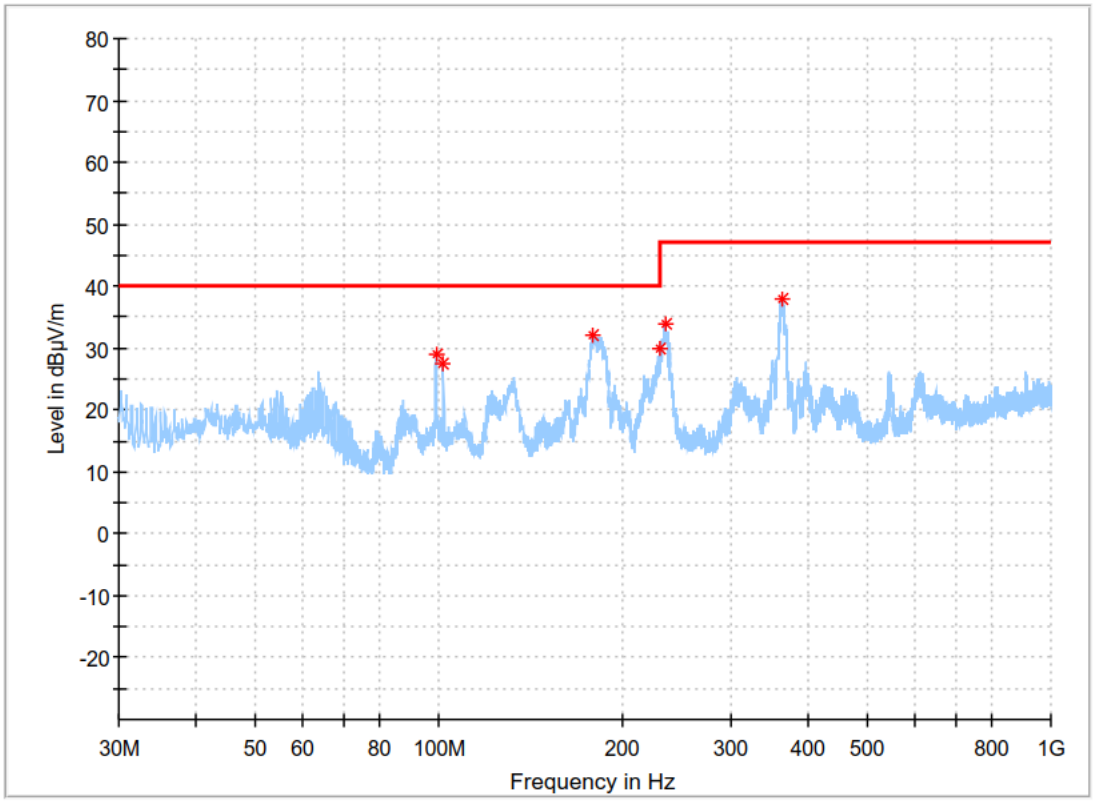
2.2.5 Test Results



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Corr. (dB/m)
98.870000	21.02	40.00	18.98	H	-35.3
179.326111	33.14	40.00	6.86	H	-38.0
229.712222	31.15	40.00	8.85	H	-35.4
235.047222	35.83	47.00	11.17	H	-35.0
307.366111	32.89	47.00	14.11	H	-33.6
365.404444	41.03	47.00	5.97	H	-32.3

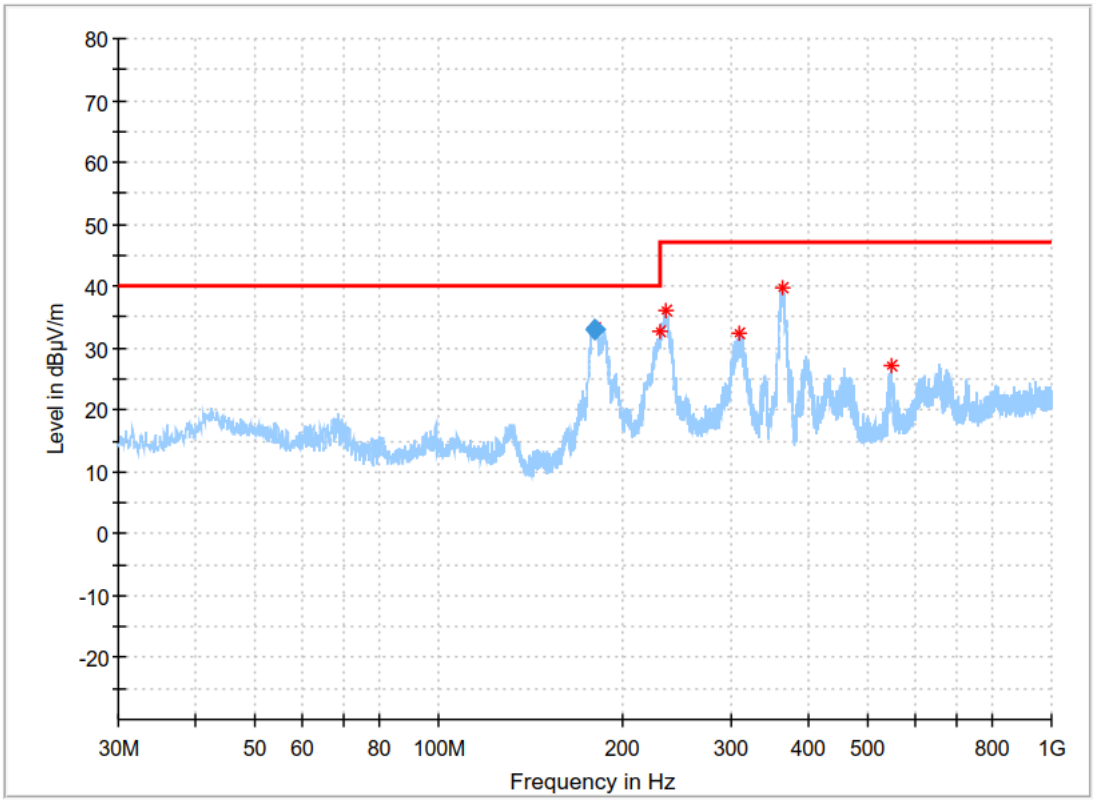
Model : WD-CSC48100-A
Test Mode : TM1
Polarity : Horizontal
Test Date : 2023-02-12



Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Corr. (dB/m)
98.870000	28.91	40.00	11.09	V	-35.3
101.672222	27.60	40.00	12.40	V	-35.3
178.733333	32.10	40.00	7.90	V	-38.1
229.981667	30.04	40.00	9.96	V	-35.4
234.562222	33.89	47.00	13.11	V	-35.1
364.596111	37.78	47.00	9.22	V	-32.3

Model : WD-CSC48100-A
Test Mode : TM1
Polarity : Vertical
Test Date : 2023-02-12



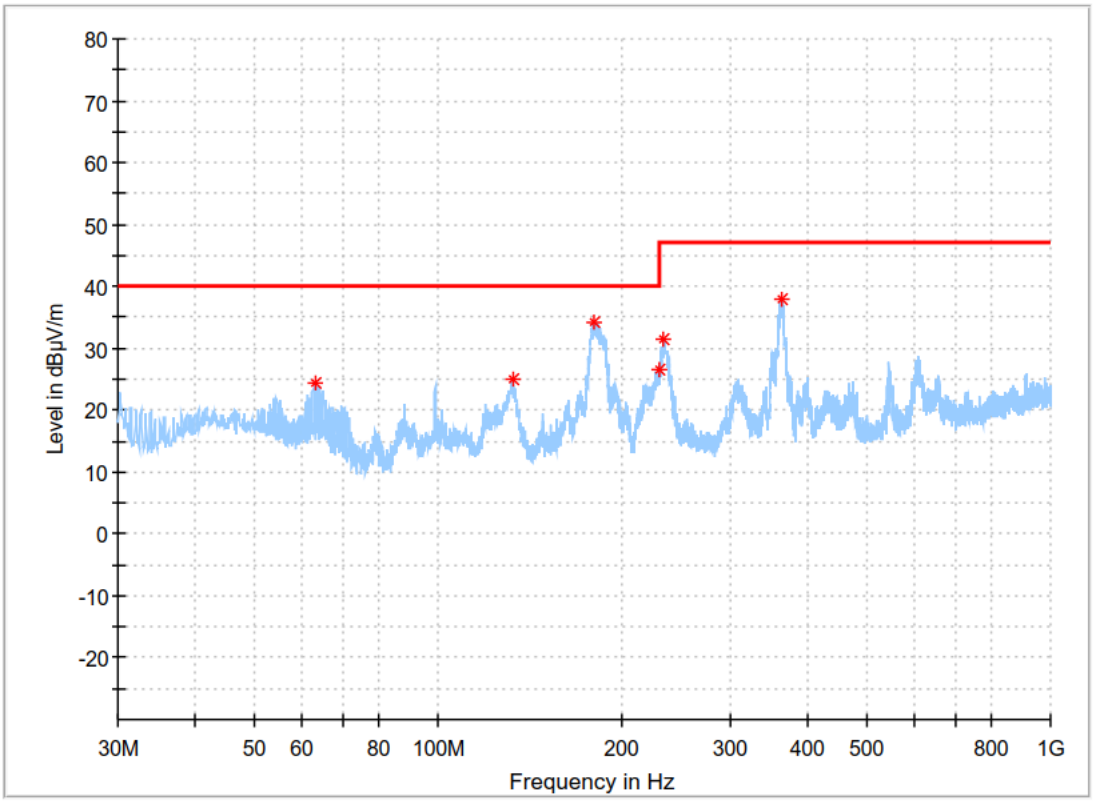
Critical_Freqs

Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Corr. (dB/m)
179.858600	33.44	40.00	6.56	H	-38.0
229.981667	32.79	40.00	7.21	H	-35.4
235.047222	36.15	47.00	10.85	H	-35.0
309.413889	32.44	47.00	14.56	H	-33.5
364.057222	39.63	47.00	7.37	H	-32.4
546.632778	27.10	47.00	19.90	H	-28.9

Final_Result

Frequency (MHz)	QuasiPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Corr. (dB/m)
179.858600	33.14	40.00	6.86	H	-38.0

Model : WD-CSC48100-A
Test Mode : TM2
Polarity : Horizontal
Test Date : 2023-02-12



Critical_Freqs

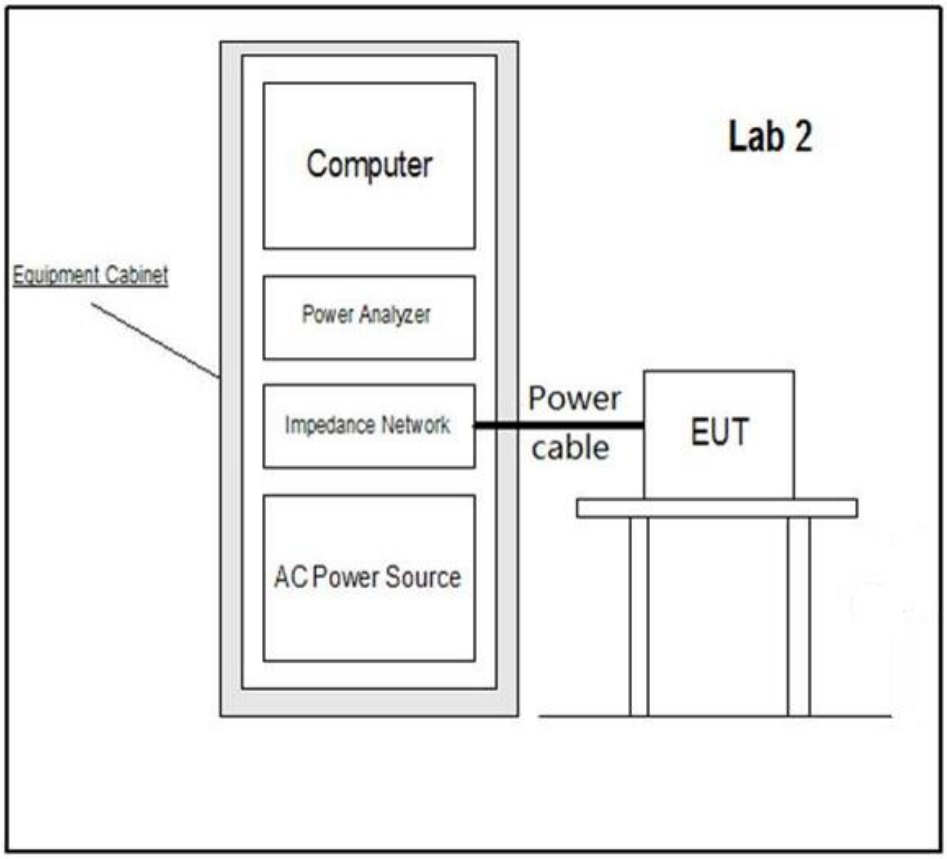
Frequency (MHz)	MaxPeak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Pol	Corr. (dB/m)
363.572222	37.94	47.00	9.06	V	-32.4
229.820000	26.47	40.00	13.53	V	-35.4
233.807778	31.60	47.00	15.40	V	-35.1
62.980000	24.53	40.00	15.47	V	-35.1
180.296111	34.24	40.00	5.76	V	-37.9
132.658333	25.07	40.00	14.93	V	-38.6

Model : WD-CSC48100-A
Test Mode : TM2
Polarity : Vertical
Test Date : 2023-02-12

2.3 Harmonic current emission

2.3.1 Test Method

Harmonic current test should be conducted with the user's operation control or automatic programs set to the mode expected to produce the maximum total harmonic current under normal operating conditions.
Specific test conditions for the measurement of harmonic currents associated with some types of equipment are given in test equipment list.



2.3.2 Specification Limits

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≤ n≤ 39	0.15(15/n)
Even harmonics	
2	1.08

Limits for class A Equipment	
4	0.43
6	0.30
8≤ n ≤40	0.23(8/n)

2.3.3 Test Setup

N/A

2.3.4 Test Location

This test was carried out in Harmonic Flicker Test area.

2.3.5 Test Results

Results for Configuration and Mode: N/A

Performance assessment of the EUT made during this test: N/A

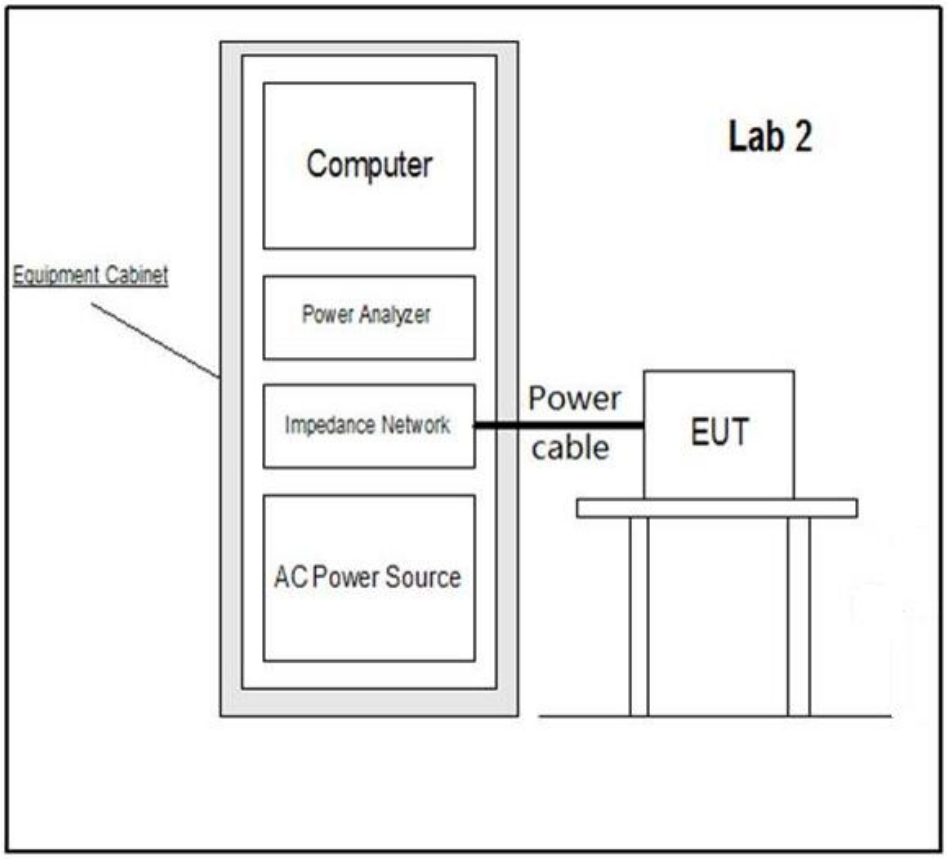
Detailed results are shown below.

Test date: N/A

2.4 Flicker

2.4.1 Test Method

Flicker test should be conducted with the user's operation controls or automatic programs set to the mode expected to produce the most unfavourable sequence of voltage change, using only those combinations of controls and programmes which are mentioned by the manufacturer in the instruction manual, or are otherwise likely to be used.



2.4.2 Specification 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 500ms
The maximum relative steady-state voltage change, *d*c, 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 start, or manual restart, after a power supply interruption

c) 7% for equipment which is:

- Attended whilst in use, 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 or manual restart, after a power supply interruption

2.4.3 Test Setup

N/A

2.4.4 Test Location

This test was carried out in Harmonic Flicker Test area.

2.4.5 Test Results

Results for Configuration and Mode: N/A

Performance assessment of the EUT made during this test: N/A

Detailed results are shown below.

Test date: N/A

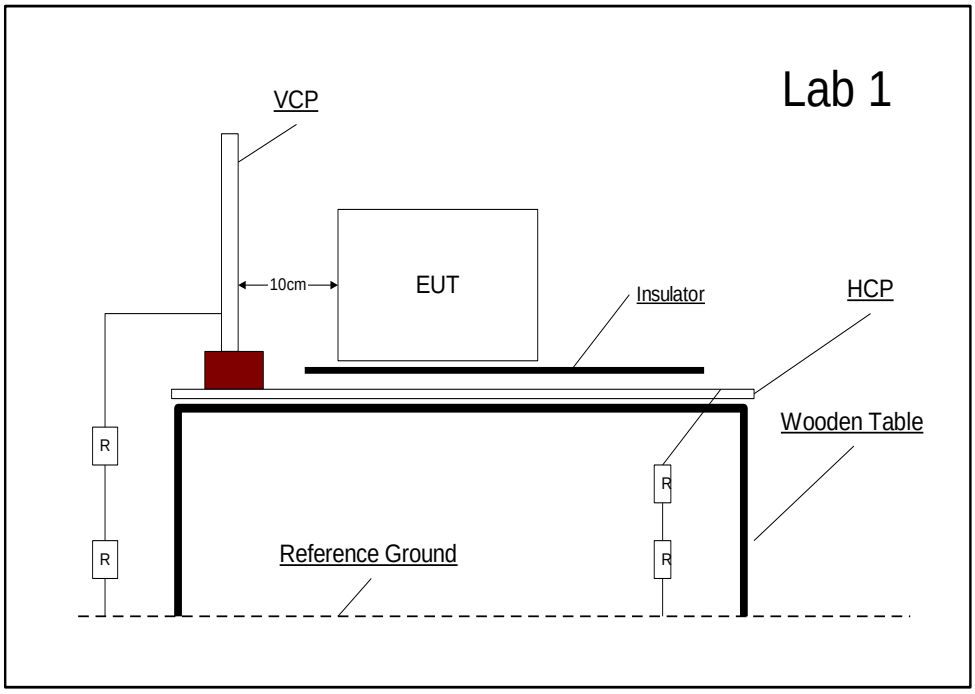
2.5 Electrostatic discharge immunity test

2.5.1 Test Method

The equipment under test including associated cabling was configured on but insulated from, using a 0.5mm isolator, a horizontal coupling plane fitted to the top of a 0.8m non-conductive table for table-top equipment; and on a 0.1m insulated support for floor standing equipment; above a ground reference plane all within a test laboratory.

Using the air discharge method for non-metallic parts, contact discharge method for metallic parts with both vertical and horizontal couple plane discharge methods for the sides of the equipment under test, the required electrostatic discharge voltage levels in both voltage polarities were applied at the detailed pulse repartition rate.

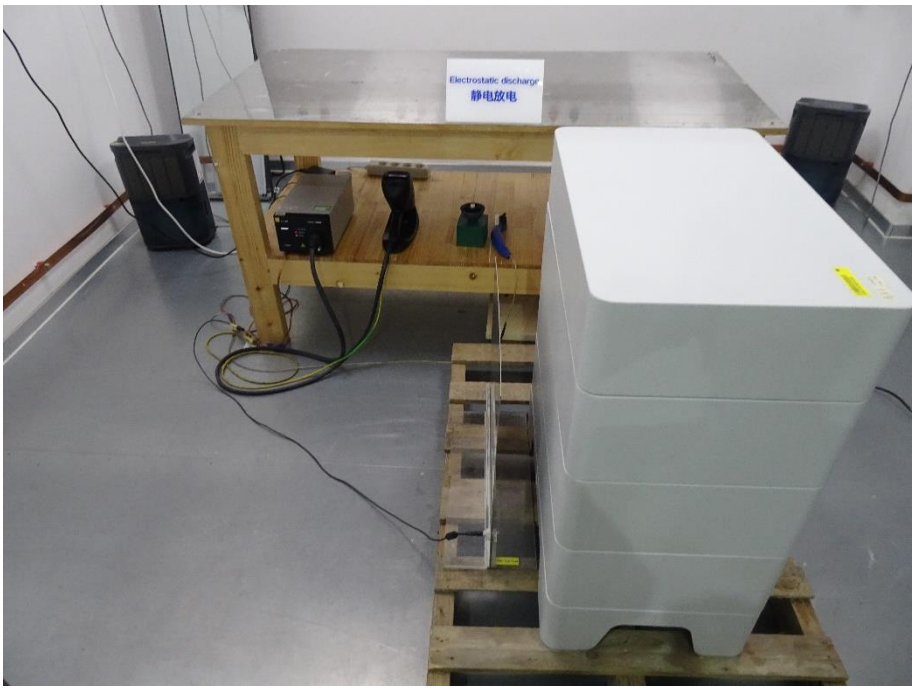
During this testing any anomalies in the equipment under tests performance was recorded.



2.5.2 Specification Limits

Required Test Levels				Performance Criteria
Discharge type	Discharge Level (kV)		Number of discharges per location (each polarity)	
	Positive	Negative		
Air – Direct	8	8	10	B
Contact – Direct	4	4	10	B
Contact – Indirect	4	4	10	B

2.5.3 Test Setup



2.5.4 Test Location

This test was carried out in ESD room.

2.5.5 Test Results

Results for Configuration and Mode: DC power/TM1 and TM2

Performance assessment of the EUT made during this test: Pass

Detailed results are shown below.

Test date: 2023-02-10

Test Point	Discharge	Results: Met Performance Criteria									
		2kV		4kV		6kV		8kV		15kV	
		+	-	+	-	+	-	+	-	+	-
HCP	Contact	N/A	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A
VCP	Contact	N/A	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A
Each conductive location touchable by hand	Contact	N/A	N/A	A	A	N/A	N/A	N/A	N/A	N/A	N/A
Each nonconductive location touchable by hand	Air	N/A	N/A	N/A	N/A	N/A	N/A	A	A	N/A	N/A
N/A	Not Appliance										

Remark: No observable change.

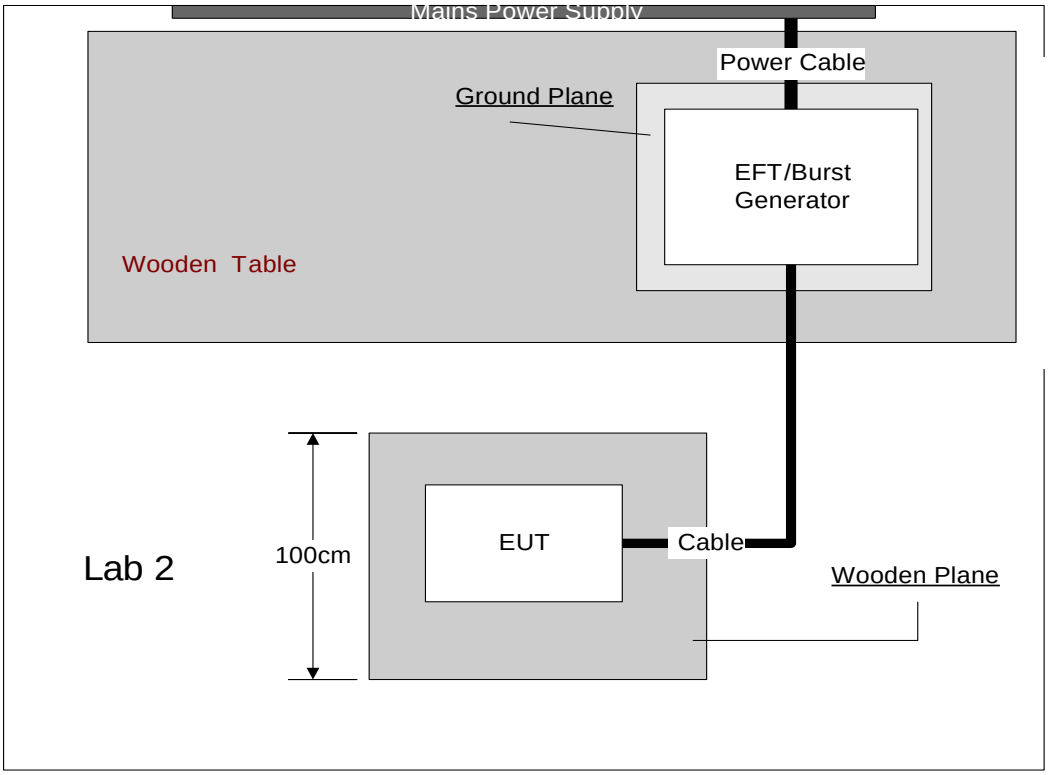
2.6 Electrical fast transient /burst immunity test

2.6.1 Test Method

The equipment under test including associated cabling was configured on but insulated from, using a 0.1 m isolator, a horizontal coupling plane fitted to the top of a 0.8 m non-conductive table for table-top equipment; and on a 0.1 m insulated support for floor standing equipment; above a ground reference plane all within a test laboratory.

Using a CDN for power ports, capacitive coupling clamp for signal and control ports and a 33nF coupling capacitor for earth ports, the required fast transient burst voltage levels in both voltage polarities were applied at the detailed pulse repartition rate and duration of test.

During this testing any anomalies in the equipment under tests performance was recorded.



2.6.2 Specification Limits

Required Test Levels at input and output a.c. power port					
Line Under Test	Level (kV)	Repetition Rate (kHz)	Test Duration	Coupling Method	Performance Criteria
AC Power Port	± 1	5 kHz	2 min per polarity	Direct	B
Note 1. The test may be performed at one or at both repetition frequencies. The use of 5 kHz repetition frequency is traditional; however, 100 kHz is closer to reality.					

Required Test Levels at input and output d.c. power ports					
Line Under Test	Level (kV)	Repetition Rate (kHz)	Test Duration	Coupling Method	Performance Criteria
DC Power Port	± 0.5	5 kHz	2 min per polarity	Direct	B
Note 1. Not applicable to input ports intended for connection to a battery or a rechargeable battery which shall be removed or disconnected from the equipment for recharging. Note 2. Equipment with a DC power input port intended for use with a dedicated AC–DC power adaptor shall be tested on the AC power input of the AC–DC power adaptor specified by the manufacturer (see test level of Table 4). Where no adaptor is specified the test shall be done on the DC power port using the test level of Table 4. Where an adaptor is specified the test is applicable to DC power input ports only when intended to be connected permanently to cables longer than 3 m. Note 3. The test may be performed at one or at both repetition frequencies. The use of 5 kHz repetition frequency is traditional; however, 100 kHz is closer to reality.					

Required Test Levels at ports for signal and control ports					
Line Under Test	Level (kV)	Repetition Rate (kHz)	Test Duration	Coupling Method	Performance Criteria
signal and control Port	± 0.5	5 kHz	2 min per polarity	Clamp	B
Note 1. Applicable only to ports interfacing with cables whose total length according to the manufacturer’s functional specification may exceed 3 m. Note 2. The test may be performed at one or at both repetition frequencies. The use of 5 kHz repetition frequency is traditional; however, 100 kHz is closer to reality.					

2.6.3 Test Setup



2.6.4 Test Location

This test was carried out in EMS Test Location.

2.6.5 Test Results

Results for Configuration and Mode: DC power/TM1 and TM2

Performance assessment of the EUT made during this test: Pass

Detailed results are shown below.

Test date: 2023-02-13

Tabulated Results for Fast Transient Burst Immunity					
Line under test	Test Level (V/m)	Repetition Rate	Test Duration	Coupling Method	Result
DC line	± 0.5 kV	5 kHz	2 min	CDN	Pass(A)
Signal Lie	± 0.5 kV	5 kHz	2 min	Clamp	Pass(A)

Remark: N/A

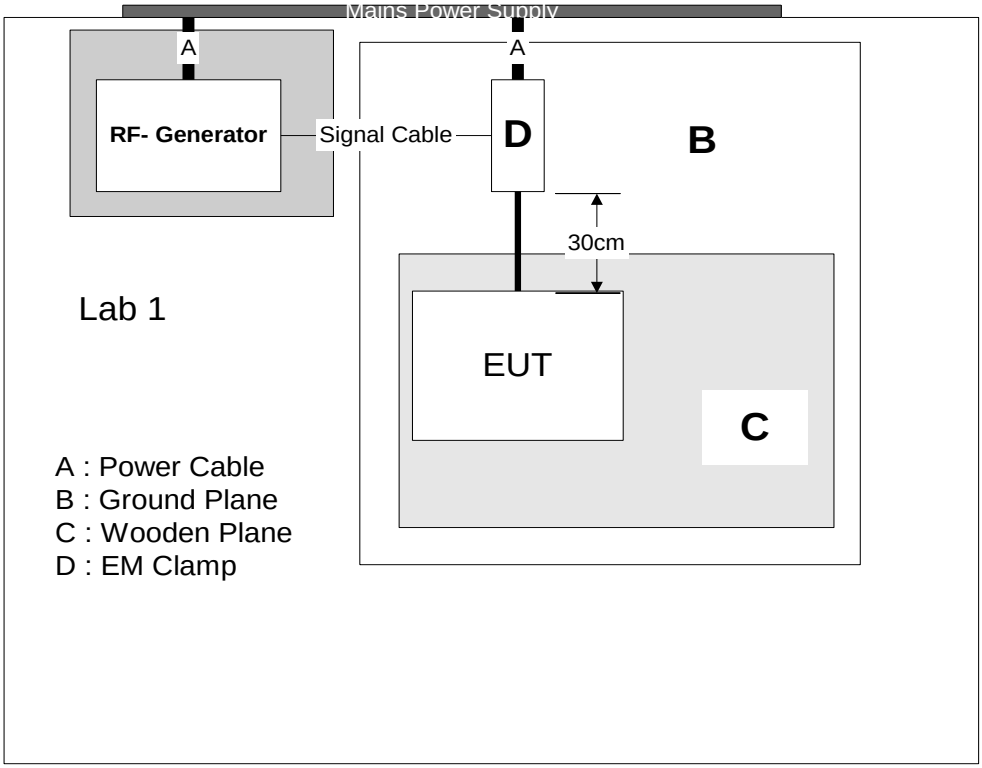
2.7 Immunity to conducted disturbances, induced by radio-frequency fields

2.7.1 Test Method

The equipment under test was configured, on but insulated from, using a 0.1 m isolator, a horizontal coupling plane fitted to the top of a 0.1 m non-conductive table for table-top equipment, above a ground reference plane all within a test laboratory.

All associated cabling was configured, on but insulated from, using a 50 mm isolator, the same horizontal coupling plane as the equipment under test.

Using CDNs, EM Clamps or current clamps as appropriate, the power ports and applicable signal and control ports were subjected to the required, pre calibrated RF injected signal strength, modulated as described, swept over the frequency range of test.
During this testing any anomalies in the equipment under tests performance was recorded.



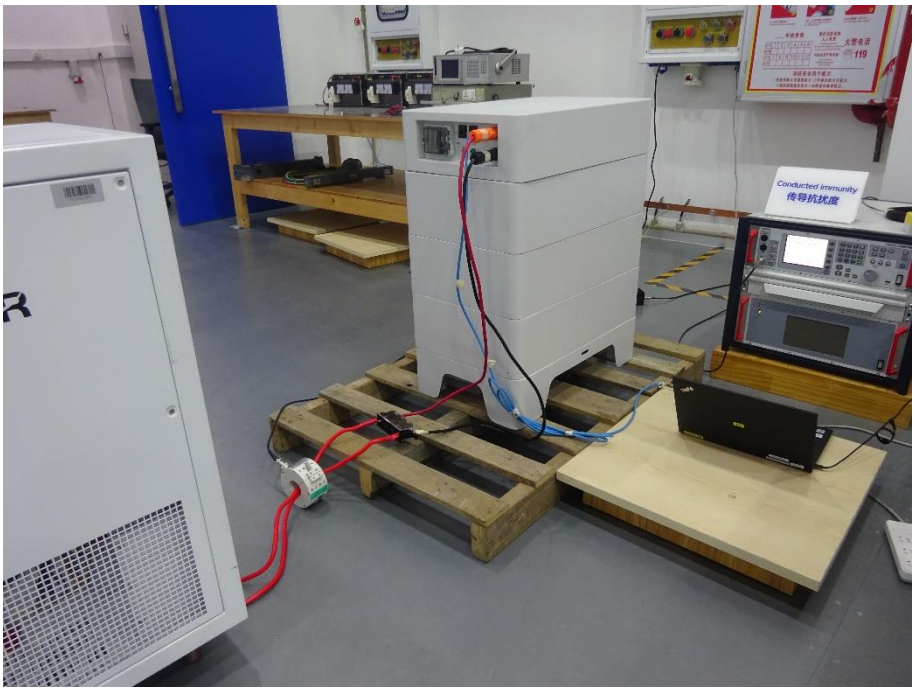
2.7.2 Specification Limits

Required Test Levels at ports for signal/control ports						Performance Criteria
Line Under Test	Frequency Range (MHz)	Level (V)	Modulation	Step Size (%)	Dwell (s)	
Signal and control lines	0.15 to 80	3	AM (80 %,1 kHz, sine wave)	1	1	A
Note 1. Applicable only to ports interfacing with cables whose total length according to the manufacturer's functional specification may exceed 3 m.						

Required Test Levels at input and output DC power ports						Performance Criteria
Line Under Test	Frequency Range (MHz)	Level (V)	Modulation	Step Size (%)	Dwell (s)	
DC power ports	0.15 to 80	3	AM (80 %,1 kHz, sine wave)	1	1	A
Note 1. Applicable only to ports interfacing with cables whose total length according to the manufacturer's functional specification may exceed 3 m.						

Required Test Levels at input and output AC power ports						Performance Criteria
Line Under Test	Frequency Range (MHz)	Level (V)	Modulation	Step Size (%)	Dwell (s)	
AC power ports	0.15 to 80	3	AM (80 %,1 kHz, sine wave)	1	1	A

2.7.3 Test Setup



2.7.4 Test Location

This test was carried out in EMS Test Location.

2.7.5 Test Results

Results for Configuration and Mode: DC power/TM1 and TM2

Performance assessment of the EUT made during this test: Pass

Detailed results are shown below.

Test date: 2023-02-13

Tabulated Results for Injected current						
Line and sensitive frequency under test	Test Level	Step	Dwell Time	Coupling Method	Modulation	Result
DC power line	3V	1%	1s	CDN	1kHz, 80%	Pass(A)
Signal line	3V	1%	1s	CDN	1kHz, 80%	Pass(A)

Remark: N/A

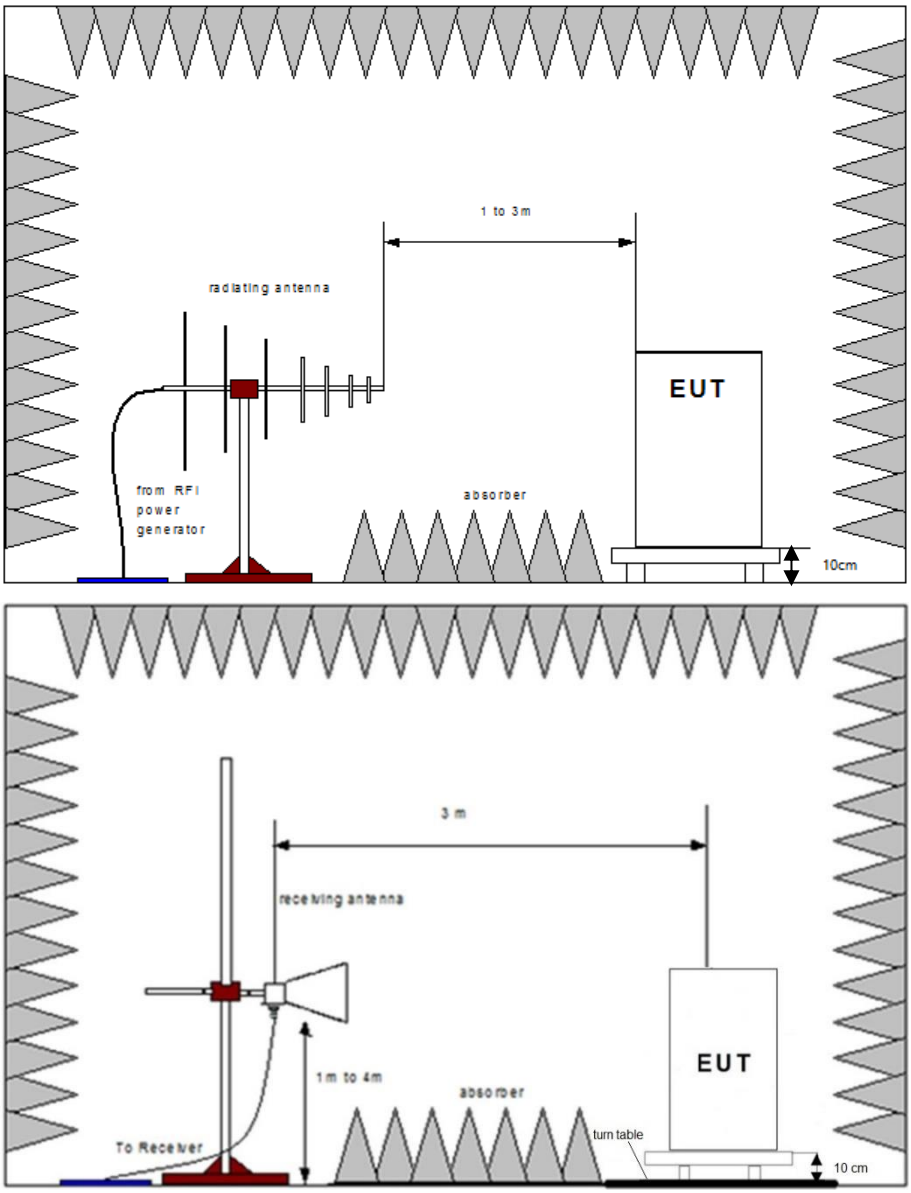
2.8 Radiated, radio-frequency, electromagnetic field immunity test

2.8.1 Test Method

The equipment under test including associated cabling was configured, on a 0.8 m non-conductive table for table-top equipment and on a 0.12 m insulated support for floor standing equipment; with a pre-calibrated semi anechoic chamber.

All four side of the equipment under test were subjected to the required RF field strength, modulated as described, swept over the frequency range of test with the antenna positioned in both horizontal and vertical polarizations.

During this testing any anomalies in the equipment under tests performance was recorded.



2.8.2 Specification Limits

Required Test Levels					Performance Criteria
Frequency Range (MHz)	Level (V/m)	Modulation	Step Size (%)	Dwell (s)	
80 to 1000	3	AM (80 %,1 kHz, sine wave)	1	1	A
1400 to 6000	3	AM (80 %,1 kHz, sine wave)	1	1	A
Note 1. EUT powered at one of the Nominal input voltages and frequencies					

2.8.3 Test Setup



2.8.4 Test Location

This test was carried out in RS Test Location.

2.8.5 Test Results

Results for Configuration and Mode: DC power/TM1 and TM2

Performance assessment of the EUT made during this test: Pass

Detailed results are shown below.

Test date: 2023-02-08

Tabulated Results for RF Electromagnetic Field 80 - 1000 MHz and 1400 MHz – 6000MHz					
Side of the equipment under test	Antenna polarization	Test Level	Dwell Time	Measuring distance	Results
All sides	Horizontal	3 V/m	1 s	3 m	A
All sides	Vertical	3 V/m	1 s	3 m	A

Remark: No observable change.

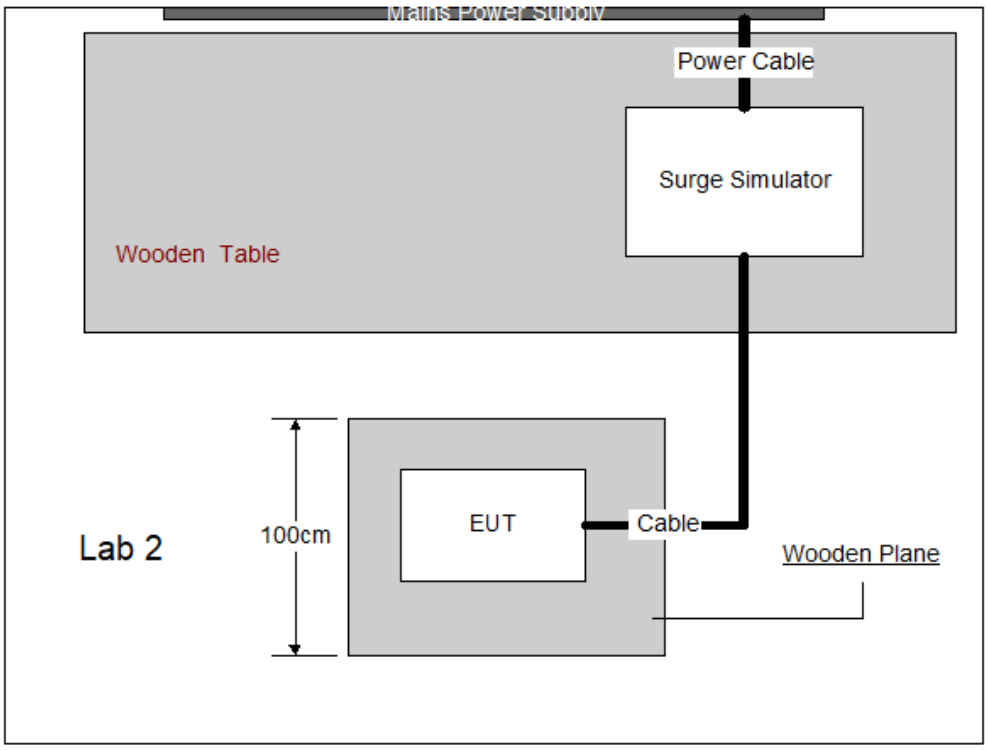
2.9 Surge immunity test

2.9.1 Test Method

The equipment under test including associated cabling was configured, on a 0.8 m non-conductive table for table-top equipment and on a 0.1 m insulated support for floor standing equipment above a ground reference plane all within a test laboratory.

Using CDNs for power ports and appropriate coupling methods for applicable signal and control ports, the required number of surges was applied for each surge voltage level using both positive and negative surge voltage polarities. Surges were applied at the power line frequency phase angles and repartition rates detailed.

During this testing any anomalies in the equipment under tests performance was recorded.



2.9.2 Specification Limits

Required Test Levels Input and output a.c. power ports			Performance Criteria
Line Under Test	Characteristics	Test Levels	
line to line with line to earth with	Wave-shape data 2Ω impedance 12Ω impedance	1.2/50 µs ± 1.0 kV ±2.0 kV	B
Note in addition to the specified test level, all lower levels as detailed in IEC 61000-4-5 should also be satisfied**.**			

Required Test Levels Input and output DC power ports			Performance Criteria
Line Under Test	Characteristics	Test Levels	
line to line with line to earth with	Wave-shape data 2Ω impedance 12Ω impedance	1.2/50 µs ± 0.5 kV ±1.0 kV	B
Applicable only to ports interfacing with long distance lines(>30m).			

Required Test Levels Ports for signal lines and control lines			Performance Criteria
Line Under Test	Characteristics	Test Levels	
line to earth with	Wave-shape data 42Ω impedance	1.2/50 µs ± 1.0 kV	B
Applicable only to ports interfacing with long distance lines(>30m). Where the normal functioning cannot be achieved because of the impact of the coupling/decoupling network (CDN) on the EUT, the test shall be done with the reduced functionality. A rationale shall be given in the test report for doing so. After the test and the removal of the CDN, the normal function shall not be affected.			

2.9.3 Test Setup

N/A

2.9.4 Test Location

This test was carried out in EMS Test Location.

2.9.5 Test Results

Results for Configuration and Mode: N/A

Performance assessment of the EUT made during this test: N/A

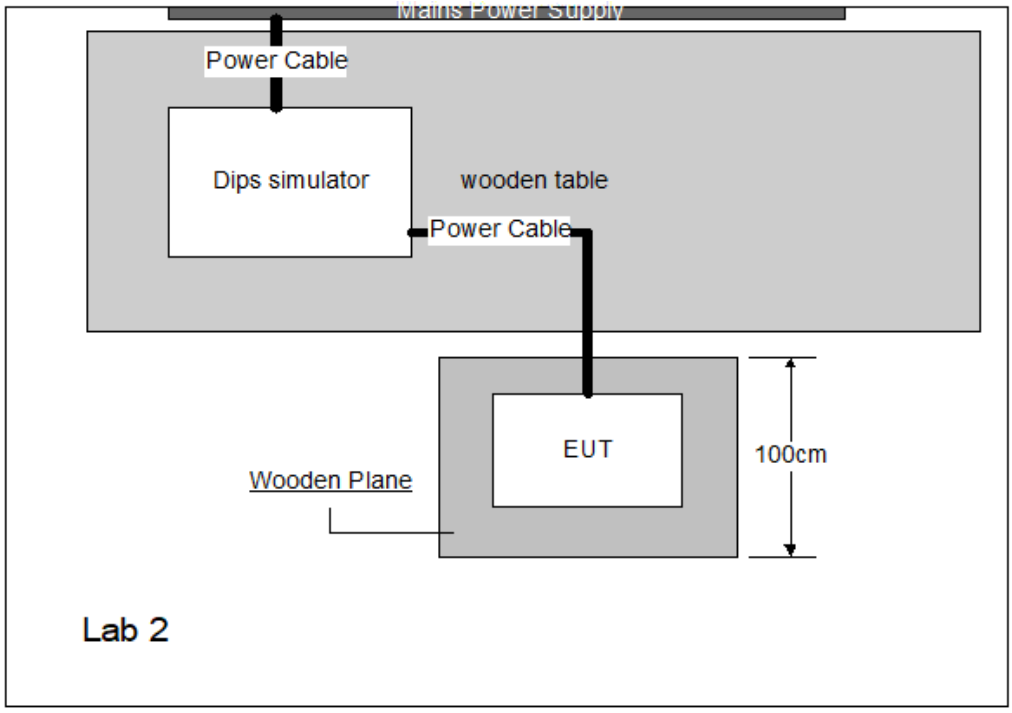
Test date: N/A

2.10 Voltage dips, short interruptions and voltage variations immunity tests

2.10.1 Test Method

The equipment under test including associated cabling was configured, on a 0.8 m non-conductive table for table-top equipment and on a 0.1 m insulated support for floor standing equipment above a ground reference plane all within a test laboratory.

Using a programmable power supply the equipment under test was subjected to the detailed supply voltage dips and interruptions. The required supply phase synchronization and test repetition rate, detailed, was controlled by the programmable power supply.
During this testing any anomalies in the equipment under tests performance was recorded.



2.10.2 Specification Limits

Voltage Dips				
Voltage Dips in % UT	Test level in % UT	Duration		Performance Criteria
		50Hz	60Hz	
100	0	½ cycle	½ cycle	B
100	0	1 cycle	1 cycle	B
30	70	25 cycles	30 cycles	C
0	100	250 cycles	300 cycles	C
UT is the rated voltage of the Equipment Under Test Only apply to AC power ports				

2.10.3 Test Setup

N/A

2.10.4 Test Location

This test was carried out in EMS Test Location.

2.10.5 Test Results

Results for Configuration and Mode: N/A

Performance assessment of the EUT made during this test: N/A

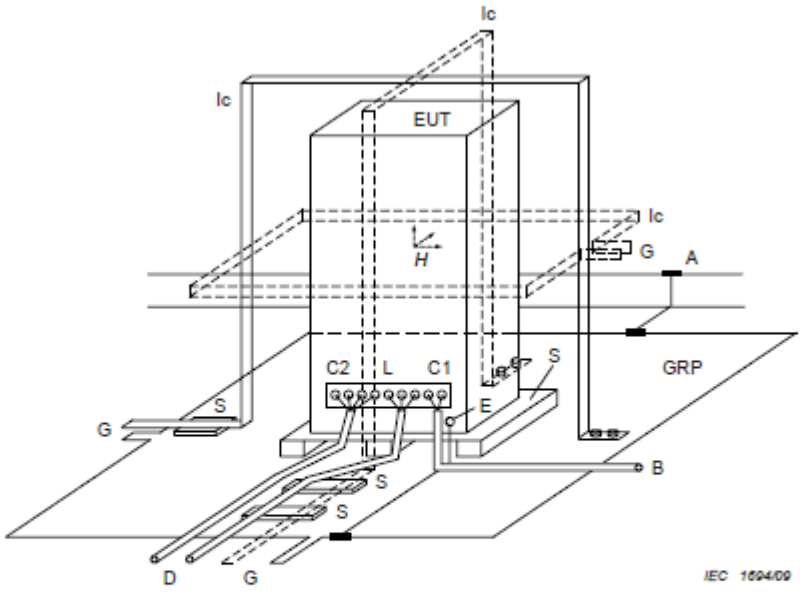
Test date: N/A

2.11 Power-frequency magnetic field immunity test

2.11.1 Test Method

The ground plane (GRP) shall be placed in the laboratory; the floor standing EUT and auxiliary test equipment shall be placed on it and connected to GRP or to earth terminal. The ground plane shall be a non-magnetic metal sheet (copper or aluminium) of 0,25 mm minimum thickness; other metals may be used but in this case they shall have at least 0,65 mm minimum thickness. The minimum size of the ground plane is 1 m × 1 m. The final size depends on the dimensions of the floor standing EUT. The ground plane shall be connected to the safety earth system of the laboratory.

The equipment is configured and connected to satisfy its functional requirements. Floor standing equipment shall be placed on the GRP with the interposition of a 0,1 m thickness insulating support (e.g. dry wood). For table top equipment see Figure 3. The equipment cabinets which can be earthed shall be connected to the safety earth directly on the GRP or via the earth terminal to PE. The power supply, input and output circuits shall be connected to the sources of power supply, control and signal. The cables supplied or recommended by the equipment manufacturer shall be used. In absence of any recommendation, unshielded cables shall be adopted, of a type appropriate for the signals involved. All cables shall be exposed to the magnetic field for 1 m of their length. The back filters, if any, shall be inserted in the circuits at 1 m cable length from the EUT and connected to the ground plane. The communication lines (data lines) shall be connected to the EUT by the cables given in the technical specification or standard for this application.



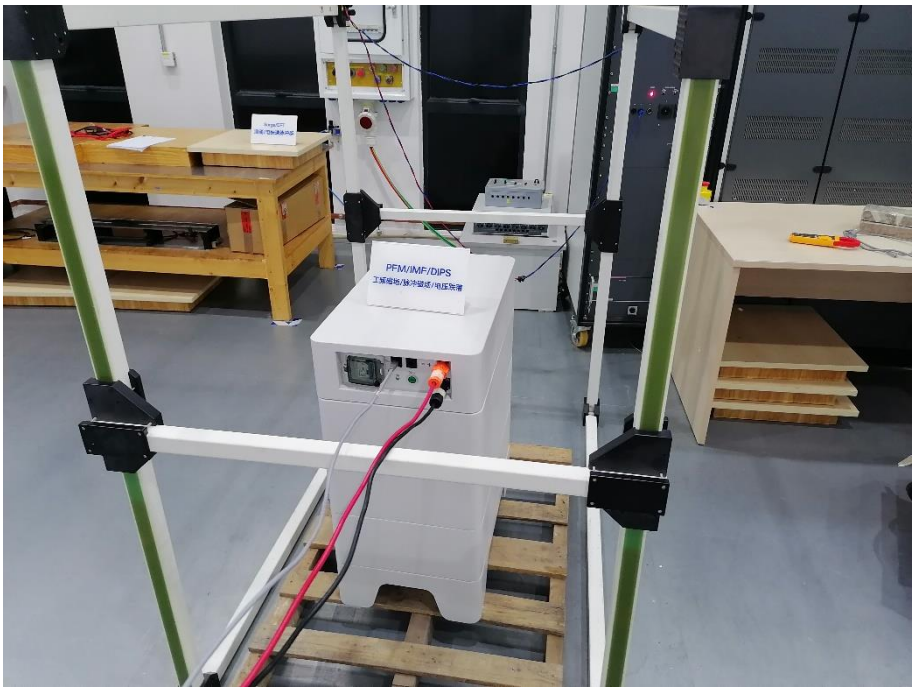
Components

GRP	Ground plane	C1	Power supply circuit
A	Safety earth	C2	Signal circuit
S	Insulating support	L	Communication line
EUT	Equipment under test	B	To power supply source
Ic	Inductive coil	D	To signal source, simulator
E	Earth terminal	G	To the test generator

2.11.2 Specification Limits

Required Test Levels			Performance Criteria
Operating Frequency (Hz)	Level (A/m)	Dwell (s)	
50	3	300	A
60	3	300	A

2.11.3 Test Setup



2.11.4 Test Location

This test was carried out in EMS Test Location.

2.11.5 Test Results

Results for Configuration and Mode: DC power/TM1 and TM2

Performance assessment of the EUT made during this test: Pass

Detailed results are shown below.

Test date: 2023-02-08

Required Test Levels			Performance Criteria
Operating Frequency (Hz)	Level (A/m)	Dwell (s)	
50	3	300	A
60	3	300	A

Remark: No observable changes.

3 Test Equipment Information

3.1 General Test Equipment Used

Conducted Disturbance Test

DESCRIPTION	MANUFACTURER	MODEL NO.	EQUIPMENT ID	SERIAL NO.	CAL. DUE DATE
EMI Test Receiver	R&S	ESCI	64-2-63-08-001	100727	2023-05-24
DC LISN	SCHWARZBECK	PVDC8300	64-2-60-22-002	00270	2023-11-24

Radiated Emission Test（SAC-3 area）

DESCRIPTION	MANUFACTURER	MODEL NO.	EQUIPMENT ID	SERIAL NO.	CAL. DUE DATE
EMI Test Receiver	Rohde & Schwarz	ESR 26	64-2-63-20-003	101702	2023-11-23
Trilog Super Broadband Test Antenna	Schwarzbeck	VULB 9162	64-2-62-20-001	00341	2023-12-28
Horn Antenna	Schwarzbeck	BBHA 9120D	64-2-62-20-004	02152	2023-12-26
Active Loop Antenna	Schwarzbeck	FMZB 1513-60	64-2-62-21-012	00041	2023-12-08
Pre-amplifier	Rohde & Schwarz	SCU08F1	64-2-28-20-010	101016	2023-11-23
Pre-amplifier	Rohde & Schwarz	SCU 18	64-2-28-20-011	100759	2023-11-23
3m Semi-anechoic chamber	TDK	SAC-3	64-2-90-20-004	----	2024-01-27

Electrostatic Discharge Test (ESD area)

DESCRIPTION	MANUFACTURER	MODEL NO.	EQUIPMENT ID	SERIAL NO.	CAL. DUE DATE
ESD Generator	EMTEST	ESD NX30	64-2-75-20-009	23124	2023-09-02

Radiated Immunity Test (CAC-3 area)

DESCRIPTION	MANUFACTURER	MODEL NO.	EQUIPMENT ID	SERIAL NO.	CAL. DUE DATE
Signal Generator	Rohde & Schwarz	SMB100B	64-2-64-20-001	101903	2023-11-23
Power Amplifier	Rohde & Schwarz	BBA150-BC500	64-2-28-20-002	104061	2023-11-22
Power Amplifier	Rohde & Schwarz	BBA150-D110E100	64-2-28-20-003	104048	2023-11-23
Microwave Log-Periodic Antenna	Schwarzbeck	STLP9129 SET	64-2-62-20-002	3074	N/A
Average Power Sensor	Rohde & Schwarz	NRP6AN	64-2-32-20-001	101424	2023-11-23
Average Power Sensor	Rohde & Schwarz	NRP6AN	64-2-32-20-002	101425	2023-11-23
3m FAC Chamber	TDK	CAC-3	64-2-90-20-003	--	2024-01-27

Electrical Fast Transients Test (EMS area)

DESCRIPTION	MANUFACTURER	MODEL NO.	EQUIPMENT ID	SERIAL NO.	CAL. DUE DATE
Compact Simulator	EMTEST	UCS 500N7.7	64-2-75-20-010	P1949235471	2023-11-22
3-phase coupling/decoupling network	EMTEST	CNI 503B9.4	64-2-60-20-054	P1740204286	2023-11-22
Capacitive Coupling Clamp	EMTEST	CCI	64-2-69-20-014	P2009239178	2023-11-22

Conducted Immunity Test (EMS area)

DESCRIPTION	MANUFACTURER	MODEL NO.	EQUIPMENT ID	SERIAL NO.	CAL. DUE DATE
Compact immunity test systemr	TESEQ	NSG 4070C-110	64-2-75-20-008	56172	2023-11-23
6dB Attenuator	TESEQ	ATN 6150	64-2-65-20-003	20011501	2023-11-22
Coupling/ Decoupling Network	EM TEST	CDN M016S	64-2-60-20-039	56466	2023-11-22
Coupling/ Decoupling Network	EMTEST	CDN M5-100-750VS	64-2-60-20-042	54984	2023-11-22
Current injection probe	EMTEST	CIP 9136A	64-2-69-20-010	56220	2023-11-22
EM Clamp	TESEQ	KEMA 801A	64-2-69-20-007	56676	2023-11-23

Power-frequency magnetic field Test (EMS area)

DESCRIPTION	MANUFACTURER	MODEL NO.	EQUIPMENT ID	SERIAL NO.	CAL. DUE DATE
Multifunctional threephase voltage source	EMTEST	NetWave 67.3-400	64-2-09-20-011	P2009239095	2023-11-23
Helmholtz Coils	Schwarzbeck	HHS 5215-100	64-2-62-20-011	HHS 5215-100 #111	2023-12-20

4 Measurement Uncertainty

For a 95% confidence level, the measurement uncertainties for defined systems are:

System Measurement Uncertainty	
Test Items	Extended Uncertainty
Uncertainty for Radiated Emission in 3m chamber 30MHz-1000MHz	Horizontal: 5.13dB; Vertical: 5.20dB;
Uncertainty for Radiated Emission in 10m chamber 30MHz-1000MHz	Horizontal: 5.00dB; Vertical: 5.10dB;
Uncertainty for Radiated Emission in 3m chamber 1000MHz-18000MHz	Horizontal: 5.02dB; Vertical: 5.02dB;
Uncertainty for Radiated Emission in 10m chamber 1000MHz-18000MHz	Horizontal: 5.01dB; Vertical: 5.01dB;
Uncertainty for Conducted Emission 9kHz-150KHz	3.63dB
Uncertainty for Conducted Emission 150kHz-30MHz	3.20dB
Uncertainty for Radiated Electromagnetic Disturbance 9KHz-30MHz	3.20dB
Uncertainty for Harmonic test	3.16%
Uncertainty for Flicker test	4.69%
Uncertainty for RS test	2.08dB
Uncertainty for CS test	2.15dB (CDN) 3.25dB (EM Clamp)
Uncertainty for ESD test	The immunity measurement system uncertainty is within standard requirement and is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%.
Uncertainty for EFT test	
Uncertainty for Surges test	
Uncertainty for PFMF test	
Uncertainty for Voltage Dips, Voltage Variations and Short Interruptions Test	

Remark:
Measurement Uncertainty Decision Rule
Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2007, clause 4.4.3 and 4.5.1.

5 Photographs

Details of: WD-DYC48100-A



Details of:



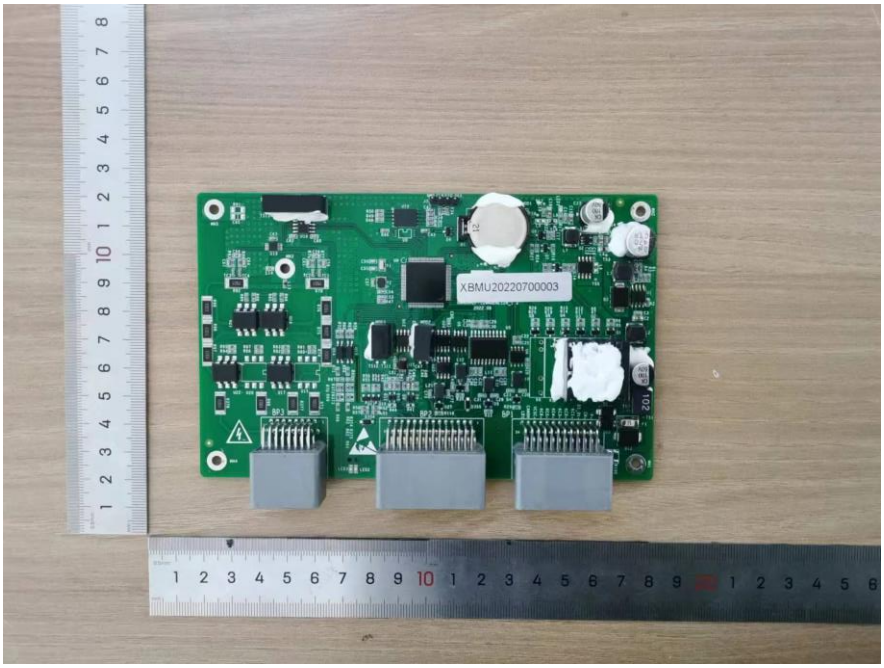
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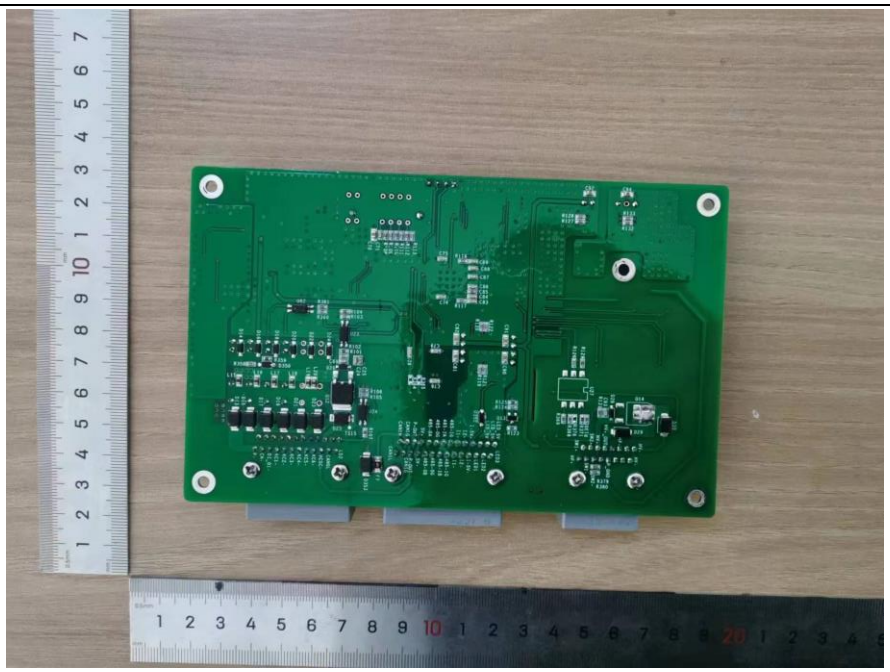
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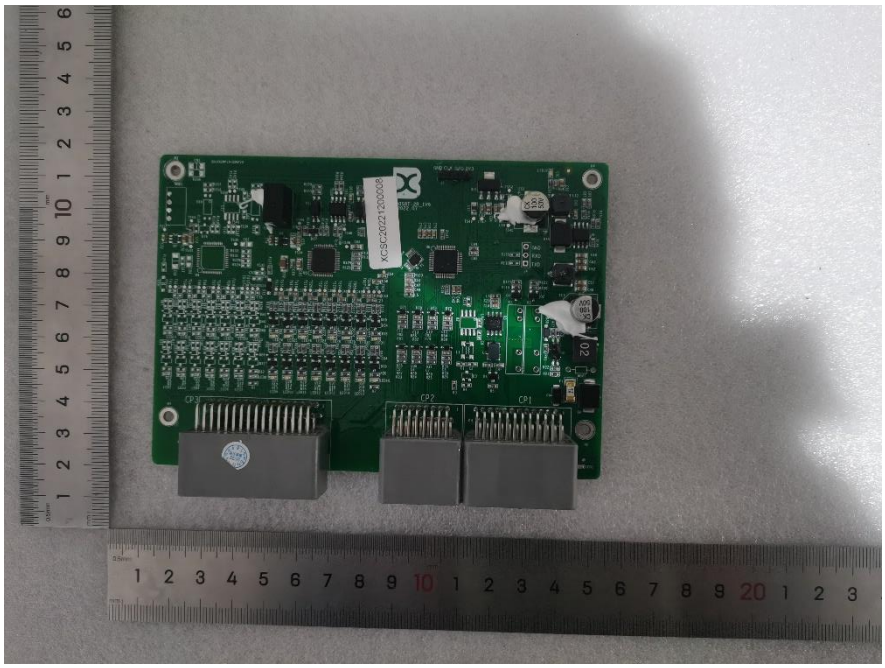
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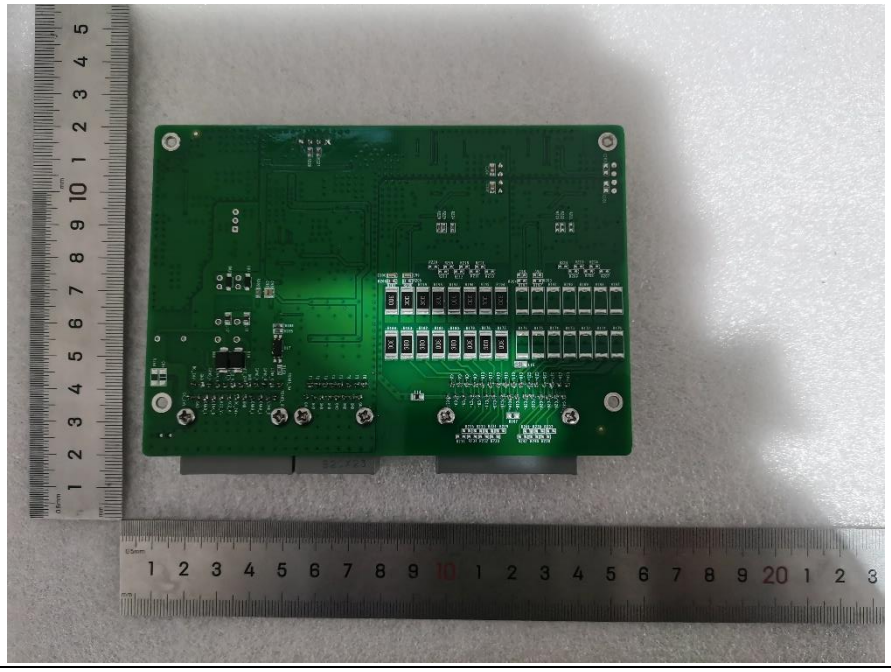
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