

ETSI EN 301 489-1 V2.2.1 (2019-03)
ETSI EN 301 489-17 V3.2.0 (2017-03)

TEST REPORT

For

Shenzhen Sonoff Technologies Co., Ltd.

Room 1001, 10F, Building 8, Lianhua Industrial Park, Longyuan Road, Longhua District,
Shenzhen, GD, China

Model: BASICZBR3

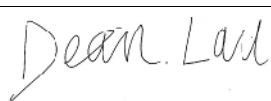
Report Type: Original Report	Product Type: ZigBee DIY Smart Switch
Report Number:	RDG190802003-02
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Reviewed By:	Dean Lau RF Supervisor 
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TABLE OF CONTENTS

General Information	4
PRODUCT DESCRIPTION FOR EQUIPMENT UNDER TEST (EUT).....	4
OBJECTIVE	4
TEST METHODOLOGY	4
System Test Configuration	5
DESCRIPTION OF TEST CONFIGURATION	5
EQUIPMENT MODIFICATIONS	5
EUT EXERCISE SOFTWARE	5
BLOCK DIAGRAM OF TEST SETUP	5
SUPPORT EQUIPMENT LIST AND DETAILS	6
SUPPORT CABLE LIST AND DETAILS	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	12
CORRECTED AMPLITUDE & MARGIN CALCULATION	12
TEST DATA	13
3 – AC mains power input/output ports	17
EUT SETUP.....	17
EMI TEST RECEIVER SETUP	17
TEST PROCEDURE	17
CORRECTED AMPLITUDE & MARGIN CALCULATION	18
TEST DATA	19
4 – Harmonic current emissions (AC mains input port).....	21
TEST SYSTEM SETUP.....	21
TEST STANDARD.....	21
TEST PRODUCT CLASS	21
TEST DATA	23
5 – Voltage fluctuations and flicker (AC mains input port)	26
TEST SYSTEM SETUP.....	26
TEST STANDARD.....	26
TEST DATA	27
7 – Radio frequency electromagnetic fields (80 MHz to 6 000 MHz).....	28
TEST SYSTEM SETUP.....	28
TEST LEVEL	28
PERFORMANCE CRITERION: A	28
TEST PROCEDURE	28
TEST DATA	29
8 – Electrostatic discharges	30
TEST SYSTEM SETUP.....	30
TEST LEVEL	30
PERFORMANCE CRITERION: B	30
TEST PROCEDURE	31

TEST DATA	32
9 – Fast transients, common mode.....	34
TEST SYSTEM SETUP.....	34
TEST LEVEL	34
PERFORMANCE CRITERION: B.....	34
TEST PROCEDURE	34
TEST DATA	35
10 – Radio frequency, common mode.....	36
TEST SETUP	36
TEST LEVEL	36
PERFORMANCE CRITERION: A	36
TEST PROCEDURE	36
TEST DATA	37
12 – Voltage dips and short interruptions.....	38
TEST SETUP	38
TEST LEVEL AND PERFORMANCE CRITERION	38
TEST PROCEDURE	38
TEST DATA	39
13 – Surges	40
TEST SYSTEM SETUP.....	40
TEST LEVEL	40
PERFORMANCE CRITERION: B.....	40
TEST PROCEDURE	40
TEST DATA	41
Exhibit A – Eut Photographs	42
Exhibit B – Test Setup Photographs.....	48

GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Name:	ZigBee DIY Smart Switch
EUT Model:	BASICZBR3
Rated Input Voltage:	AC 100-240V
External Dimension:	91mm(L)*43mm(W)*25mm(H)
Serial Number:	190802003
EUT Received Date:	2019/8/4

Objective

This report is prepared on behalf of *Shenzhen Sonoff Technologies Co., Ltd.* in accordance with ETSI EN 301 489-1 V2.2.1 (2019-03) ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU and the essential requirements of article 6 of Directive 2014/30/EU; ETSI EN 301 489-17 V3.2.0 (2017-03) 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 V2.2.1 (2019-03) ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 1: Common technical requirements; Harmonised Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU and the essential requirements of article 6 of Directive 2014/30/EU; ETSI EN 301 489-17 V3.2.0 (2017-03) ElectroMagnetic Compatibility (EMC) standard for radio equipment and services; Part 17: Specific conditions for Broadband Data Transmission Systems.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

The system was configured for testing in Wireless Link & Operating mode

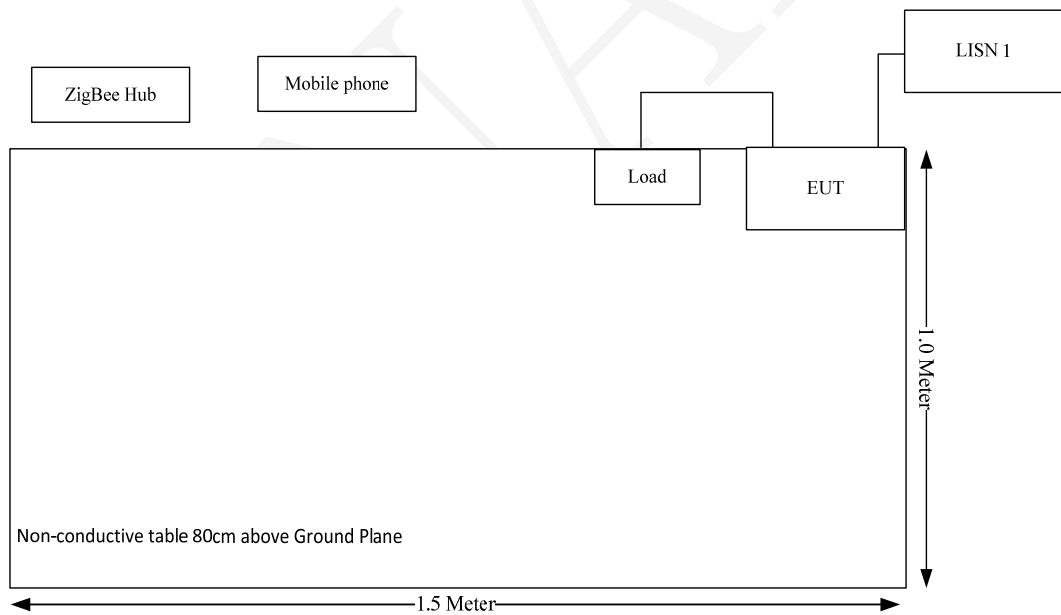
Equipment Modifications

No modification was made to the EUT.

EUT Exercise Software

No software was used for testing.

Block Diagram of Test Setup



Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
Apple	Mobile Phone	MGAA2CG/A	FK1R95UYG5QT
unknown	Load	/	/
Unknown	ZigBee Hub	/	/

Support Cable List and Details

Cable Description	Shielding Cable	Ferrite Core	Length (m)	From Port	To
AC Power Cable	Yes	No	2	Input Port of EUT	LISN
Power Cable	Yes	No	0.5	Output Port of EUT	Load

Test Equipment List

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
Conducted emission					
Unknown	Coaxial Cable	C-NJNJ-50	C-0200-01	2018-09-05	2019-09-05
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A
R&S	Two-line V-network	ENV 216	101614	2018-12-10	2019-12-10
R&S	EMI Test Receiver	ESPI	100120	2019-05-09	2020-05-09
Radiated emissions below 1GHz					
R&S	EMI Test Receiver	ESCI	101121	2019/5/9	2020/5/9
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
Sunol Sciences	Antenna	JB3	A060611-2	2017-08-25	2020-08-25
Unknown	Coaxial Cable	C-NJNJ-50	C-1000-01	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-02	2018-09-05	2019-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0530-01	2018-09-24	2019-09-24
HP	Amplifier	8447F	2443A01912	2018-09-05	2019-09-05
Radiated emissions above 1GHz					
R&S	Spectrum Analyzer	FSP 38	100478	2019-05-09	2020-05-09
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
TDK RF	Horn Antenna	HRN-0118	130 084	2018-10-12	2021-10-12
MICRO-COAX	Coaxial Cable	UFA147-1-2362-100100	64639 231029-001	2019-02-24	2020-02-24
Mini	Pre-amplifier	ZVA-183-S+	5969001149	2018-09-05	2019-09-05
E-Microwave	Band-stop Filters	OBSF-2400-2483.5-S	OE01601525	2019-06-16	2020-06-16
Flicker & Harmonic					
ELGAR	AC Power Source	1751SX	5611	2018-09-10	2019-09-10
EM TEST	Harmonic & Flicker Analyzer	DPA 500	303278	2018-12-14	2019-12-14
CS					
Werlatone	Dual Directional Coupler	C5091-10	113192	2019-02-09	2020-02-09
HP	Power Meter	HP EPM-441A	GB37481494	2018-08-13	2019-08-13
HP	Power Meter	HP EPM-441A	GB37481494	2019-08-13	2020-08-13
Agilent	8482A Power sensor	8482A	US37296108	2018-08-13	2019-08-13
Agilent	8482A Power sensor	8482A	US37296108	2019-08-13	2020-08-13
HP	Signal Generator	8648A	3246A00831	2018-12-14	2019-12-14
R&S	Power Amplifier	15A250	12934	N/A	N/A
NARDA	Attenuator	769-6	2754	N/A	N/A

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
EFT & Surge & Dips					
EM TEST	Ultra Compact Generator	UCS500-M6	V6016101357	2019-05-09	2020-05-09
EM TEST	Auto Transformer	MV2616	0403-16	N/A	N/A
ESD					
SCHAFFNER	ESD Tester	NSG435	005 101	2019-07-27	2020-07-27
RS					
Sunol Sciences	Antenna	JB3	A060611-2	2017-08-25	2020-08-25
ETS-Lindgren	Horn Antenna	3115	000 527 35	2018-10-12	2021-10-12
Unknown	Coaxial Cable	C-SJSJ-50	C-0800-01	2018-09-05	2019-09-05
AR	Power Amplifier	100W1000M1	13410	N/A	N/A
AR	Power Amplifier	60S1G6	348711	N/A	N/A
PASTERNAK	Dual Directional Coupler	PE2239-30	1711	2019-07-16	2020-07-16
Microwave	Directional Coupler	441490	488Z	2019-07-16	2020-07-16
Agilent	EPM Series Power Meter	E4419B	MY45103907	2019-05-09	2020-05-09
Agilent	E-Series Avg Power Sensor	E9301A	MY41497625	2019-05-09	2020-05-09
Agilent	E-Series Avg Power Sensor	E9301A	MY41497628	2019-05-09	2020-05-09
HP	Signal Generator	8665B	3438a00584	2019-07-19	2020-07-19

* 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

Temperature:	22.7~27.9 °C
Relative Humidity:	51~64%*
ATM Pressure:	100.1~100.7kPa
Tester:	Sky Lu, Miller Zhao, Jakson Zhang
Test Date:	2019.08.09-2019.08.23

Note:

*The relative humidity of ESD test environment is 51%.

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)	Compliance
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	Not applicable**
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 AC230V 50Hz.

Not applicable**: Without wired network ports

Not applicable***: The EUT is not apply 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.

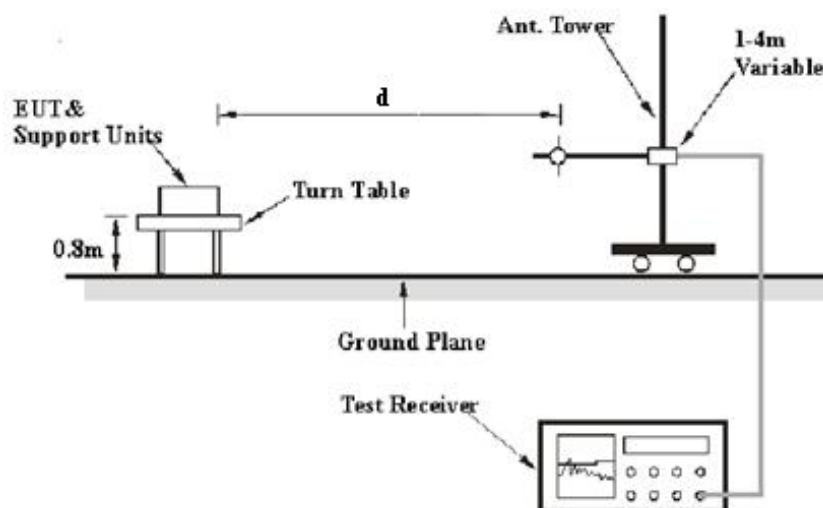
Based on CISPR 16-4-2: 2011, measurement uncertainty of radiated emission at a distance of 10m at Bay Area Compliance Laboratories Corp. (Dongguan) is: 30M~200MHz: 4.55 dB for Horizontal, 4.57 dB for Vertical; 200M~1GHz: 4.66 dB for Horizontal, 4.56 dB for Vertical; measurement uncertainty of radiated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

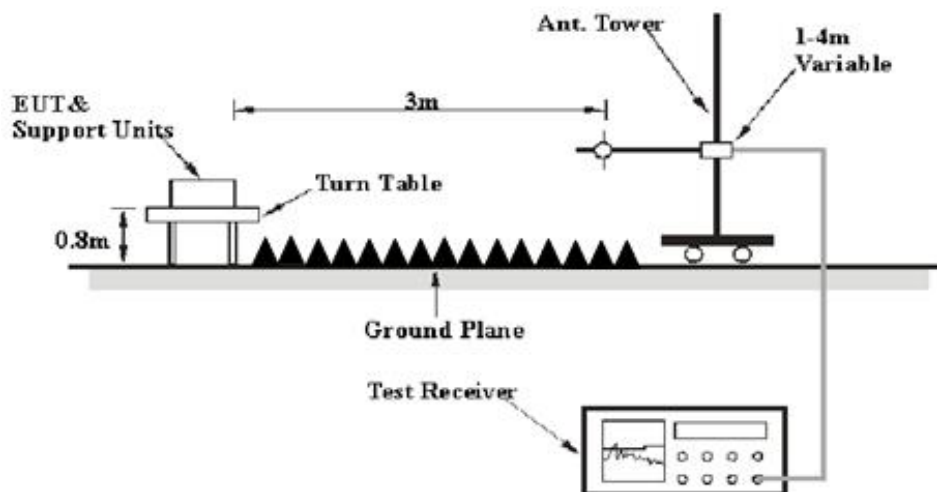
Measurement	U_{cisp}
Radiated disturbance (electric field strength at an OATS or in a SAC) (30 MHz to 1000 MHz)	6.3 dB
Radiated disturbance (electric field strength in a FAR) (1 GHz to 6 GHz)	5.2 dB
Radiated disturbance (electric field strength in a FAR) (6 GHz to 18 GHz)	5.5 dB

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 B 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.

Corrected Amplitude & Margin Calculation

The basic equation is as follows:

Result = Meter Reading+ Corrected

Note:

Corrected = Antenna Factor + Cable Loss - Amplifier Gain

or

Corrected = Antenna Factor + Cable Loss + Insertion loss of attenuator - 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:

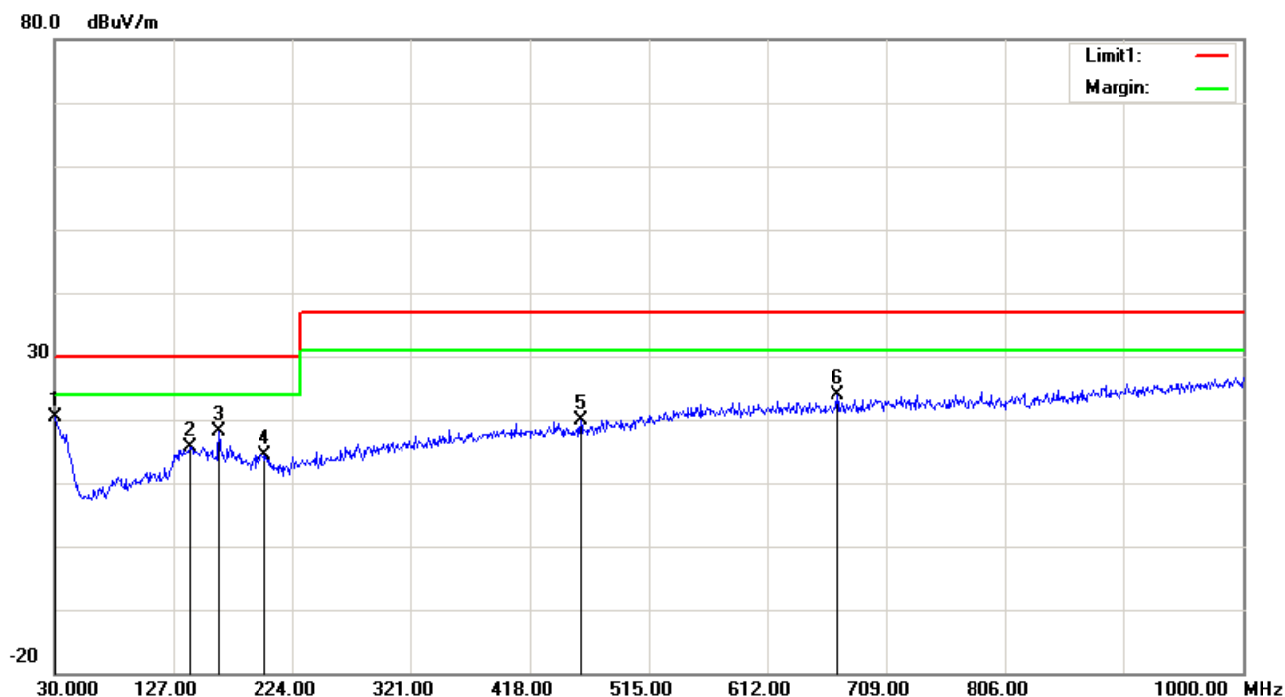
Margin = Limit – Result

Test Data

Please refer to following table and plots:

Condition: EN 301 489 Class B
EUT: ZigBee DIY Smart Switch
Model: BASICZBR3
Test Mode: Wireless Link & Operating
Note:

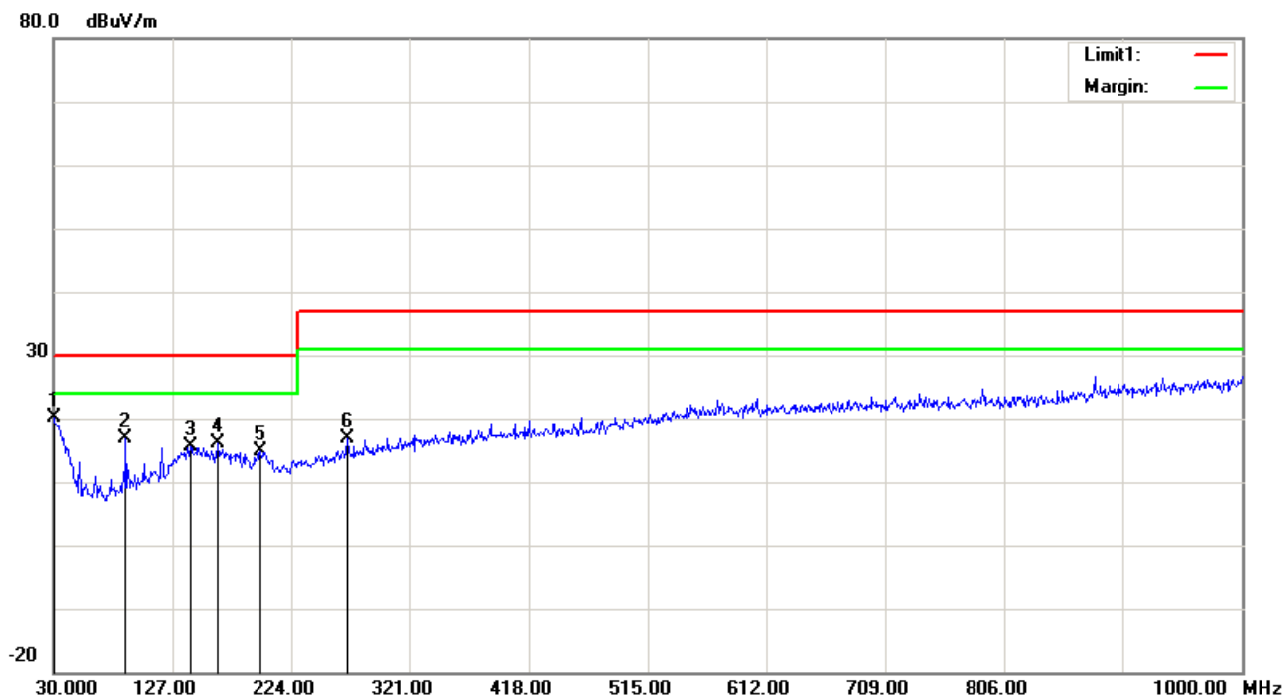
Polarization: Horizontal
Power: AC 230V/50Hz
Distance: 10m



No.	Frequency (MHz)	Reading (dBμV)	Detector	Corrected (dB/m)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)
1	30.9700	28.86	peak	-8.40	20.46	30.00	9.54
2	140.5800	28.40	peak	-12.71	15.69	30.00	14.31
3	163.8600	31.09	peak	-12.86	18.23	30.00	11.77
4	200.7200	27.31	peak	-12.90	14.41	30.00	15.59
5	459.7100	26.98	peak	-7.14	19.84	37.00	17.16
6	669.2300	26.19	peak	-2.30	23.89	37.00	13.11

Condition: EN 301 489 Class B
EUT: ZigBee DIY Smart Switch
Model: BASICZBR3
Test Mode: Wireless Link&Operating
Note:

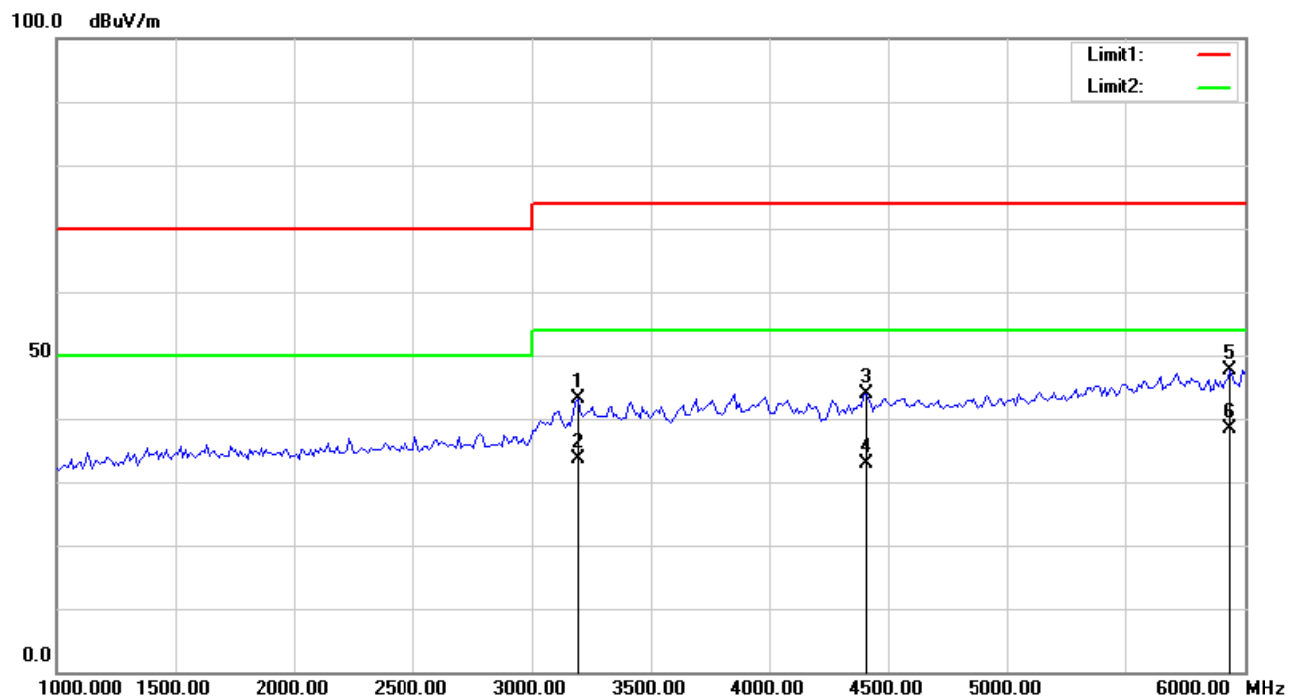
Polarization: Vertical
Power: AC 230V/50Hz
Distance: 10m



No.	Frequency (MHz)	Reading (dB μ V)	Detector	Corrected (dB/m)	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
1	30.0000	28.19	peak	-7.95	20.24	30.00	9.76
2	89.1700	35.69	peak	-18.84	16.85	30.00	13.15
3	141.5500	28.45	peak	-12.71	15.74	30.00	14.26
4	163.8600	29.00	peak	-12.86	16.14	30.00	13.86
5	198.7800	27.77	peak	-12.96	14.81	30.00	15.19
6	269.5900	28.99	peak	-12.06	16.93	37.00	20.07

Condition: EN 301 489 Class B Peak
EUT: ZigBee DIY Smart Switch
Model: BASICZBR3
Test Mode: Wireless Link&Operating
Note:

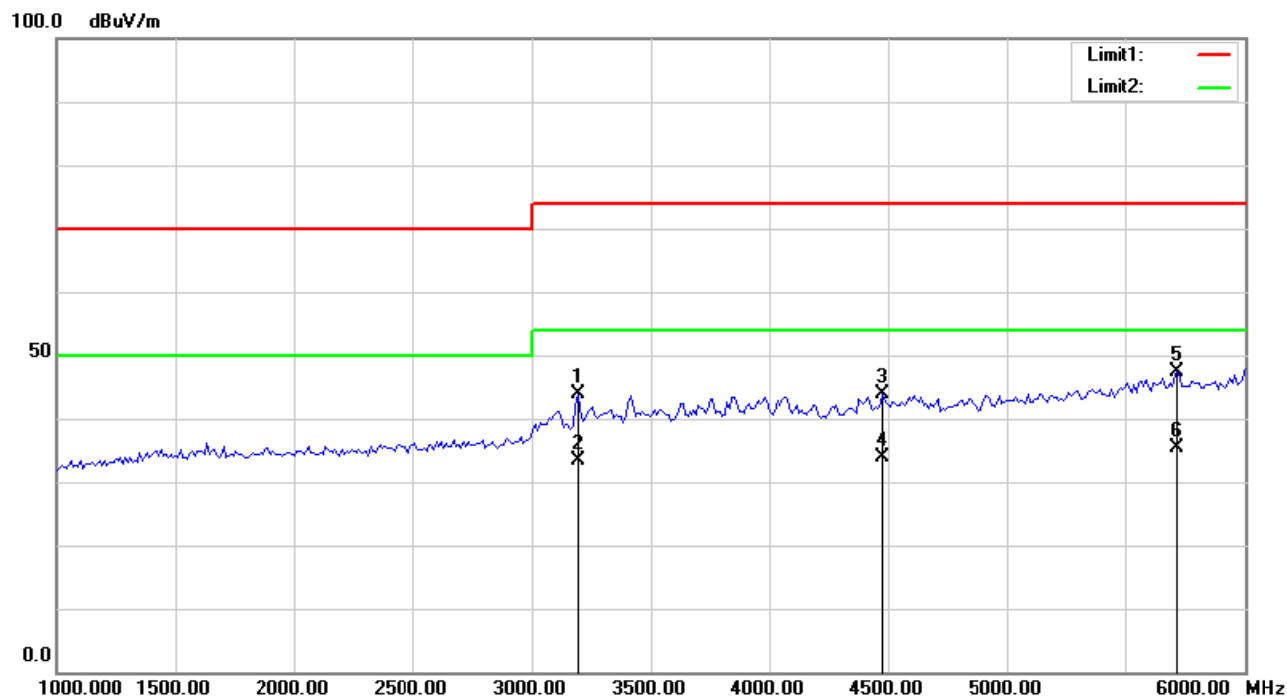
Polarization: Horizontal
Power: AC 230V/50Hz
Distance: 3m



No.	Frequency (MHz)	Reading (dB μ V)	Detector	Corrected (dB/m)	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
1	3194.389	40.18	peak	2.87	43.05	74.00	30.95
2	3194.389	30.73	AVG	2.87	33.60	54.00	20.40
3	4406.814	37.78	peak	6.02	43.80	74.00	30.20
4	4406.814	26.94	AVG	6.02	32.96	54.00	21.04
5	5939.880	37.43	peak	10.31	47.74	74.00	26.26
6	5939.880	28.10	AVG	10.31	38.41	54.00	15.59

Condition: EN 301 489 Class B Peak
EUT: ZigBee DIY Smart Switch
Model: BASICZBR3
Test Mode: Wireless Link&Operating
Note:

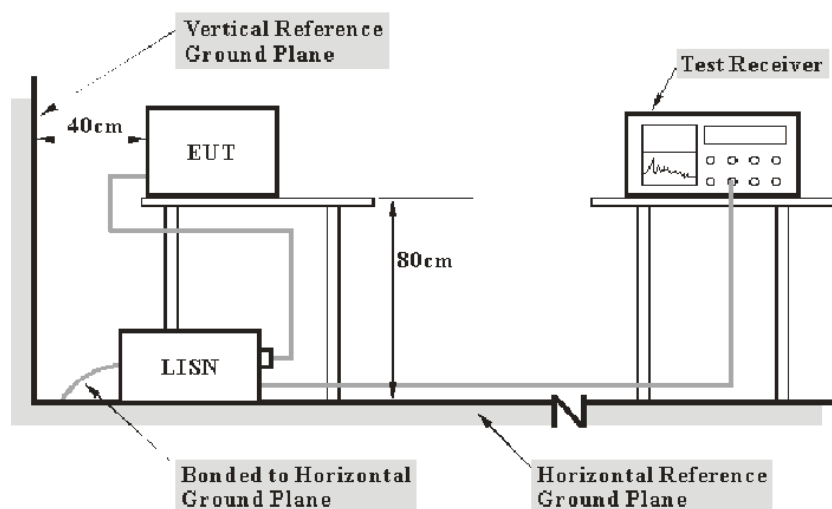
Polarization: Vertical
Power: AC 230V/50Hz
Distance: 3m



No.	Frequency (MHz)	Reading (dB μ V)	Detector	Corrected (dB/m)	Result (dB μ V/m)	Limit (dB μ V/m)	Margin (dB)
1	3194.389	40.96	peak	2.87	43.83	74.00	30.17
2	3194.389	30.49	AVG	2.87	33.36	54.00	20.64
3	4476.954	37.77	peak	6.00	43.77	74.00	30.23
4	4476.954	27.81	AVG	6.00	33.81	54.00	20.19
5	5719.439	37.57	peak	9.89	47.46	74.00	26.54
6	5719.439	25.61	AVG	9.89	35.50	54.00	18.50

3 - AC MAINS POWER INPUT/OUTPUT PORTS

EUT 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 EUT 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 EUT 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:

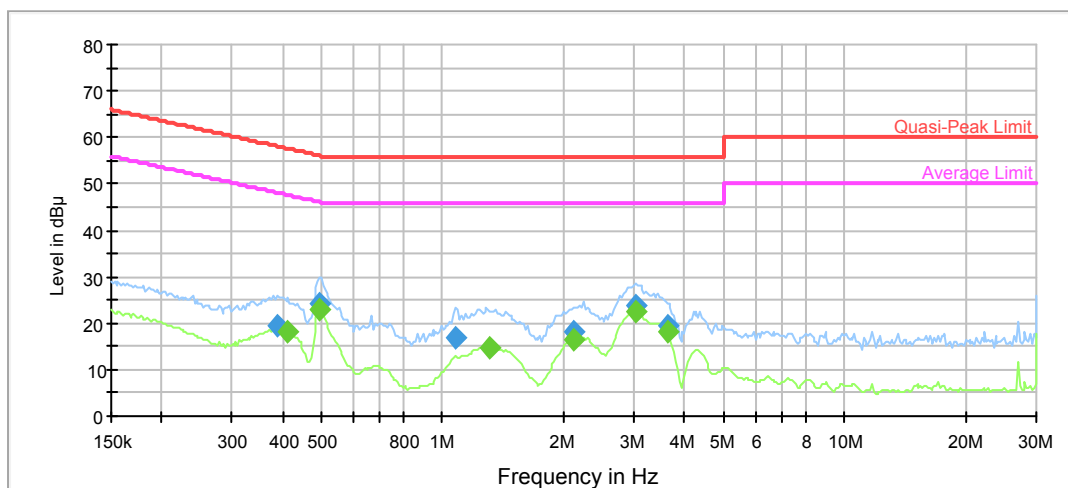
Margin = Limit – Result

FINAL

Test Data

Please refer to following table and plots:

Model Number: BASICZBR3
 Port: L
 Test Mode: Wireless Link&Operating
 Power Source: AC 230V/50Hz
 Note:



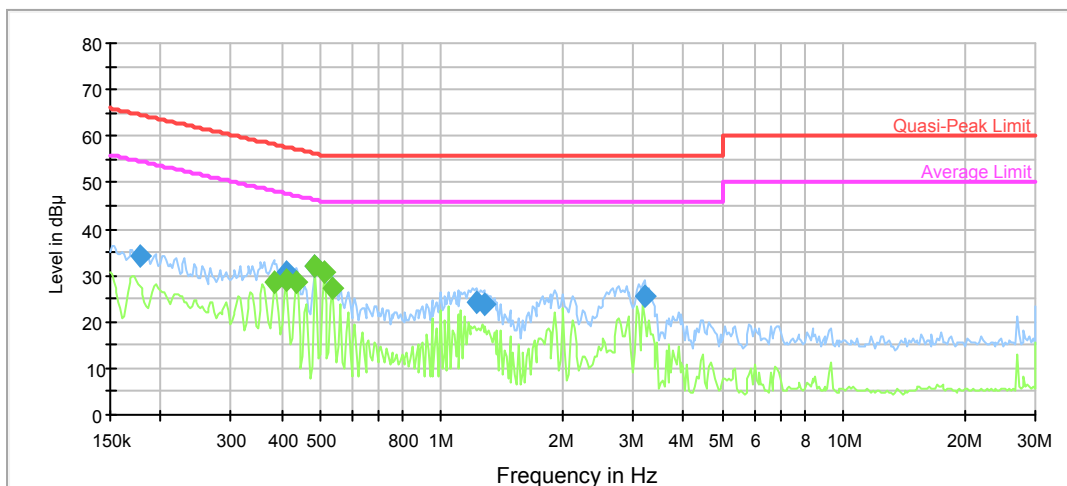
Final Result 1

Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.389891	19.6	9.000	L1	10.0	38.5	58.1
0.495058	24.2	9.000	L1	9.9	31.9	56.1
1.075780	17.0	9.000	L1	9.8	39.0	56.0
2.116299	18.3	9.000	L1	9.7	37.7	56.0
3.027934	23.8	9.000	L1	9.8	32.2	56.0
3.621856	19.6	9.000	L1	9.8	36.4	56.0

Final Result 2

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.413877	18.0	9.000	L1	9.9	29.6	47.6
0.495058	23.1	9.000	L1	9.9	23.0	46.1
1.312656	14.9	9.000	L1	9.8	31.1	46.0
2.116299	16.4	9.000	L1	9.7	29.6	46.0
3.027934	22.6	9.000	L1	9.8	23.4	46.0
3.621856	18.1	9.000	L1	9.8	27.9	46.0

Model Number: BASICZBR3
 Port: N
 Test Mode: Wireless Link&Operating
 Power Source: AC 230V/50Hz
 Note:



Final Result 1

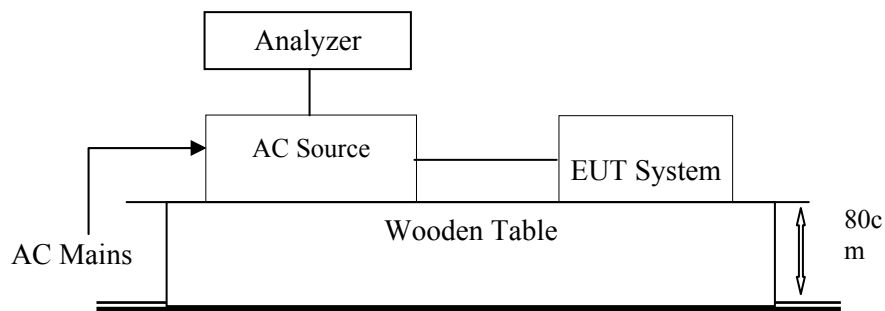
Frequency (MHz)	QuasiPeak (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.177646	34.0	9.000	N	10.8	30.6	64.6
0.413877	30.6	9.000	N	9.9	27.0	57.6
0.485304	32.2	9.000	N	9.9	24.0	56.2
1.224338	24.4	9.000	N	9.8	31.6	56.0
1.274051	23.9	9.000	N	9.8	32.1	56.0
3.214213	25.7	9.000	N	9.8	30.3	56.0

Final Result 2

Frequency (MHz)	Average (dBμV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBμV)
0.386031	28.6	9.000	N	10.0	19.5	48.1
0.409780	29.1	9.000	N	10.0	18.6	47.7
0.434989	28.6	9.000	N	9.9	18.6	47.2
0.485304	31.9	9.000	N	9.9	14.3	46.2
0.510059	30.6	9.000	N	9.9	15.4	46.0
0.536077	27.3	9.000	N	9.9	18.7	46.0

4 – HARMONIC CURRENT EMISSIONS (AC MAINS INPUT PORT)

Test System Setup



Test Standard

EN 61000-3-2:2014

Test product class

- Class A: - Balanced three-phase equipment
- Household appliances excluding equipment identified as class D
 - Tools excluding portable tools
 - Dimmers for incandescent lamps
- Audio equipment
- Class B: - Portable tools
- Arc welding equipment, which is not professional equipment
- Class C: - Lighting equipment
- Class D: Equipment having a specified power less than or equal to 600w, of the following type:
- Personal computer and personal computer monitors
 - Television receivers

Table 1 – Limits for Class A equipment

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

Table 2 – Limits for Class C equipment

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

* λ is the circuit power factor**Table 3 – Limits for Class D equipment**

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

Test Data**Average harmonic current results**

Hn	leff [A]	leff [%]	Limit [A]	Result
1	2.117	100.000		
2	2.456E-3	0.116	1.08	PASS
3	7.947E-3	0.375	2.30	PASS
4	185.437E-6	0.009	430.00E-3	PASS
5	2.818E-3	0.133	1.14	PASS
6	489.585E-6	0.023	300.00E-3	PASS
7	4.131E-3	0.195	770.00E-3	PASS
8	455.853E-6	0.022	230.00E-3	PASS
9	2.653E-3	0.125	400.00E-3	PASS
10	541.753E-6	0.026	184.00E-3	PASS
11	3.716E-3	0.176	330.00E-3	PASS
12	215.032E-6	0.010	153.33E-3	PASS
13	3.024E-3	0.143	210.00E-3	PASS
14	510.405E-6	0.024	131.43E-3	PASS
15	3.314E-3	0.157	150.00E-3	PASS
16	366.485E-6	0.017	115.00E-3	PASS
17	2.876E-3	0.136	132.35E-3	PASS
18	460.956E-6	0.022	102.22E-3	PASS
19	2.505E-3	0.118	118.42E-3	PASS
20	219.607E-6	0.010	92.00E-3	PASS
21	2.613E-3	0.123	160.71E-3	PASS
22	439.924E-6	0.021	83.64E-3	PASS
23	2.038E-3	0.096	146.74E-3	PASS
24	298.799E-6	0.014	76.66E-3	PASS
25	2.133E-3	0.101	135.00E-3	PASS
26	459.389E-6	0.022	70.77E-3	PASS
27	1.327E-3	0.063	124.99E-3	PASS
28	390.136E-6	0.018	65.71E-3	PASS
29	2.004E-3	0.095	116.39E-3	PASS
30	315.244E-6	0.015	61.33E-3	PASS
31	1.220E-3	0.058	108.87E-3	PASS
32	125.502E-6	0.006	57.50E-3	PASS
33	1.244E-3	0.059	102.27E-3	PASS
34	278.470E-6	0.013	54.12E-3	PASS
35	975.700E-6	0.046	96.44E-3	PASS
36	486.389E-6	0.023	51.11E-3	PASS
37	726.022E-6	0.034	91.21E-3	PASS
38	207.559E-6	0.010	48.42E-3	PASS
39	609.548E-6	0.029	86.53E-3	PASS
40	433.046E-6	0.020	46.00E-3	PASS

Maximum harmonic voltage results

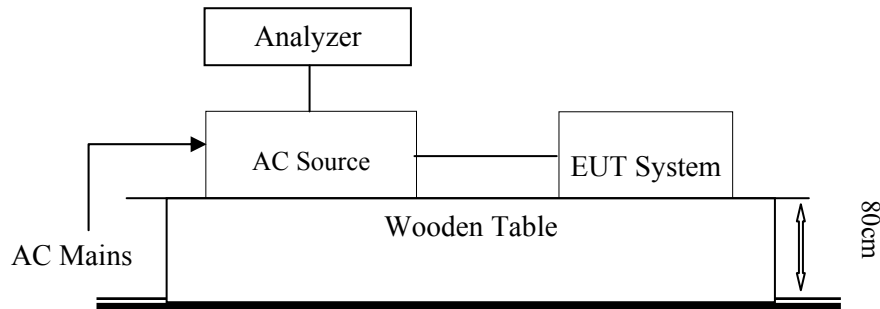
Hn	Ueff [V]	Ueff [%]	Limit [%]	Result
1	227.75	99.023		
2	188.63E-3	0.082	0.2	PASS
3	393.80E-3	0.171	0.9	PASS
4	38.44E-3	0.017	0.2	PASS
5	30.30E-3	0.013	0.4	PASS
6	24.02E-3	0.010	0.2	PASS
7	6.21E-3	0.003	0.3	PASS
8	18.47E-3	0.008	0.2	PASS
9	18.13E-3	0.008	0.2	PASS
10	8.14E-3	0.004	0.2	PASS
11	11.14E-3	0.005	0.1	PASS
12	8.35E-3	0.004	0.1	PASS
13	6.58E-3	0.003	0.1	PASS
14	10.89E-3	0.005	0.1	PASS
15	3.56E-3	0.002	0.1	PASS
16	11.34E-3	0.005	0.1	PASS
17	6.98E-3	0.003	0.1	PASS
18	10.38E-3	0.005	0.1	PASS
19	14.29E-3	0.006	0.1	PASS
20	3.35E-3	0.001	0.1	PASS
21	8.31E-3	0.004	0.1	PASS
22	2.83E-3	0.001	0.1	PASS
23	16.26E-3	0.007	0.1	PASS
24	4.01E-3	0.002	0.1	PASS
25	10.74E-3	0.005	0.1	PASS
26	5.72E-3	0.002	0.1	PASS
27	7.44E-3	0.003	0.1	PASS
28	8.64E-3	0.004	0.1	PASS
29	9.17E-3	0.004	0.1	PASS
30	5.70E-3	0.002	0.1	PASS
31	1.43E-3	0.001	0.1	PASS
32	7.48E-3	0.003	0.1	PASS
33	7.36E-3	0.003	0.1	PASS
34	6.62E-3	0.003	0.1	PASS
35	1.40E-3	0.001	0.1	PASS
36	8.55E-3	0.004	0.1	PASS
37	1.93E-3	0.001	0.1	PASS
38	7.62E-3	0.003	0.1	PASS
39	3.38E-3	0.001	0.1	PASS
40	8.09E-3	0.004	0.1	PASS

Test Setup Photo



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: Wireless Link&Operating
Power Source: AC 230V/50Hz
Test Result: PASS

Maximum Flicker results

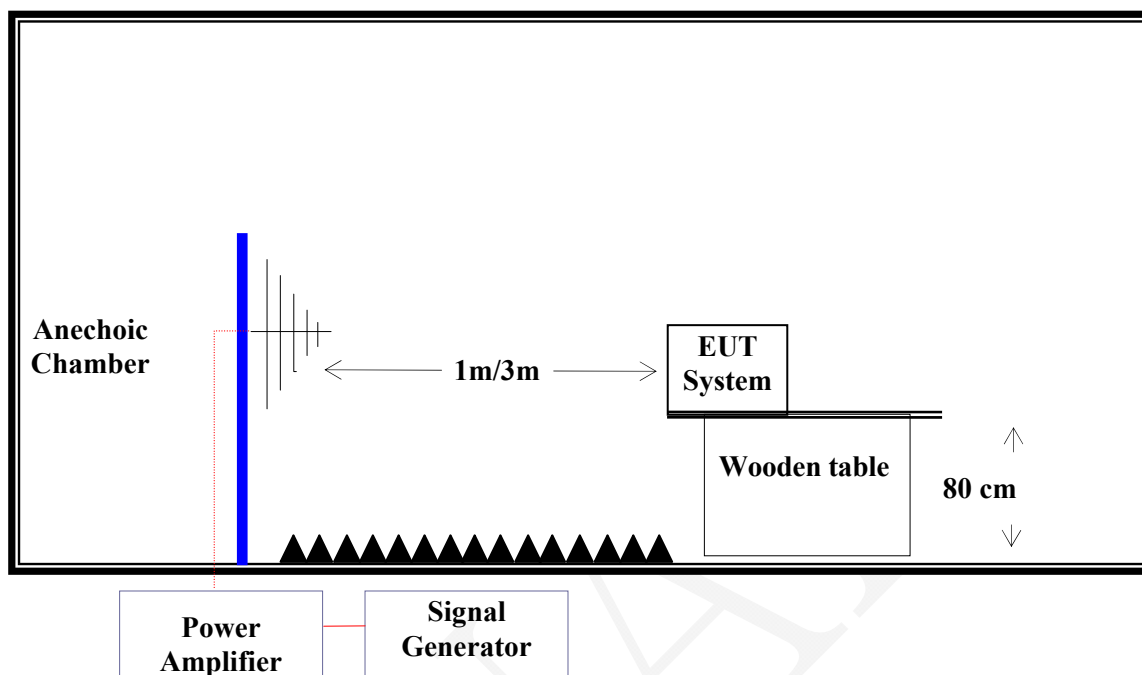
	EUT values	Limit	Result
Pst	0.028	1.00	PASS
Plt	0.028	0.65	PASS
dc [%]	0.042	3.30	PASS
dmax [%]	0.308	4.00	PASS
dt [s]	0.000	0.50	PASS

Test Setup Photo



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 (Below 1GHz) or 1 meter (Above 1GHz) 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 the 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: Wireless link and 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
80-6000	A	A	A	A	A	A	A	A

Performance criteria “A”

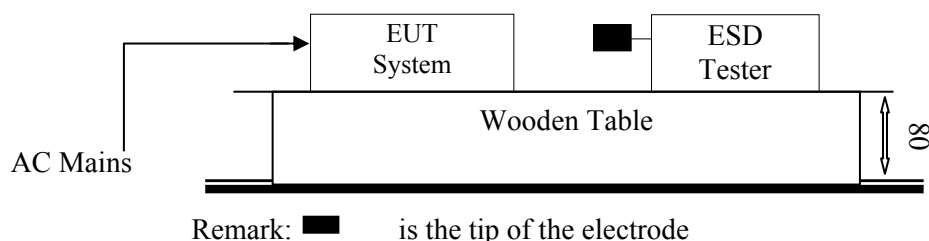
The EUT shall operate as intended with no loss of user control functions or stored data, and the communication link shall have been maintained.

Test Setup Photo



8 - ELECTROSTATIC DISCHARGES

Test System Setup



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 10 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: Wireless Link&Operating

Note:

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
Surface	A	A	A	A	A	A	/	/
Seam	A	A	A	A	A	A	/	/
Button	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
/	/	/	/	/	/	/	/	/

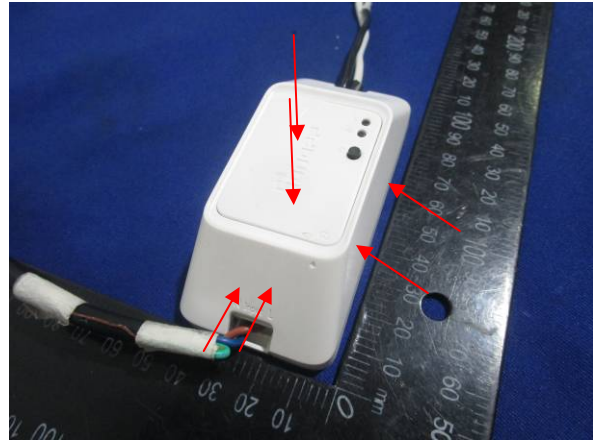
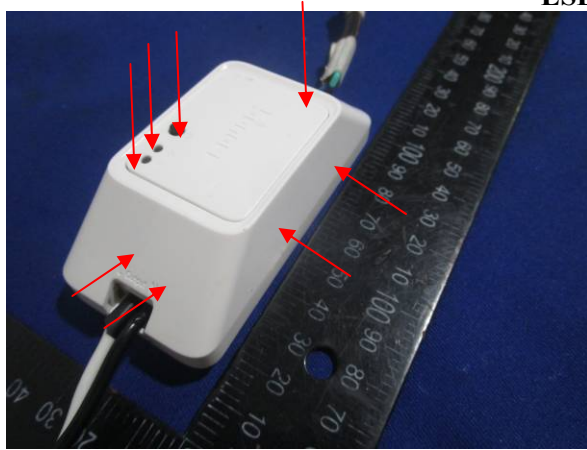
Table 3: Electrostatic Discharge Immunity (Indirect Contact HCP)


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: 

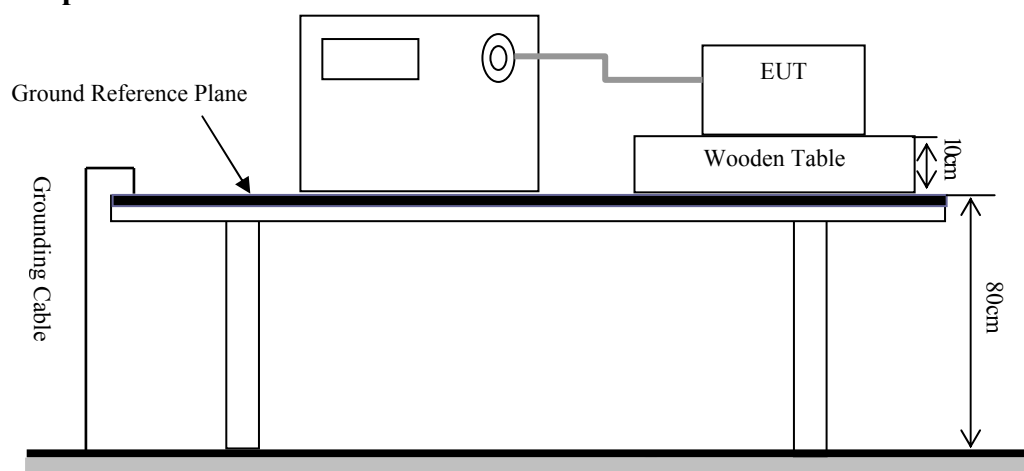
Direct Contact: 

Test Setup Photo



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

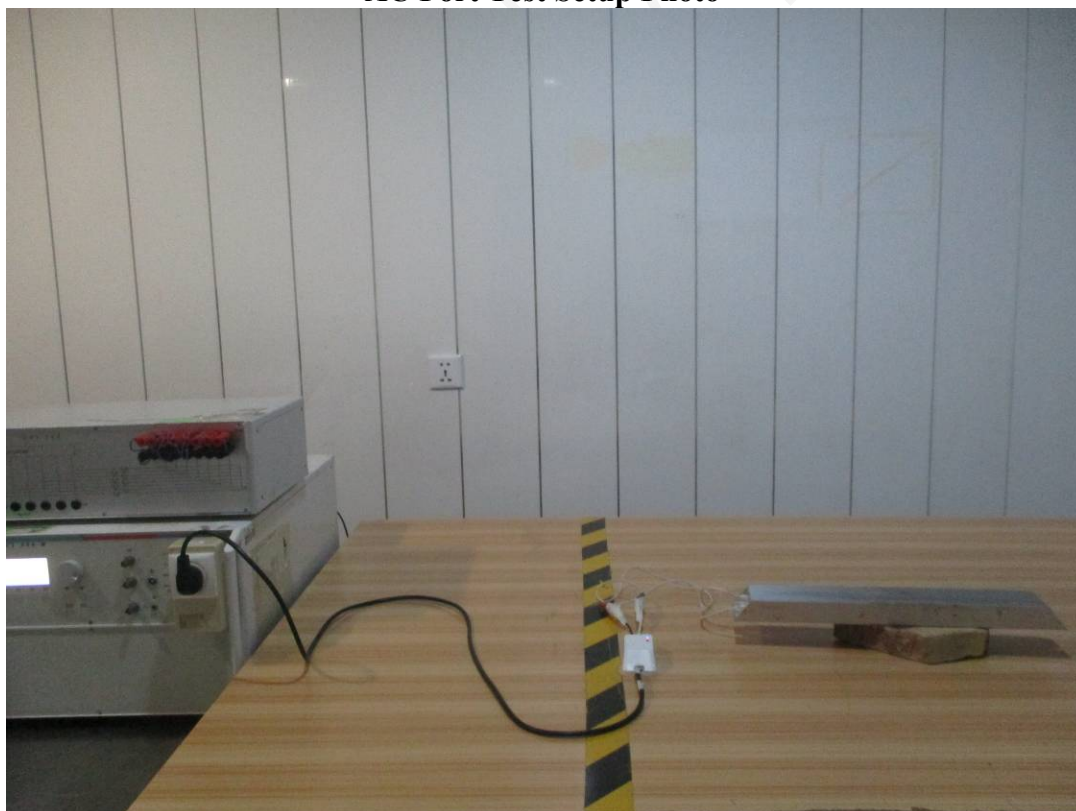
Please refer to following tables:

Test Mode: Wireless Link&Operating

Note:

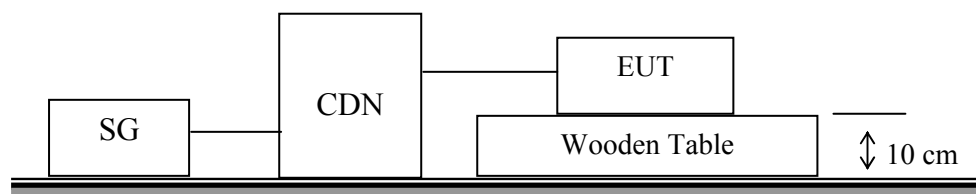
Test Points		Test Level (kV)							
		+0.5	-0.5	+1.0	-1.0	+2.0	-2.0	+4.0	-4.0
AC mains power input ports	L	A	A	A	A	/	/	/	/
	N	A	A	A	A	/	/	/	/
	Earth	/	/	/	/	/	/	/	/
	L+N	A	A	A	A	/	/	/	/
	L + Earth	/	/	/	/	/	/	/	/
	N + Earth	/	/	/	/	/	/	/	/
	L+N+Earth	/	/	/	/	/	/	/	/
Signal ports	/	/	/	/	/	/	/	/	/

AC Port Test Setup Photo



10 – RADIO FREQUENCY, COMMON MODE

Test 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: Wireless Link & 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

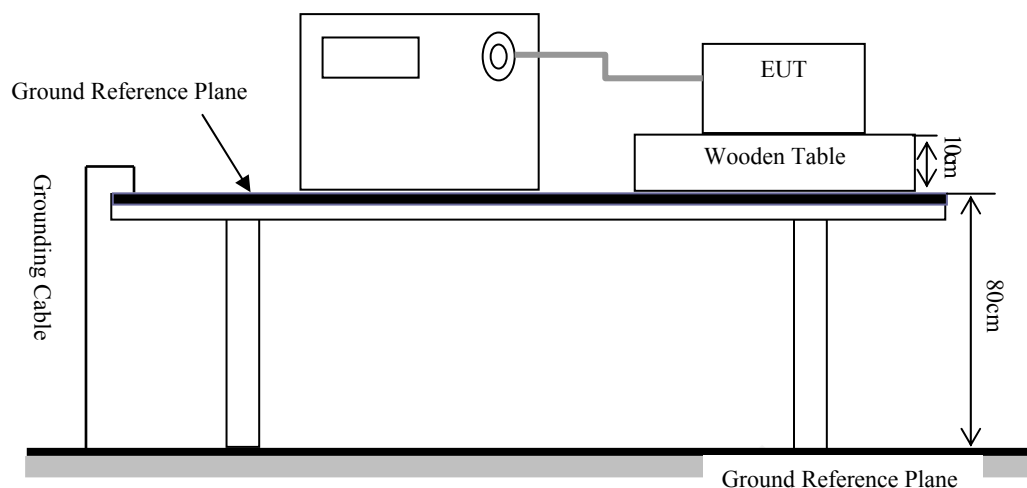
Level	Voltage Level (e.m.f.) U_0	Pass	Fail
1	1	/	/
2	3	A	/
3	10	/	/
X	Special	/	/

AC Port Test Setup Photo



12 - VOLTAGE DIPS AND SHORT INTERRUPTIONS

Test Setup



Test Level and Performance Criterion

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	B
4	0	250	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:

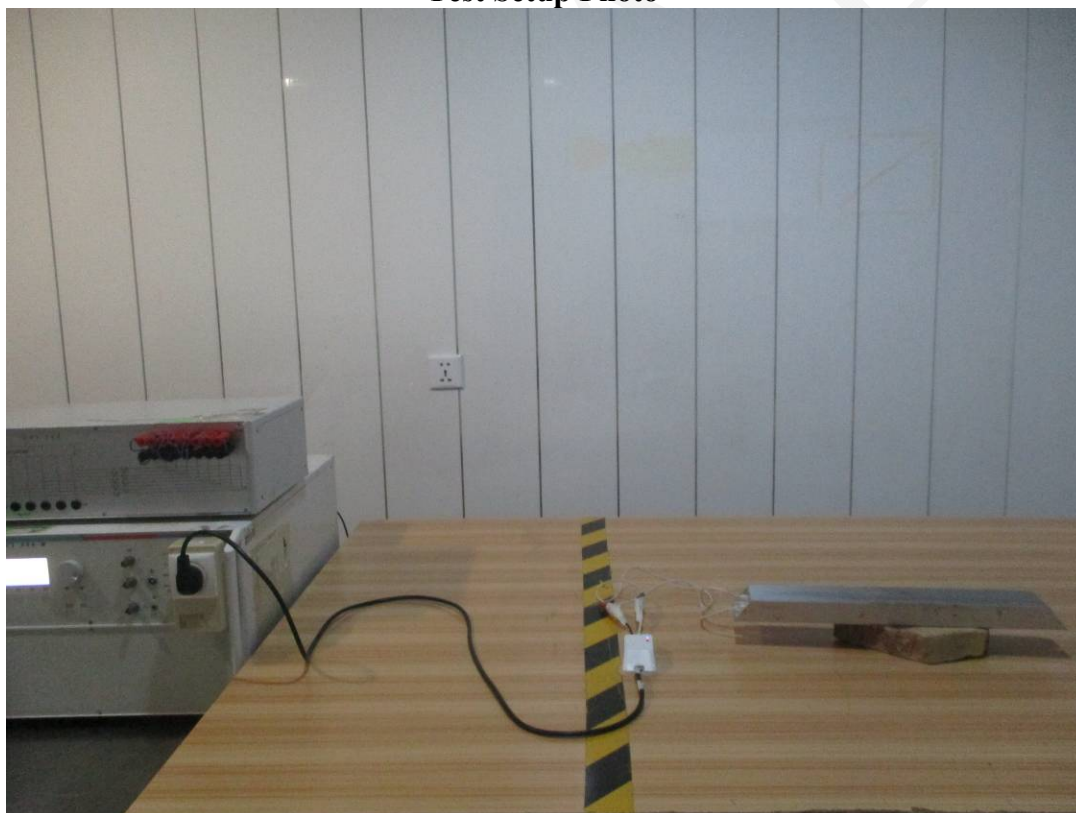
Test Mode: Wireless Link&Operating

Note: B indicates that the EUT was power off when it was tested, but it could recover normal use after test be finished.

Table 1: Voltage Dips/Interruptions Test

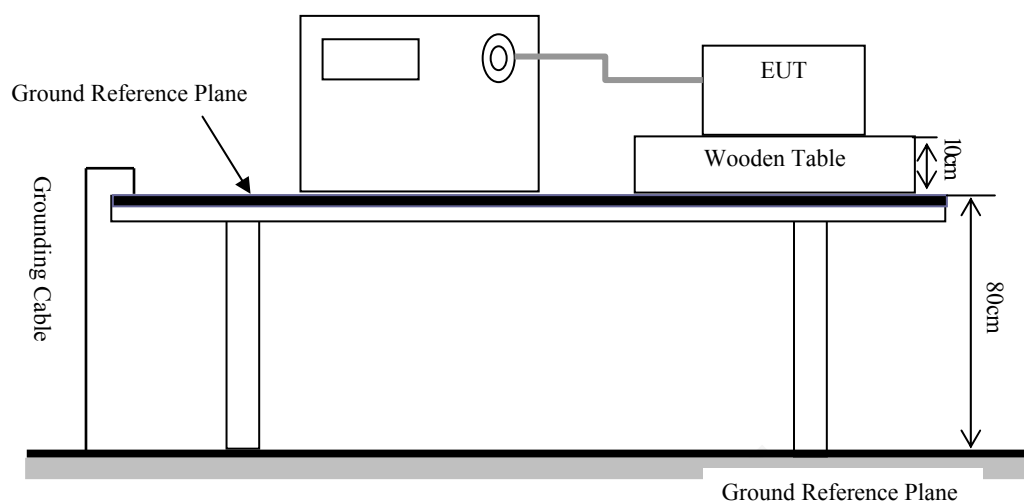
U2 (% Reduction)	Td (Periods)	Phase Angle	N	Result
100	0.5P	0/90/180/270	3	A
100	1P	0/90/180/270	3	A
30	25P	0/90/180/270	3	A
100	250P	0/90/180/270	3	B

Test Setup Photo



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: Wireless Link & 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	±	/	/	/

AC Port Test Setup Photo

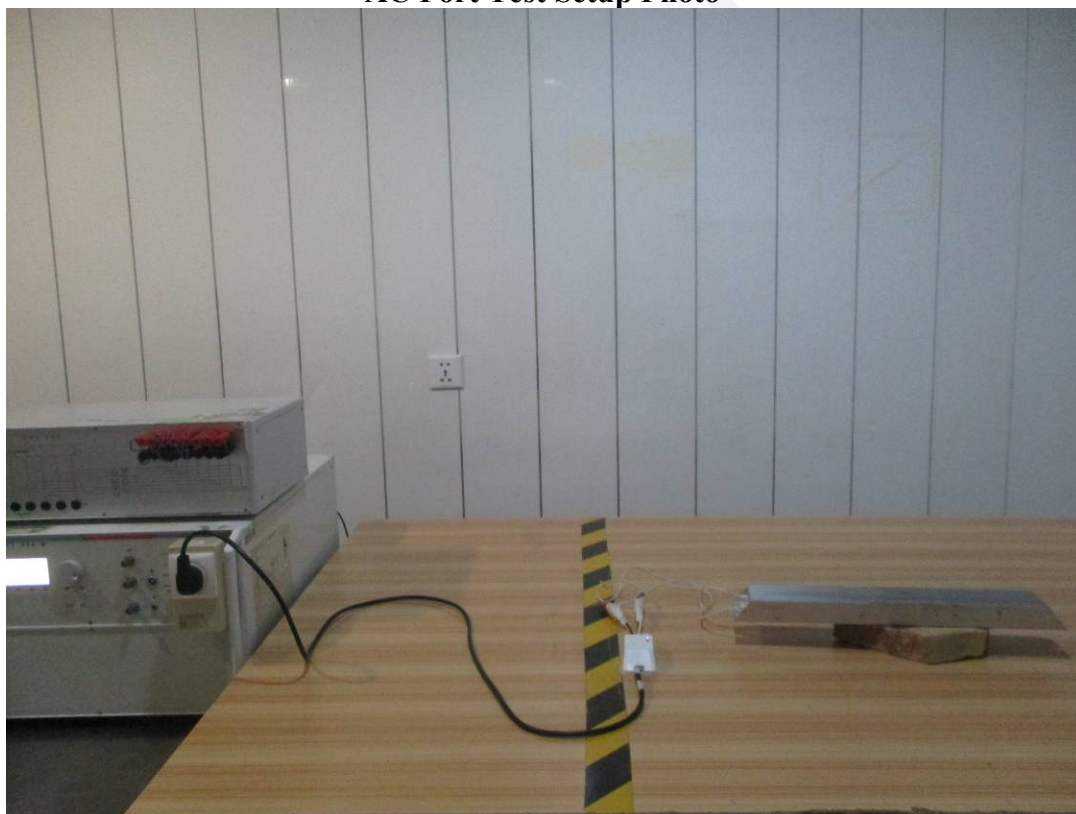
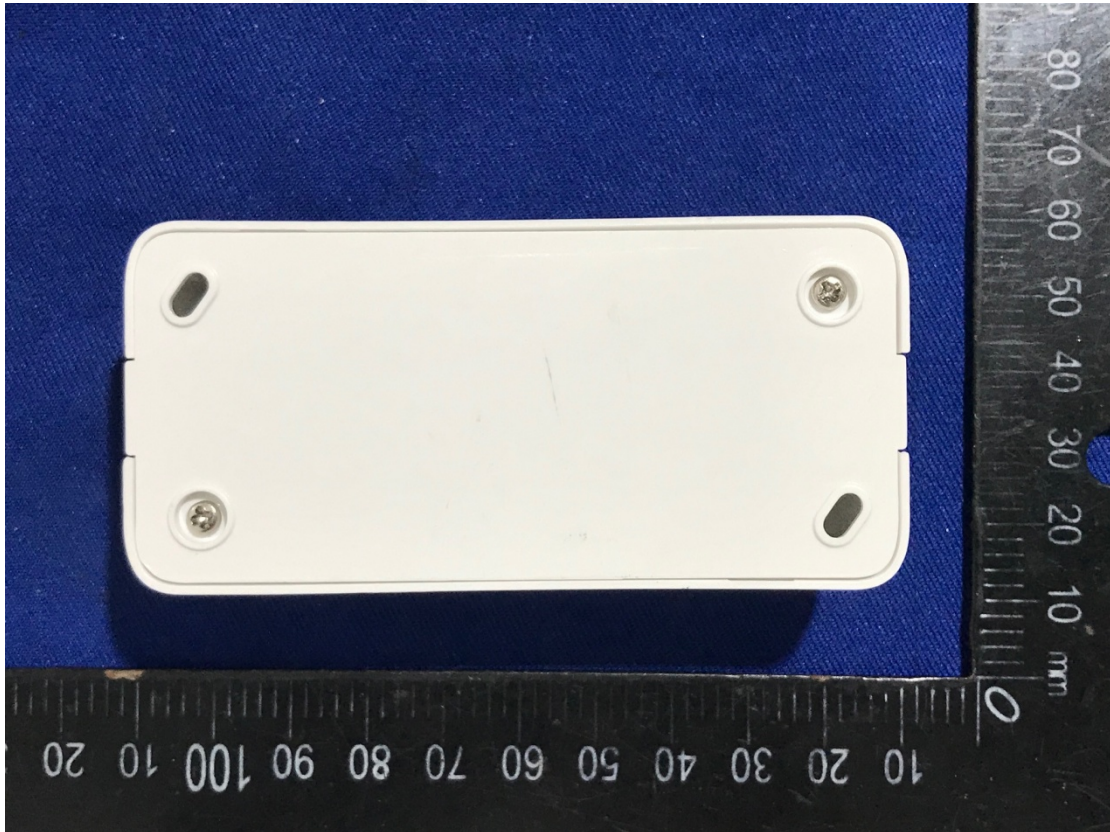


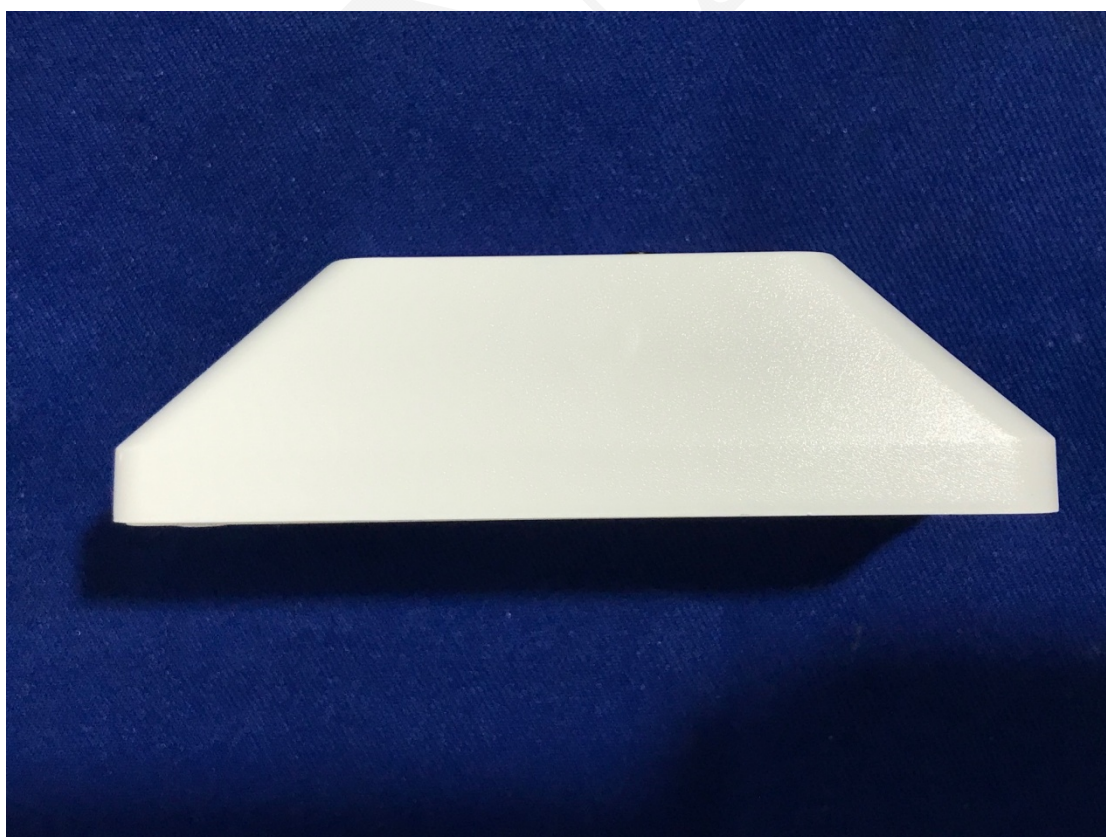
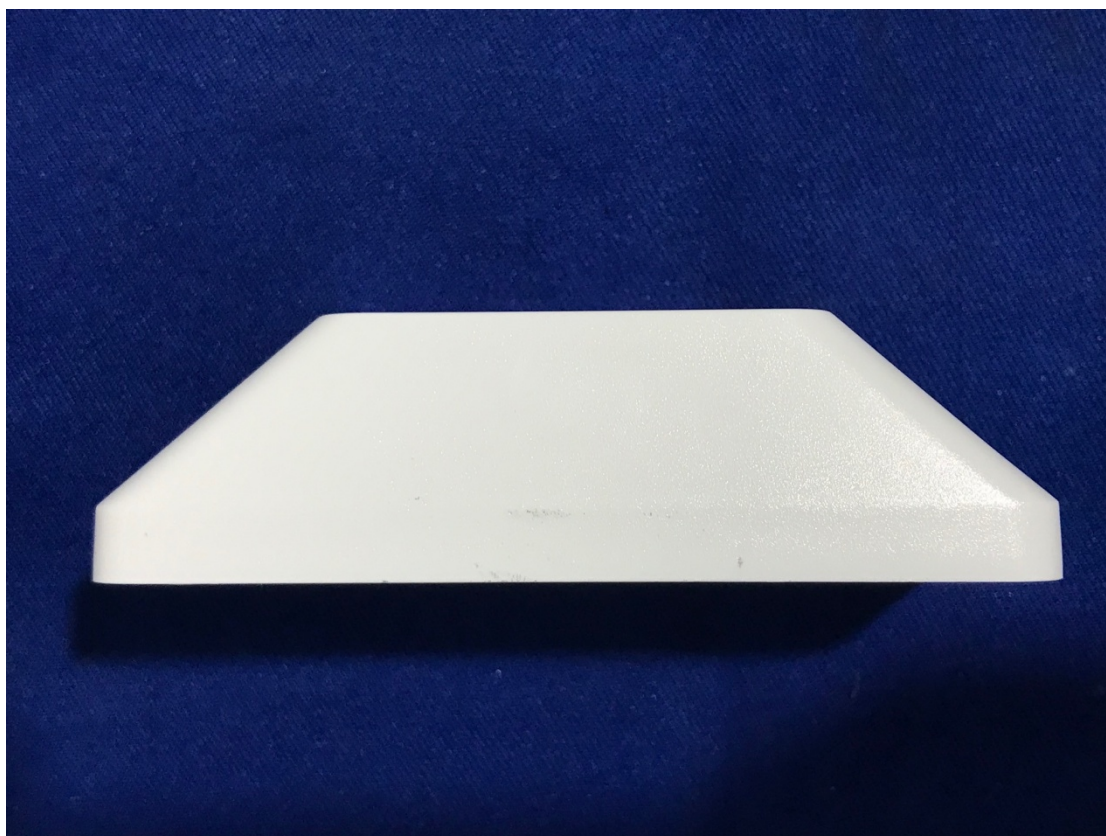
EXHIBIT A – EUT PHOTOGRAPHS

EUT Top



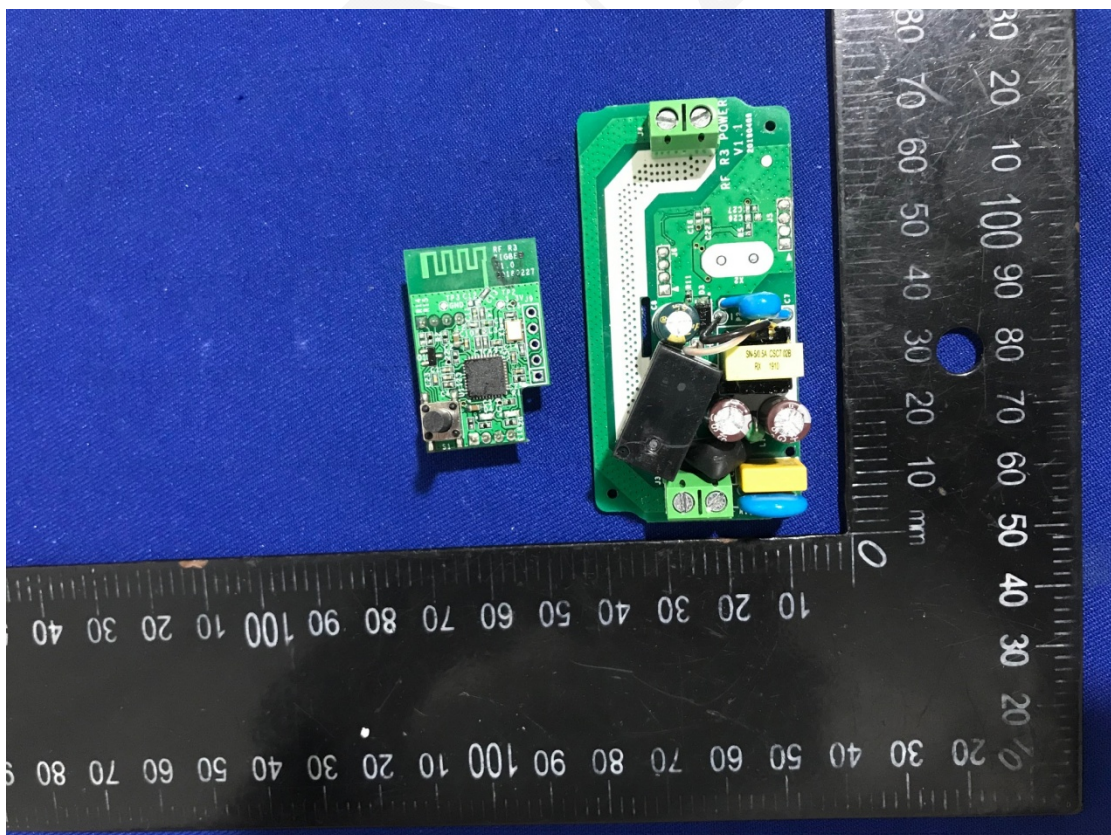
bottom

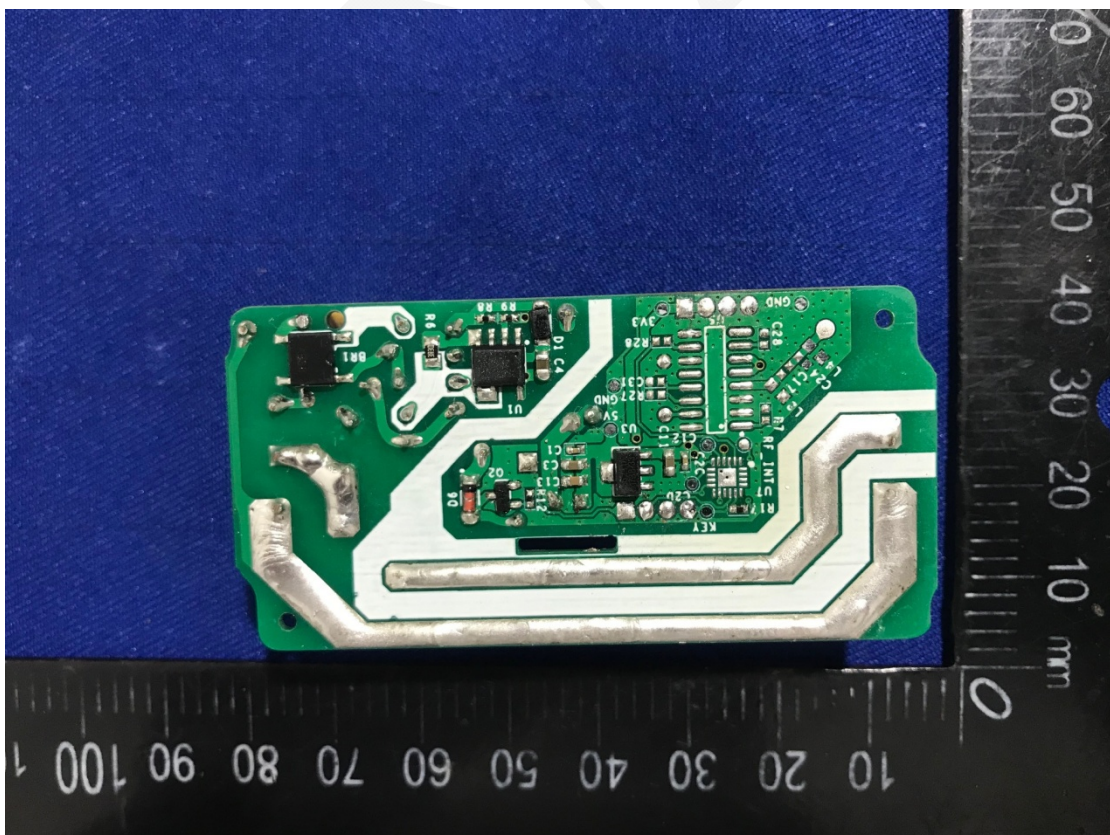
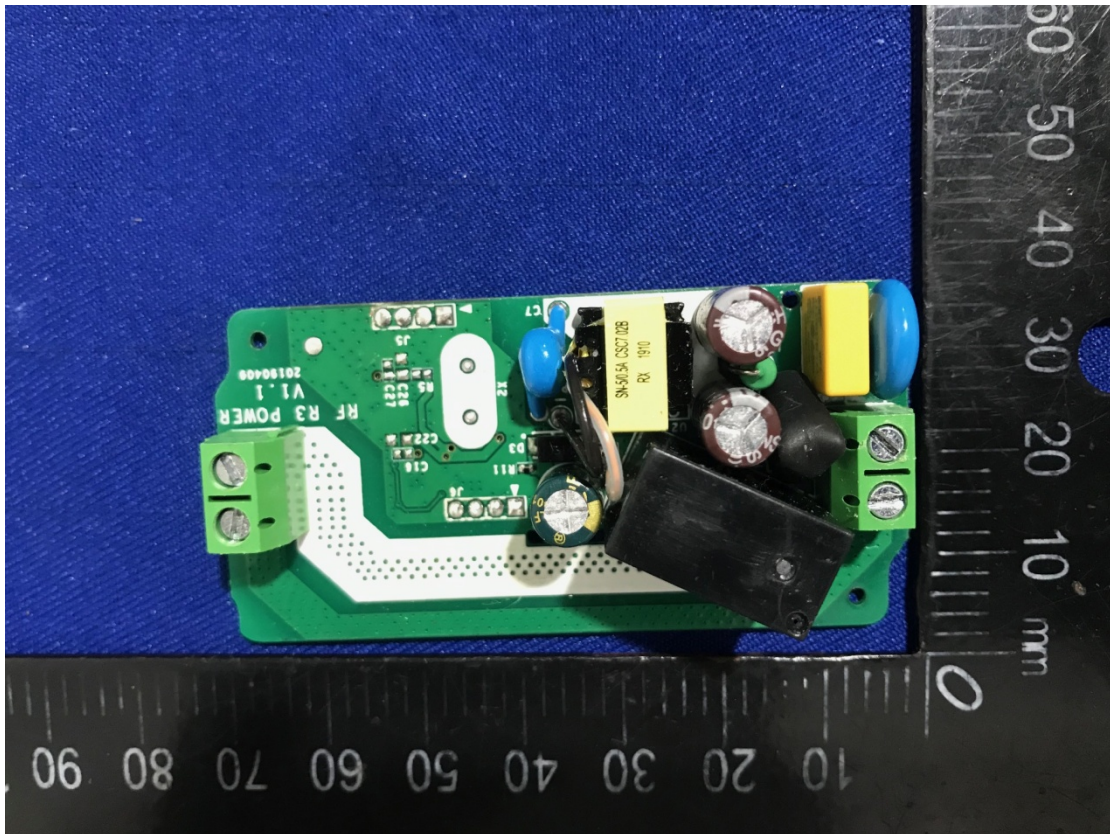






Uncover





Antenna

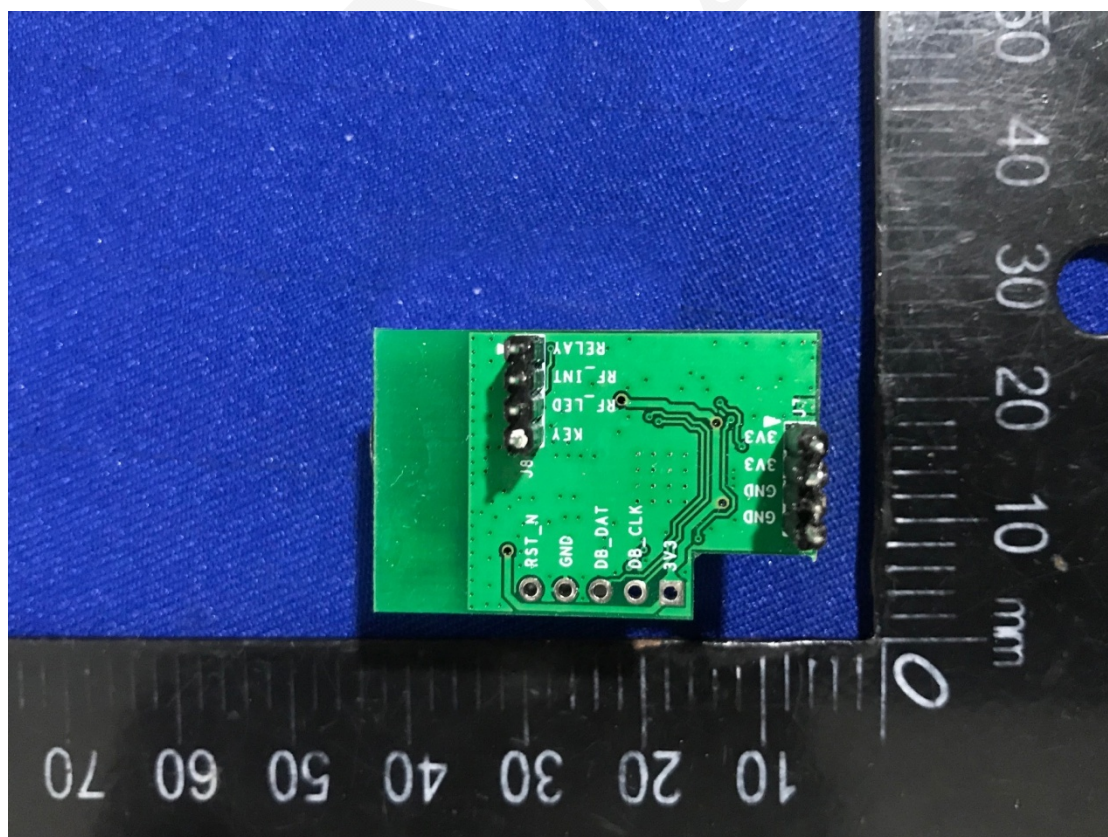
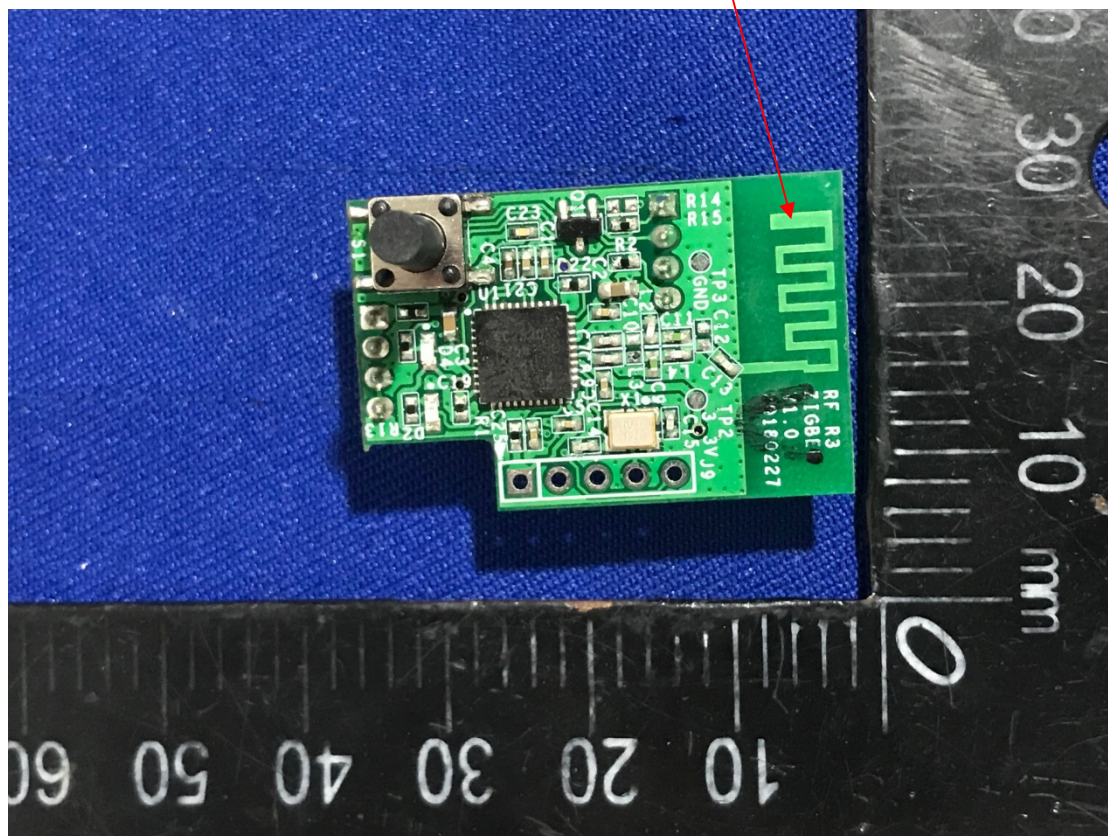
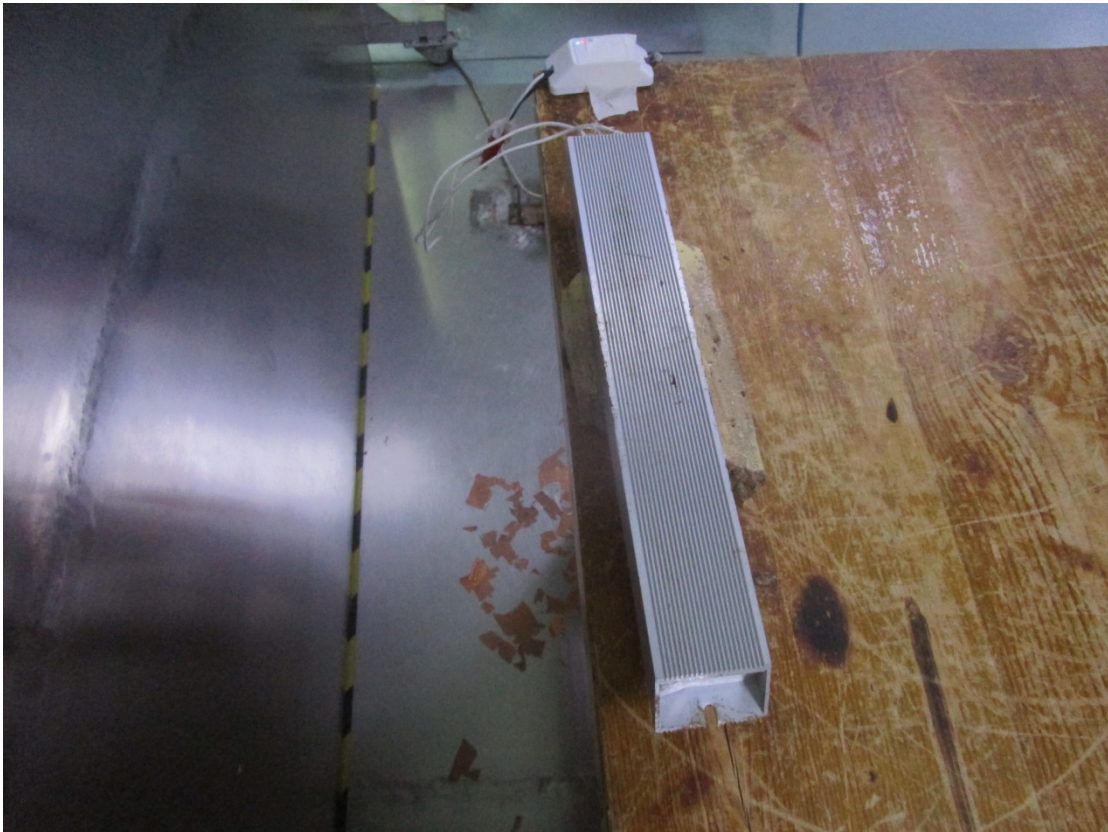


EXHIBIT B – TEST SETUP PHOTOGRAPHS

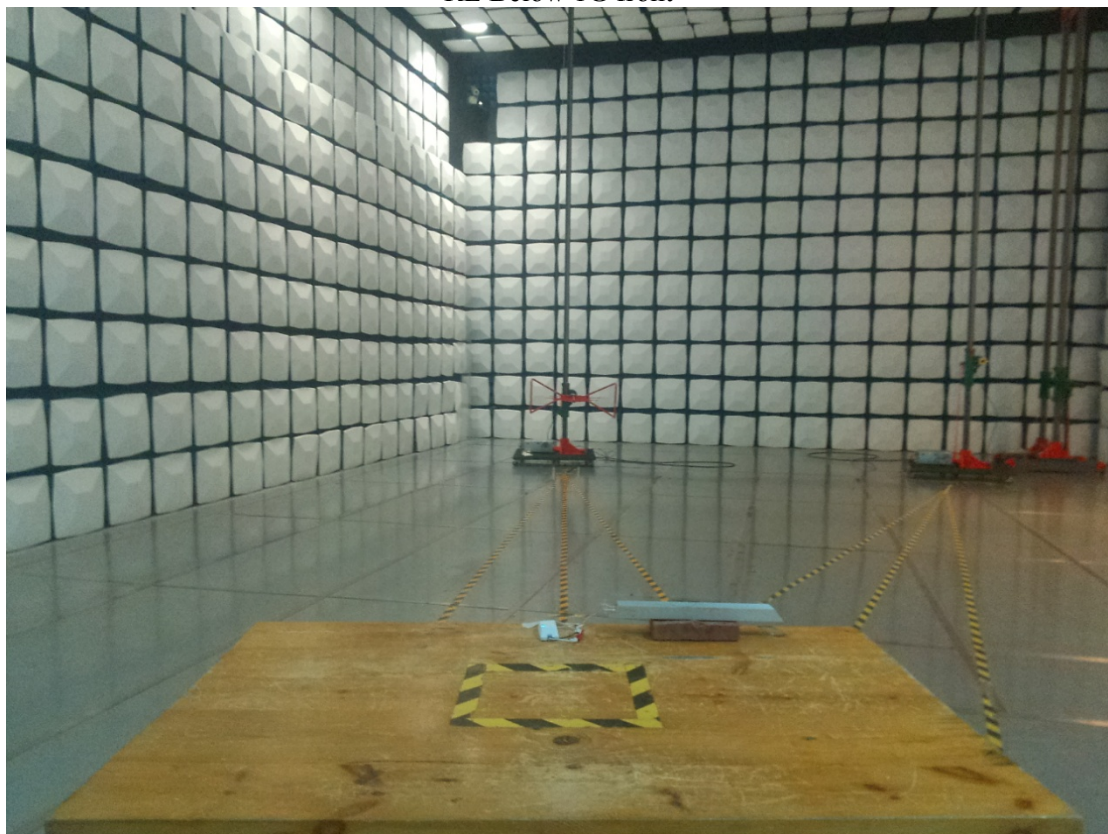
CE front View



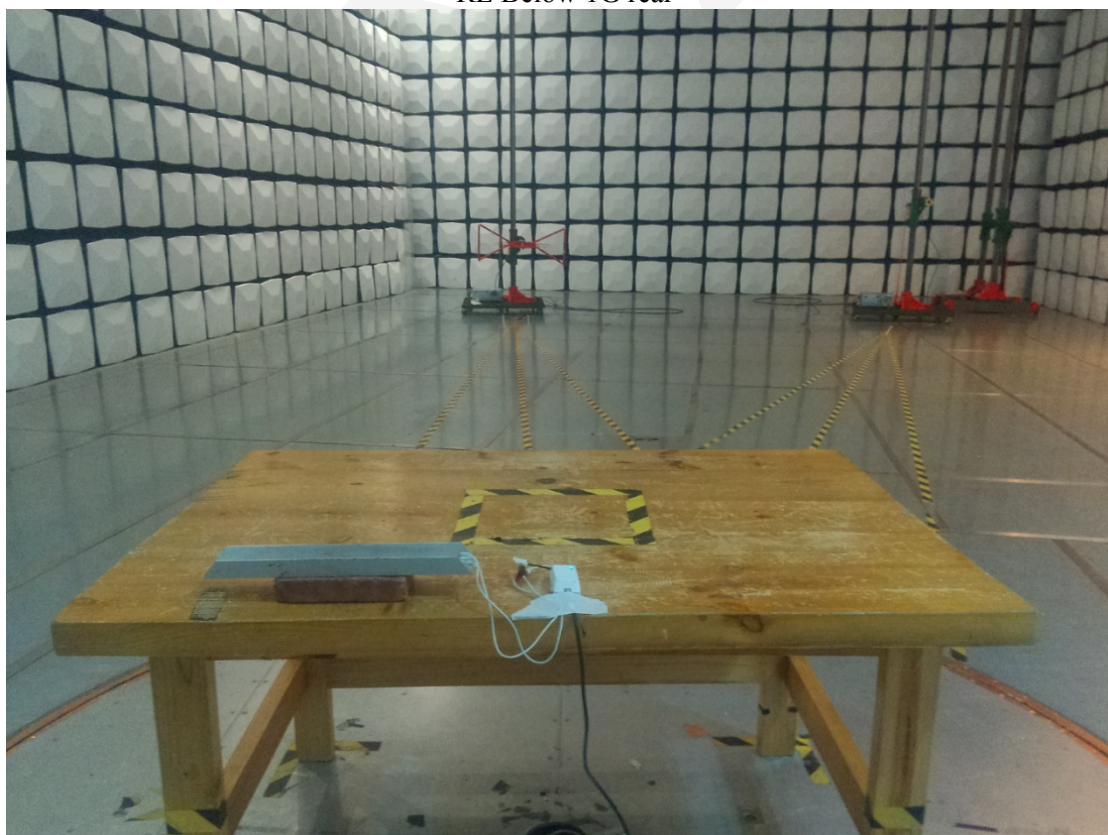
CE side View



RE Below 1G front



RE Below 1G rear



RE Above 1G rear



RE Above 1G front



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