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

TEST REPORT

For

Shenzhen Sonoff Technologies Co.,Ltd.

Building 8, Room 1001, Lianhua industrial park, Longyuan Road, Hualian community, Longhua St, Longhua dist, Shenzhen, Guangdong, China

Tested Model: TH16
Multiple Model: TH10

Report Type: Original Report	**Product Type:** WiFi Smart Switch
Report Number:	RDG180807018-02
Report Date:	2018-08-31
Reviewed By:	Allen Qiao RF Supervisor
Test Laboratory:	Bay Area Compliance Laboratories Corp. (Dongguan) No.69 Pulongcun, Puxinhu Industry Area, Tangxia, Dongguan, Guangdong, China Tel: +86-769-86858888 Fax: +86-769-86858891 www.baclcorp.com.cn

Note: This test report is prepared for the customer shown above and for the device described herein. It may not be duplicated or used in part without prior written consent from Bay Area Compliance Laboratories Corp. (Dongguan).

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GENERAL INFORMATION

Product Description for Equipment under Test (EUT)

EUT Name:	WiFi Smart Switch
EUT Model:	TH16
Multiple Models:	TH10
Rated Input Voltage:	100-240Vac
External Dimension:	114mm(L)*51mm(W)*32mm(H)
Serial Number:	180807018
EUT Received Date:	2018-08-10

Note: The series product, model TH16, TH10 are electrically identical. For marketing purpose, we selected TH16 for fully test. The differences between them are explained in the declaration letter.

Objective

This report is prepared on behalf of *Shenzhen Sonoff Technologies Co.,Ltd.* in accordance with ETSI EN 301 489-1 V2.2.0 (2017-03) 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 V2.2.0 (2017-03), ETSI EN 301 489-17 V3.2.0 (2017-03).

Test Methodology

All measurements contained in this report were conducted with ETSI EN 301 489-1 V2.2.0 (2017-03) 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.

SYSTEM TEST CONFIGURATION

Description of Test Configuration

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

Test mode: WIFI Link & Operating

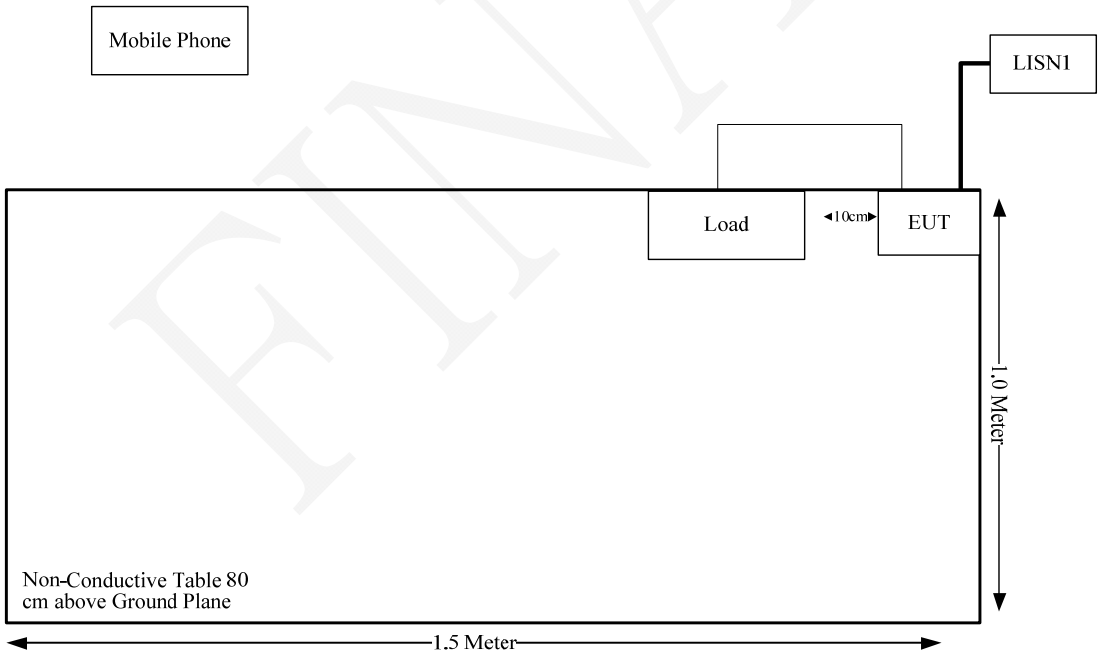
Equipment Modifications

No modification was made to the EUT.

EUT Exercise Software

No software was used during test.

Block Diagram of Test Setup



Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
unknown	load	/	/
APPLE	Mobile Phone	MGAA2CG/A	FK1R96UYG5QT

Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
Power Cable	no	no	1.5	EUT	LISN
Power Cable	no	no	1.0	EUT	Load
Power Cable	no	no	2.0	EUT	Ground

Test Equipment List

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date
R&S	EMI Test Receiver	ESCS 30	830245/006	2017-12-11	2018-12-11
N/A	Coaxial Cable	C-NJNJ-50	C-0200-01	2017-09-05	2018-09-05
R&S	Test Software	EMC32	Version8.53.0	N/A	N/A
R&S	Two-line V-network	ENV 216	101614	2017-12-08	2018-12-08
R&S	EMI Test Receiver	ESCI	100035	2018-08-03	2019-08-03
Farad	Test Software	EZ-EMC	V1.1.4.2	N/A	N/A
Sunol Sciences	Antenna	JB3	A060611-3	2017-07-21	2019-07-21
Unknown	Coaxial Cable	C-NJNJ-50	C-0400-02	2017-09-05	2018-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-0075-02	2017-09-05	2018-09-05
Unknown	Coaxial Cable	C-NJNJ-50	C-2200-01	2017-09-05	2018-09-05
HP	Amplifier	8447F	2443A01912	2017-09-05	2018-09-05
Agilent	Spectrum Analyzer	E4440A	SG43360054	2018-01-04	2019-01-04
ETS-Lindgren	Horn Antenna	3115	000 527 35	2016-01-05	2019-01-04
Unknown	Coaxial Cable	C-SJSJ-50	C-0800-01	2017-09-05	2018-09-05
MITEQ	Amplifier	AFS42-00101800-25-S-42	2001271	2017-09-05	2018-09-05
ELGAR	AC Power Source	1751SX	5611	2017-09-25	2018-09-25
EM TEST	Harmonic & Flicker Analyzer	DPA 500	303278	2017-12-13	2018-12-13
HP	Signal Generator	8648A	3246A00831	2017-12-14	2018-12-14
R&S	Power Amplifier	15A250	12934	N/A	N/A
NARDA	Attenuator	769-6	2754	N/A	N/A
COM-POWER	CDN	M325E	521064	2017-12-14	2018-12-14
EM TEST	Ultra Compact Generator	UCS500-M6	V6016101357	2018-01-04	2019-01-04
EM TEST	Auto Transformer	MV2616	0403-16	N/A	N/A
SCHAFFNER	ESD Tester	NSG435	005 101	2018-07-10	2019-07-10
Sunol Sciences	Antenna	JB3	A060611-2	2017-08-25	2020-08-25
Unknown	Coaxial Cable	C-NJNJ-50	C-1400-01	2018-05-06	2019-05-06
AR	Power Amplifier	100W1000M1	13410	N/A	N/A
AR	Power Amplifier	60S1G6	348711	N/A	N/A
HP	Signal Generator	8665B	3438a00584	2018-07-19	2019-07-19

* 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:	26.6~28.9 °C
Relative Humidity:	45~56%*
ATM Pressure:	99.6~100.2kPa
Tester:	Alex You, Blake Yang, Lily Xie, Kellen Tang
Test Date:	2018.08.13-2018.08.21

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 230Vac.
Not applicable**: The EUT without wired network port.
Not applicable***: This device 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_{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.

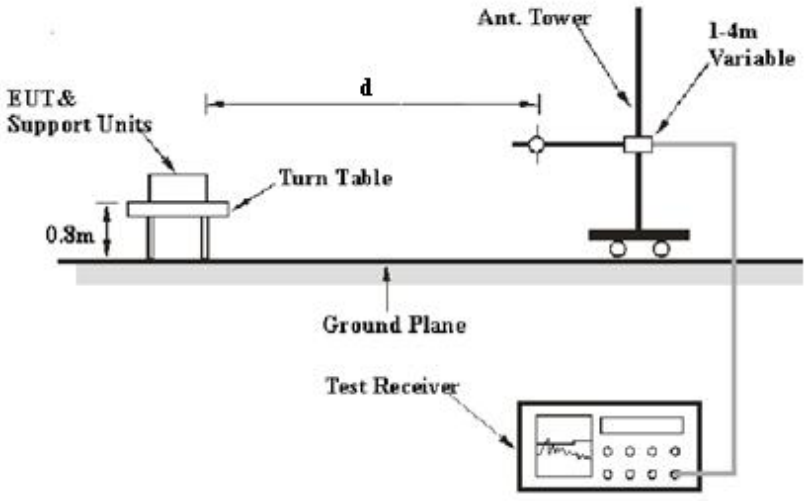
Based on CISPR 16-4-2: 2011, measurement uncertainty of radiated emission at a distance of 10m at Bay Area Compliance Laboratories Corp. (Dongguan) is:30M~200MHz: 4.55 dB for Horizontal, 4.57 dB for Vertical; 200M~1GHz: 4.66 dB for Horizontal, 4.56 dB for Vertical; measurement uncertainty of radiated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

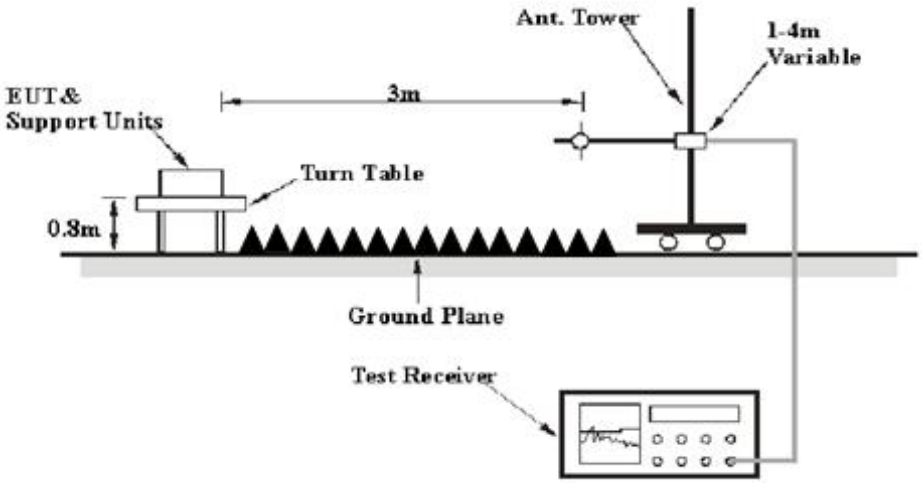
Measurement		U_{cispr}
Radiated disturbance (electric field strength at an OATS or in a SAC)	(30 MHz to 1000 MHz)	6.3 dB
Radiated disturbance (electric field strength in a FAR)	(1 GHz to 6 GHz)	5.2 dB
Radiated disturbance (electric field strength in a FAR)	(6 GHz to 18 GHz)	5.5 dB

Test System Setup

Below 1GHz:



Above 1GHz:



The radiated emission tests below 1GHz were performed in 10 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

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

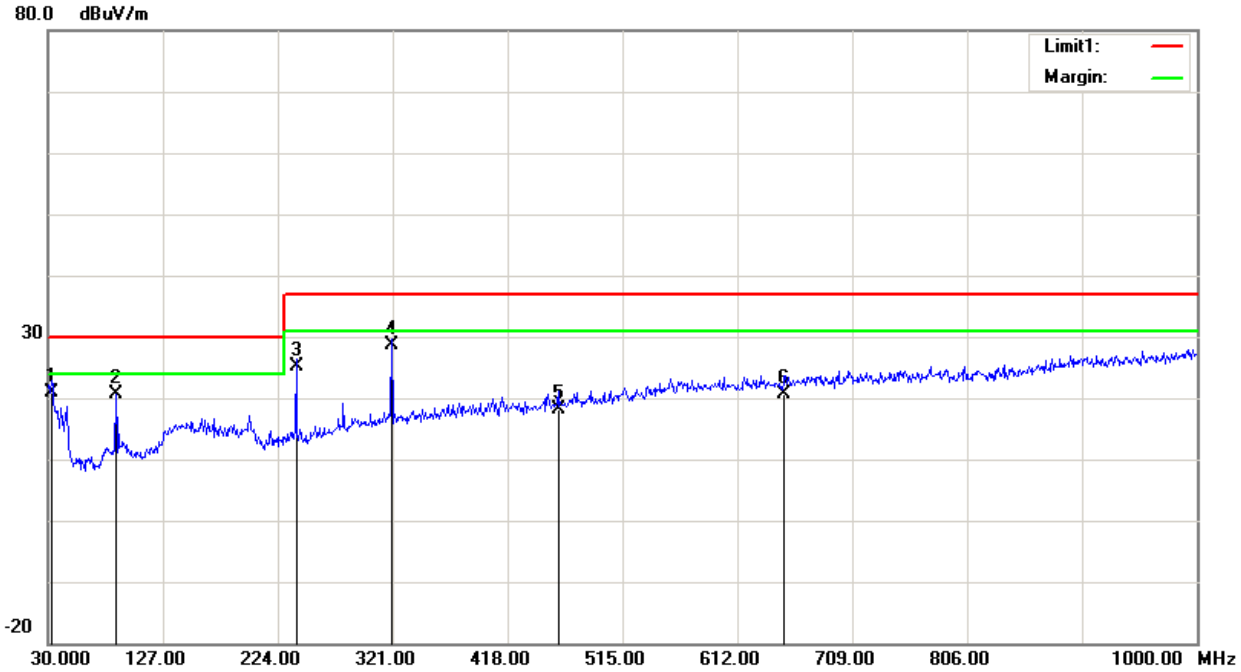
The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin = Limit – Result

Test Data

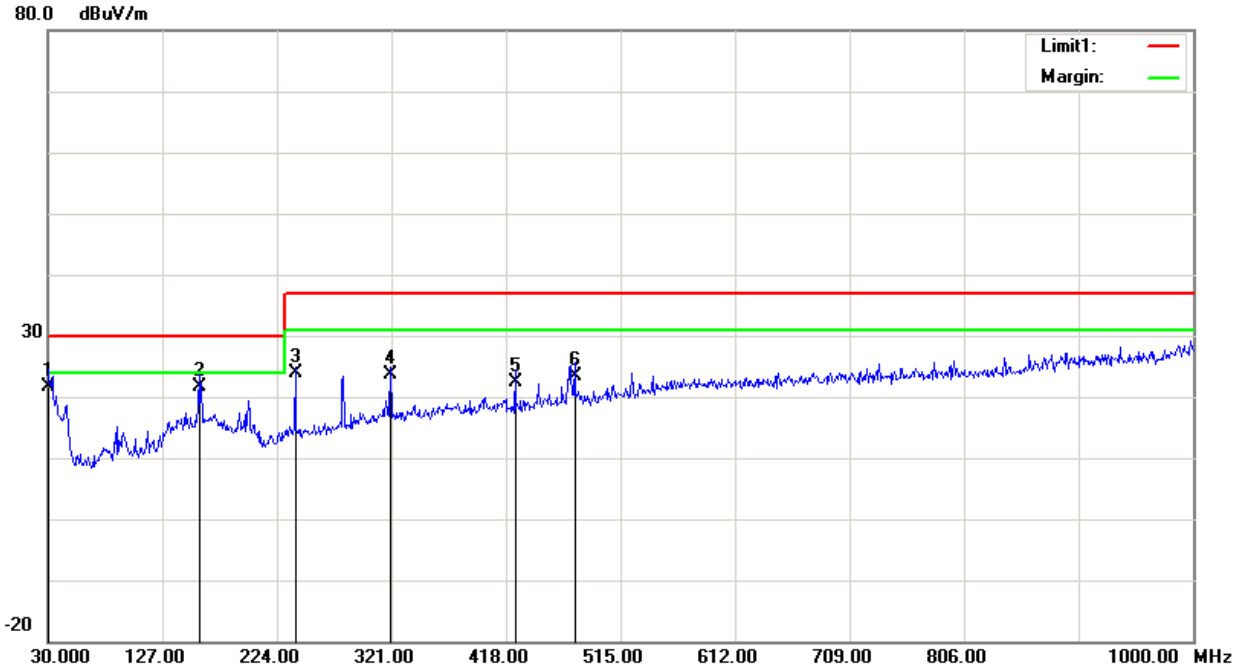
Please refer to following table and plots:

Condition:	**EN301489**	**Polarization:**	**Horizontal**
EUT:	WiFi Smart Switch	**Power:**	**AC 230V/50Hz**
Model:	**TH16**	**Distance:**	10m
Test Mode:	**WIFI Link & Operating**		
Note:	**Worst Case**		



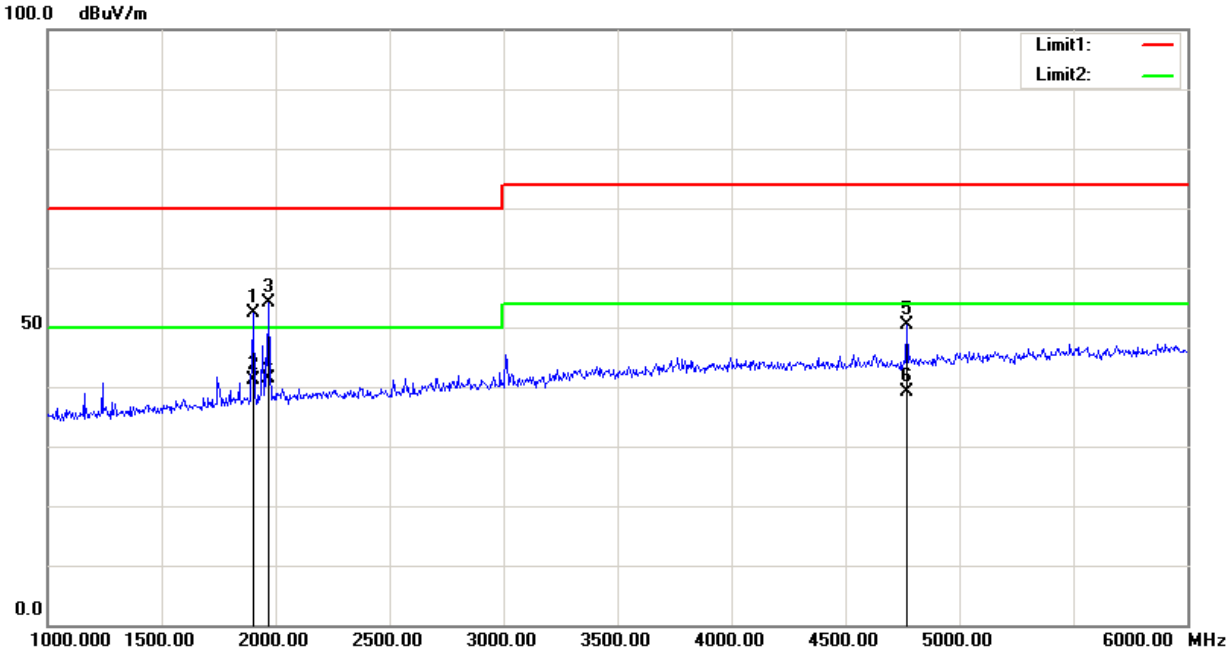
No.	Frequency (MHz)	Reading (dBµV)	Detector	Corrected dB/m	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1	32.9100	30.14	QP	-9.34	20.80	30.00	9.20
2	87.2300	39.56	QP	-18.86	20.70	30.00	9.30
3	239.5200	38.87	QP	-13.67	25.20	37.00	11.80
4	320.0300	39.03	QP	-10.43	28.60	37.00	8.40
5	460.6800	25.34	QP	-7.24	18.10	37.00	18.90
6	651.7700	23.15	QP	-2.55	20.60	37.00	16.40

Condition:	**EN301489**	**Polarization:**	**Horizontal**
EUT:	WiFi Smart Switch	**Power:**	**AC 230V/50Hz**
Model:	**TH16**	**Distance:**	10m
Test Mode:	**WIFI Link & Operating**		
Note:	**Worst Case**		



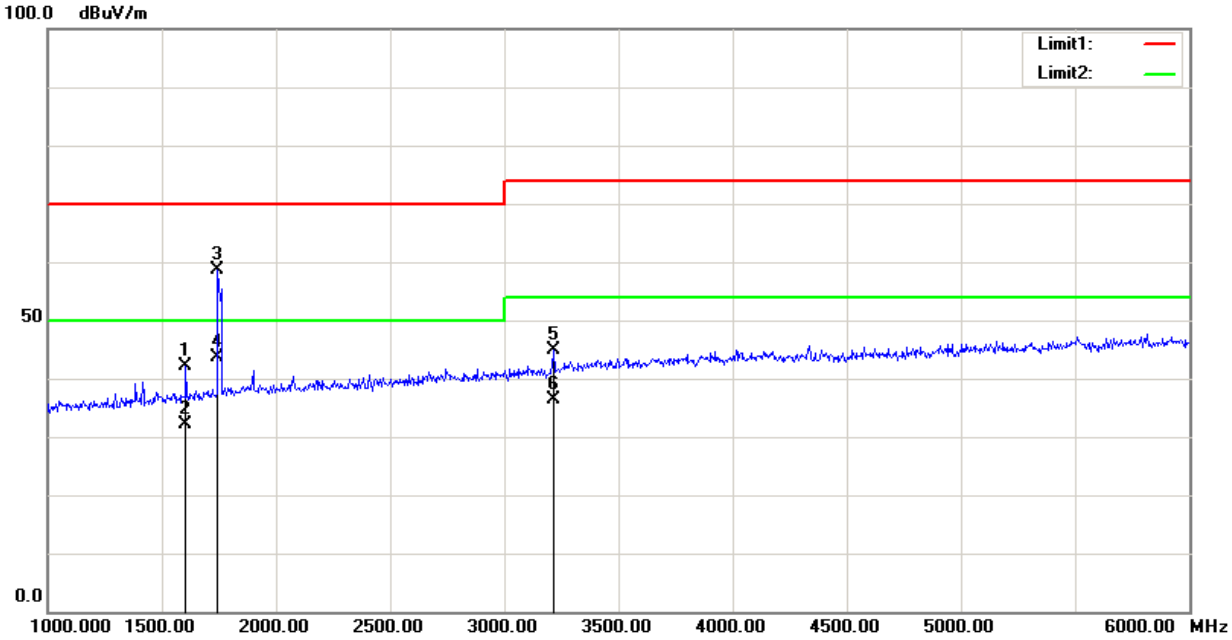
No.	Frequency (MHz)	Reading (dBµV)	Detector	Corrected dB/m	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1	30.0000	29.61	QP	-7.91	21.70	30.00	8.30
2	158.0400	34.45	QP	-12.85	21.60	30.00	8.40
3	239.5200	37.67	QP	-13.67	24.00	37.00	13.00
4	320.0300	34.13	QP	-10.43	23.70	37.00	13.30
5	425.7600	30.36	QP	-8.06	22.30	37.00	14.70
6	476.2000	30.37	QP	-6.87	23.50	37.00	13.50

Condition:	**EN 301489 Class B**	**Polarization:**	**Horizontal**
EUT:	WiFi Smart Switch	**Power:**	**AC 230V/50Hz**
Model:	**TH16**	**Distance:**	3m
Test Mode:	**WIFI Link & Operating**		
Note:	**Worst Case**		



No.	Frequency (MHz)	Reading (dBµV)	Detector	Corrected dB/m	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1	1905.000	59.89	peak	-7.53	52.36	70.00	17.64
2	1905.000	48.72	AVG	-7.53	41.19	50.00	8.81
3	1972.500	61.39	peak	-7.28	54.11	70.00	15.89
4	1972.500	48.63	AVG	-7.28	41.35	50.00	8.65
5	4772.500	51.64	peak	-1.20	50.44	74.00	23.56
6	4772.500	40.35	AVG	-1.20	39.15	54.00	14.85

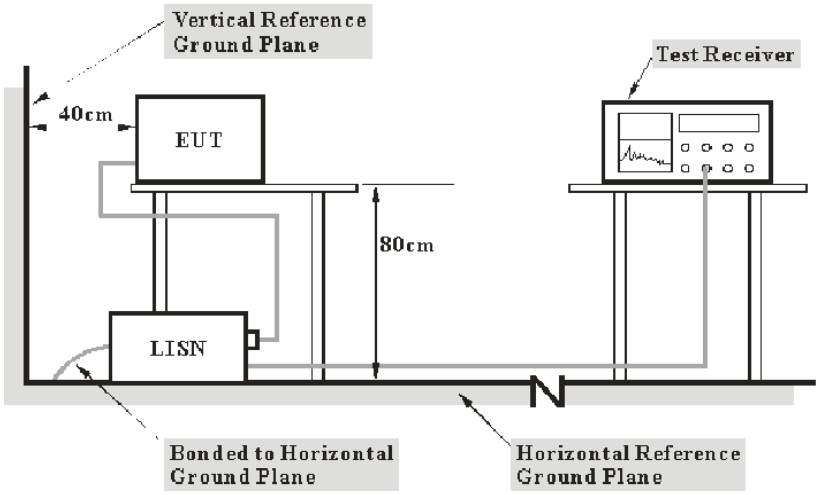
Condition:	**EN 301489 Class B**	**Polarization:**	**Vertical**
EUT:	WiFi Smart Switch	**Power:**	**AC 230V/50Hz**
Model:	**TH16**	**Distance:**	3m
Test Mode:	**WIFI Link & Operating**		
Note:	**Worst Case**		



No.	Frequency (MHz)	Reading (dBµV)	Detector	Corrected dB/m	Result (dBµV/m)	Limit (dBµV/m)	Margin (dB)
1	1605.000	50.86	peak	-8.71	42.15	70.00	27.85
2	1605.000	40.72	AVG	-8.71	32.01	50.00	17.99
3	1747.500	66.76	peak	-8.14	58.62	70.00	11.38
4	1747.500	51.68	AVG	-8.14	43.54	50.00	6.46
5	3215.000	49.13	peak	-4.16	44.97	74.00	29.03
6	3215.000	40.65	AVG	-4.16	36.49	54.00	17.51

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 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.

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

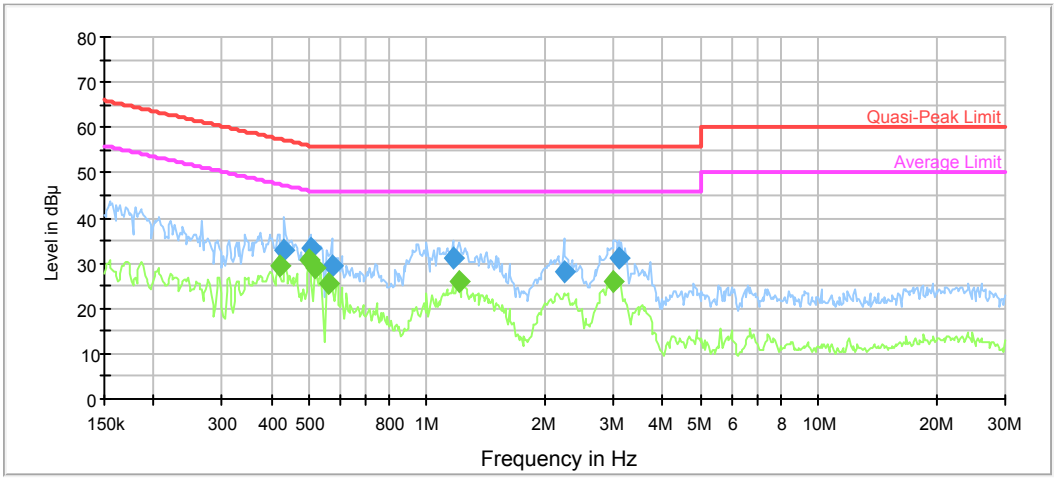
The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin = Limit – Result

Test Data

Please refer to following table and plots:

Model Number:	TH16
Port:	L
Test Mode:	WIFI Link & Operating
Power Source:	AC 230V/50Hz
Note:	Worst Case



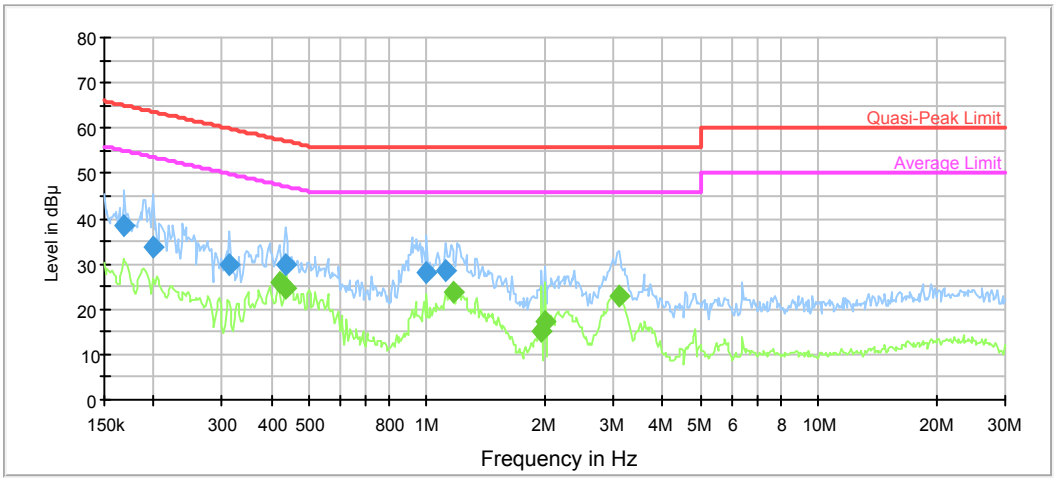
Final Result 1

Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.432855	32.7	9.000	L1	9.9	24.5	57.2
0.503608	33.2	9.000	L1	9.9	22.8	56.0
0.572086	29.2	9.000	L1	9.8	26.8	56.0
1.162648	31.0	9.000	L1	9.8	25.0	56.0
2.234662	27.9	9.000	L1	9.7	28.1	56.0
3.098088	31.0	9.000	L1	9.8	25.0	56.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.419276	29.2	9.000	L1	10.0	18.3	47.5
0.499611	30.6	9.000	L1	9.9	15.4	46.0
0.519918	28.8	9.000	L1	9.9	17.2	46.0
0.558572	25.5	9.000	L1	9.9	20.5	46.0
1.209904	25.9	9.000	L1	9.8	20.1	46.0
3.000901	25.9	9.000	L1	9.8	20.1	46.0

Model Number:	TH16
Port:	N
Test Mode:	WIFI Link & Operating
Power Source:	AC 230V/50Hz
Note:	Worst Case



Final Result 1

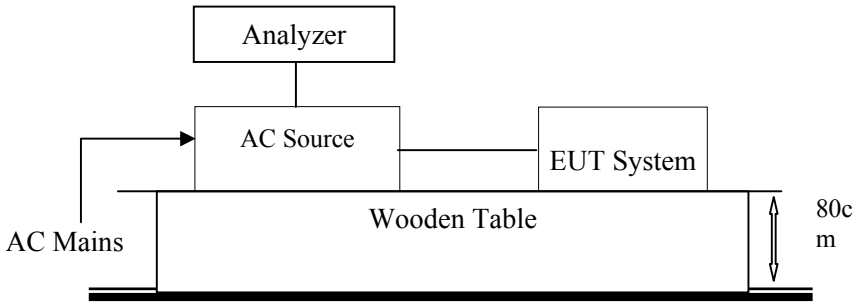
Frequency (MHz)	QuasiPeak (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.169044	38.4	9.000	N	10.9	26.6	65.0
0.199835	33.9	9.000	N	10.6	29.7	63.6
0.312220	29.9	9.000	N	10.1	30.0	59.9
0.436318	29.7	9.000	N	9.9	27.4	57.1
0.999305	28.3	9.000	N	9.8	27.7	56.0
1.117238	28.5	9.000	N	9.8	27.5	56.0

Final Result 2

Frequency (MHz)	Average (dBµV)	Bandwidth (kHz)	Line	Corr. (dB)	Margin (dB)	Limit (dBµV)
0.419276	25.7	9.000	N	10.0	21.8	47.5
0.436318	24.6	9.000	N	9.9	22.5	47.1
1.162648	23.9	9.000	N	9.8	22.1	46.0
1.967177	15.1	9.000	N	9.7	30.9	46.0
1.998778	17.5	9.000	N	9.7	28.5	46.0
3.098088	23.1	9.000	N	9.8	22.9	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
$15 \le n \le 39$	$0{,}15 \frac{15}{n}$
Even harmonics	
2	1,08
4	0,43
6	0,30
$8 \le n \le 40$	$0{,}23 \frac{8}{n}$

Table 2 – Limits for Class C equipment

Harmonic order n	Maximum permissible harmonic currrent expressed as a percentage of the input current at the fundamental frequency %
2	2
3	$30 \cdot \lambda$ *
5	10
7	7
9	5
$11 \le n \le 39$ (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
$13 \le n \le 39$ (odd harmonics only)	$\frac{3{,}85}{n}$	See Table 1

Test Data

Please refer to following tables:

Test Mode:	WIFI Link & Operating
Standard used:	EN/IEC 61000-3-2 A14 (2000) Quasi-stationary Equipment class A
Observation time:	150s
Windows width:	10 periods
Note:	Worst Case

Average harmonic current results

Hn	Ieff [A]	Ieff [%]	Limit [A]	Result
1	2.266	100.000		
2	2.836E-3	0.125	1.08	PASS
3	9.308E-3	0.411	2.30	PASS
4	1.042E-3	0.046	430.00E-3	PASS
5	3.979E-3	0.176	1.14	PASS
6	938.081E-6	0.041	300.00E-3	PASS
7	4.020E-3	0.177	770.00E-3	PASS
8	862.228E-6	0.038	230.00E-3	PASS
9	3.501E-3	0.155	400.00E-3	PASS
10	893.818E-6	0.039	184.00E-3	PASS
11	3.294E-3	0.145	330.00E-3	PASS
12	751.288E-6	0.033	153.33E-3	PASS
13	3.472E-3	0.153	210.00E-3	PASS
14	1.309E-3	0.058	131.43E-3	PASS
15	2.875E-3	0.127	150.00E-3	PASS
16	751.198E-6	0.033	115.00E-3	PASS
17	3.010E-3	0.133	132.35E-3	PASS
18	882.561E-6	0.039	102.22E-3	PASS
19	2.928E-3	0.129	118.42E-3	PASS
20	815.439E-6	0.036	92.00E-3	PASS
21	2.465E-3	0.109	160.71E-3	PASS
22	755.232E-6	0.033	83.64E-3	PASS
23	2.652E-3	0.117	146.74E-3	PASS
24	786.947E-6	0.035	76.66E-3	PASS
25	2.174E-3	0.096	135.00E-3	PASS
26	745.260E-6	0.033	70.77E-3	PASS
27	1.988E-3	0.088	124.99E-3	PASS
28	1.150E-3	0.051	65.71E-3	PASS
29	1.904E-3	0.084	116.39E-3	PASS
30	728.310E-6	0.032	61.33E-3	PASS
31	1.574E-3	0.069	108.87E-3	PASS
32	835.852E-6	0.037	57.50E-3	PASS
33	1.717E-3	0.076	102.27E-3	PASS
34	720.543E-6	0.032	54.12E-3	PASS
35	1.333E-3	0.059	96.44E-3	PASS
36	746.935E-6	0.033	51.11E-3	PASS
37	1.415E-3	0.062	91.21E-3	PASS
38	732.180E-6	0.032	48.42E-3	PASS
39	1.070E-3	0.047	86.53E-3	PASS
40	739.157E-6	0.033	46.00E-3	PASS

Maximum harmonic current results

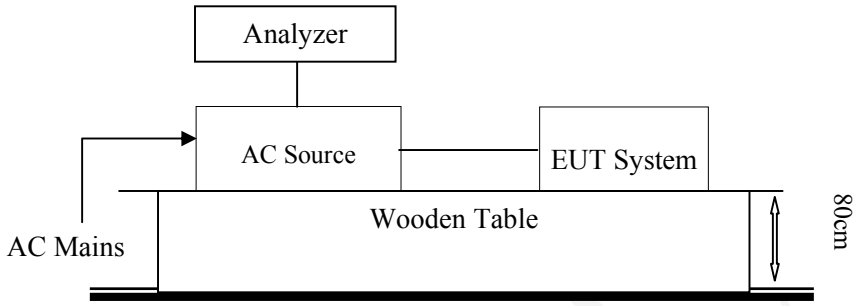
Hn	Ieff [A]	Ieff [%]	Limit [A]	Result
1	2.281	100.000		
2	10.883E-3	0.477	1.62	PASS
3	11.386E-3	0.499	3.45	PASS
4	3.207E-3	0.141	645.00E-3	PASS
5	4.704E-3	0.206	1.71	PASS
6	2.038E-3	0.089	450.00E-3	PASS
7	4.332E-3	0.190	1.15	PASS
8	1.586E-3	0.070	345.00E-3	PASS
9	3.784E-3	0.166	600.00E-3	PASS
10	1.378E-3	0.060	276.00E-3	PASS
11	3.496E-3	0.153	495.00E-3	PASS
12	1.061E-3	0.047	229.99E-3	PASS
13	3.652E-3	0.160	315.00E-3	PASS
14	1.565E-3	0.069	197.15E-3	PASS
15	3.023E-3	0.133	225.00E-3	PASS
16	982.586E-6	0.043	172.50E-3	PASS
17	3.182E-3	0.140	198.52E-3	PASS
18	1.434E-3	0.063	153.33E-3	PASS
19	3.166E-3	0.139	177.63E-3	PASS
20	1.012E-3	0.044	138.00E-3	PASS
21	2.614E-3	0.115	160.71E-3	PASS
22	933.434E-6	0.041	125.46E-3	PASS
23	2.857E-3	0.125	146.74E-3	PASS
24	933.240E-6	0.041	114.99E-3	PASS
25	2.354E-3	0.103	135.00E-3	PASS
26	859.631E-6	0.038	106.16E-3	PASS
27	2.238E-3	0.098	124.99E-3	PASS
28	1.315E-3	0.058	98.57E-3	PASS
29	2.077E-3	0.091	116.39E-3	PASS
30	836.955E-6	0.037	92.00E-3	PASS
31	1.723E-3	0.076	108.87E-3	PASS
32	1.181E-3	0.052	86.25E-3	PASS
33	1.928E-3	0.085	102.27E-3	PASS
34	866.041E-6	0.038	81.18E-3	PASS
35	1.533E-3	0.067	96.44E-3	PASS
36	862.745E-6	0.038	76.66E-3	PASS
37	1.589E-3	0.070	91.21E-3	PASS
38	838.035E-6	0.037	72.63E-3	PASS
39	1.286E-3	0.056	86.53E-3	PASS
40	866.945E-6	0.038	69.00E-3	PASS

Maximum harmonic voltage results

Hn	Ueff [V]	Ueff [%]	Limit [%]	Result
1	228.41	99.307		
2	399.64E-3	0.174	0.2	PASS
3	607.01E-3	0.264	0.9	PASS
4	140.73E-3	0.061	0.2	PASS
5	138.47E-3	0.060	0.4	PASS
6	80.63E-3	0.035	0.2	PASS
7	63.18E-3	0.027	0.3	PASS
8	54.61E-3	0.024	0.2	PASS
9	63.32E-3	0.028	0.2	PASS
10	40.17E-3	0.017	0.2	PASS
11	32.93E-3	0.014	0.1	PASS
12	36.08E-3	0.016	0.1	PASS
13	31.28E-3	0.014	0.1	PASS
14	33.15E-3	0.014	0.1	PASS
15	32.43E-3	0.014	0.1	PASS
16	33.65E-3	0.015	0.1	PASS
17	26.10E-3	0.011	0.1	PASS
18	23.83E-3	0.010	0.1	PASS
19	23.95E-3	0.010	0.1	PASS
20	24.25E-3	0.011	0.1	PASS
21	25.19E-3	0.011	0.1	PASS
22	20.00E-3	0.009	0.1	PASS
23	19.18E-3	0.008	0.1	PASS
24	16.14E-3	0.007	0.1	PASS
25	17.57E-3	0.008	0.1	PASS
26	16.44E-3	0.007	0.1	PASS
27	18.60E-3	0.008	0.1	PASS
28	14.71E-3	0.006	0.1	PASS
29	16.60E-3	0.007	0.1	PASS
30	16.56E-3	0.007	0.1	PASS
31	17.74E-3	0.008	0.1	PASS
32	15.55E-3	0.007	0.1	PASS
33	19.45E-3	0.008	0.1	PASS
34	13.41E-3	0.006	0.1	PASS
35	14.99E-3	0.007	0.1	PASS
36	14.99E-3	0.007	0.1	PASS
37	18.99E-3	0.008	0.1	PASS
38	15.50E-3	0.007	0.1	PASS
39	18.20E-3	0.008	0.1	PASS
40	17.34E-3	0.008	0.1	PASS

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

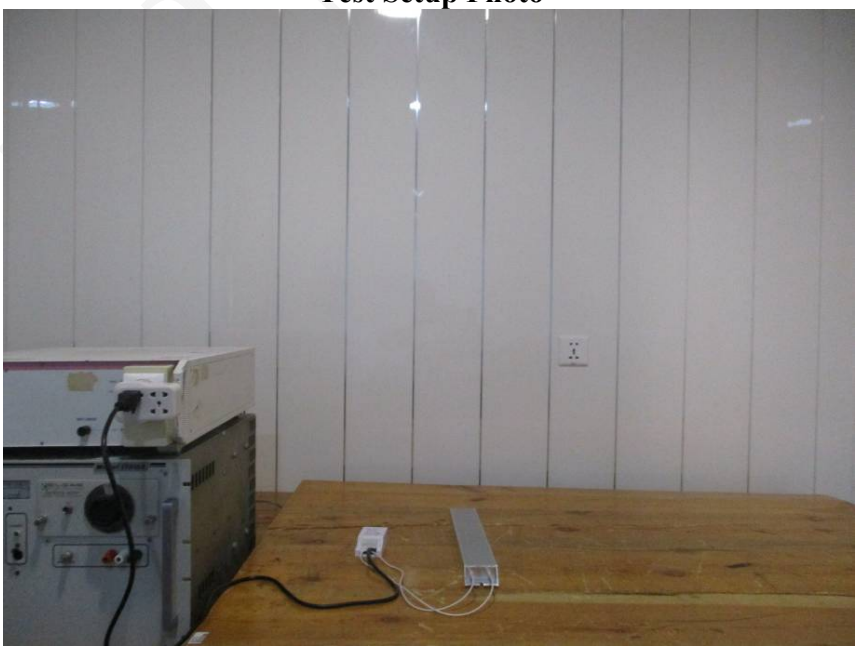
Please refer to following tables:

Short time (Pst):	10 min
Observation time:	10 min (1 Flicker measurement)
Test Mode:	WIFI Link & Operating
Power Source:	AC 230V/50Hz
Test Result	PASS
Note:	Worst Case

Maximum Flicker results

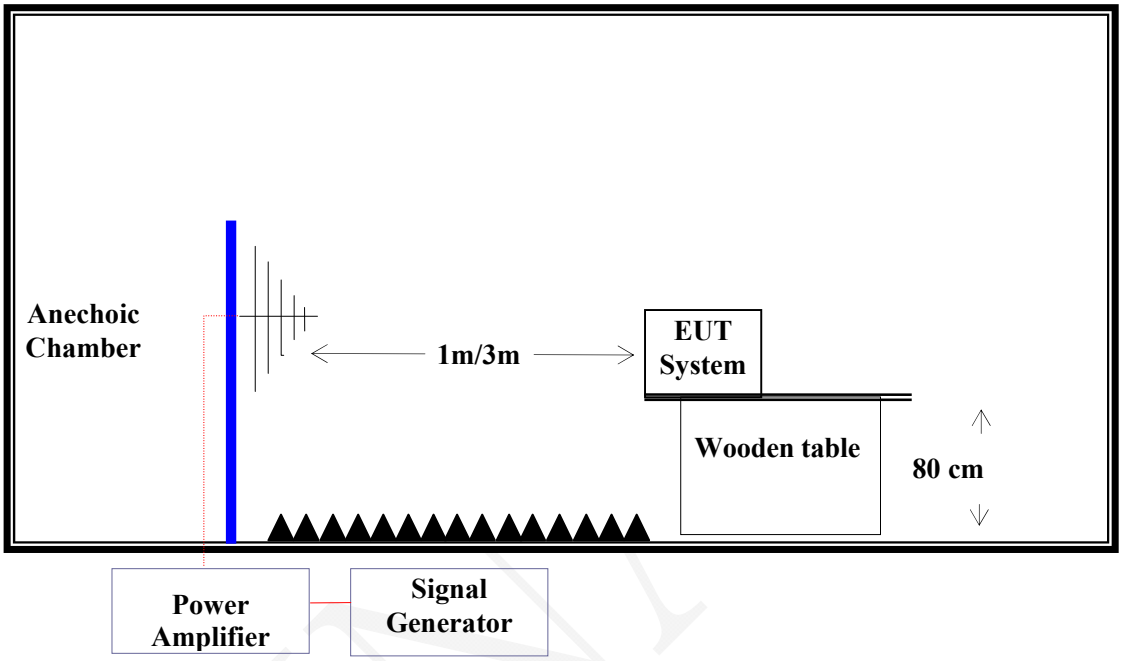
	EUT values	Limit	Result
Pst	0.028	1.00	PASS
Plt	0.028	0.65	PASS
dc [%]	0.030	3.30	PASS
dmax [%]	0.192	4.00	PASS
dt [s]	0.000	0.50	PASS

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 1 meter or 3 meter away from the Receiving 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 Receiving 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:

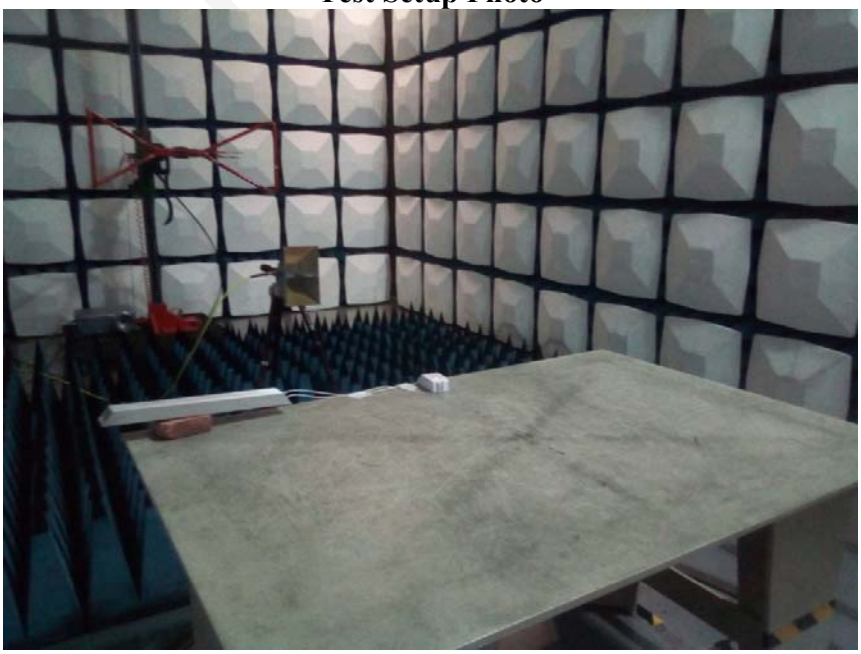
Test Mode: WIFI Link & Operating
Note: TH16/TH10

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

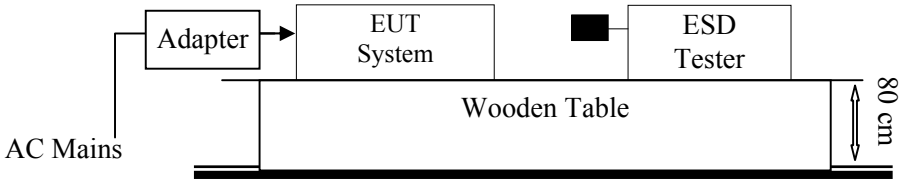
"A" stand for, during test, operate as intended no loss of function, no degradation of performance, no unintentional transmissions and after test, no degradation of performance, no loss of function, no loss of stored data or user programmable functions.

Test Setup Photo



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 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 (±kV)	Test Voltage Air Discharge (±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: WIFI Link & Operating
Note: TH16/TH10

Table 1: Electrostatic Discharge Immunity (Air Discharge)

Test Points Location	Test Levels							
	-2 kV	+2 kV	-4 kV	+4 kV	-8 kV	+8 kV	-15 kV	+15 kV
Plastic shell	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 Levels							
	-2 kV	+2 kV	-4 kV	+4 kV	-6 kV	+6 kV	-8 kV	+8 kV
Metal	A	A	A	A	/	/	/	/

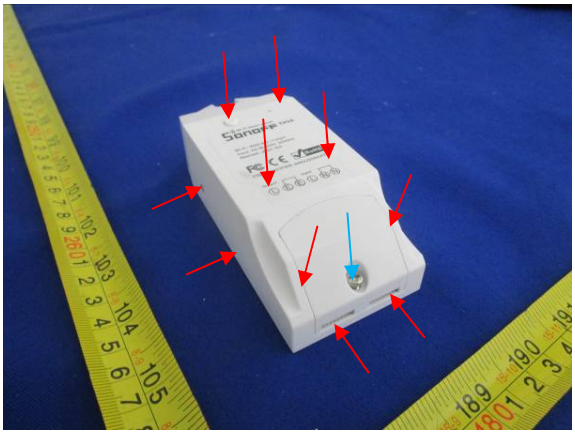
Table 3: Electrostatic Discharge Immunity (Indirect Contact HCP)

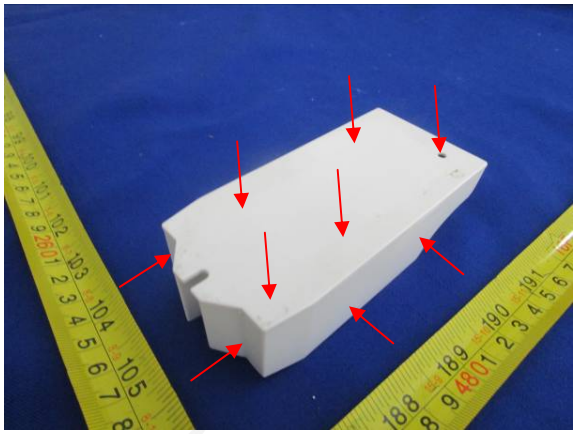
Test Points Location	Test Levels							
	-2 kV	+2 kV	-4 kV	+4 kV	-6 kV	+6 kV	-8 kV	+8 kV
Front Side	A	A	A	A	/	/	/	/
Back Side	A	A	A	A	/	/	/	/
Left Side	A	A	A	A	/	/	/	/
Right Side	A	A	A	A	/	/	/	/

Table 4: Electrostatic Discharge Immunity (Indirect Contact VCP)

Test Points Location	Test Levels							
	-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



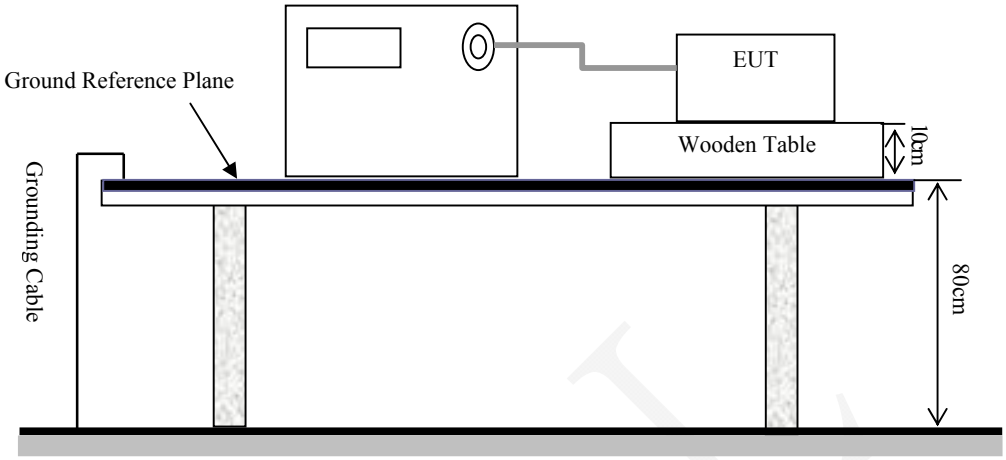


Air Discharge: → Direct Contact: →

Test Setup Photo

9 - FAST TRANSIENTS, COMMON MODE

Test System Setup



Test Level

Open Circuit Output Test Voltage ±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.

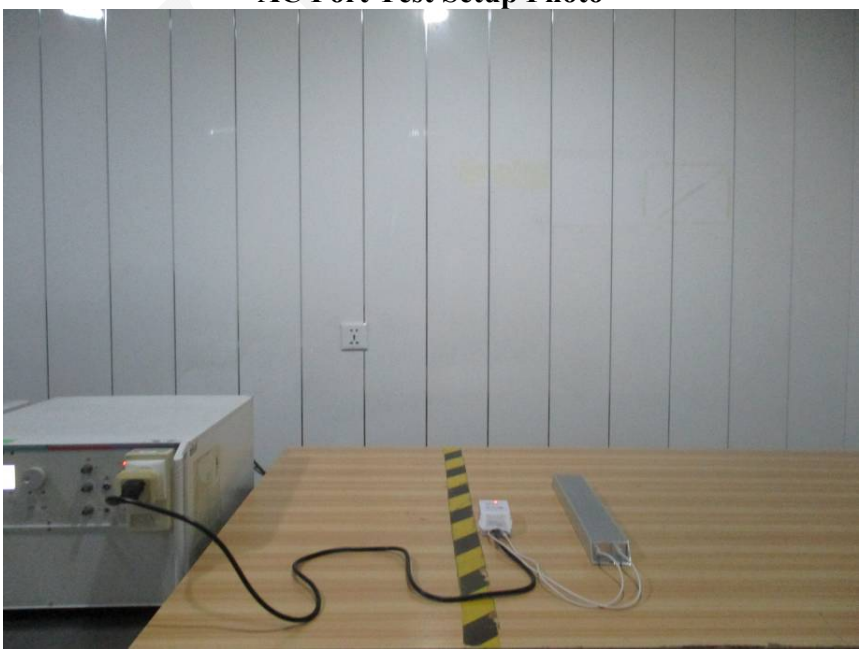
Test Data

Please refer to following tables:

Test Mode: WIFI Link & Operating
Note: TH16/TH10

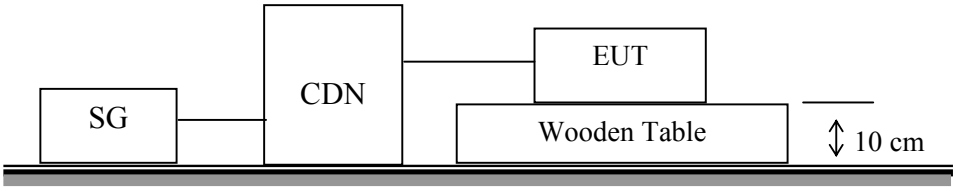
Test Points		Test Levels (kV)							
		+0.5	-0.5	+1.0	-1.0	+2.0	-2.0	+4.0	-4.0
AC mains power input ports	L	A	A	A	A	/	/	/	/
	N	A	A	A	A	/	/	/	/
	Earth	A	A	A	A	/	/	/	/
	L+N	A	A	A	A	/	/	/	/
	L + Earth	A	A	A	A	/	/	/	/
	N + Earth	A	A	A	A	/	/	/	/
	L+N+Earth	A	A	A	A	/	/	/	/
Signal ports	/	/	/	/	/	/	/	/	/

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: WIFI Link & Operating
Note: TH16/TH10

Table 1: AC mains power input port

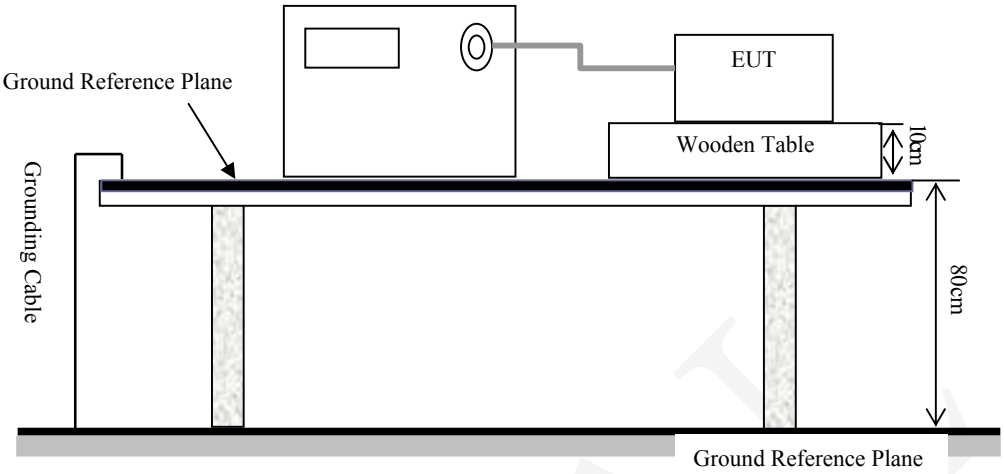
Frequency range: 150 kHz to 80 MHz
■Modulated: Amplitude 80%, 1kHz sine wave □ Unmodulated □ Other:
Severity Level: 3 V Un modulated , r.m.s

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: WIFI Link & Operating
Note: TH16/TH10
C indicates that the operating interrupts when EUT was tested, but it could recover normal use by manual after test be finished

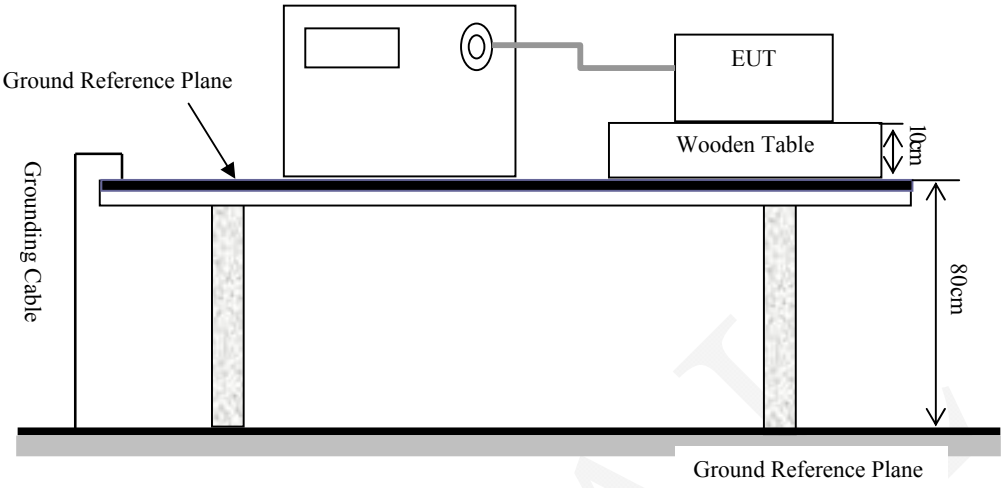
Table 1: Voltage Dips/Interruptions Test

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

Test Setup Photo

13 - SURGES

Test System Setup



Test Level

Level	Open Circuit Output Test Voltage ±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: WIFI Link & Operating
Note: TH16/TH10

Table 1: AC mains power input port

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

AC Port Test Setup Photo

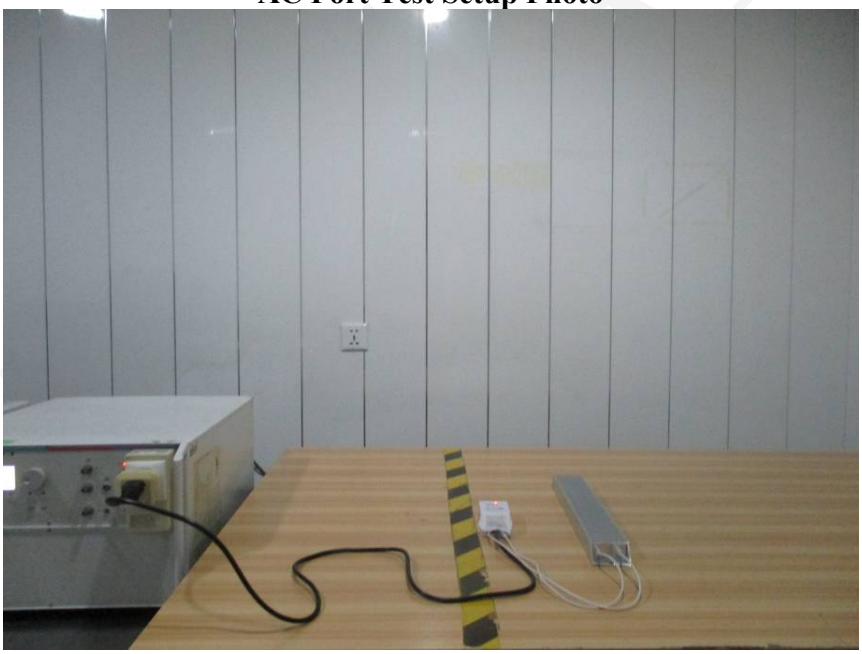
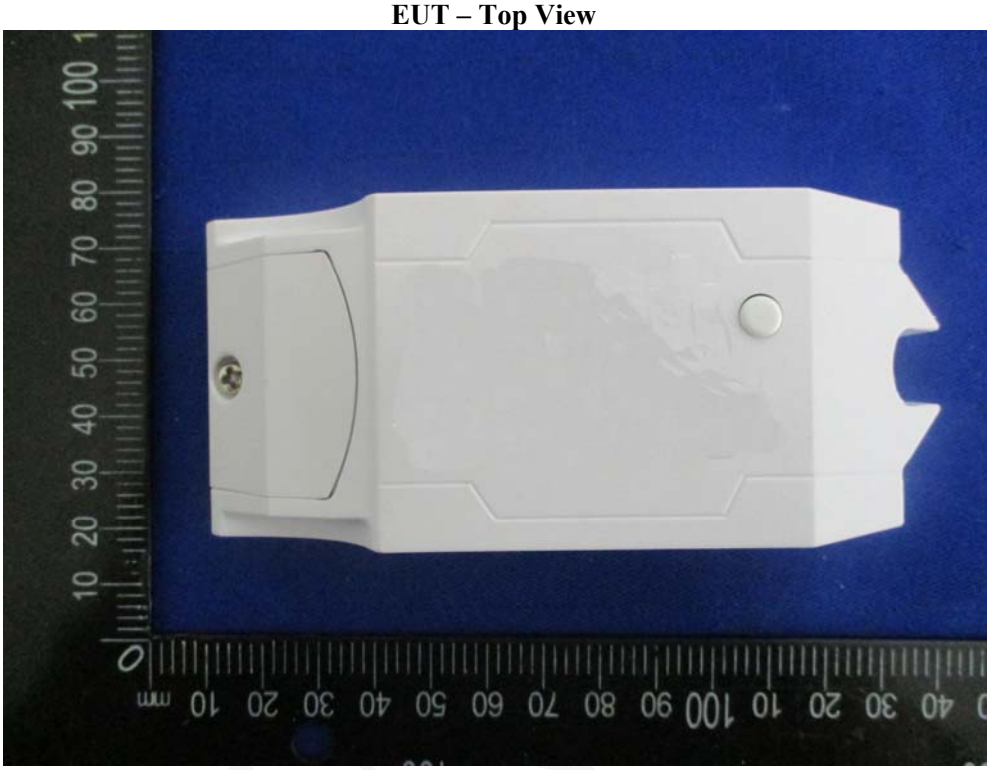


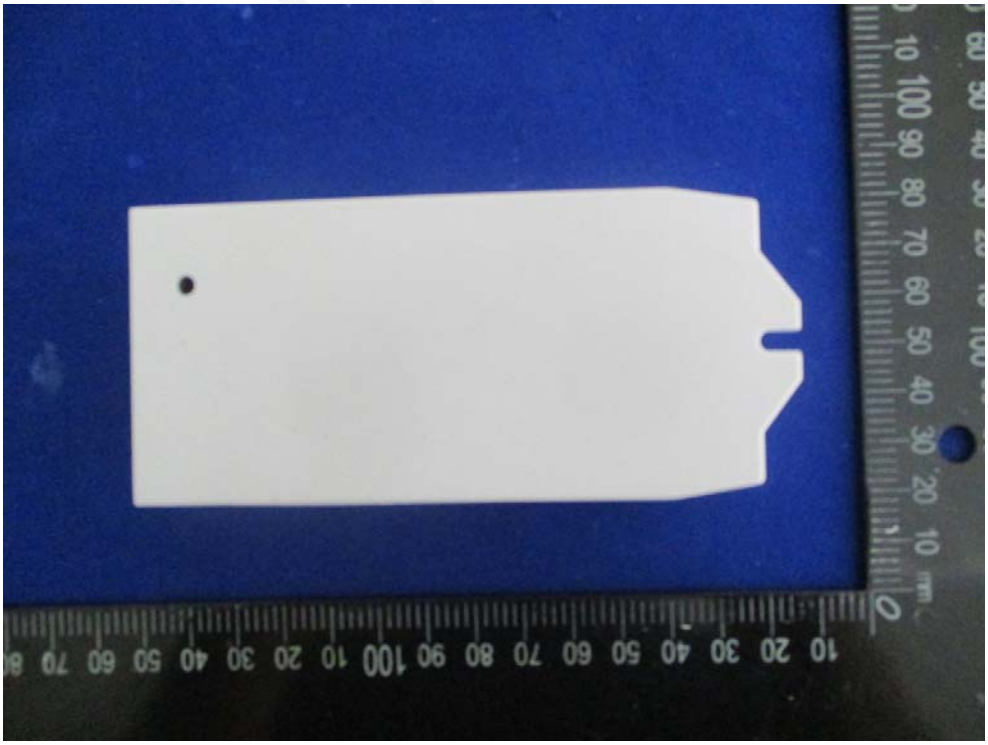
EXHIBIT A – EUT PHOTOGRAPHS

Model: TH16

EUT – Top View

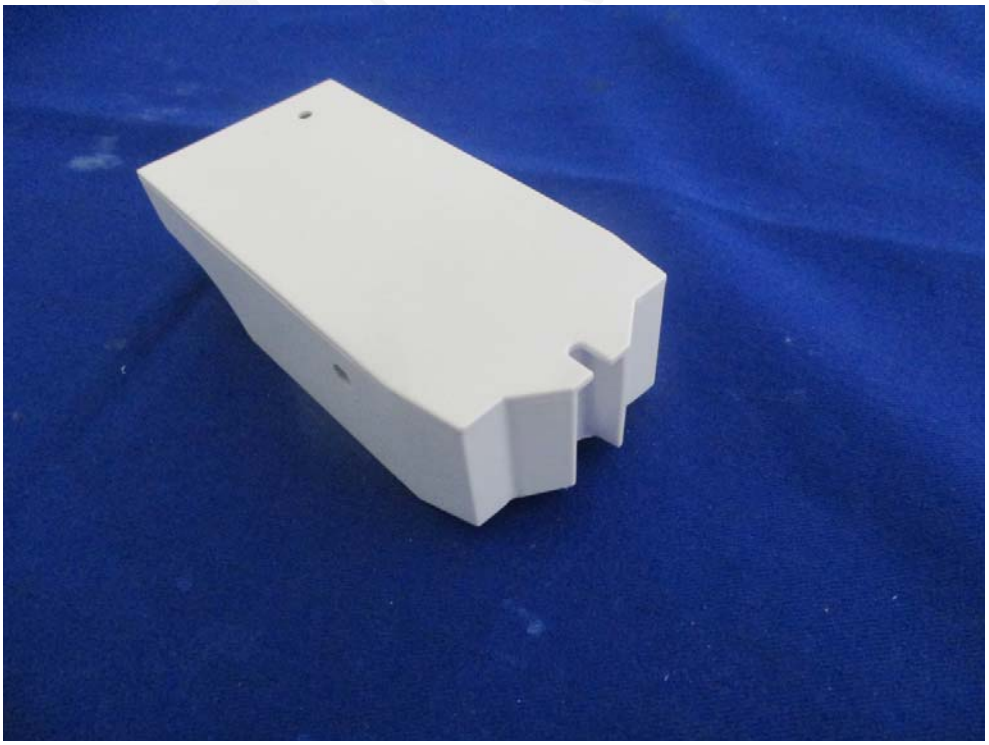


EUT – Bottom View

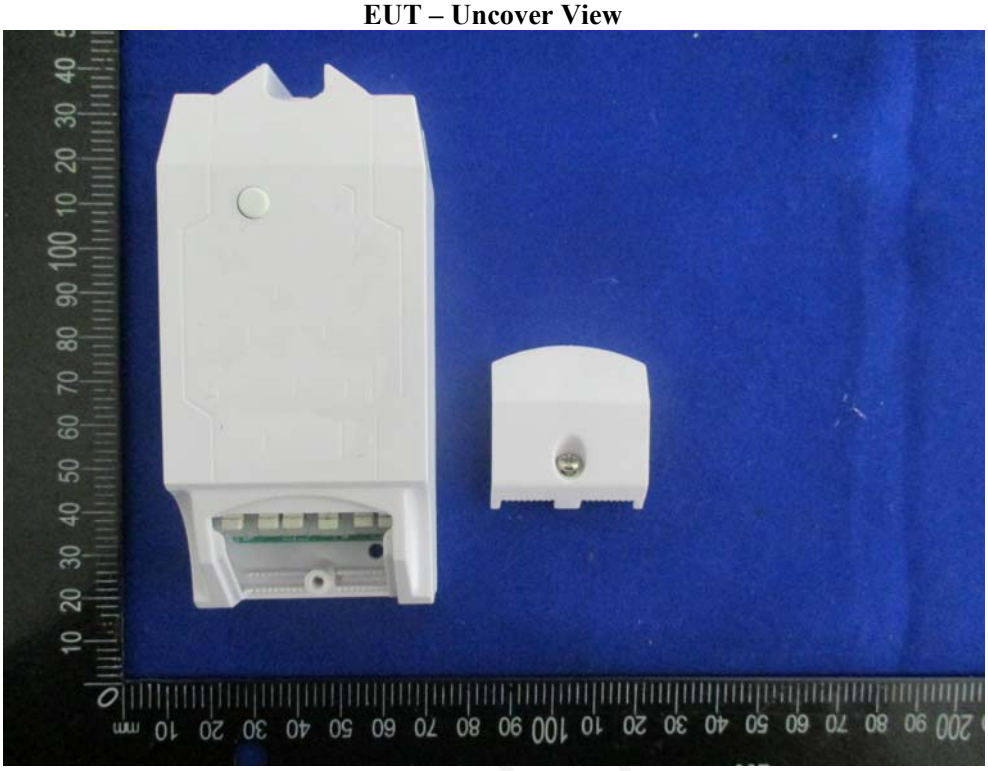


EUT – Side View

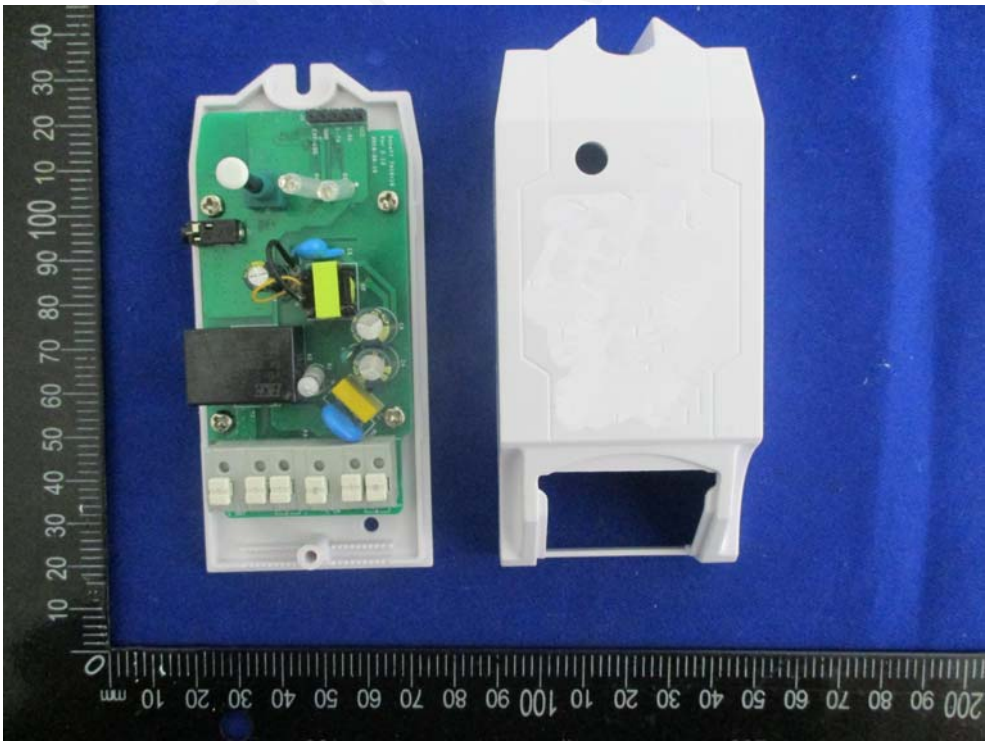
EUT – Side View



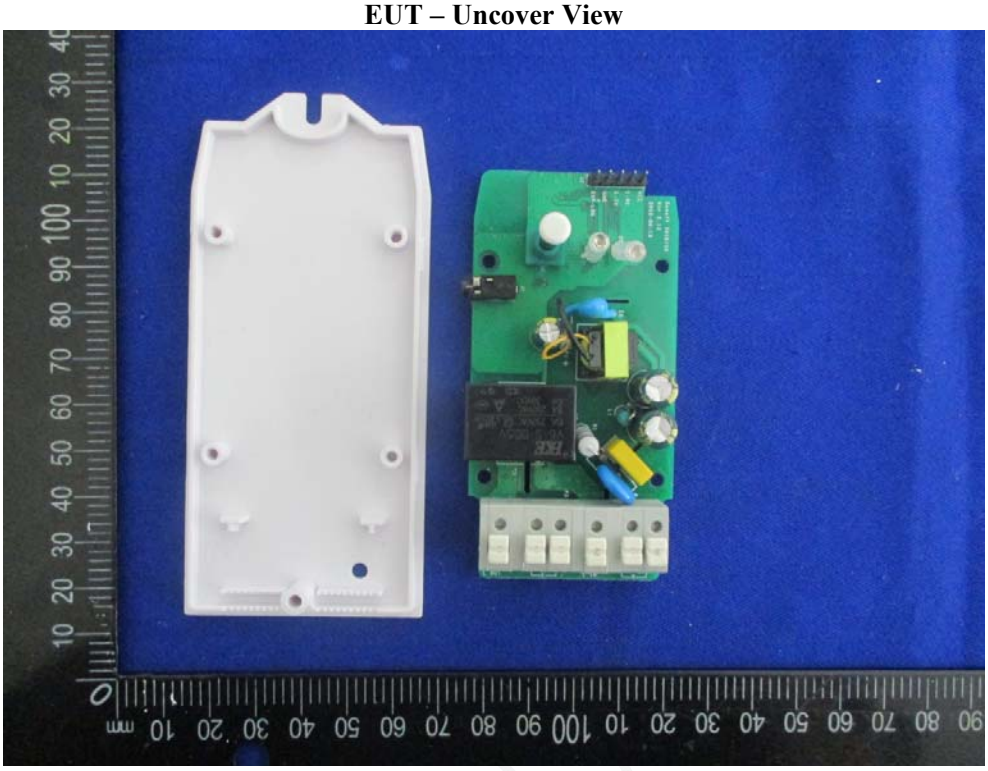
EUT – Uncover View



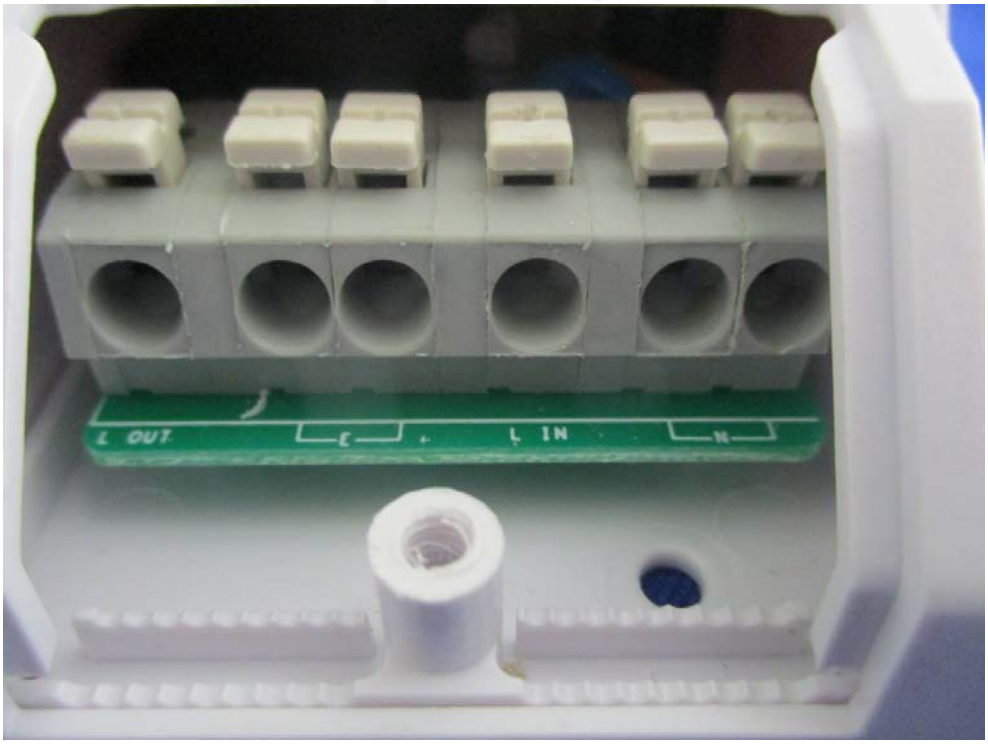
EUT – Uncover View



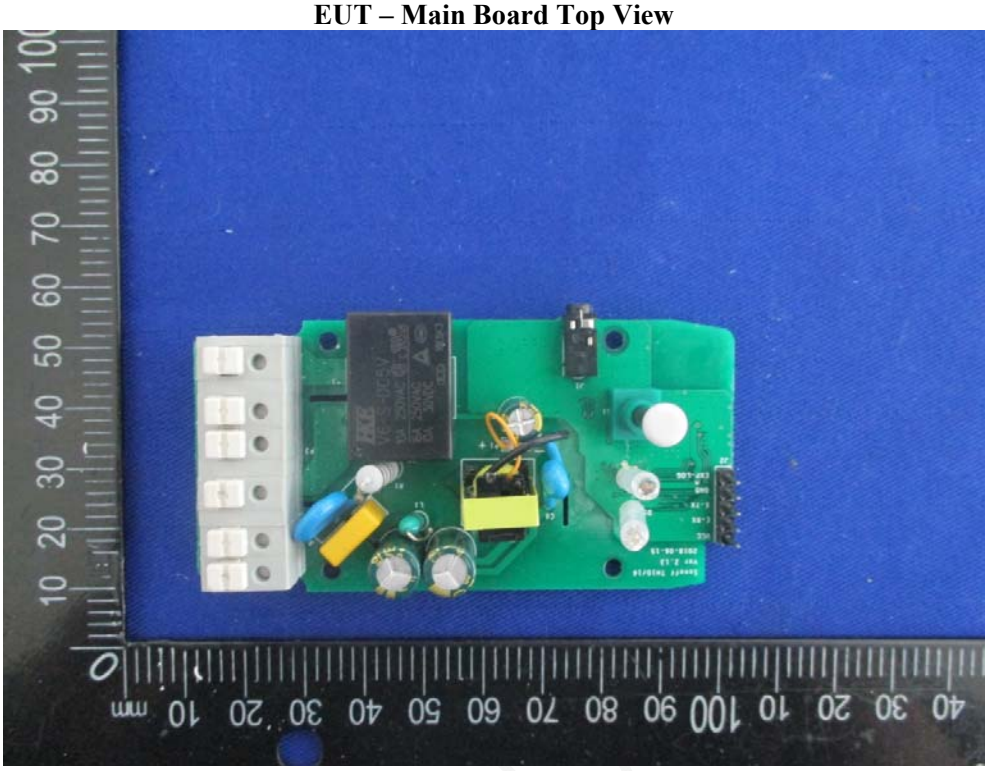
EUT – Uncover View



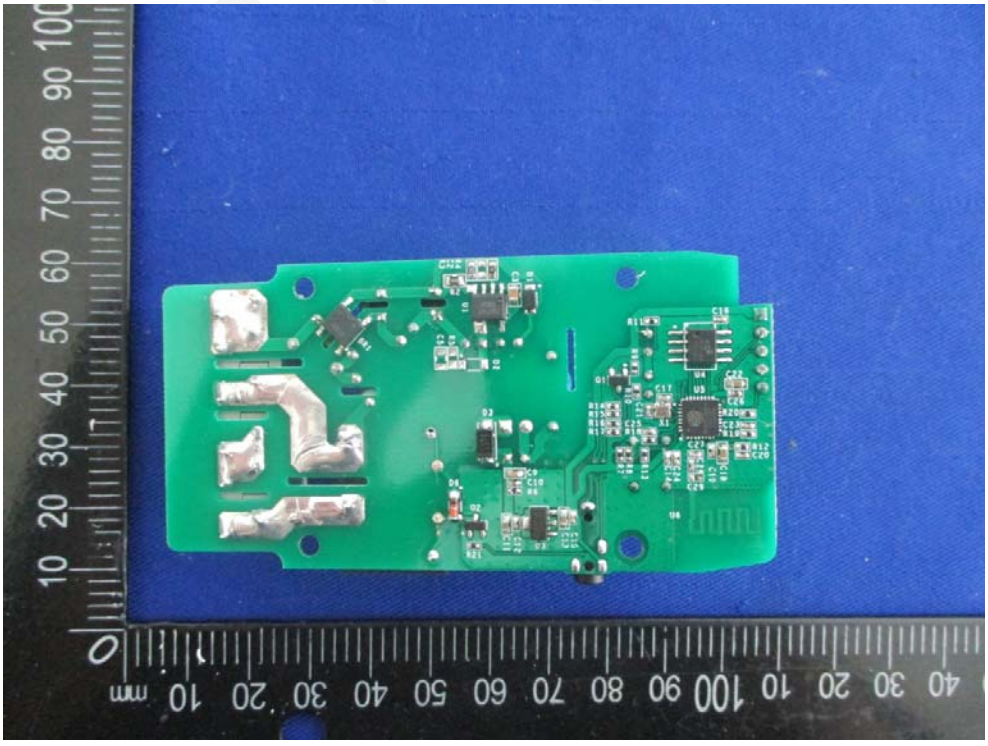
EUT – Ports View



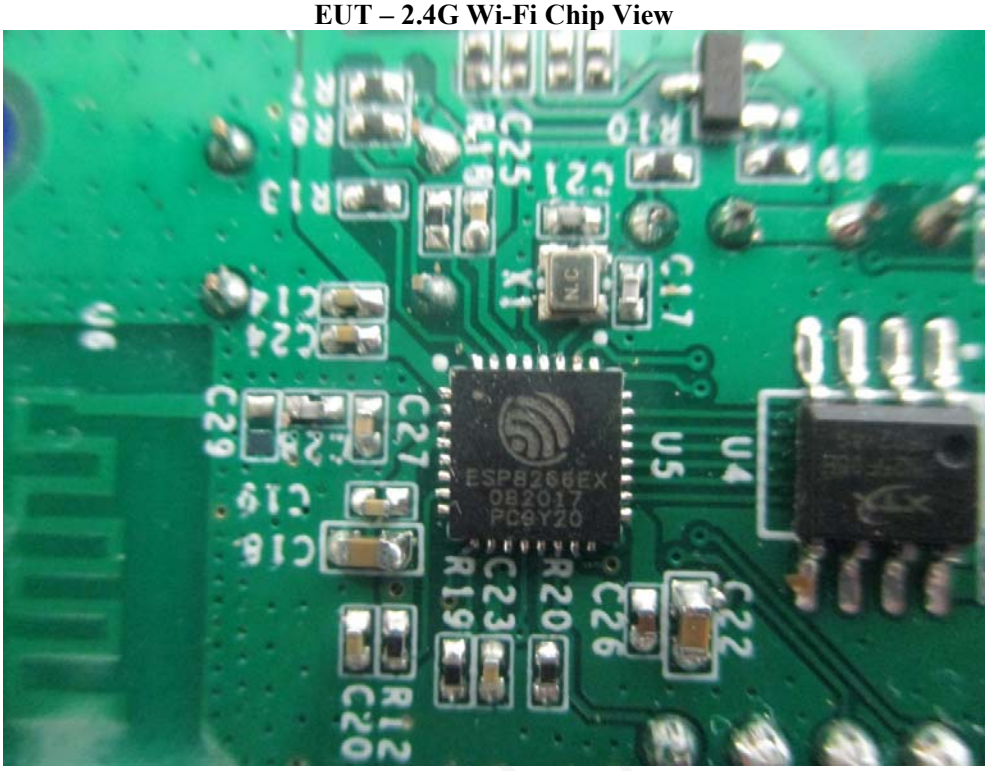
EUT – Main Board Top View



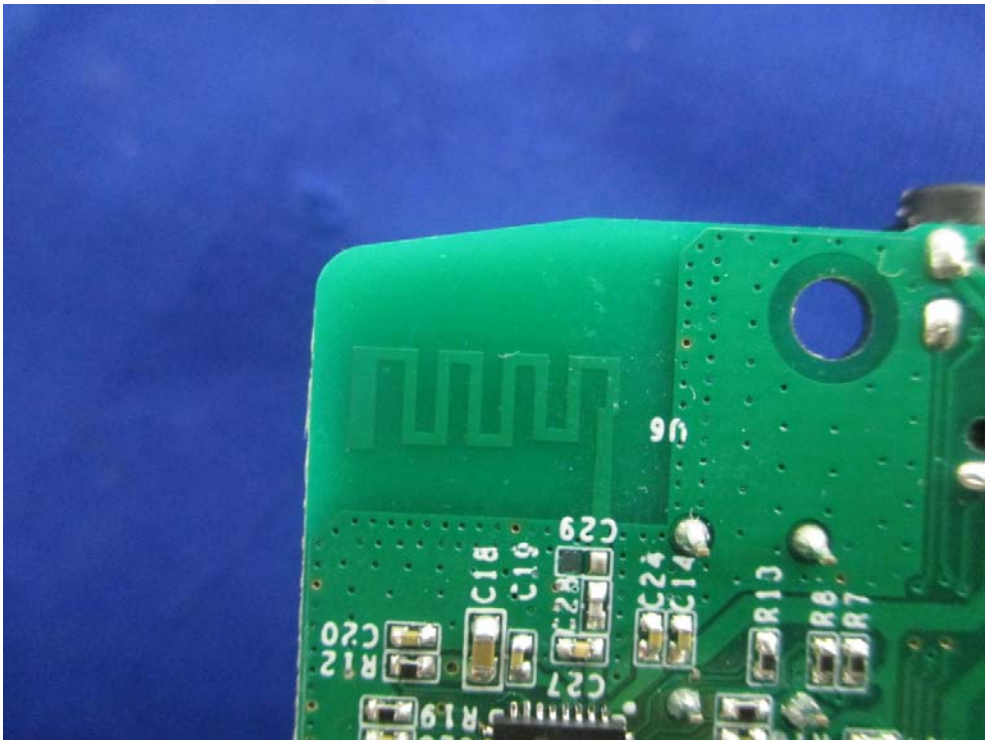
EUT – Main Board Bottom View



EUT – 2.4G Wi-Fi Chip View



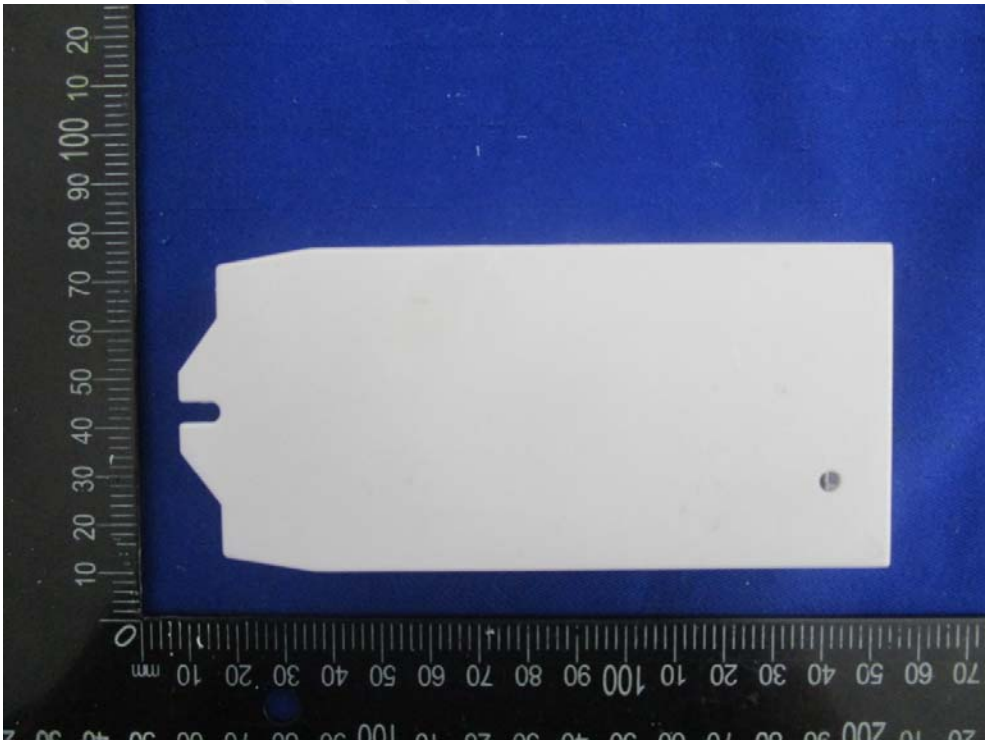
EUT – Antenna View



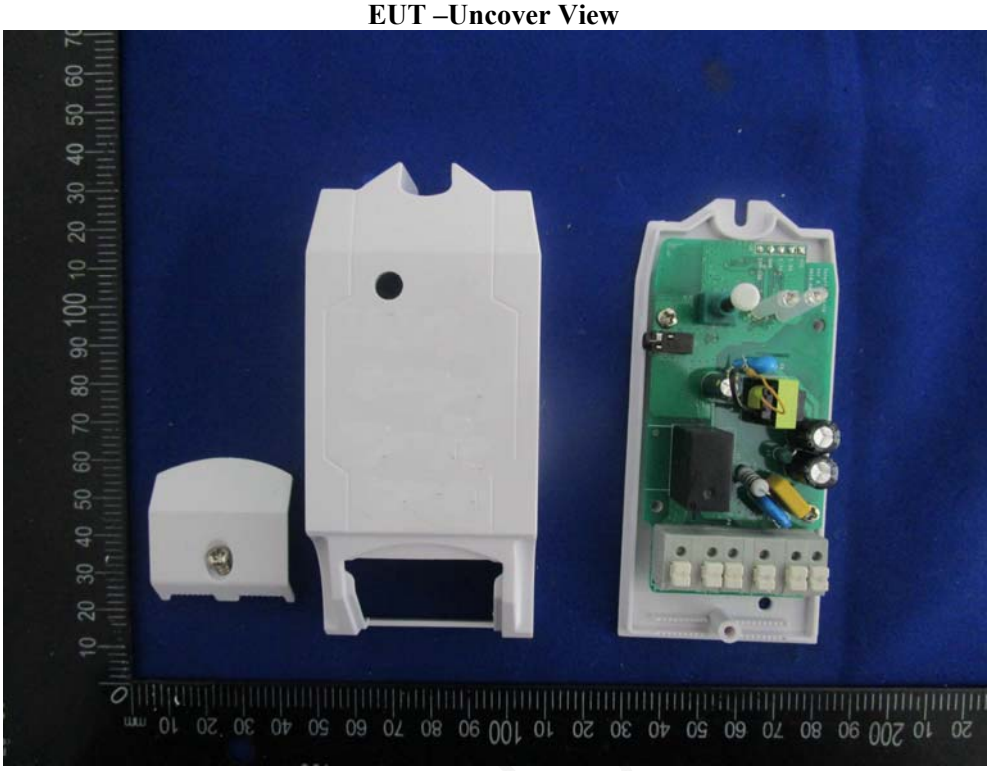
Model: TH10

EUT – Top View

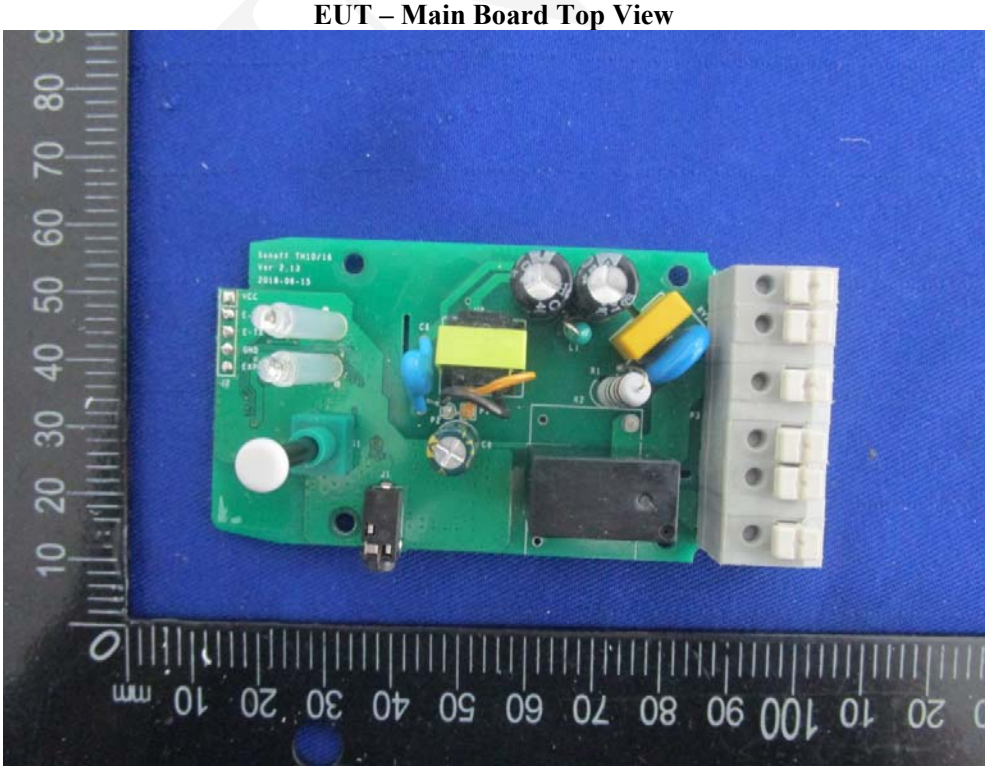
EUT – Bottom View



EUT –Uncover View



EUT – Main Board Top View



EUT – Main Board Bottom View

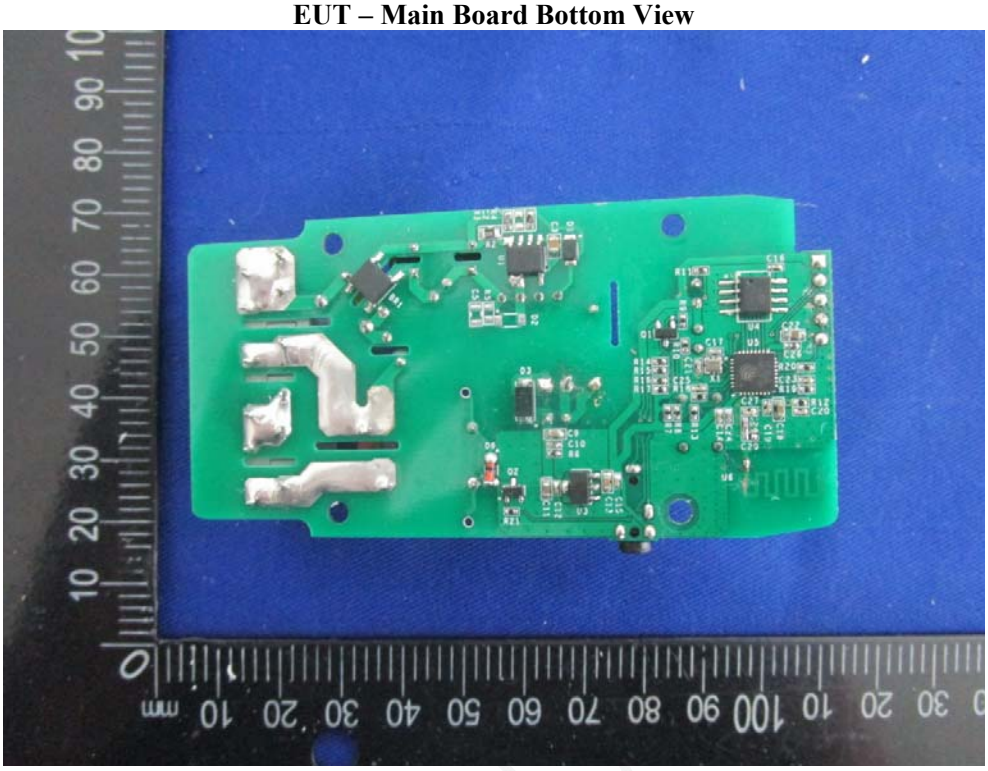
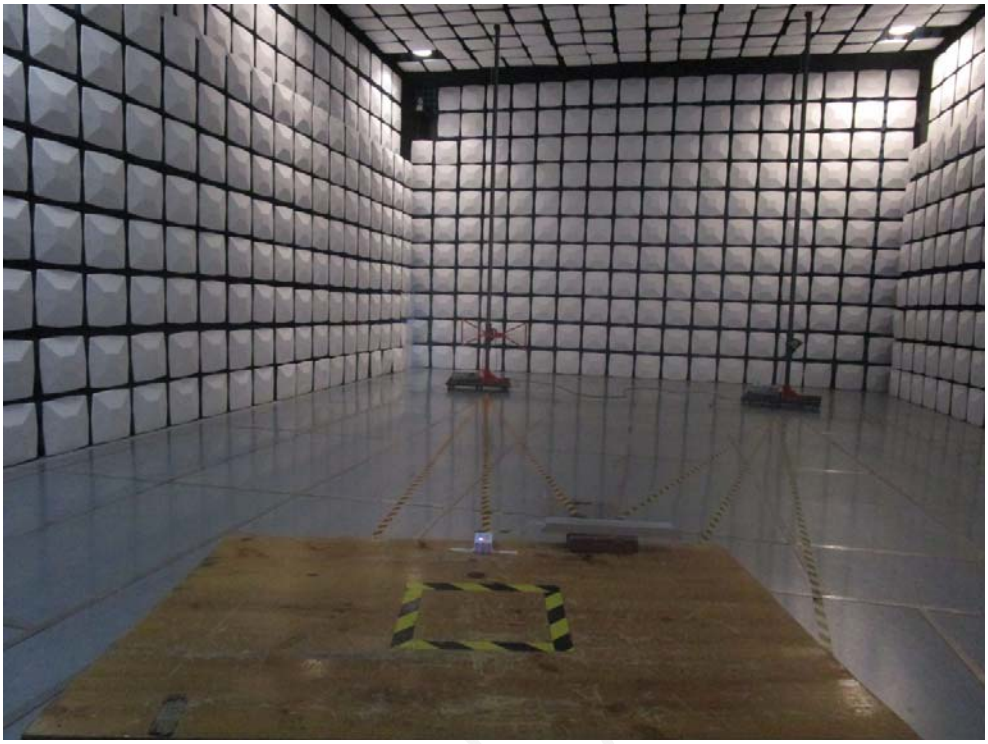


EXHIBIT B – TEST SETUP PHOTOGRAPHS

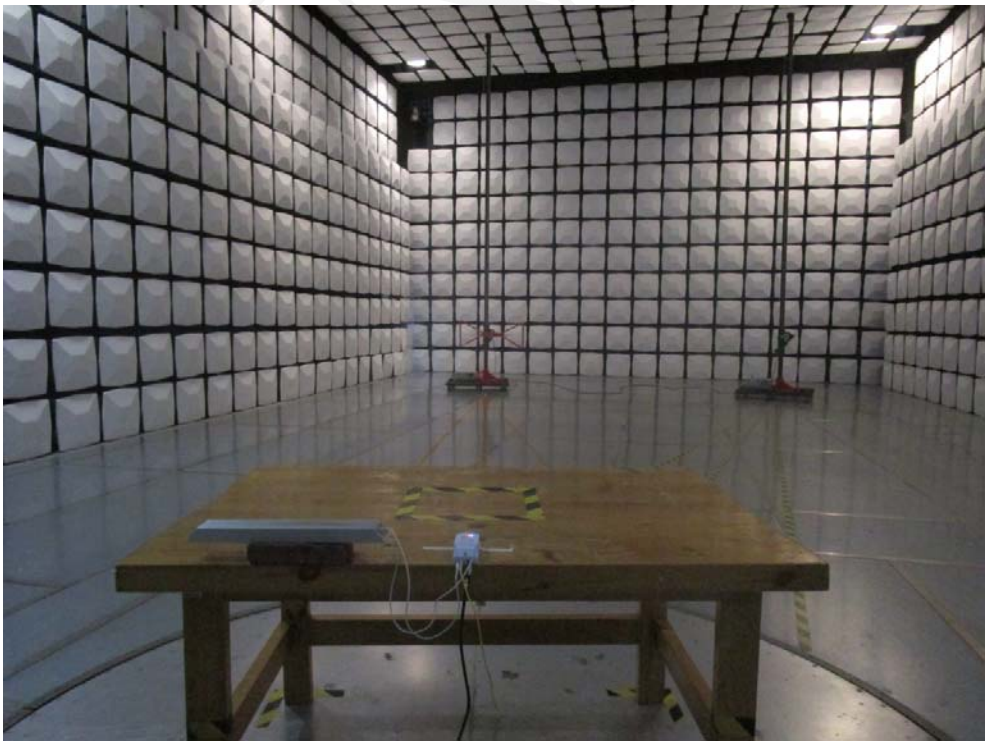
CE Front View

CE Side View

RE Below 1G Front View

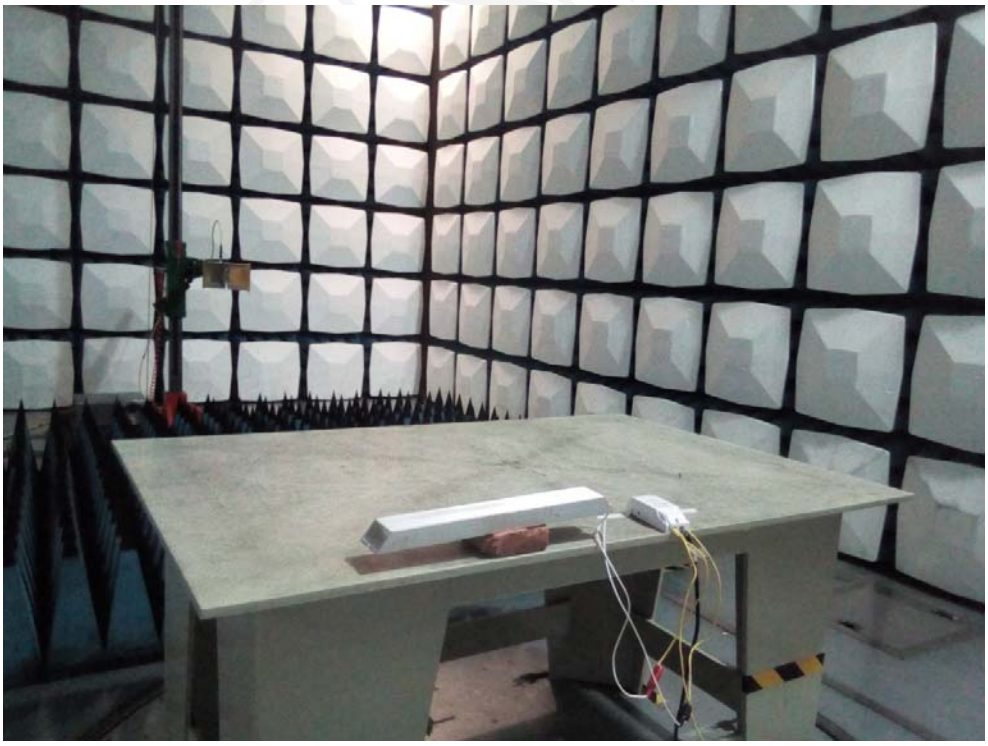


RE Below 1G Rear View



RE Above 1G Front View

RE Above 1G Rear View



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