

ETSI EN 301 489-1 V2.2.3 (2019-11)
ETSI EN 301 489-17 V3.2.4 (2020-09)

TEST REPORT

For

SHENZHEN TENDA TECHNOLOGY CO.,LTD

6-8 Floor, Tower E3, No. 1001, Zhongshanyuan Road, Nanshan District, Shenzhen, China. 518052

Tested Model: O8

Report Type: Original Report	Product Type: 5GHz 23dBi 11ac Outdoor CPE
Report Number:	DG2210607-21788E-02
Report Date:	2021-07-08
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TABLE OF CONTENTS

General Information.....	4
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT).....	4
OBJECTIVE.....	4
TEST METHODOLOGY	4
DECLARATIONS	5
System Test Configuration	6
DESCRIPTION OF TEST CONFIGURATION	6
EQUIPMENT MODIFICATIONS	6
EUT EXERCISE SOFTWARE	6
SUPPORT EQUIPMENT LIST AND DETAILS.....	6
SUPPORT CABLE LIST AND DETAILS.....	6
BLOCK DIAGRAM OF TEST SETUP.....	6
TEST EQUIPMENT LIST	7
ENVIRONMENTAL CONDITIONS.....	8
Summary of Test Results	9
1 – Enclosure of ancillary equipment measured on a stand alone basis.....	10
MEASUREMENT UNCERTAINTY.....	10
TEST SYSTEM SETUP	10
EMI TEST RECEIVER SETUP.....	11
TEST PROCEDURE.....	11
CORRECTED AMPLITUDE & MARGIN CALCULATION	12
TEST DATA	13
3 – AC mains power input/output ports	21
TEST SYSTEM SETUP	21
EMI TEST RECEIVER SETUP.....	21
TEST PROCEDURE.....	21
CORRECTED AMPLITUDE & MARGIN CALCULATION	22
TEST DATA	23
5 – Voltage fluctuations and flicker (AC mains input port)	27
TEST SYSTEM SETUP	27
TEST STANDARD	27
TEST DATA.....	28
6 – Wired network ports	29
MEASUREMENT UNCERTAINTY.....	29
TEST SYSTEM SETUP	29
EMI TEST RECEIVER SETUP.....	30
TEST PROCEDURE.....	30
CORRECTED AMPLITUDE & MARGIN CALCULATION	30
TEST DATA	31
7 – Radio frequency electromagnetic fields (80 MHz to 6 000 MHz)	33
TEST SYSTEM SETUP	33
TEST LEVEL.....	33
PERFORMANCE CRITERION: A	33
TEST PROCEDURE.....	33
TEST DATA	34
8 – Electrostatic discharges.....	35
TEST SYSTEM SETUP	35
TEST LEVEL.....	35

PERFORMANCE CRITERION: B	35
TEST PROCEDURE.....	36
TEST DATA.....	37
9 – Fast transients, common mode.....	39
TEST SYSTEM SETUP	39
TEST LEVEL.....	39
PERFORMANCE CRITERION: B.....	39
TEST PROCEDURE.....	39
TEST DATA.....	40
10 – Radio frequency, common mode.....	41
TEST SYSTEM SETUP	41
TEST LEVEL.....	41
PERFORMANCE CRITERION: A	41
TEST PROCEDURE.....	41
TEST DATA.....	42
12 – Voltage dips and short interruptions.....	43
TEST SYSTEM SETUP	43
TEST LEVEL.....	43
PERFORMANCE CRITERION: C.....	43
TEST PROCEDURE.....	43
TEST DATA.....	44
13 – Surges	45
TEST SYSTEM SETUP	45
TEST LEVEL.....	45
PERFORMANCE CRITERION: B.....	45
TEST PROCEDURE.....	45
TEST DATA.....	46
Exhibit A – Eut Photographs.....	47
Exhibit B – Test Setup Photographs.....	61
RE	61
CE_AC.....	63
CE_ISN.....	64
FLICKER.....	65
RS.....	66
ESD	67
EFT	68
CS.....	69
DIPS.....	70
SURGE	71

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Name:		5GHz 23dBi 11ac Outdoor CPE
Test Model:		O8
Rated Input Voltage:		DC 12V from adapter
EU Adapter Information	Model:	BN073-A12012E
	Input:	AC 100-240V, 50/60Hz, 0.4A
	Output:	DC 12.0V, 1.0A
Serial Number:		DG2210607-21788E-RF-S-8SY
EUT Received Date:		2021.06.08
EUT Received Status:		Good

Note: The EUT was used in industry environment

Objective

This report is prepared on behalf of **SHENZHEN TENDA TECHNOLOGY CO.,LTD** in accordance with ETSI EN 301 489-1 V2.2.3 (2019-11) ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard for ElectroMagnetic Compatibility; ETSI EN 301 489-17 V3.2.4 (2020-09) ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for Broadband Data Transmission Systems.

The objective is to determine the compliance of EUT with: ETSI EN 301 489-1&17.

Test Methodology

All measurements contained in this report were conducted with ETSI EN 301 489-1 V2.2.3 (2019-11).

Declarations

BACL is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with a triangle symbol “▲”. Customer model name, addresses, names, trademarks etc. are not considered data.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.

The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval.

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SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in a typical fashion (as normally used by a typical user)

Equipment Modifications

No modification was made to the EUT.

EUT Exercise Software

No software was used for testing.

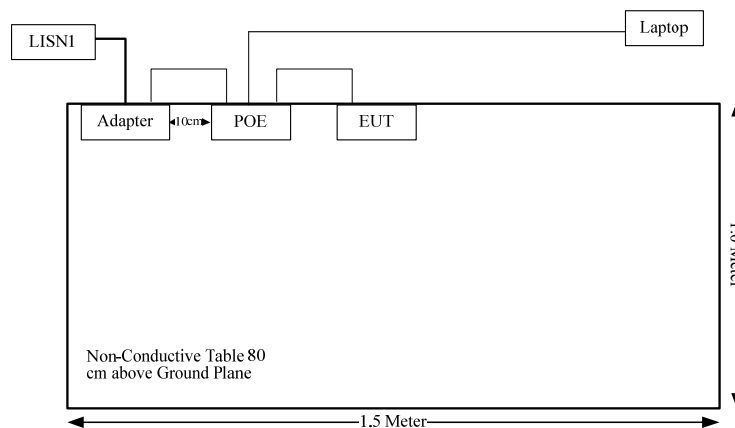
Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Lenovo	Lenovo	E450	PF-OMRADG
Lenovo	Adapter	ADLX65NDC3A	45N0253
DELL	Laptop	E6410	QDS-BRCM1017
DELL	Adapter	PA-1900-02D	9T215

Support Cable List and Details

Cable Description	Shielding Cable	Ferrite Core	Length (m)	From Port	To
RJ45 Cable	No	No	1.2	POE	EUT
RJ45 Cable	No	No	1.2	POE	Laptop
Power Cable	No	No	1.2	Adapter	POE

Block Diagram of Test Setup



Test Equipment List

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted emission					
R&S	LISN	ENV 216	101614	2020-09-12	2021-09-12
TESEQ	ISN	T800	34379	2020-09-12	2021-09-12
R&S	EMI Test Receiver	ESCI	101121	2020-07-07	2021-07-07
MICRO-COAX	Coaxial Cable	C-NJNJ-50	C-0200-01	2020-09-05	2021-09-05
R&S	Test Software	EMC32	Version 9.10.00	N/A	N/A
Radiated emissions below 1GHz					
Sunol Sciences	Antenna	JB3	A060611-1	2020-11-10	2023-11-10
R&S	EMI Test Receiver	ESR3	102453	2020-09-12	2021-09-12
Unknown	Coaxial Cable	C-NJNJ-50	C-0075-01	2020-09-05	2021-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-01	2020-09-05	2021-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-1400-01	2021-05-06	2022-05-05
HP	Amplifier	8447D	2727A05902	2020-09-05	2021-09-05
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
Radiated emissions above 1GHz					
ETS-Lindgren	Horn Antenna	3115	000 527 35	2018-10-12	2021-10-12
Agilent	Spectrum Analyzer	E4440A	SG43360054	2020-07-07	2021-07-07
Unknown	Coaxial Cable	C-SJSJ-50	C-0800-01	2020-09-05	2021-09-05
Mini-Circuit	Amplifier	ZVA-213-S+	54201245	2020-09-05	2021-09-05
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
E-Microwave	Band-stop Filters	OBSF-2400-2483.5-S	OE01601525	2021-06-16	2022-06-15
Mini Circuits	High Pass Filter	VHF-6010+	31118	2021-06-16	2022-06-15
CS					
HP	Signal Generator	8648A	3246A00831	2020-09-12	2021-09-12
R&S	Power Amplifier	15A250	12934	N/A	N/A
Werlatone	Dual Directional Coupler	C5091-10	113192	2021-02-09	2022-02-08
HP	Power Meter	HP EPM-441A	GB37481494	2020-09-12	2021-09-12
Agilent	8482A Power sensor	8482A	US37296108	2020-09-12	2021-09-12
NARDA	Attenuator	769-6	2754	N/A	N/A
COM-POWER	CDN	M325E	521064	2020-09-12	2021-09-12
COM-POWER	CDN	T8E	581607	2019-05-09	2022-05-09
Flicker & Harmonic					
ELGAR	AC Power Source	1751SX	5611	2020-09-23	2021-09-23
EM TEST	Harmonic & Flicker Analyzer	DPA 500	303278	2020-09-17	2021-09-16
EFT & Surge & Dips					
EM TEST	Ultra Compact Generator	UCS 500N5	P1406130994	2020-07-28	2021-07-27
EM TEST	Autotransformer	MV2616	P1450144859	N/A	N/A
EM TEST	CDN	CNV508 S1	311137	2021-01-26	2022-01-25
EM TEST	EFT Clamp	N/A	300886	2020-11-12	2021-11-11
ESD					
HAEFELY	Electrostatic Discharge Simulator	ONYX	180786	2020-09-16	2021-09-16

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
RS					
AR	Antenna	ATL80M1G	0351400	N/A	N/A
AR	Antenna	ATT700M12G	0349410	N/A	N/A
HP	Signal Generator	8665B	3438a00584	2020-09-12	2021-09-12
AR	Power Amplifier	500W1000C	0353561	N/A	N/A
AR	Power Amplifier	60S1G6	0348711	N/A	N/A
PASTERNAK	Dual Directional Coupler	PE2239-30	1711	2020-07-16	2021-07-16
Agilent	EPM Series Power Meter	E4419B	MY45103907	2020-09-12	2021-09-12
Agilent	E-Series Avg Power Sensor	E9301A	MY41497625	2020-09-12	2021-09-12
Agilent	E-Series Avg Power Sensor	E9301A	MY41497628	2020-09-12	2021-09-12

* Statement of Traceability: Bay Area Compliance Laboratories Corp.(Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

Environmental Conditions

Test Item:	Conducted emission	Radiated emissions below 1GHz	Radiated emissions above 1GHz	EMS & Flicker
Temperature:	26.7°C	27.7°C	29.2°C	25.9~26.4°C
Relative Humidity:	69%	49%	39%	53~59 %
ATM Pressure:	100kPa	100.3kPa	100.2kPa	100.2kPa
Tester:	Walker Chen	Joker Chen	Jeremy Liang	Joyce Qiao
Test Date:	2021.06.20	2021.06.23	2021.06.22	2021.06.24

SUMMARY OF TEST RESULTS

SN	Rule and Clause	Description of Test	Test Result
1	EN 301 489 Clause 8.2	Enclosure of ancillary equipment measured on a stand alone basis	Compliance
2	EN 301 489 Clause 8.3	DC power input/output ports	Not applicable*
3	EN 301 489 Clause 8.4	AC mains power input/output ports	Compliance
4	EN 301 489 Clause 8.5	Harmonic current emissions (AC mains input port)	Not applicable**
5	EN 301 489 Clause 8.6	Voltage fluctuations and flicker (AC mains input port)	Compliance
6	EN 301 489 Clause 8.7	Wired network ports	Compliance
7	EN 301 489 Clause 9.2	Radio frequency electromagnetic fields (80 MHz to 6 000 MHz)	Compliance
8	EN 301 489 Clause 9.3	Electrostatic discharges	Compliance
9	EN 301 489 Clause 9.4	Fast transients, common mode	Compliance
10	EN 301 489 Clause 9.5	Radio frequency, common mode	Compliance
11	EN 301 489 Clause 9.6	Transients and surges in the vehicular environment	Not applicable***
12	EN 301 489 Clause 9.7	Voltage dips and short interruptions	Compliance
13	EN 301 489 Clause 9.8	Surges	Compliance

Note:

Not applicable*: Test voltage is AC 230V/50Hz

Not applicable**: EUT power is less than 75W.

Not applicable***: EUT is not equipment intended for vehicular use.

1 - ENCLOSURE OF ANCILLARY EQUIPMENT MEASURED ON A STAND ALONE BASIS

Measurement Uncertainty

Compliance or non-compliance with a disturbance limit shall be determined in the following manner:

If U_{lab} is less than or equal to U_{cisp} of Table 1, then:

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

If U_{lab} is greater than U_{cisp} of Table 1, then:

- compliance is deemed to occur if no measured disturbance level, increased by $(U_{lab} - U_{cisp})$, exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level, increased by $(U_{lab} - U_{cisp})$, exceeds the disturbance limit.

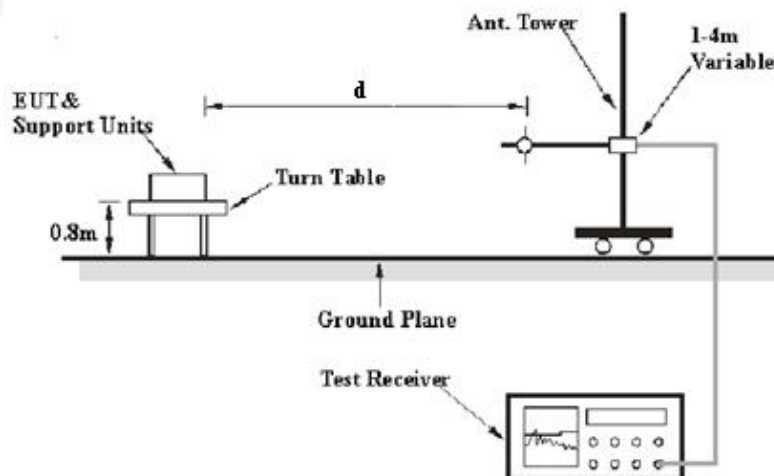
Based on CISPR 16-4-2: 2011, measurement uncertainty of radiated emission at a distance of 10m at Bay Area Compliance Laboratories Corp. (Dongguan) is: 30M~200MHz: 4.55 dB for Horizontal, 4.57 dB for Vertical; 200M~1GHz: 4.66 dB for Horizontal, 4.56 dB for Vertical; measurement uncertainty of radiated emission at a distance of 3m at Bay Area Compliance Laboratories Corp. (Dongguan) is: 30M~200MHz: 4.58 dB for Horizontal, 4.59 dB for Vertical; 200M~1GHz: 4.83 dB for Horizontal, 5.85 dB for Vertical; 1G~6GHz: 4.45 dB, 6G~18GHz: 5.23 dB.

Table 1 – Values of U_{cisp}

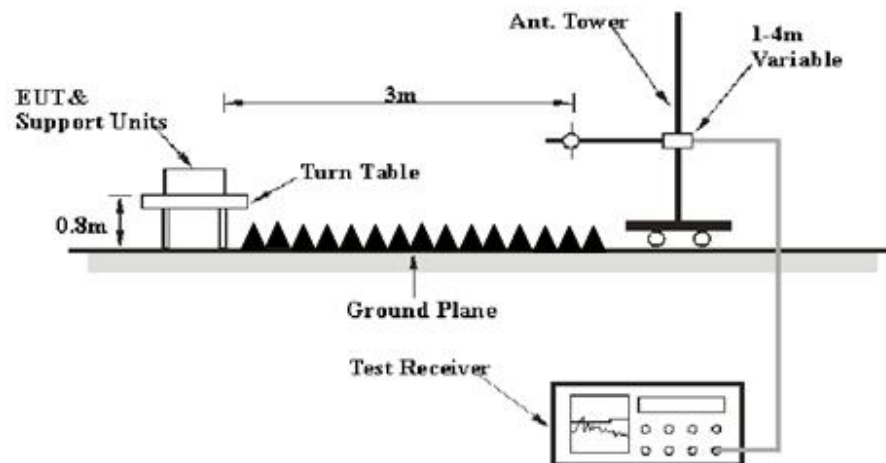
Measurement	U_{cisp}
Radiated disturbance (electric field strength at an OATS or in a SAC) (30 MHz to 1000 MHz)	6.3 dB
Radiated disturbance (electric field strength in a FAR) (1 GHz to 6 GHz)	5.2 dB
Radiated disturbance (electric field strength in a FAR) (6 GHz to 18 GHz)	5.5 dB

Test System Setup

Below 1GHz:



Above 1GHz:



The radiated emission tests below 1GHz were performed in 3 meters, above 1GHz were performed in the 3 meters. The specification used was EN 55032 Class A limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle. The spacing between the peripherals was 10 cm.

EMI Test Receiver Setup

The system was investigated from 30 MHz to 6 GHz.

During the radiated emission test, the EMI test receiver Setup was set with the following configurations:

Frequency Range	RBW	Video B/W	IF B/W	Detector
30 MHz – 1000 MHz	120 kHz	300 kHz	120 kHz	QP
Above 1 GHz	1MHz	3 MHz	/	Peak
	1MHz	10Hz	/	Peak

If the maximized peak measured value complies with under the QP/Average limit more than 6dB, then it is unnecessary to perform an QP/Average measurement.

Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All data was recorded in the Quasi-peak detection mode from 30MHz to 1GHz, Peak and average detection mode above 1 GHz.

If the maximized peak measured value complies with under the QP limit more than 6dB, then it is unnecessary to perform an QP measurement.

Corrected Amplitude & Margin Calculation

The basic equation is as follows:

$$\text{Result} = \text{Meter Reading} + \text{Corrected}$$

Note:

$$\text{Corrected} = \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

or

$$\text{Corrected} = \text{Antenna Factor} + \text{Cable Loss} + \text{Insertion loss of attenuator} - \text{Amplifier Gain}$$

The “**Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

$$\text{Margin} = \text{Limit} - \text{Result}$$

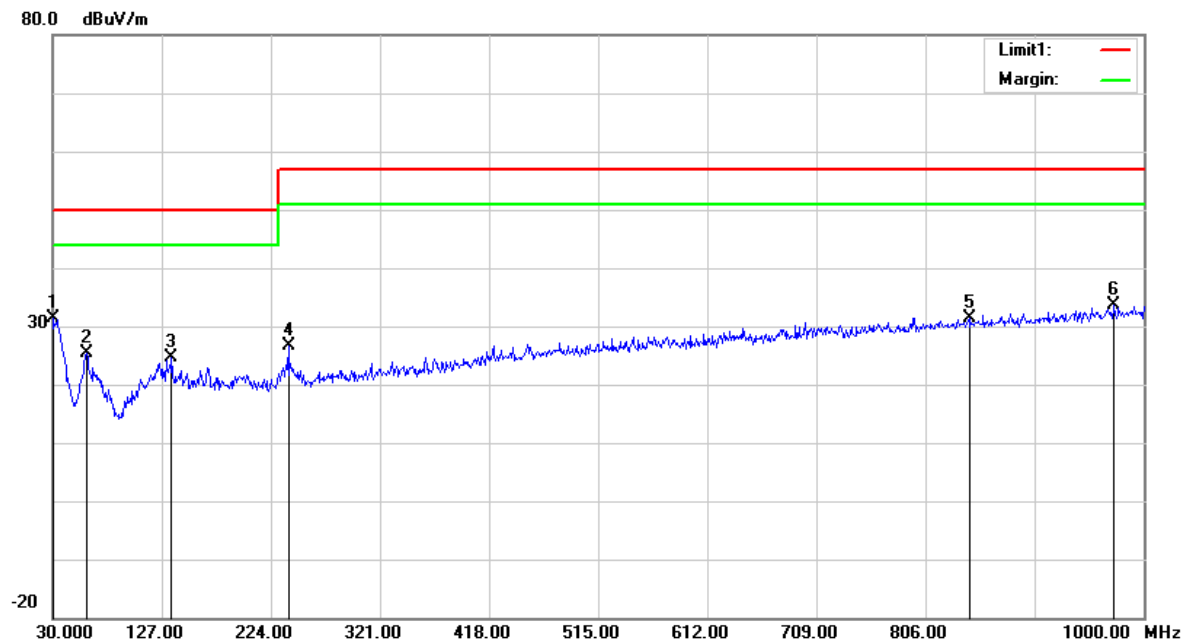
FINAL

Test Data

Please refer to following table and plots:

Condition: EN 301 489 Class A
Test Mode: operating
Model: O8
Note:

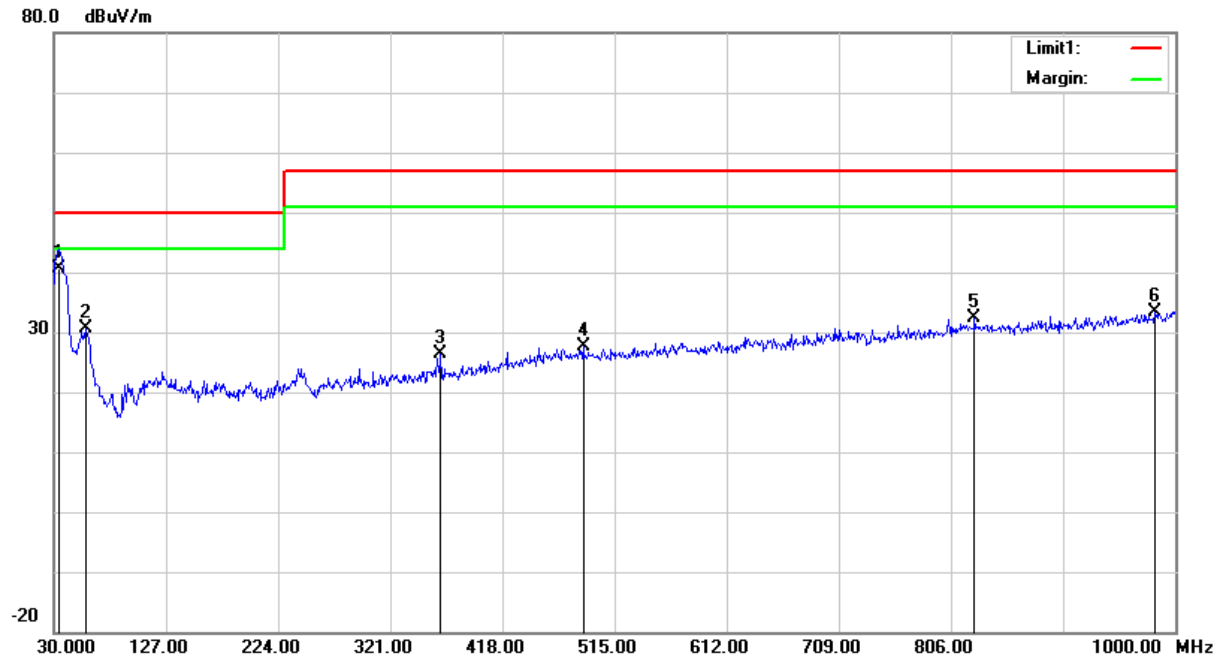
Polarization: Horizontal
Power: AC 110V/60Hz
Distance: 3m



No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1	30.0000	30.00	peak	1.46	31.46	50.00	18.54
2	60.0700	37.78	peak	-12.34	25.44	50.00	24.56
3	135.7300	30.05	peak	-5.32	24.73	50.00	25.27
4	239.5200	32.55	peak	-6.00	26.55	57.00	30.45
5	844.8000	27.10	peak	4.39	31.49	57.00	25.51
6	973.8100	33.23	peak	0.42	33.65	57.00	23.35

Condition: EN 301 489 Class A
Test Mode: operating
Model: O8
Note:

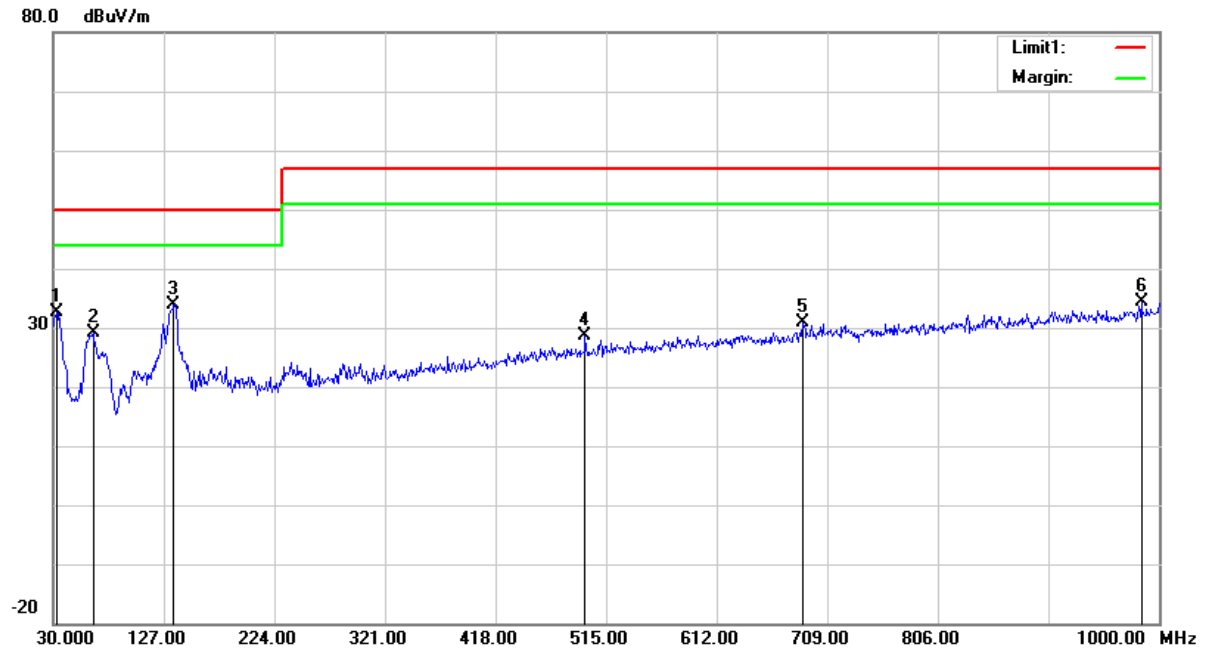
Polarization: Vertical
Power: AC 110V/60Hz
Distance: 3m



No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1	33.8800	42.20	QP	-1.51	40.69	50.00	9.31
2	57.1600	43.04	peak	-12.44	30.60	50.00	19.40
3	364.6500	29.00	peak	-2.72	26.28	57.00	30.72
4	487.8400	27.95	peak	-0.44	27.51	57.00	29.49
5	826.3700	27.91	peak	4.37	32.28	57.00	24.72
6	982.5400	32.85	peak	0.42	33.27	57.00	23.73

Condition: EN 301 489 Class A
Test Mode: operating
Model: O8
Note:

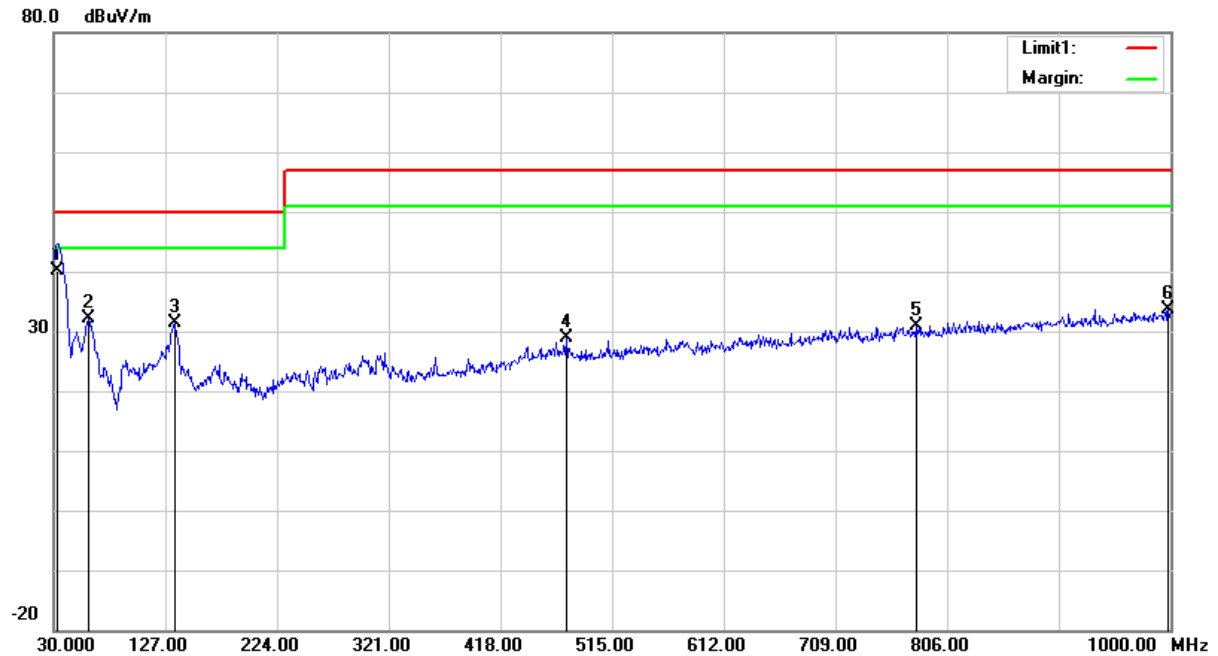
Polarization: Horizontal
Power: AC 230V/50Hz
Distance: 3m



No.	Frequency (MHz)	Reading (dB μ V)	Detector	Corrected (dB/m)	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
1	32.9100	33.34	peak	-0.76	32.58	50.00	17.42
2	64.9200	41.05	peak	-11.81	29.24	50.00	20.76
3	135.7300	39.20	peak	-5.32	33.88	50.00	16.12
4	496.5700	28.92	peak	-0.39	28.53	57.00	28.47
5	687.6600	28.66	peak	2.24	30.90	57.00	26.10
6	984.4800	33.93	peak	0.43	34.36	57.00	22.64

Condition: EN 301 489 Class A
Test Mode: operating
Model: O8
Note:

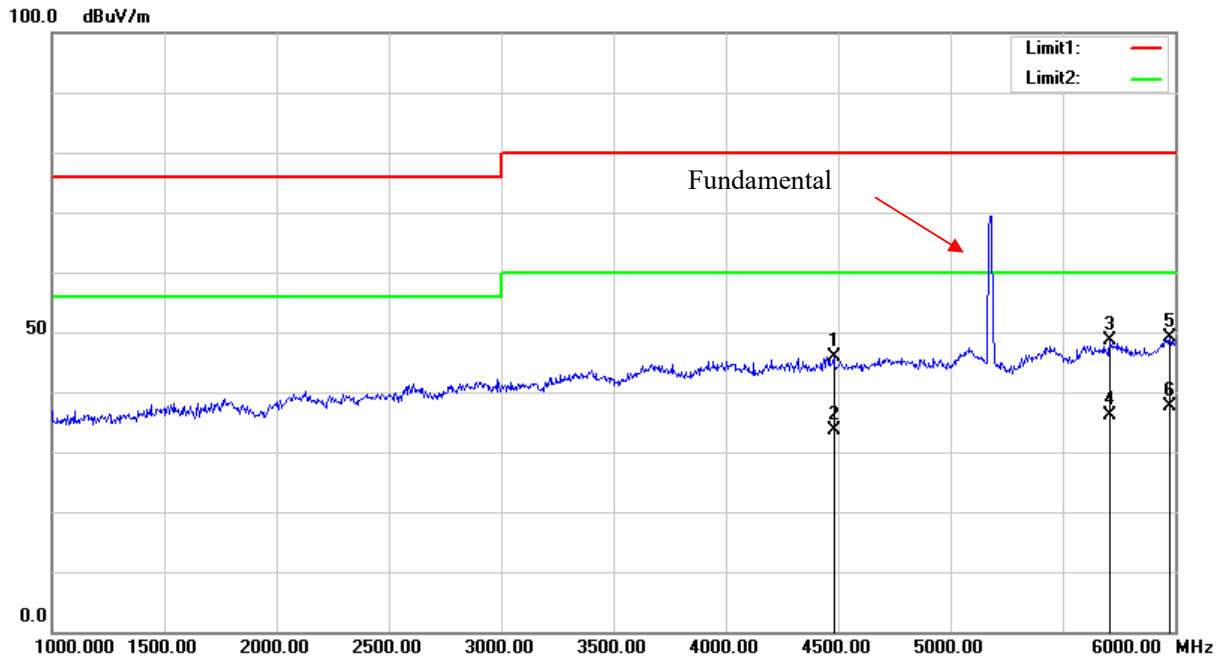
Polarization: Vertical
Power: AC 230V/50Hz
Distance: 3m



No.	Frequency (MHz)	Reading (dB μ V)	Detector	Corrected (dB/m)	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
1	32.9100	40.90	QP	-0.76	40.14	50.00	9.86
2	60.0700	44.44	peak	-12.34	32.10	50.00	17.90
3	135.7300	36.64	peak	-5.32	31.32	50.00	18.68
4	475.2300	29.48	peak	-0.48	29.00	57.00	28.00
5	778.8400	27.06	peak	3.74	30.80	57.00	26.20
6	998.0600	32.74	peak	0.77	33.51	57.00	23.49

Condition: EN 301 489 Class A
Test Mode: Operating
Model: O8
Note:

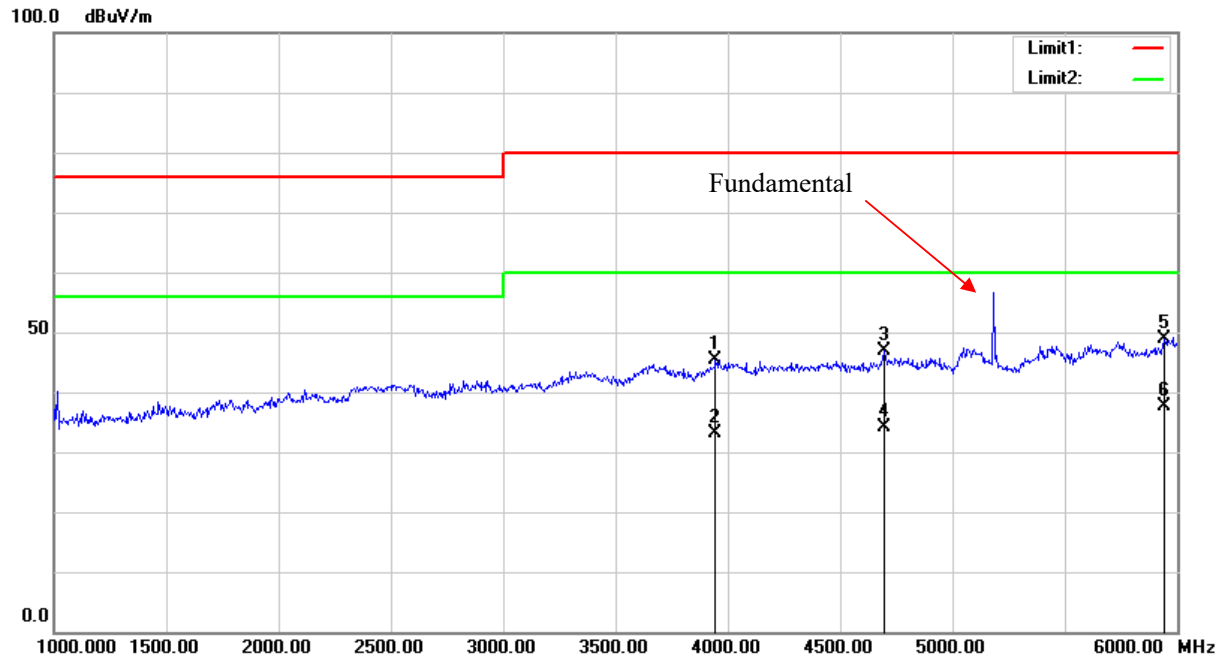
Polarization: Horizontal
Power: AC 110V/60Hz
Distance:



No.	Frequency (MHz)	Reading (dBuV)	Detector	Corrected (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	4480.000	36.30	peak	9.55	45.85	80.00	34.15
2	4480.000	24.18	AVG	9.55	33.73	60.00	26.27
3	5712.500	35.55	peak	13.04	48.59	80.00	31.41
4	5712.500	23.14	AVG	13.04	36.18	60.00	23.82
5	5975.000	35.03	peak	13.98	49.01	80.00	30.99
6	5975.000	23.64	AVG	13.98	37.62	60.00	22.38

Condition: EN 301 489 Class A
Test Mode: Operating
Model: O8
Note:

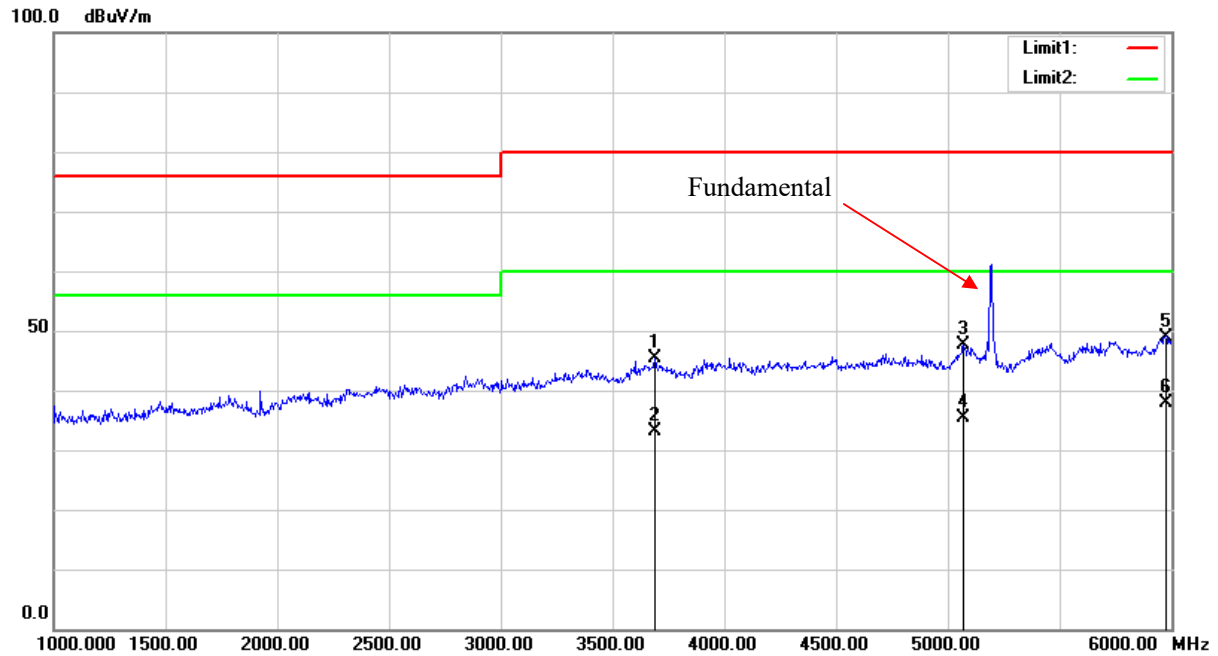
Polarization: Vertical
Power: AC 110V/60Hz
Distance:



No.	Frequency (MHz)	Reading (dB μ V)	Detector	Corrected (dB/m)	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
1	3947.500	36.40	peak	9.05	45.45	80.00	34.55
2	3947.500	24.17	AVG	9.05	33.22	60.00	26.78
3	4697.500	36.96	peak	10.03	46.99	80.00	33.01
4	4697.500	24.13	AVG	10.03	34.16	60.00	25.84
5	5947.500	35.10	peak	13.88	48.98	80.00	31.02
6	5947.500	23.68	AVG	13.88	37.56	60.00	22.44

Condition: EN 301 489 Class A
Test Mode: Operating
Note:

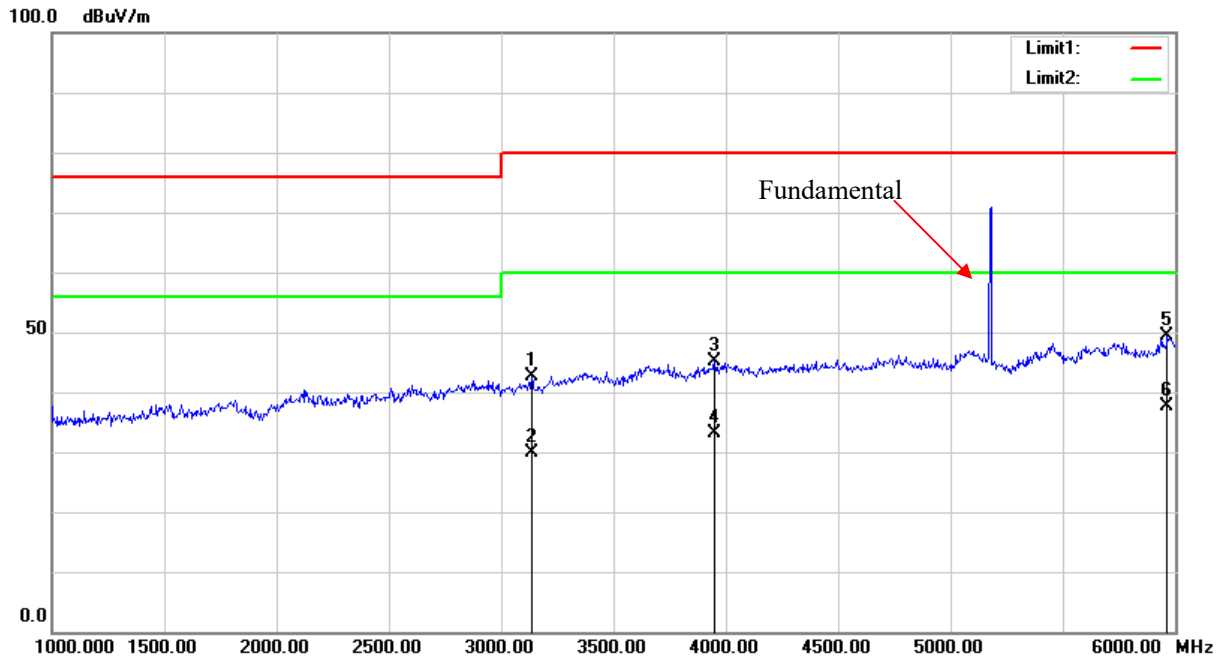
Polarization: Horizontal
Power: AC 230V/50Hz
Distance:



No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1	3690.000	36.93	peak	8.37	45.30	80.00	34.70
2	3690.000	24.86	AVG	8.37	33.23	60.00	26.77
3	5072.500	36.31	peak	11.22	47.53	80.00	32.47
4	5072.500	24.16	AVG	11.22	35.38	60.00	24.62
5	5975.000	35.02	peak	13.98	49.00	80.00	31.00
6	5975.000	23.98	AVG	13.98	37.96	60.00	22.04

Condition: EN 301 489 Class A
 Test Mode: Operating
 Note:

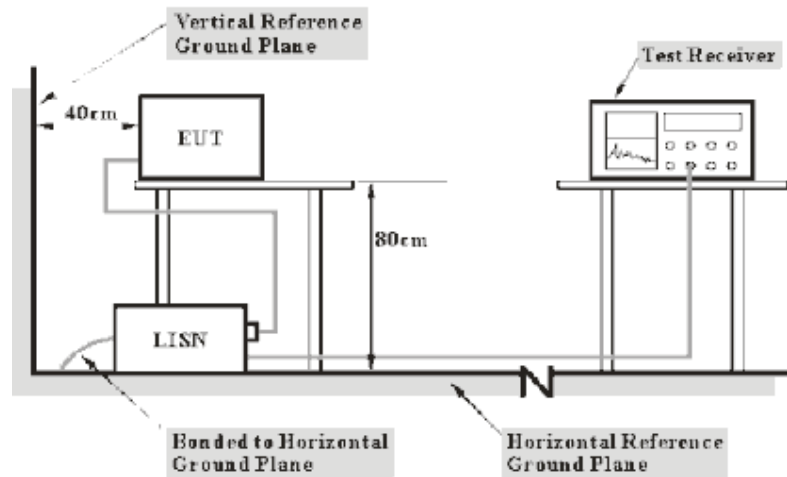
Polarization: Vertical
 Power: AC 230V/50Hz
 Distance:



No.	Frequency (MHz)	Reading (dBuV)	Detector	Corrected (dB/m)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)
1	3135.000	35.89	peak	6.73	42.62	80.00	37.38
2	3135.000	23.16	AVG	6.73	29.89	60.00	30.11
3	3950.000	35.95	peak	9.06	45.01	80.00	34.99
4	3950.000	23.98	AVG	9.06	33.04	60.00	26.96
5	5967.500	35.52	peak	13.96	49.48	80.00	30.52
6	5967.500	23.58	AVG	13.96	37.54	60.00	22.46

3 - AC MAINS POWER INPUT/OUTPUT PORTS

Test System Setup



Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per EN 301 489-1 measurement procedures. The specification used was with the EN 301 489-1 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

The adapter was connected to AC230V/50Hz power source.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

During the conducted emissions test, the adapter was connected to the main outlet of the first LISN and the other support equipments were connected to the outlet of the second LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

Except for the recorded frequency points (no more than 6), the remaining frequency points have a margin more than 20dB.

Corrected Amplitude & Margin Calculation

The basic equation is as follows:

Result (QuasiPeak or Average) = Meter Reading + Corr.

Note:

Corr. = Cable loss + Factor of coupling device

The “**Margin**” column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

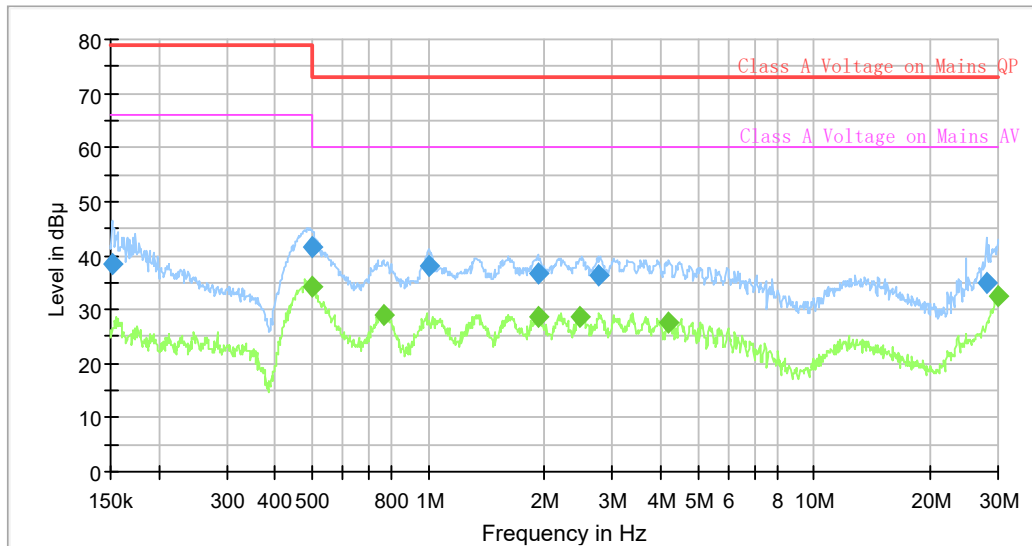
Margin = Limit – Result

FINAL

Test Data

Please refer to following table and plots:

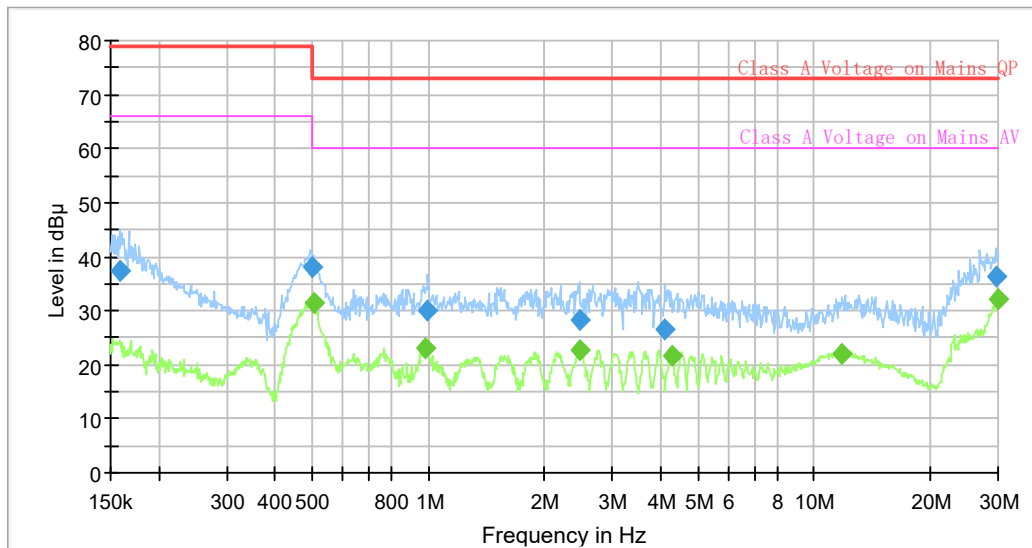
Model Number: O8
 Port: L
 Test Mode: Operating
 Power Source: AC 110V/60Hz
 Note:



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.151504	38.29	---	79.00	40.71	9.000	L1	9.6
0.501508	---	34.07	60.00	25.93	9.000	L1	9.6
0.501508	41.57	---	73.00	31.43	9.000	L1	9.6
0.770122	---	28.95	60.00	31.05	9.000	L1	9.7
1.003138	37.99	---	73.00	35.01	9.000	L1	9.7
1.918443	36.64	---	73.00	36.36	9.000	L1	9.7
1.928035	---	28.64	60.00	31.36	9.000	L1	9.7
2.461795	---	28.72	60.00	31.28	9.000	L1	9.7
2.761031	36.21	---	73.00	36.79	9.000	L1	9.7
4.197788	---	27.73	60.00	32.27	9.000	L1	9.7
27.933412	34.91	---	73.00	38.09	9.000	L1	10.1
30.000000	---	32.37	60.00	27.63	9.000	L1	10.2

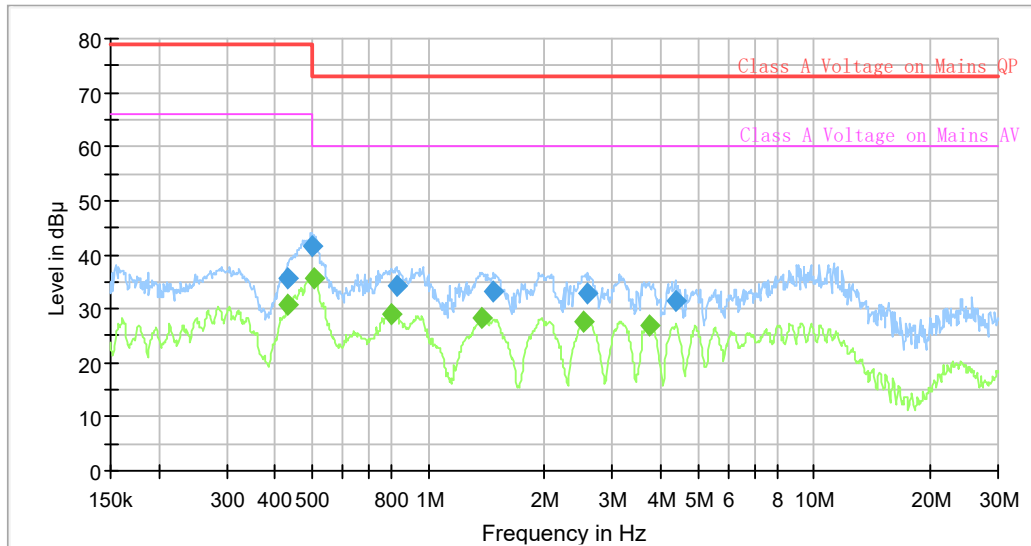
Model Number: O8
 Port: N
 Test Mode: Operating
 Power Source: AC 110V/60Hz
 Note:



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.158459	37.45	---	79.00	41.55	9.000	N	9.6
0.501508	37.94	---	73.00	35.06	9.000	N	9.6
0.504016	---	31.30	60.00	28.70	9.000	N	9.6
0.978432	---	23.21	60.00	36.79	9.000	N	9.6
0.993182	29.90	---	73.00	43.10	9.000	N	9.6
2.461795	28.47	---	73.00	44.53	9.000	N	9.6
2.461795	---	22.56	60.00	37.44	9.000	N	9.6
4.114871	26.53	---	73.00	46.47	9.000	N	9.6
4.261070	---	21.54	60.00	38.46	9.000	N	9.6
11.728143	---	22.13	60.00	37.87	9.000	N	9.8
29.508740	36.22	---	73.00	36.78	9.000	N	9.9
29.953587	---	32.14	60.00	27.86	9.000	N	9.9

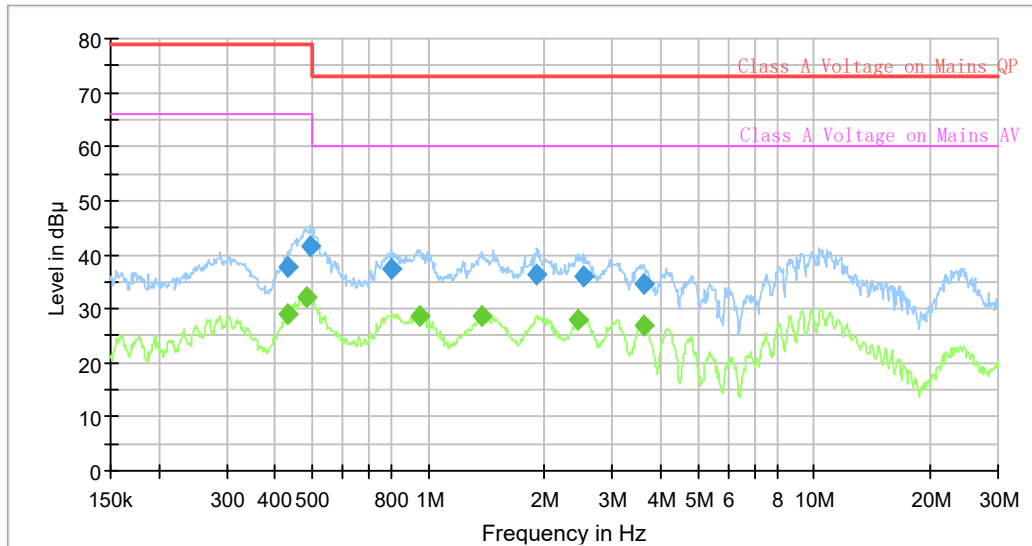
Model Number: O8
 Port: L
 Test Mode: Operating
 Power Source: AC 230V/50Hz
 Note:



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.431814	---	30.60	66.00	35.40	9.000	L1	9.6
0.431814	35.80	---	79.00	43.20	9.000	L1	9.6
0.499013	41.61	---	79.00	37.39	9.000	L1	9.6
0.506536	---	35.74	60.00	24.26	9.000	L1	9.6
0.797484	---	29.01	60.00	30.99	9.000	L1	9.7
0.825818	34.25	---	73.00	38.75	9.000	L1	9.7
1.380348	---	28.35	60.00	31.65	9.000	L1	9.7
1.472813	33.19	---	73.00	39.81	9.000	L1	9.7
2.511402	---	27.64	60.00	32.36	9.000	L1	9.7
2.587692	32.86	---	73.00	40.14	9.000	L1	9.7
3.724217	---	26.97	60.00	33.03	9.000	L1	9.7
4.368668	31.43	---	73.00	41.57	9.000	L1	9.7

Model Number: O8
 Port: N
 Test Mode: Operating
 Power Source: AC 230V/50Hz
 Note:

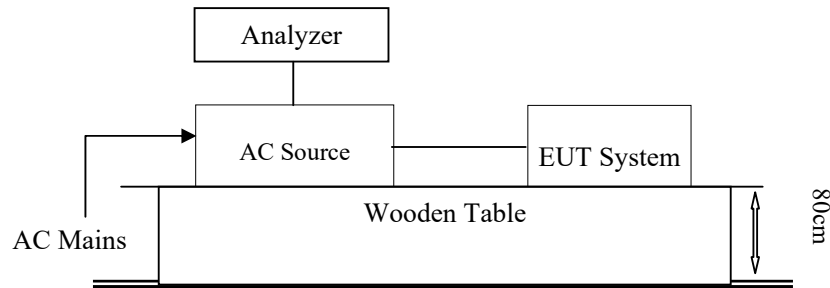


Final Result

Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.429665	---	28.88	66.00	37.12	9.000	N	9.6
0.431814	37.79	---	79.00	41.21	9.000	N	9.6
0.484301	---	32.05	66.00	33.95	9.000	N	9.6
0.494060	41.57	---	79.00	37.43	9.000	N	9.6
0.805479	37.21	---	73.00	35.79	9.000	N	9.6
0.949586	---	28.65	60.00	31.35	9.000	N	9.6
1.380348	---	28.53	60.00	31.47	9.000	N	9.6
1.908898	36.25	---	73.00	36.75	9.000	N	9.6
2.449547	---	27.96	60.00	32.04	9.000	N	9.6
2.511402	35.99	---	73.00	37.01	9.000	N	9.6
3.632492	---	26.80	60.00	33.20	9.000	N	9.6
3.632492	34.75	---	73.00	38.25	9.000	N	9.6

5 - VOLTAGE FLUCTUATIONS AND FLICKER (AC MAINS INPUT PORT)

Test System Setup



Test Standard

EN 61000-3-3:2013

Flicker Test Limits :

The limits shall be applicable to voltage fluctuations and flicker at the supply terminals of the equipment under test, measured or calculated according to clause 4 under test conditions described in clause 6 and annex A.

Tests made to prove compliance with the limits are considered to be type tests.

The following limits apply:

- the value of Pst shall not be greater than 1,0;
- the value of Plt shall not be greater than 0,65;
- the value of d(t) during a voltage change shall not exceed 3,3 % for more than 500 ms;
- the relative steady-state voltage change, dc, shall not exceed 3,3 %;
- the maximum relative voltage change dmax, 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.

Note: The cycling frequency will be further limited by the Pst and Plt limit. For example: a dmax of 6 % producing a rectangular voltage change characteristic twice per hour will give a Plt of about 0,65.

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.

In the case of equipment having several separately controlled circuits in accordance with 6.6, limits b) and c) shall apply only if there is delayed or manual restart after a power supply interruption; for all equipment with automatic switching which is energized immediately on restoration of supply after a power supply interruption, limits a) shall apply; for all equipment with manual switching, limits b) or c) shall apply depending on the rate of switching. Pst and Plt requirements shall not be applied to voltage changes caused by manual switching. The limits shall not be applied to voltage changes associated with emergency switching or emergency interruptions.

Test Data

Please refer to following tables:

Short time (Pst): 10 min
Observation time: 120 min (12 Flicker measurement)
Test Mode: Operating
Power Source: AC 230V/50Hz
Test Result: PASS

Maximum Flicker results

	EUT values	Limit	Result
Pst	0.028	1.00	PASS
Plt	0.028	0.65	PASS
dc [%]	0.034	3.30	PASS
dmax [%]	0.159	4.00	PASS
dt [s]	0.000	0.50	PASS

6 – WIRED NETWORK PORTS

Measurement Uncertainty

Compliance or non-compliance with a disturbance limit shall be determined in the following manner:

If U_{lab} is less than or equal to U_{cispr} of Table 1, then:

- compliance is deemed to occur if no measured disturbance level exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level exceeds the disturbance limit.

If U_{lab} is greater than U_{cispr} of Table 1, then:

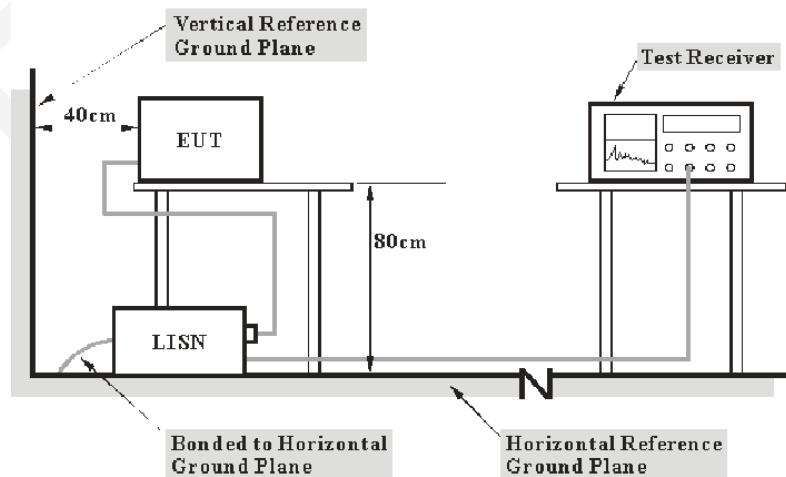
- compliance is deemed to occur if no measured disturbance level, increased by $(U_{lab} - U_{cispr})$, exceeds the disturbance limit;
- non-compliance is deemed to occur if any measured disturbance level, increased by $(U_{lab} - U_{cispr})$, exceeds the disturbance limit.

Based on CISPR 16-4-2-2011, measurement uncertainty of conducted disturbance at mains port using AMN at Bay Area Compliance Laboratories Corp. (Dongguan) is 3.12 dB (150 kHz to 30 MHz), and conducted disturbance at telecommunication port using AAN is 5.0 dB (150 kHz to 30 MHz).

Table 1 – Values of U_{cispr}

Measurement	U_{cispr}
Conducted disturbance at mains port using AMN (9 kHz to 150 kHz)	3.8 dB
(150 kHz to 30 MHz)	3.4 dB
Conducted disturbance at mains port using voltage probe (9 kHz to 30 MHz)	2.9 dB
Conducted disturbance at telecommunication port using AAN (150 kHz to 30 MHz)	5.0 dB
Conducted disturbance at telecommunication port using CVP (150 kHz to 30 MHz)	3.9 dB
Conducted disturbance at telecommunication port using CP (150 kHz to 30 MHz)	2.9 dB

Test System Setup



- Note: 1. Support units were connected to second LISN.
 2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per EN 301 489-1 measurement procedures. The specification used was with the EN 301 489-1 limits.

The external I/O cables were draped along the test table and formed a bundle 30 to 40 cm long in the middle.

The spacing between the peripherals was 10 cm.

EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz

During the conducted emission test, the EMI test receiver was set with the following configurations:

Frequency Range	IF B/W
150 kHz – 30 MHz	9 kHz

Test Procedure

During the conducted emissions test, the adapter was connected to the main outlet of the first LISN and the other support equipments were connected to the outlet of the second LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All data was recorded in the Quasi-peak and average detection mode.

Corrected Amplitude & Margin Calculation

The basic equation is as follows:

Result (QuasiPeak or Average) = Meter Reading + Corr.

Note:

Corr. = Cable loss + Factor of coupling device

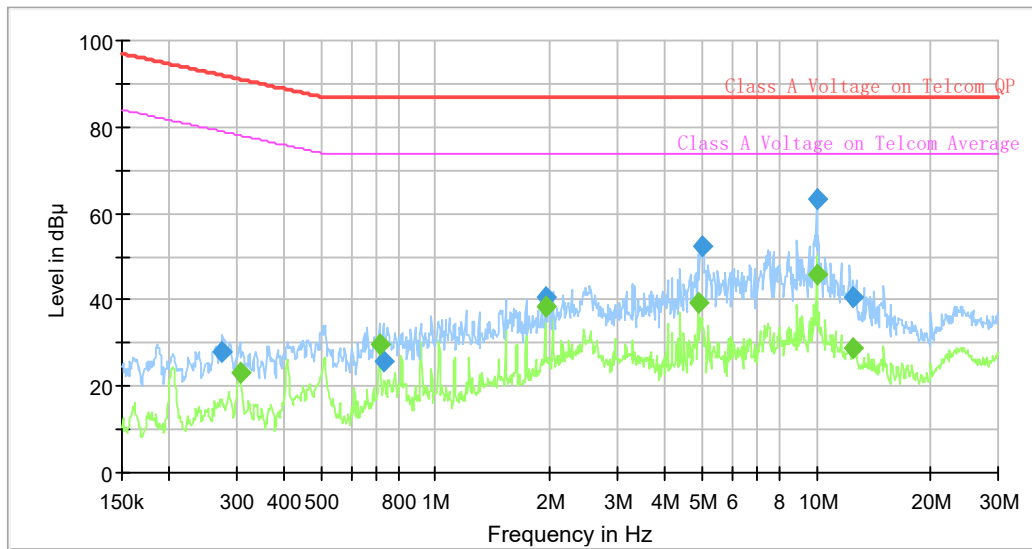
The “**Margin**” column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin = Limit – Result

Test Data

Please refer to following table and plots:

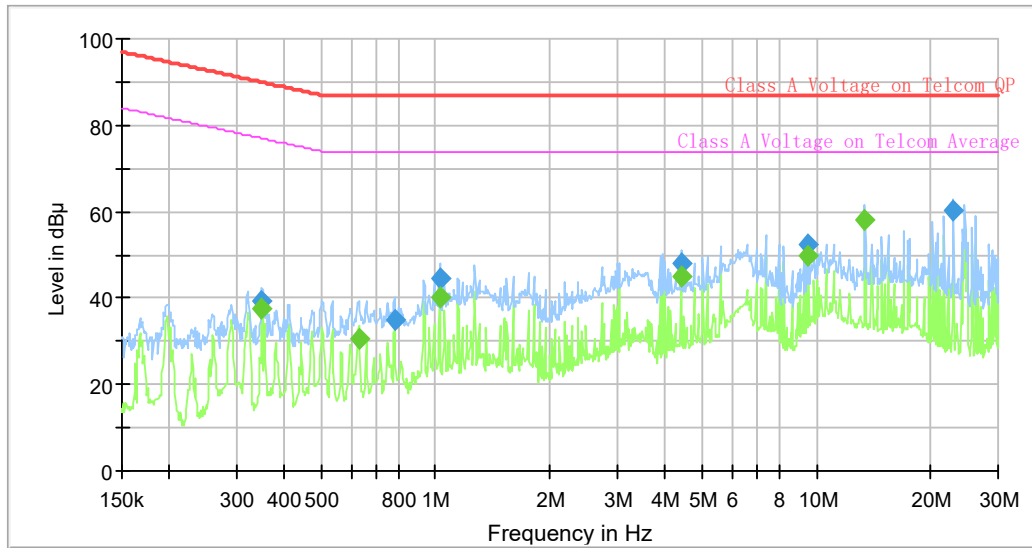
Port: RJ45
 Test Mode: 10Mbps
 Note:



Final Result

Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.275645	27.99	---	91.95	63.96	9.000	Line 1	9.9
0.306082	---	23.26	78.08	54.82	9.000	Line 1	9.9
0.714609	---	29.88	74.00	44.12	9.000	Line 1	9.7
0.729009	25.62	---	87.00	61.38	9.000	Line 1	9.7
1.937675	---	38.47	74.00	35.53	9.000	Line 1	9.6
1.937675	40.63	---	87.00	46.37	9.000	Line 1	9.6
4.875311	---	39.09	74.00	34.91	9.000	Line 1	9.6
4.998419	52.42	---	87.00	34.58	9.000	Line 1	9.6
9.998049	63.44	---	87.00	23.56	9.000	Line 1	9.6
9.998049	---	46.05	74.00	27.95	9.000	Line 1	9.6
12.513766	---	28.77	74.00	45.23	9.000	Line 1	9.6
12.513766	40.41	---	87.00	46.59	9.000	Line 1	9.6

Port: RJ45
 Test Mode: 100Mbps
 Note:

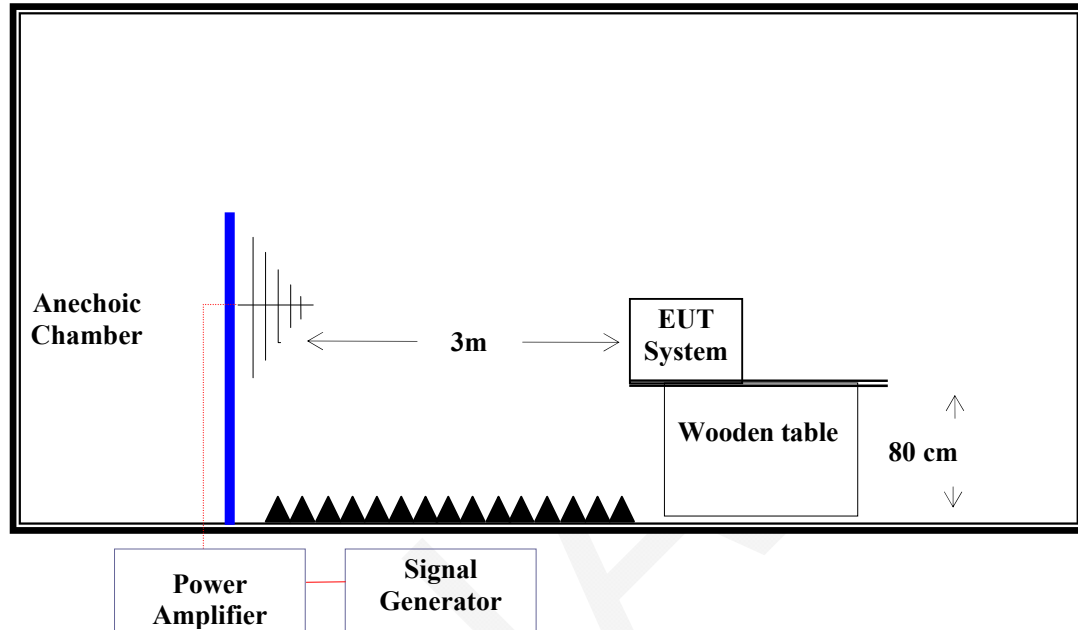


Final Result

Frequency (MHz)	QuasiPeak (dBμV)	Average (dBμV)	Limit (dBμV)	Margin (dB)	Bandwidth (kHz)	Line	Corr. (dB)
0.350205	---	37.49	76.96	39.47	9.000	Line 1	9.9
0.350205	39.19	---	89.96	50.77	9.000	Line 1	9.9
0.627698	---	30.69	74.00	43.31	9.000	Line 1	9.8
0.781732	35.01	---	87.00	51.99	9.000	Line 1	9.7
1.023352	---	40.30	74.00	33.70	9.000	Line 1	9.7
1.023352	44.49	---	87.00	42.51	9.000	Line 1	9.7
4.412464	47.93	---	87.00	39.07	9.000	Line 1	9.6
4.412464	---	45.02	74.00	28.98	9.000	Line 1	9.6
9.511623	52.38	---	87.00	34.62	9.000	Line 1	9.6
9.511623	---	49.84	74.00	24.16	9.000	Line 1	9.6
13.418776	---	57.87	74.00	16.13	9.000	Line 1	9.6
22.881343	60.30	---	87.00	26.70	9.000	Line 1	9.7

7 - RADIO FREQUENCY ELECTROMAGNETIC FIELDS (80 MHZ TO 6 000 MHZ)

Test System Setup



Test Level

Level	Field Strength V/m
1.	1
2.	3
3.	10
X.	Special

Performance Criterion: A

Test Procedure

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 antenna which is mounted on an antenna tower. Both horizontal and vertical polarizations of the antenna are set on test. Each of the four sides of EUT must be faced this antenna and measured individually.

In order to judge the EUT performance, a CCD camera was used to monitor the EUT.

Test Data

Please refer to following tables:

Test Mode: Operating

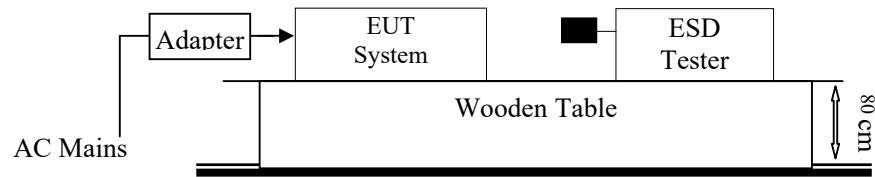
Note:


Condition of Test	Remarks
Field Strength	3 V/m (Test Level 2)
RF Signal	1 kHz, 80% AM, sine wave
Sweep Frequency Step	1%, logarithmic
Dwell Time	1 Sec

Frequency Range (MHz)	Front Side		Rear Side		Left Side		Right Side	
	VERT	HORI	VERT	HORI	VERT	HORI	VERT	HORI
80-1000	A	A	A	A	A	A	A	A
1000-6000	A	A	A	A	A	A	A	A

8 - ELECTROSTATIC DISCHARGES

Test System Setup



Remark:  is the tip of the electrode

EN 61000-4-2 specifies that a tabletop EUT shall be placed on a non-conducting table which is 80 centimeters above a ground reference plane and that floor mounted equipment shall be placed on a insulating support approximately 80 centimeters above a ground plane. During the tests, the EUT is positioned over a ground reference plane in conformance with this requirement.

For tabletop equipment, a 1.6 by 0.8-meter metal sheet (HCP) is placed on the table and connected to the ground plane via a metal strap with two 470 k Ohms resistors in series. The EUT and attached cables are isolated from this metal sheet by 0.5-millimeter thick insulating material. A Vertical Coupling Plane (VCP) grounded on the ground plane through the same configuration as in the HCP is used.

Test Level

Level	Test Voltage Contact Discharge (\pm kV)	Test Voltage Air Discharge (\pm kV)
1.	2	2
2.	4	4
3.	6	8
4.	8	15
X.	Special	Special

Test Level 3 for Air Discharge at ± 8 kV

Test Level 2 for Direct Discharge at ± 4 kV

Performance criterion: B

Test Procedure

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.

Contact Discharge:

All the procedure shall be same as Section 8.3.1 of EN 61000-4-2, except that the tip of the discharge electrode shall touch the EUT before the discharge switch is operated.

Indirect discharge for horizontal coupling plane

At least 50 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.

Indirect discharge for vertical coupling plane

At least 50 single discharges 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.

Test Data

Please refer to following tables:

Test Mode: Operating

Note: B indicates that the EUT network connection was interrupted during the test, and it can be automatically restored after the test.

Table 1: Electrostatic Discharge Immunity (Air Discharge)

Test Points Location	Test Level							
	-2 kV	+2 kV	-4 kV	+4 kV	-8 kV	+8 kV	-15 kV	+15 kV
Non-metallic Shell	A	A	A	A	A	A	/	/
DC Port	A	A	A	A	B	B	/	/
RJ45 Port	A	A	A	A	A	A	/	/
Seam	A	A	A	A	A	A	/	/

Table 2: Electrostatic Discharge Immunity (Direct Contact)

Test Points Location	Test Level							
	-2 kV	+2 kV	-4 kV	+4 kV	-6 kV	+6 kV	-8 kV	+8 kV
Metal shell	A	A	A	A	/	/	/	/
Screw	A	A	A	A	/	/	/	/

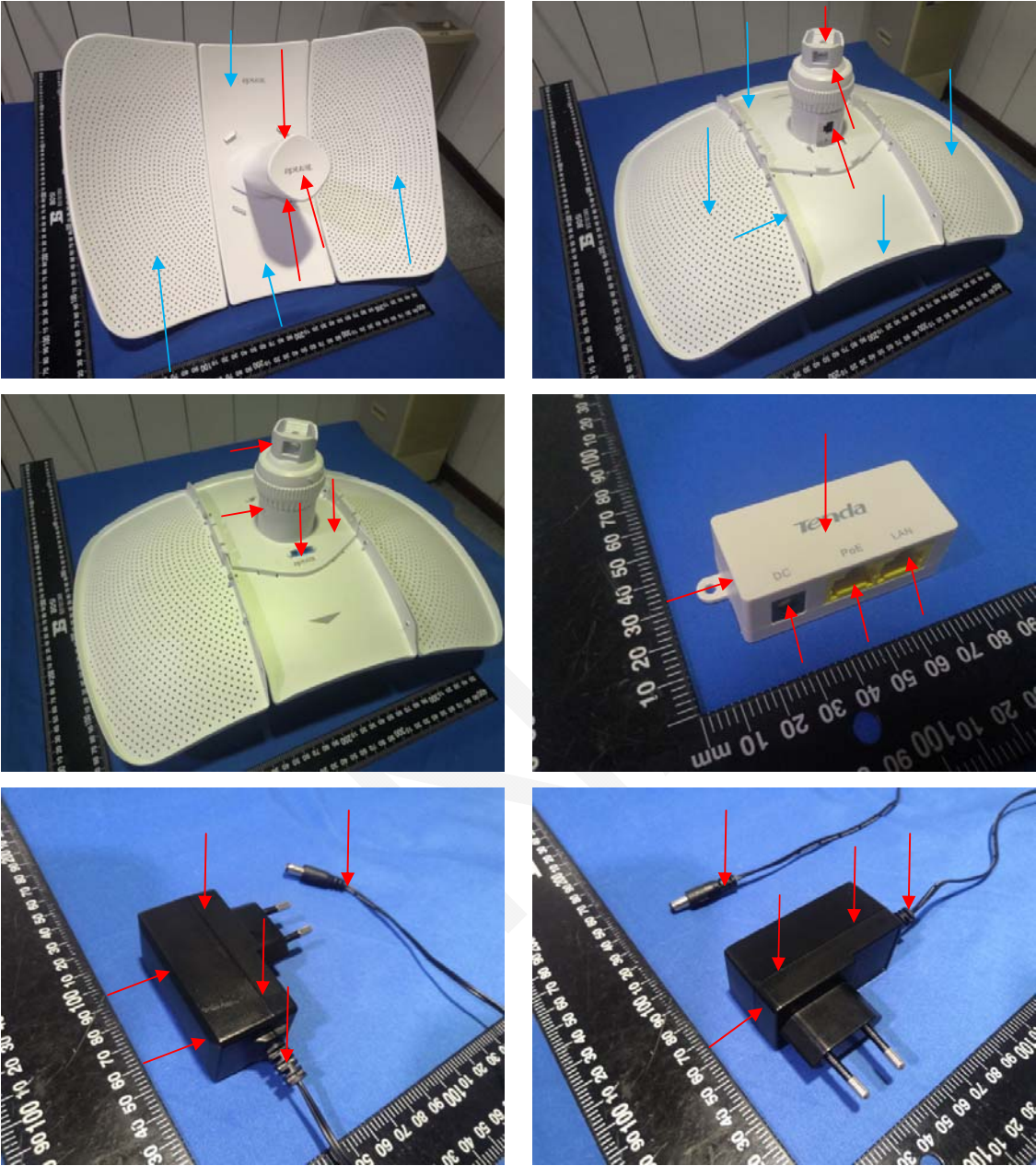
Table 3: Electrostatic Discharge Immunity (Indirect Contact HCP)


Test Points Location	Test Level							
	-2 kV	+2 kV	-4 kV	+4 kV	-6 kV	+6 kV	-8 kV	+8 kV
Front Side	A	A	A	A	/	/	/	/
Back Side	A	A	A	A	/	/	/	/
Left Side	A	A	A	A	/	/	/	/
Right Side	A	A	A	A	/	/	/	/


Table 4: Electrostatic Discharge Immunity (Indirect Contact VCP)

Test Points Location	Test Level							
	-2 kV	+2 kV	-4 kV	+4 kV	-6 kV	+6 kV	-8 kV	+8 kV
Front Side	A	A	A	A	/	/	/	/
Back Side	A	A	A	A	/	/	/	/
Left Side	A	A	A	A	/	/	/	/
Right Side	A	A	A	A	/	/	/	/

ESD Location Photo

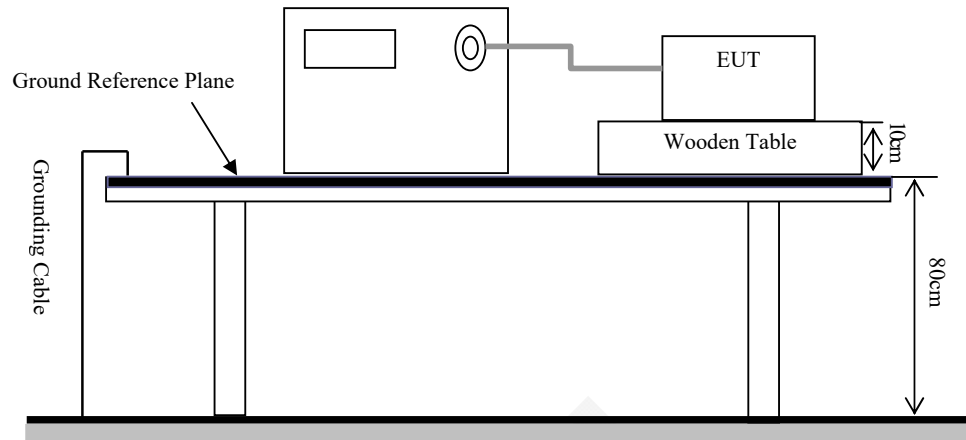


Air Discharge: 

Direct Contact: 

9 - FAST TRANSIENTS, COMMON MODE

Test System Setup



Test Level

Open Circuit Output Test Voltage $\pm 10\%$		
Level	On Power Supply Lines	On I/O (Input/Output) Signal data and control lines
1	0.5 kV	0.25 kV
2	1 kV	0.5 kV
3	2 kV	1 kV
4	4 kV	2 kV
X	Special	Special

Test Level 2 for AC power supply lines at 1 kV

Performance Criterion: B

Test Procedure

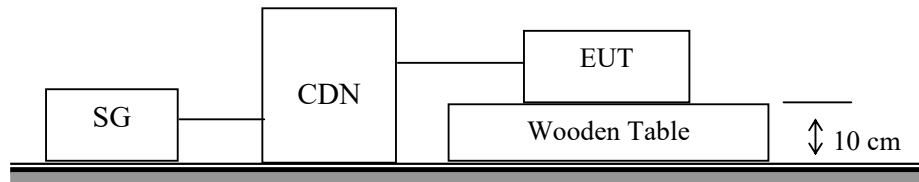
The EUT was arranged for Power Line Coupling and for I/O Line Coupling through a capacitive clamp, where applicable. (Note: The I/O coupling test using a capacitive clamp is performed on the I/O interface cables that are longer in length than 3 meters.) A metal ground plane 2.4 meter by 2.0 meter was placed between the floor and the table and is connected to the earth by a 2.0 meter ground rod. The ground rod is connected to the test facility's electrical earth.

Test Data*Please refer to following tables:***Test Mode:** Operating**Note:**

Test Points		Test Level (kV)							
		+0.5	-0.5	+1.0	-1.0	+2.0	-2.0	+4.0	-4.0
AC mains power input ports	L	A	A	A	A	/	/	/	/
	N	A	A	A	A	/	/	/	/
	Earth	/	/	/	/	/	/	/	/
	L+N	A	A	A	A	/	/	/	/
	L + Earth	/	/	/	/	/	/	/	/
	N + Earth	/	/	/	/	/	/	/	/
	L+N+Earth	/	/	/	/	/	/	/	/
Signal ports	RJ45	A	A	/	/	/	/	/	/

10 - RADIO FREQUENCY, COMMON MODE

Test System Setup



Test Level

Level	Voltage Level (r.m.s.) (U_0)
1	1
2	3
3	10
X	Special

Test level 2 at 3 V (r.m.s.)

Performance Criterion: A

Test Procedure

- 1) Let the EUT work in test mode and test it.
- 2) The EUT are placed on an insulating support 0.1 m high above a ground reference plane. CDN (coupling and decoupling device) is placed on the ground plane about 0.3 m 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).
- 3) The disturbance signal described below is injected to EUT through CDN.
- 4) The EUT operates within its operational mode(s) under intended climatic conditions after power on.
- 5) The frequency range is swept from 150 kHz to 80 MHz using 3V signal level, and with the disturbance signal 80% amplitude modulated with a 1 kHz sine wave.
- 6) Where the frequency is swept incrementally, the step size shall not exceed 1 % of the preceding frequency value. The dwell time of the amplitude modulated carrier at each frequency shall not be less than the time necessary for the EUT to be exercised and to respond, but shall in no case be less than 0.5 s.
- 7) Recording the EUT operating situation during compliance testing and decide the EUT immunity criterion.

Test Data*Please refer to following tables:***Test Mode:** Operating**Note:****Table 1: AC mains power input port**

Frequency range: 150 kHz to 80 MHz
☒ Modulated: Amplitude 80%, 1kHz sine wave ☐ Unmodulated ☐ Other:
 Severity Level: 3 V Unmodulated, r.m.s

Level	Voltage Level (e.m.f.) U ₀	Pass	Fail
1	1	/	/
2	3	A	/
3	10	/	/
X	Special	/	/

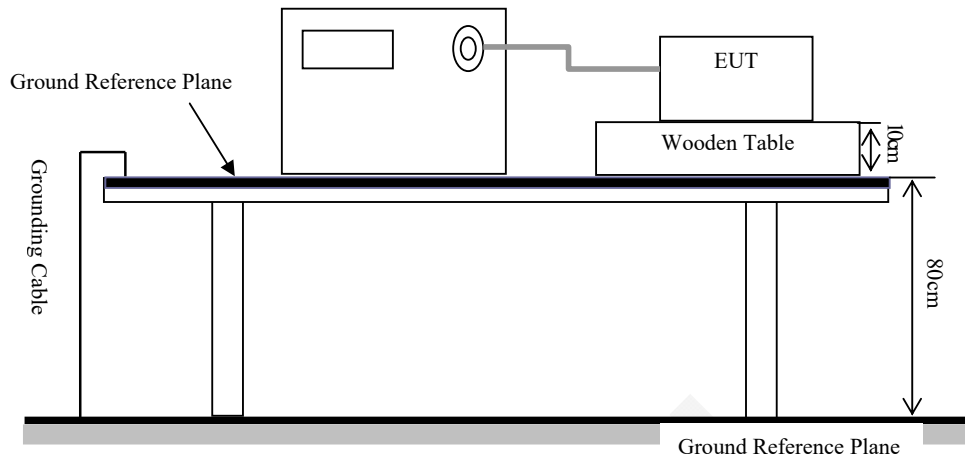
Table 2: Signal Port : RJ45

Frequency range: 150 kHz to 80 MHz
☒ Modulated: Amplitude 80%, 1kHz sine wave ☐ Unmodulated ☐ Other:
 Severity Level: 3 V Unmodulated, r.m.s

Level	Voltage Level (e.m.f.) U ₀	Pass	Fail
1	1	/	/
2	3	A	/
3	10	/	/
X	Special	/	/

12 - VOLTAGE DIPS AND SHORT INTERRUPTIONS

Test System Setup



Test Level

Test Level	Voltage dip and short interruptions (%) Residual	Duration (in period)	Performance criterion
1	0	0.5	B
2	0	1	B
3	70	25	C
4	0	250	C

Performance Criterion: C

Test Procedure

- 1) The interruption is introduced at selected phase angles with specified duration.
- 2) Record any degradation of performance.

Test Data

Please refer to following tables:

Test Mode: Operating

B indicates that the power supply of the EUT was interrupted

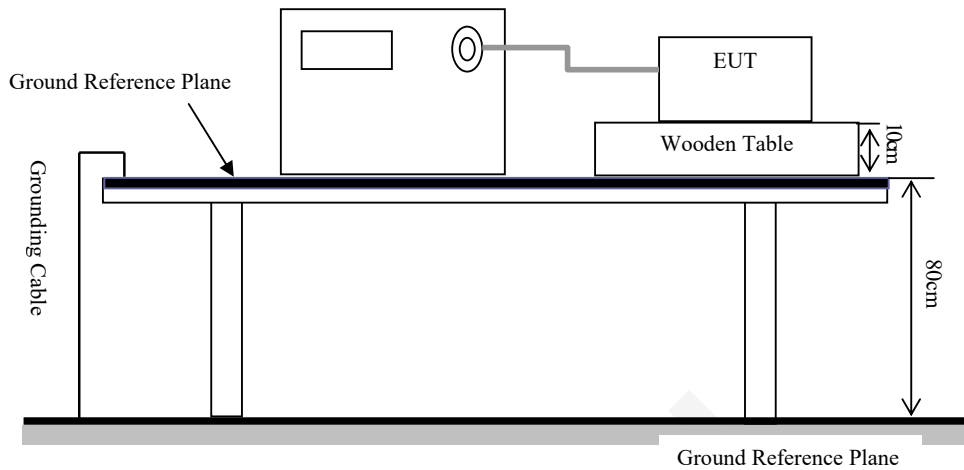
Note: during the test, and the EUT was restarted. After the test, it can automatically return to normal use.

Table 1: Voltage Dips/Interruptions Test

U2 (% Reduction)	Td (Periods)	Phase Angle	N	Result
100	0.5	0/90/180/270	3	A
100	1	0/90/180/270	3	A
30	25	0/90/180/270	3	A
100	250	0/90/180/270	3	B

13 - SURGES

Test System Setup



Test Level

Level	Open Circuit Output Test Voltage $\pm 10\%$
1	0.5 kV
2	1 kV
3	2 kV
4	4 kV
X	Special

AC Mains: L-N: Test level 2 at 1 kV

Performance Criterion: B

Test Procedure

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

Test Data

Please refer to following tables:

Test Mode: Operating

Note:

Table 1: AC mains power input port

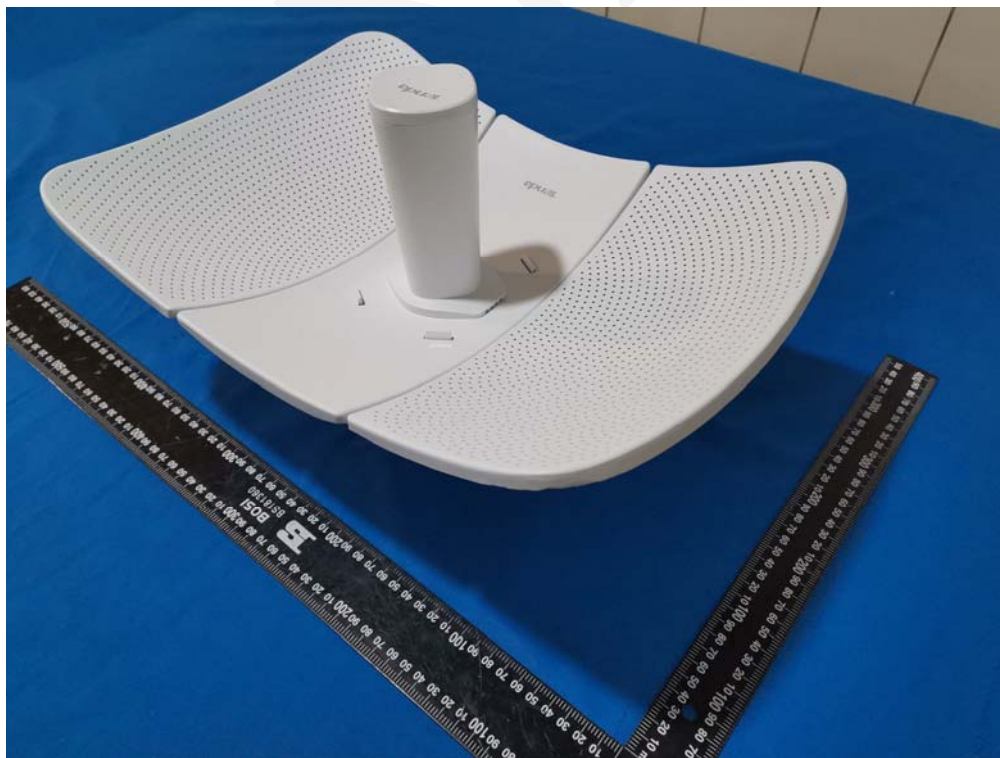
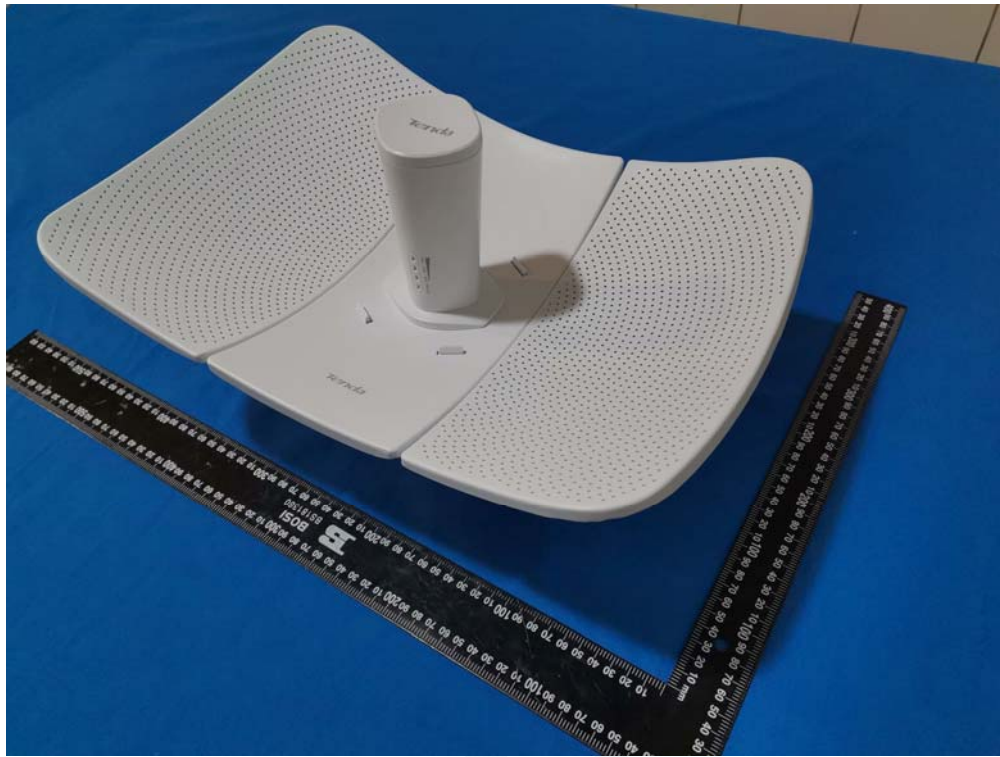
Level	Voltage	Poll	Path	Pass	Fail
1	0.5kV	±	Line-Line	A	/
2	1kV	±	Line-Line	A	/
3	2kV	±	/	/	/
4	4kV	±	/	/	/

Table 2: RJ45 I/O Circuit and Lines

Level	Voltage	Poll	Path	Pass	Fail
1	0.5kV	±	Line-Ground	A	/
2	1kV	±	Line-Ground	A	/
3	2kV	±	Line-Ground	/	/

EXHIBIT A – EUT PHOTOGRAPHS



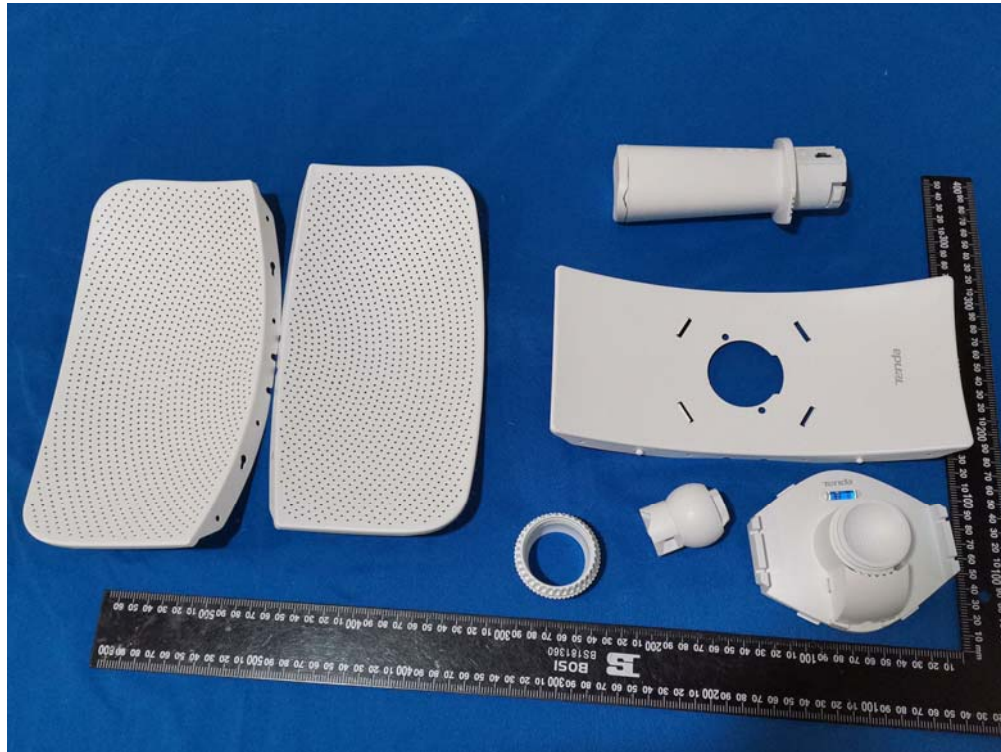




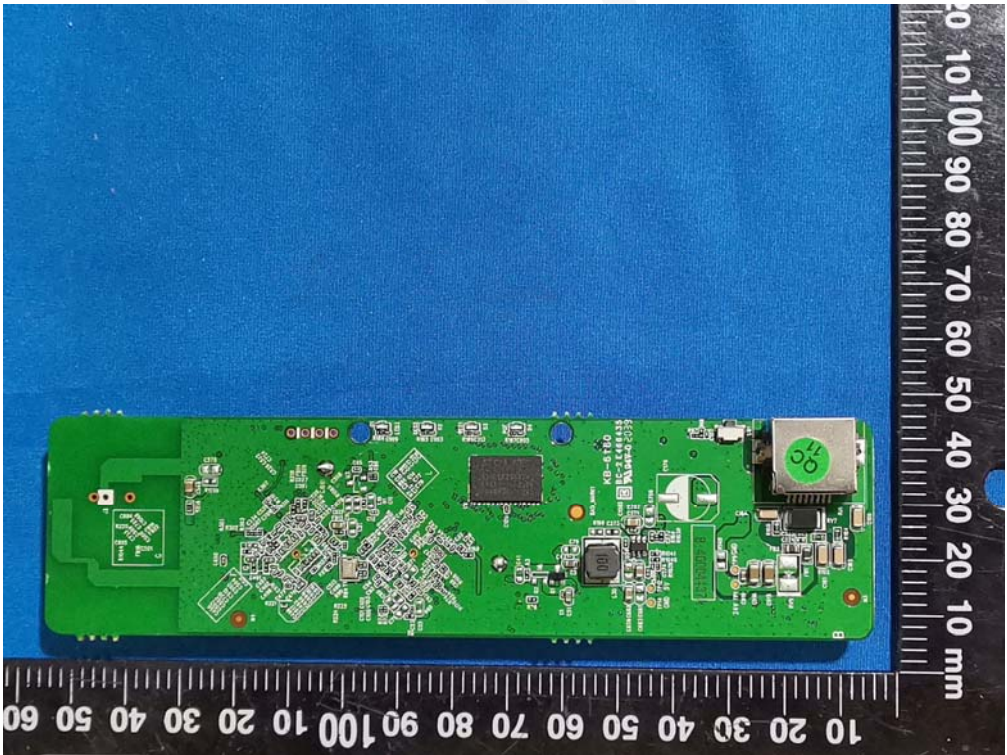
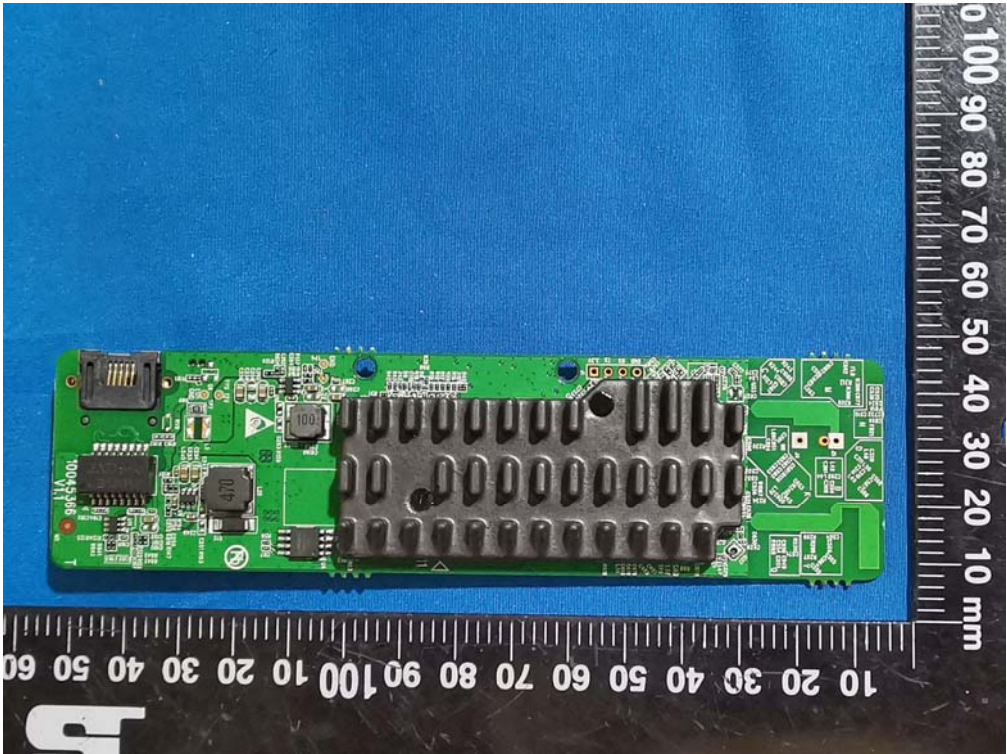


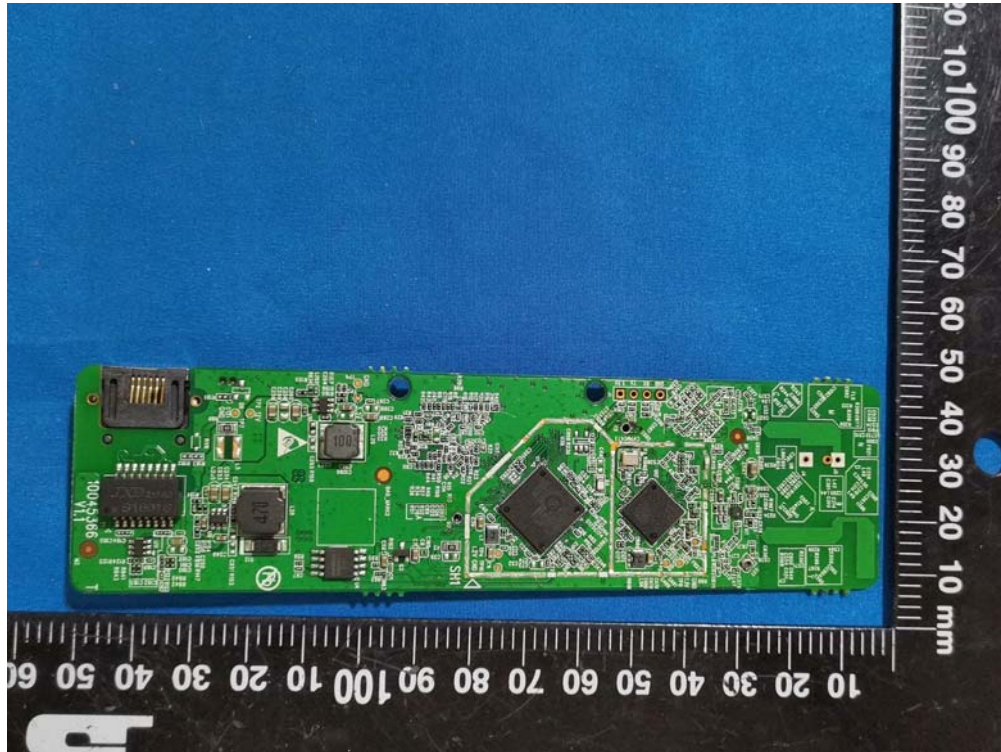
Port



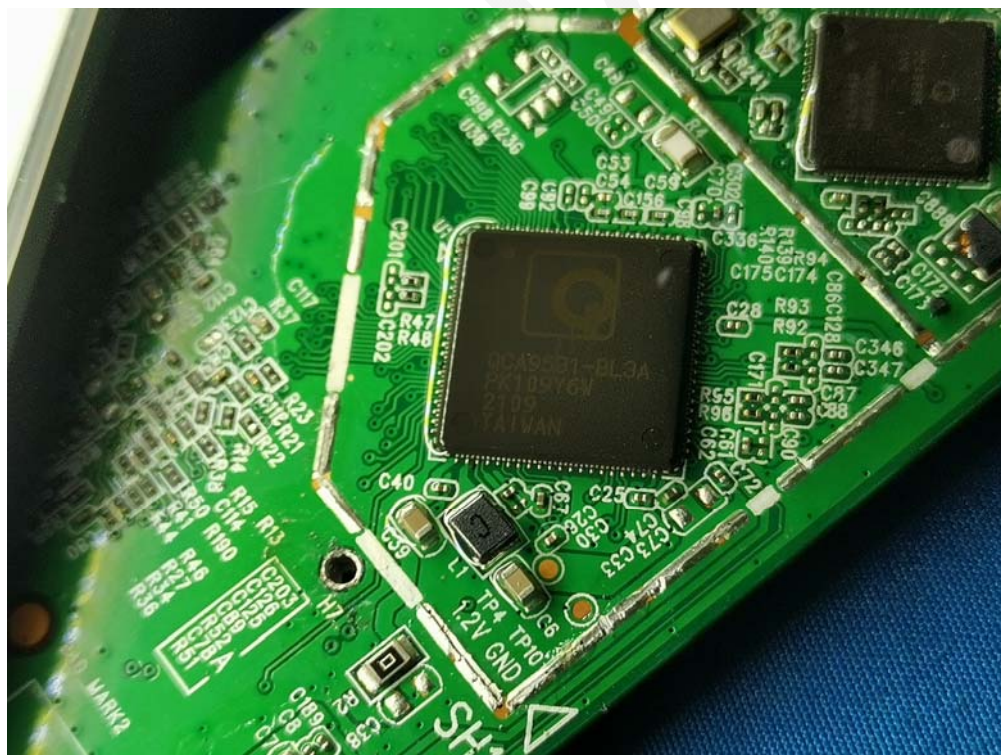




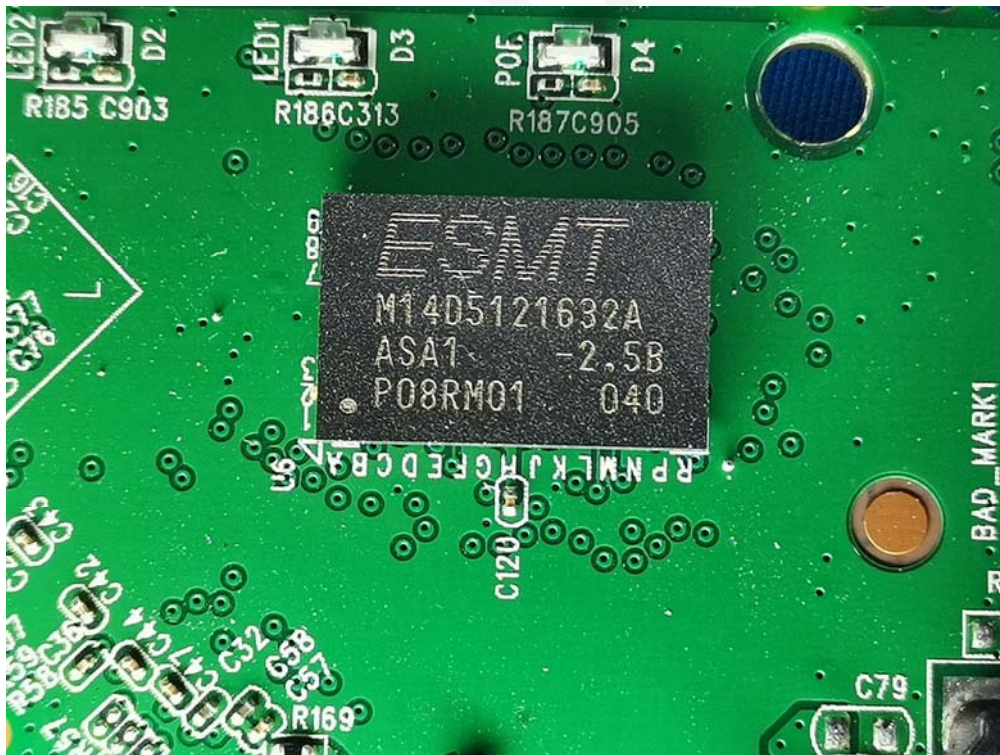
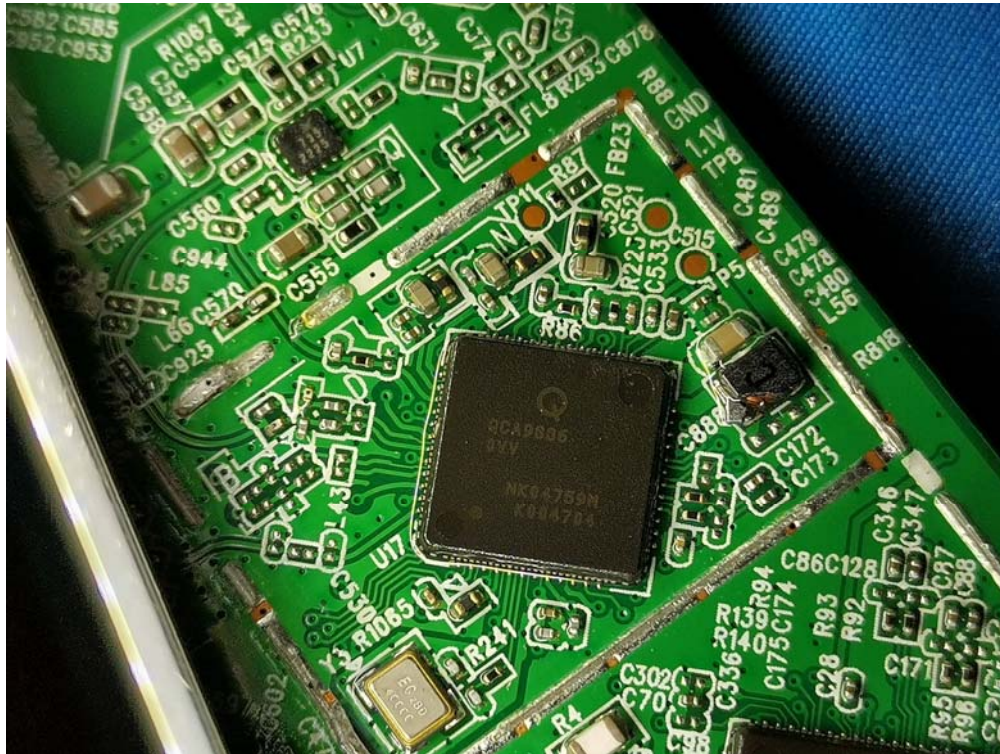


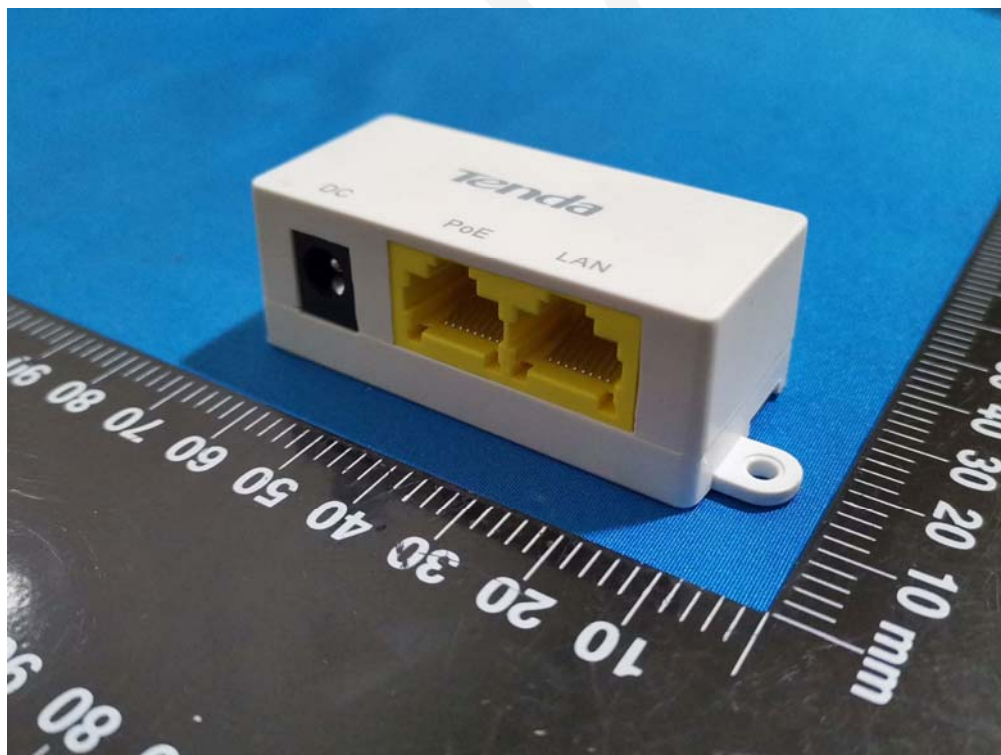


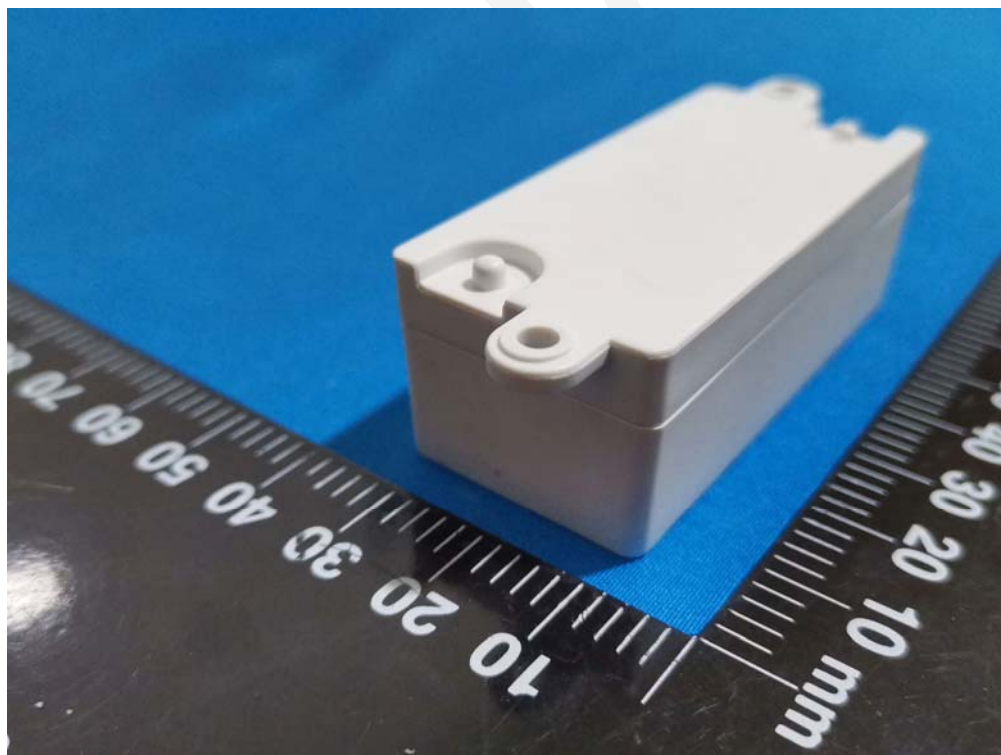
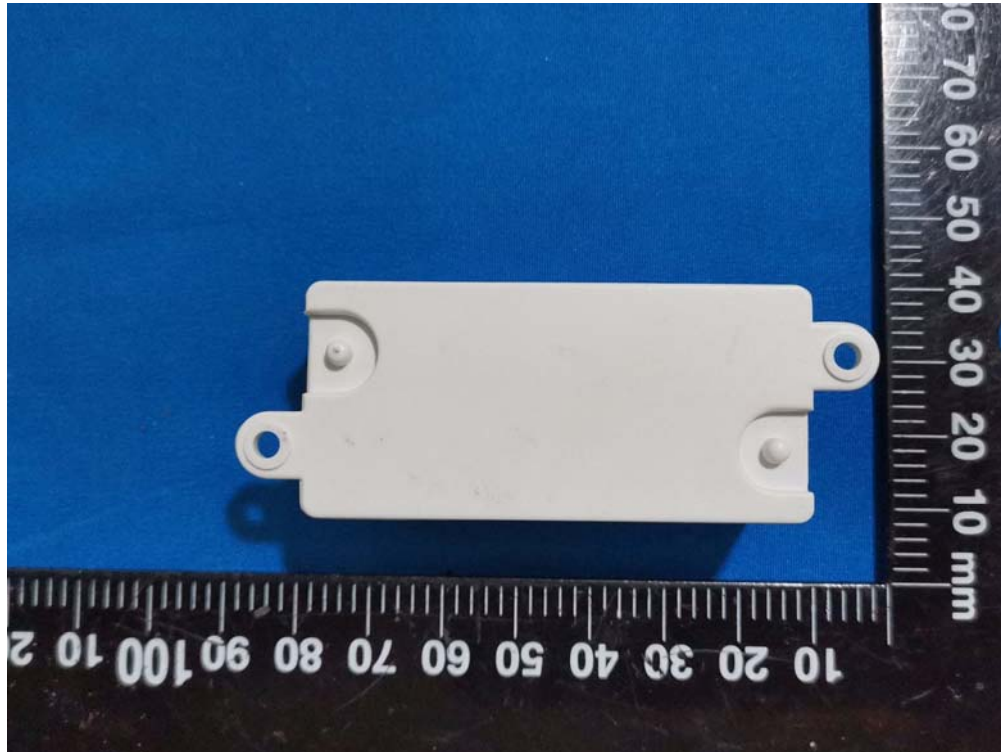
Chip 1

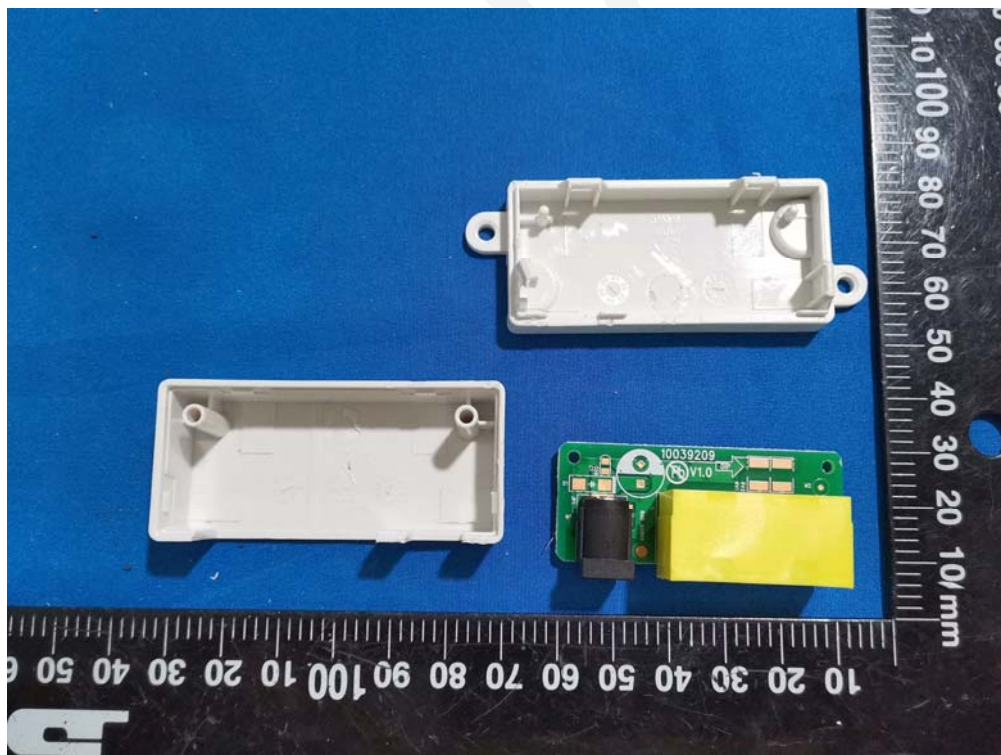
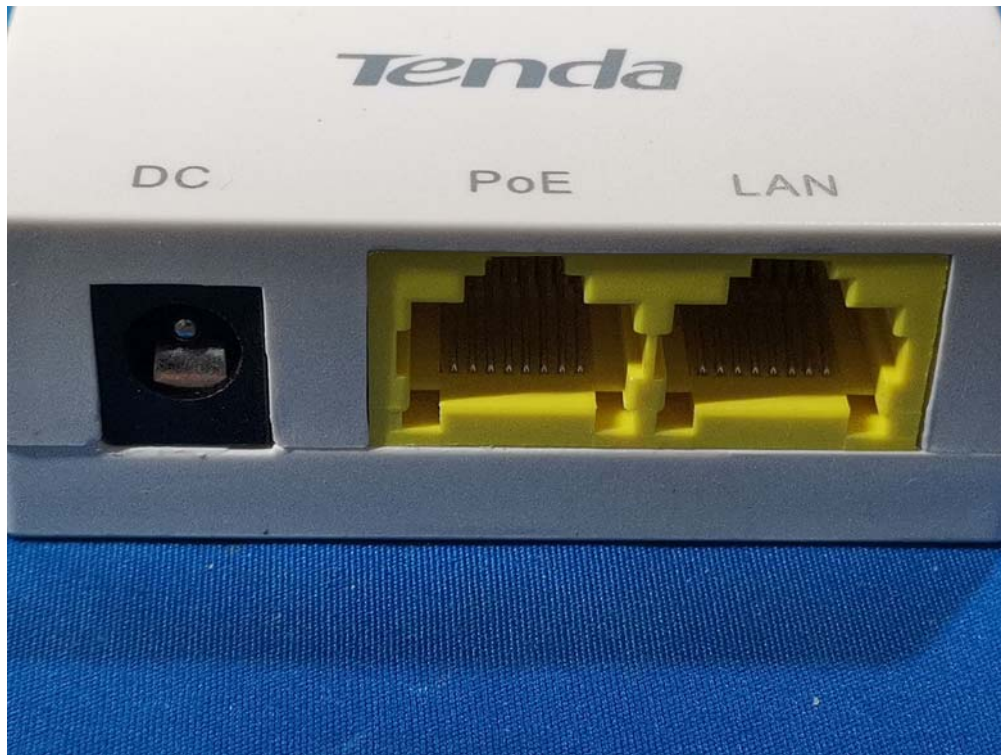


Chip 2









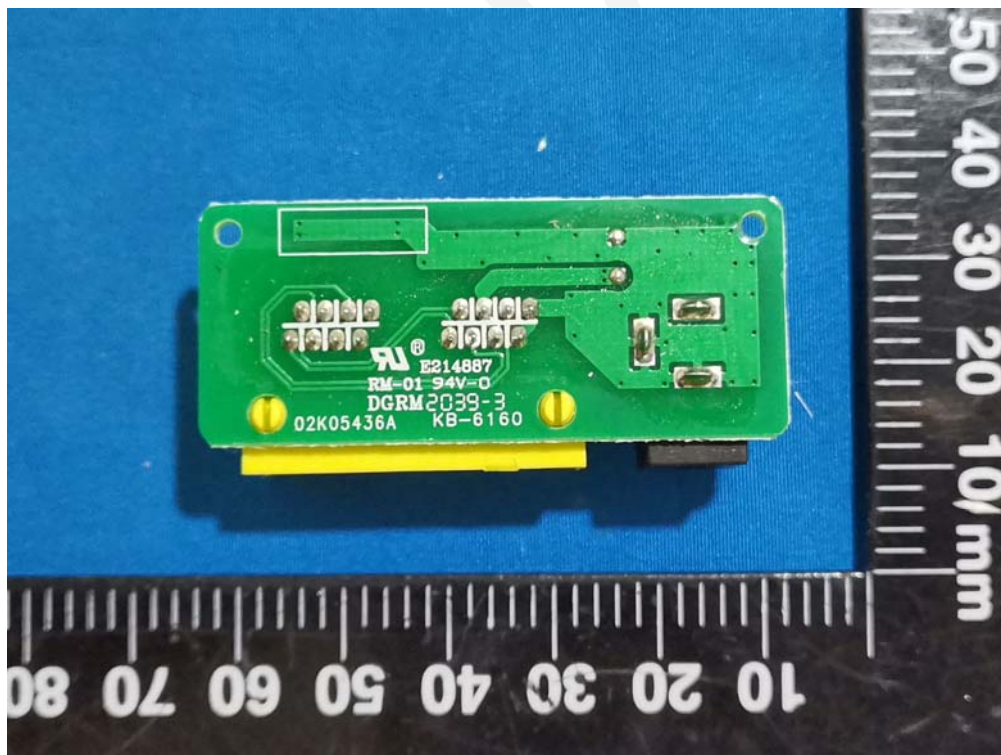
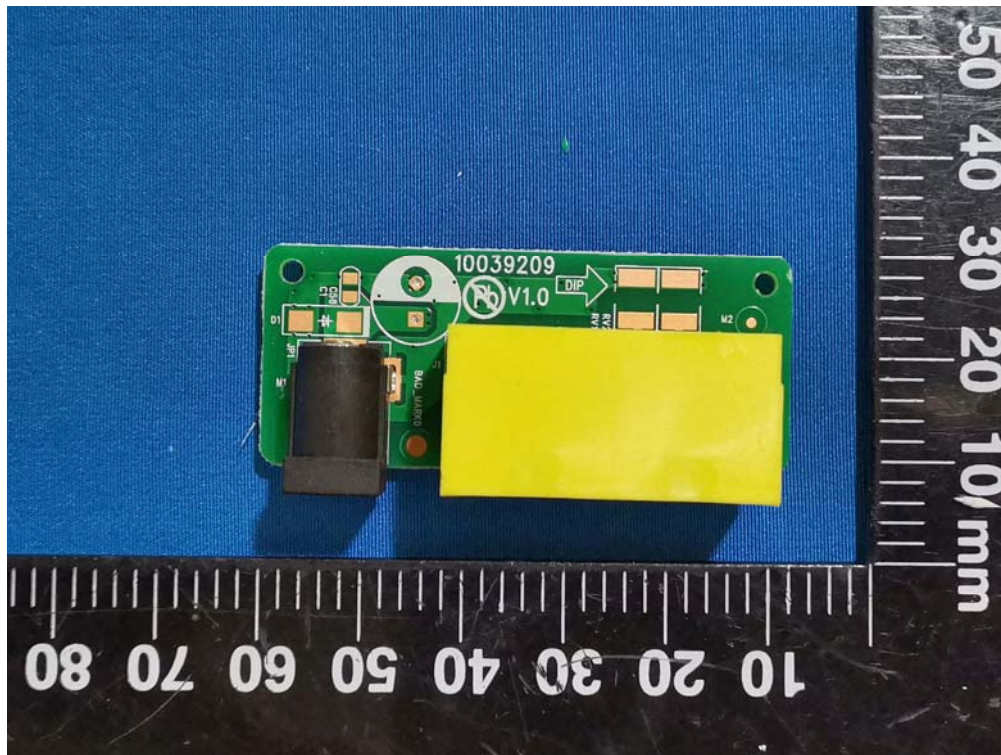




EXHIBIT B – TEST SETUP PHOTOGRAPHS

RE

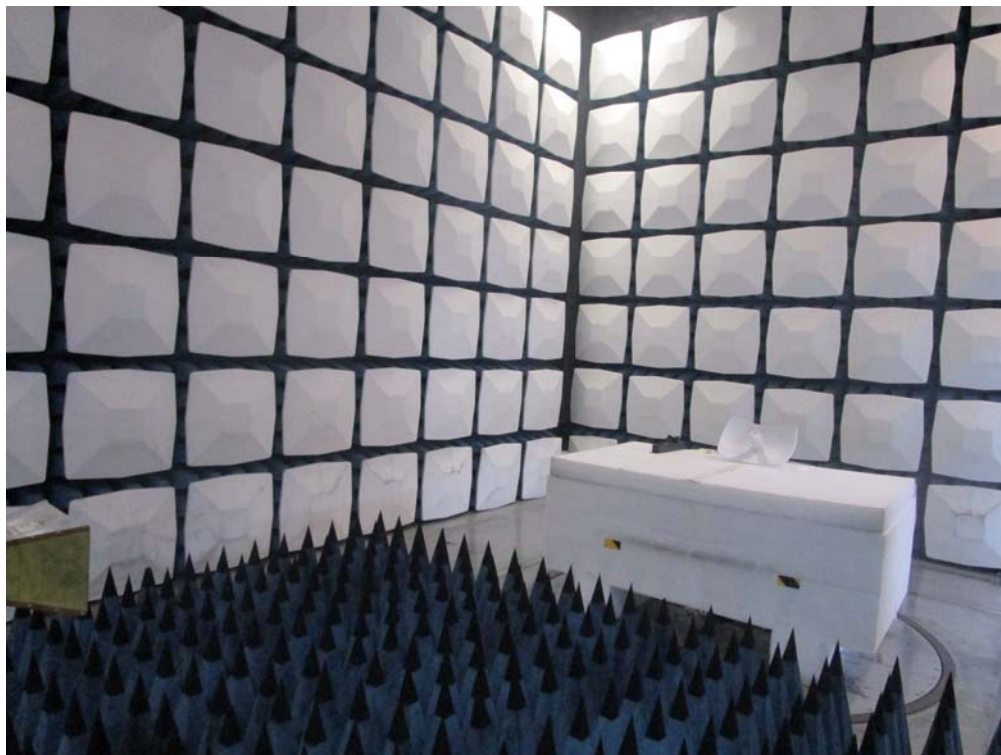
RE Below 1G front View



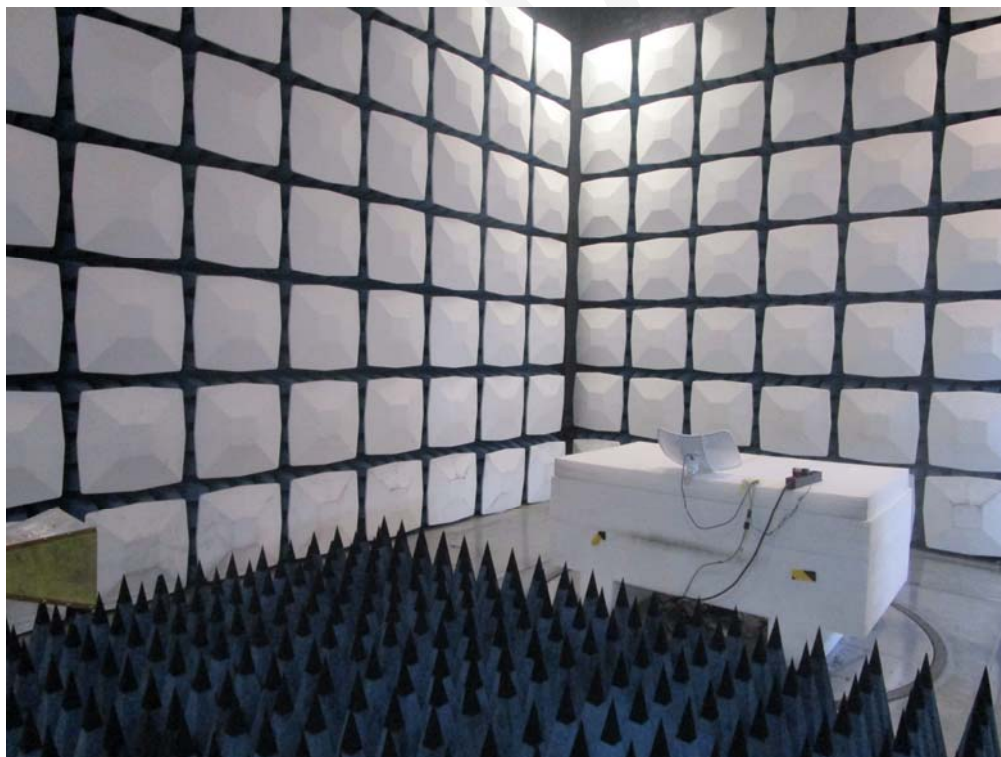
RE Below1G rear View



RE Above 1G front View



RE Above 1G rear View

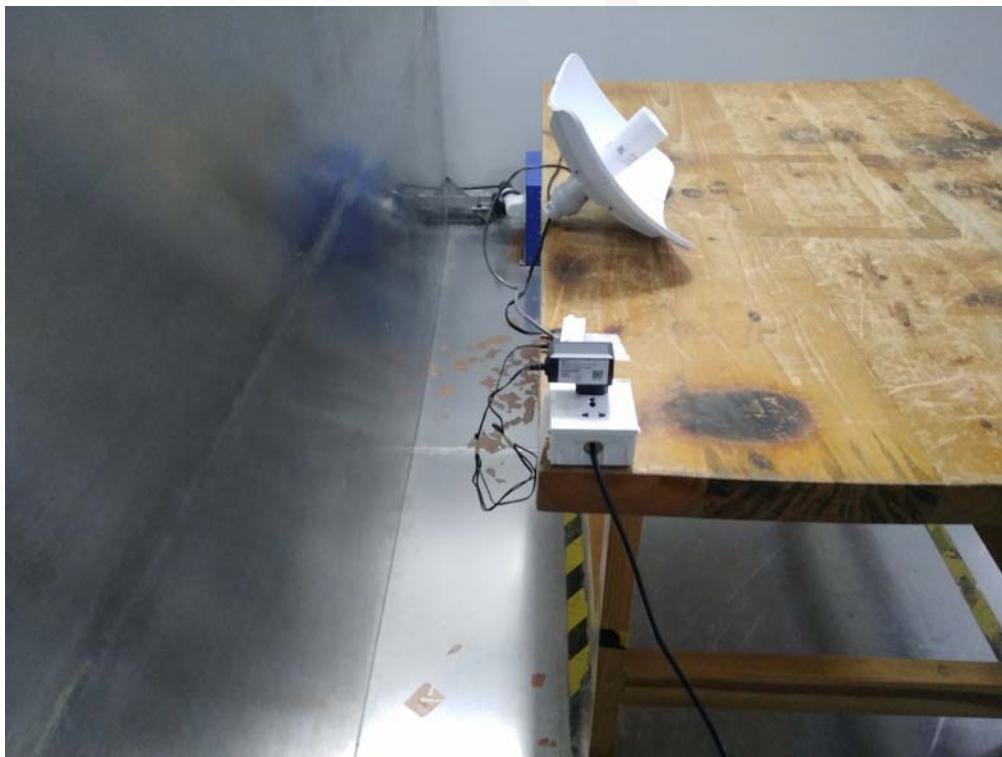


CE_AC

CE front View



CE side View

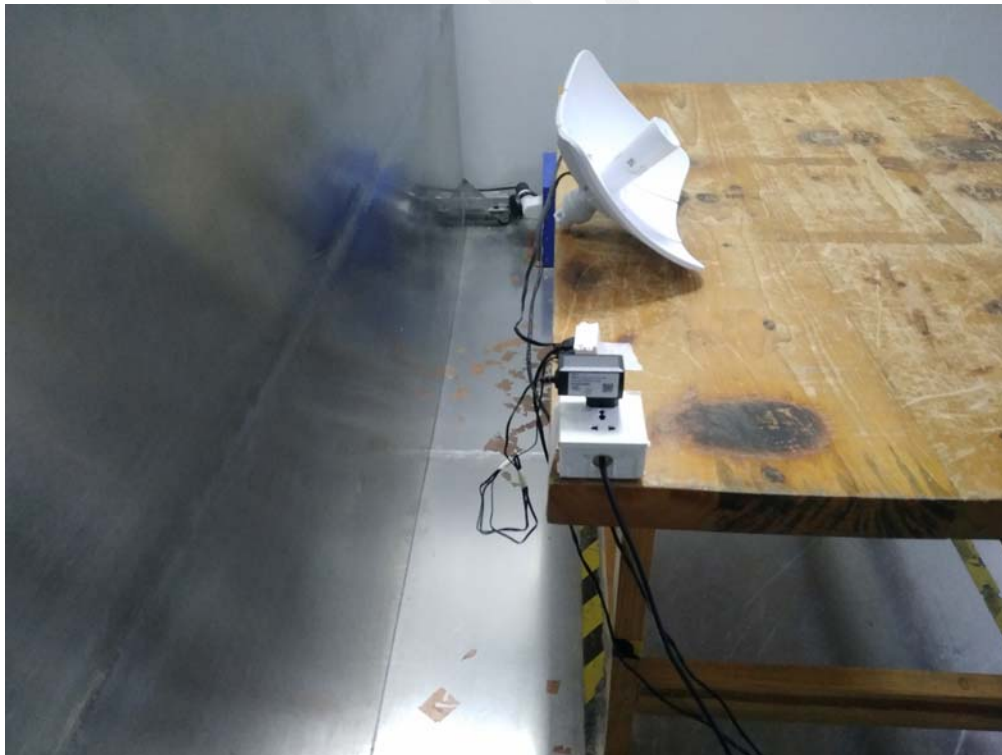


CE_ISN

CE front View



CE side View



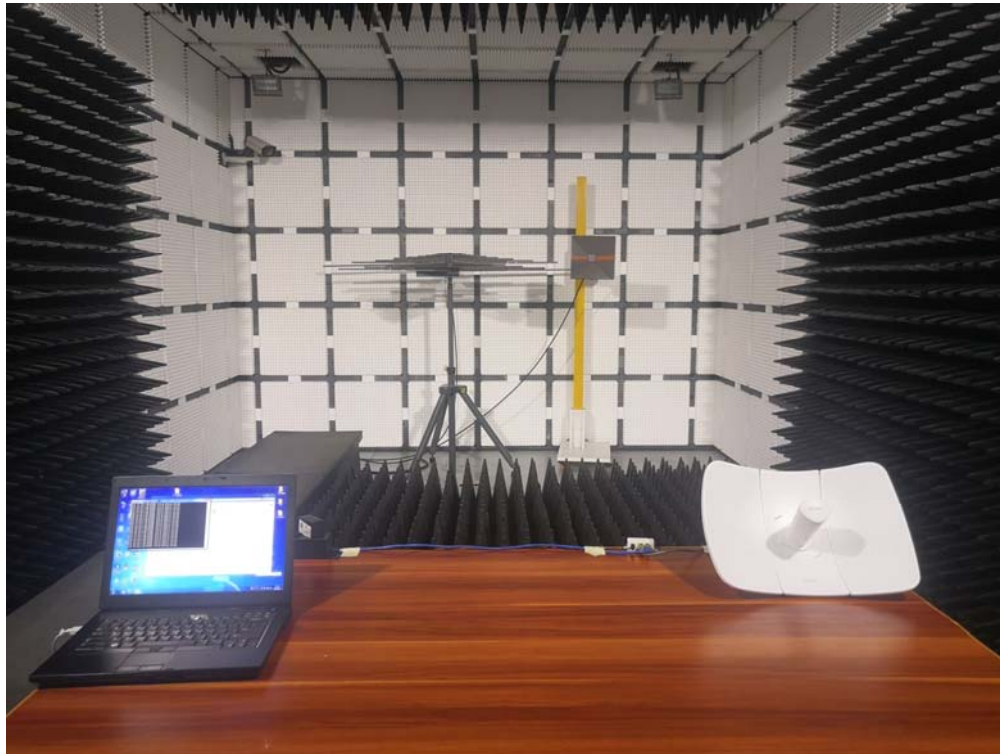
Flicker

Test Setup Photo View



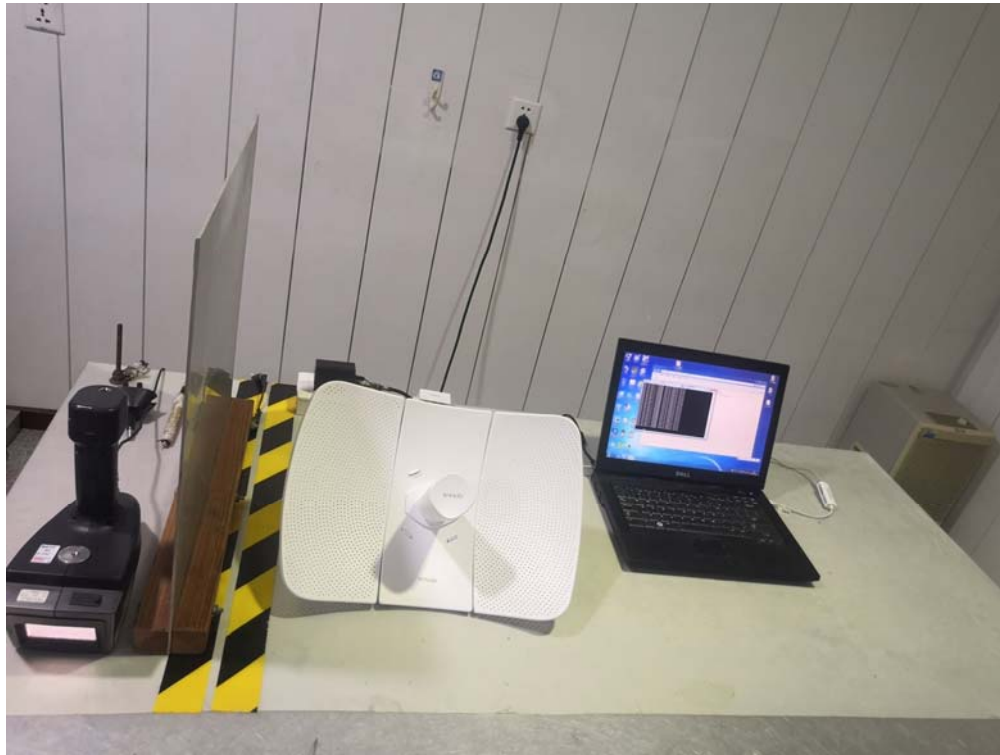
RS

Test Setup Photo View



ESD

Test Setup Photo View

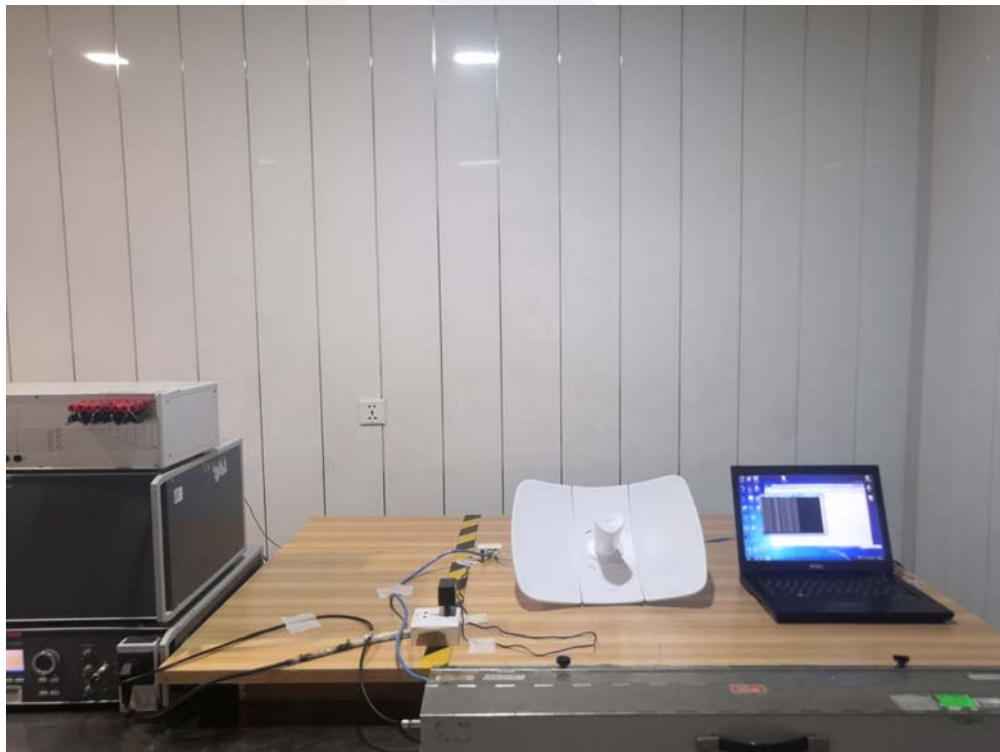


EFT

Test Setup Photo View



RJ45 Test Setup Photo View



CS

Test Setup Photo View



RJ45 Test Setup Photo View



Dips

Test Setup Photo View

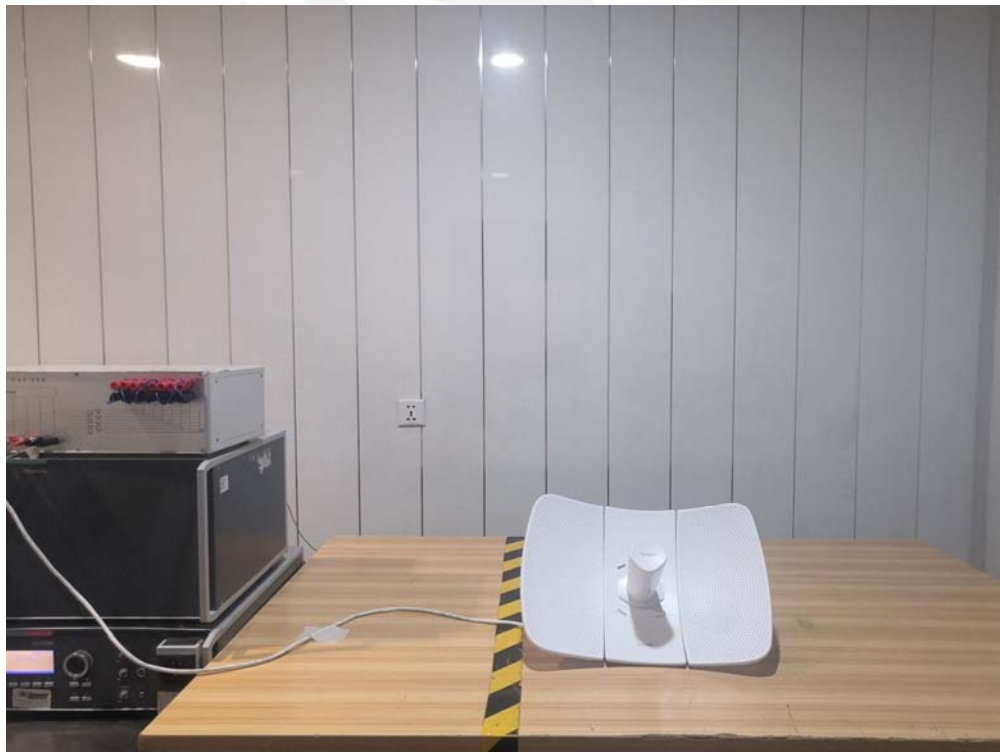


Surge

Test Setup Photo View



RJ45 Test Setup Photo View



*****END OF REPORT*****