

FCC REPORT

Applicant: Centrica Connected home Limited
Address of Applicant: Millstream Maidenhead road, Berkshire SL4 5GD, United Kingdom
Manufacturer/ Factory: Computime Electronics(Shenzhen)Company Limited
Address of Manufacturer/ Factory: Yuekenguangyu Industrial Park,Kangqiao Road 88#,Danzhutou Community,Nanwan Street Office Longgang District,Shenzhen,China

Equipment Under Test (EUT)

Product Name: Smart Plug
Model No.: SLP2c
FCC ID: WJHSLP2C
Applicable standards: FCC CFR Title 47 Part 15 Subpart C Section 15.247:2016
Date of sample receipt: April 14, 2017
Date of Test: April 17-20, 2017
Date of report issued: April 20, 2017
Test Result : PASS *

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

Authorized Signature:



Robinson Lo
Laboratory Manager

This results shown in this test report refer only to the sample(s) tested, this test report cannot be reproduced, except in full, without prior written permission of the company. The report would be invalid without specific stamp of test institute and the signatures of compiler and approver.

2 Version

Version No.	Date	Description
00	April 20, 2017	Original

Prepared By: Edward Pan **Date:** April 20, 2017
Project Engineer

Check By: Andy Wu **Date:** April 20, 2017
Reviewer

3 Contents

	Page
1 COVER PAGE.....	1
2 VERSION.....	2
3 CONTENTS	3
4 TEST SUMMARY	4
4.1 MEASUREMENT UNCERTAINTY	4
5 GENERAL INFORMATION.....	5
5.1 GENERAL DESCRIPTION OF EUT	5
5.2 TEST MODE	6
5.3 DESCRIPTION OF SUPPORT UNITS	6
5.4 TEST FACILITY.....	7
5.5 TEST LOCATION	7
6 TEST INSTRUMENTS LIST	8
7 TEST RESULTS AND MEASUREMENT DATA.....	9
7.1 ANTENNA REQUIREMENT.....	9
7.2 CONDUCTED EMISSIONS	10
7.3 CONDUCTED PEAK OUTPUT POWER.....	13
7.4 CHANNEL BANDWIDTH	16
7.5 POWER SPECTRAL DENSITY	19
7.6 BAND EDGES.....	22
7.6.1 Conducted Emission Method.....	22
7.6.2 Radiated Emission Method.....	24
7.7 SPURIOUS EMISSION.....	27
7.7.1 Conducted Emission Method.....	27
7.7.2 Radiated Emission Method.....	30
8 TEST SETUP PHOTO.....	37
9 EUT CONSTRUCTIONAL DETAILS	39

4 Test Summary

Test Item	Section in CFR 47	Result
Antenna requirement	15.203/15.247 (c)	Pass
AC Power Line Conducted Emission	15.207	Pass
Conducted Peak Output Power	15.247 (b)(3)	Pass
Channel Bandwidth	15.247 (a)(2)	Pass
Power Spectral Density	15.247 (e)	Pass
Band Edge	15.247(d)	Pass
Spurious Emission	15.205/15.209	Pass

Pass: The EUT complies with the essential requirements in the standard.

Remark : Test according to ANSI C63.4:2014 and ANSI C63.10:2013

4.1 Measurement Uncertainty

Test Item	Frequency Range	Measurement Uncertainty	Notes
Radiated Emission	9kHz ~ 30MHz	± 4.34dB	(1)
Radiated Emission	30MHz ~ 1000MHz	± 4.24dB	(1)
Radiated Emission	1GHz ~ 26.5GHz	± 4.68dB	(1)
AC Power Line Conducted Emission	0.15MHz ~ 30MHz	± 3.45dB	(1)

Note (1): The measurement uncertainty is for coverage factor of k=2 and a level of confidence of 95%.

5 General Information

5.1 General Description of EUT

Product Name:	Smart Plug
Model No.:	SLP2c
Operation Frequency:	2405MHz~2480MHz
Channel numbers:	16
Channel separation:	5MHz
Modulation type:	O-QPSK
Antenna Type:	PCB Antenna
Antenna gain:	0.52dBi
Power supply:	AC 120V/60Hz

Operation Frequency each of channel							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
1	2405MHz	5	2425MHz	9	2445MHz	13	2465MHz
2	2410MHz	6	2430MHz	10	2450MHz	14	2470MHz
3	2415MHz	7	2435MHz	11	2455MHz	15	2475MHz
4	2420MHz	8	2440MHz	12	2460MHz	16	2480 MHz

Note:

In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

Channel	Frequency
The lowest channel	2405MHz
The middle channel	2445MHz
The Highest channel	2475MHz and 2480MHz

5.2 Test mode

Transmitting mode	Keep the EUT in continuously transmitting mode.
<i>Remark: During the test, the test voltage was tuned from 85% to 115% of the nominal rated supply voltage, and found that the worst case was under the nominal rated supply condition. So the report just shows that condition's data.</i>	

5.3 Description of Support Units

N/A

5.4 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **FCC —Registration No.: 600491**

Global United Technology Services Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in files. Registration 600491, June 22, 2016.

- **Industry Canada (IC) —Registration No.: 9079A-2**

The 3m Semi-anechoic chamber of Global United Technology Services Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 9079A-2, August 15, 2016.

5.5 Test Location

All tests were performed at:

Global United Technology Services Co., Ltd.

Address: No. 301-309, 3/F., Jinyuan Business Building, No.2, Laodong Industrial Zone, Xixiang Road, Baoan District, Shenzhen, Guangdong, China

Tel: 0755-27798480

Fax: 0755-27798960

6 Test Instruments list

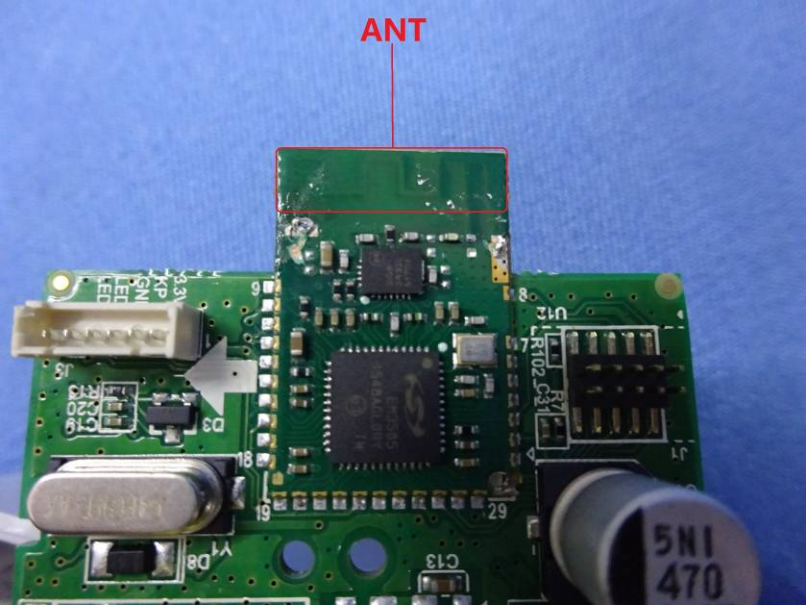
Radiated Emission:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	3m Semi- Anechoic Chamber	ZhongYu Electron	9.0(L)*6.0(W)* 6.0(H)	GTS250	July. 03 2015	July. 02 2020
2	Control Room	ZhongYu Electron	6.2(L)*2.5(W)* 2.4(H)	GTS251	N/A	N/A
3	ESU EMI Test Receiver	R&S	ESU26	GTS203	June. 29 2016	June. 28 2017
4	Loop Antenna	Zhinan	ZN30900A	GTS534	June. 29 2016	June. 28 2017
5	BiConiLog Antenna	SCHWARZBECK	VULB9163	GTS214	June. 29 2016	June. 28 2017
6	Double-ridged horn antenna	SCHWARZBECK	9120D	GTS208	June. 29 2016	June. 28 2017
7	Horn Antenna	ETS-LINDGREN	3160-09	GTS218	June. 29 2016	June. 28 2017
8	RF Amplifier	HP	8347A	GTS204	June. 29 2016	June. 28 2017
9	RF Amplifier	HP	8349B	GTS206	June. 29 2016	June. 28 2017
10	Broadband Preamplifier	SCHWARZBECK	BBV9718	GTS535	June. 29 2016	June. 28 2017
11	PSA Series Spectrum Analyzer	Agilent	E4440A	GTS536	June. 29 2016	June. 28 2017
12	Universal Radio Communication tester	ROHDE&SCHWARZ	CMU 200	GTS538	June. 29 2016	June. 28 2017
13	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
14	Coaxial Cable	GTS	N/A	GTS210	June. 29 2016	June. 28 2017
15	Coaxial Cable	GTS	N/A	GTS211	June. 29 2016	June. 28 2017
16	Coaxial Cable	GTS	N/A	GTS210	June. 29 2016	June. 28 2017

Conducted Emission:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Shielding Room	ZhongYu Electron	7.3(L)x3.1(W)x2.9(H)	GTS252	May.16 2014	May.15 2019
2	EMI Test Receiver	R&S	ESCI 7	GTS552	June. 29 2016	June. 28 2017
3	Coaxial Switch	ANRITSU CORP	MP59B	GTS225	June. 29 2016	June. 28 2017
4	Artificial Mains Network	SCHWARZBECK MESS	NSLK8127	GTS226	June. 29 2016	June. 28 2017
5	Coaxial Cable	GTS	N/A	GTS227	N/A	N/A
6	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
7	Thermo meter	KTJ	TA328	GTS233	June. 29 2016	June. 28 2017

General used equipment:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Barometer	ChangChun	DYM3	GTS257	June. 29 2016	June. 28 2017

7 Test results and Measurement Data

7.1 Antenna requirement

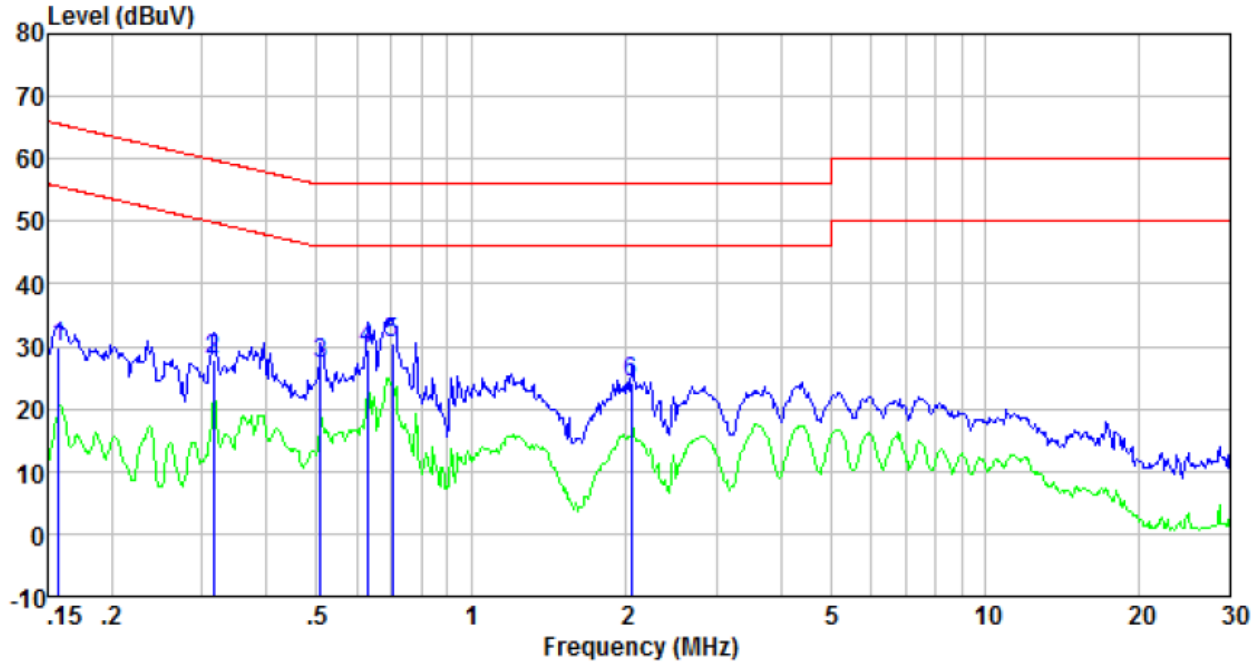
Standard requirement:	FCC Part15 C Section 15.203 /247(c)
<p>15.203 requirement:</p> <p>An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.</p> <p>15.247(c) (1)(i) requirement:</p> <p>(i) Systems operating in the 2400-2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.</p>	
EUT Antenna:	
<p><i>The antenna is PCB Antenna, the best case gain of the antenna is 0.52dBi</i></p> 	

7.2 Conducted Emissions

Test Requirement:	FCC Part15 C Section 15.207														
Test Method:	ANSI C63.10:2013														
Test Frequency Range:	150KHz to 30MHz														
Class / Severity:	Class B														
Receiver setup:	RBW=9KHz, VBW=30KHz, Sweep time=auto														
Limit:	<table border="1"> <thead> <tr> <th rowspan="2">Frequency range (MHz)</th> <th colspan="2">Limit (dBuV)</th> </tr> <tr> <th>Quasi-peak</th> <th>Average</th> </tr> </thead> <tbody> <tr> <td>0.15-0.5</td> <td>66 to 56*</td> <td>56 to 46*</td> </tr> <tr> <td>0.5-5</td> <td>56</td> <td>46</td> </tr> <tr> <td>5-30</td> <td>60</td> <td>50</td> </tr> </tbody> </table> <p>* Decreases with the logarithm of the frequency.</p>	Frequency range (MHz)	Limit (dBuV)		Quasi-peak	Average	0.15-0.5	66 to 56*	56 to 46*	0.5-5	56	46	5-30	60	50
Frequency range (MHz)	Limit (dBuV)														
	Quasi-peak	Average													
0.15-0.5	66 to 56*	56 to 46*													
0.5-5	56	46													
5-30	60	50													
Test setup:	<p><i>Remark</i> E.U.T: Equipment Under Test LISN: Line Impedance Stabilization Network Test table height=0.8m</p>														
Test procedure:	<ol style="list-style-type: none"> 1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50ohm/50uH coupling impedance for the measuring equipment. 2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refer to the block diagram of the test setup and photographs). 3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10:2013 on conducted measurement. 														
Test Instruments:	Refer to section 6.0 for details														
Test mode:	Refer to section 5.2 for details														
Test results:	Pass														

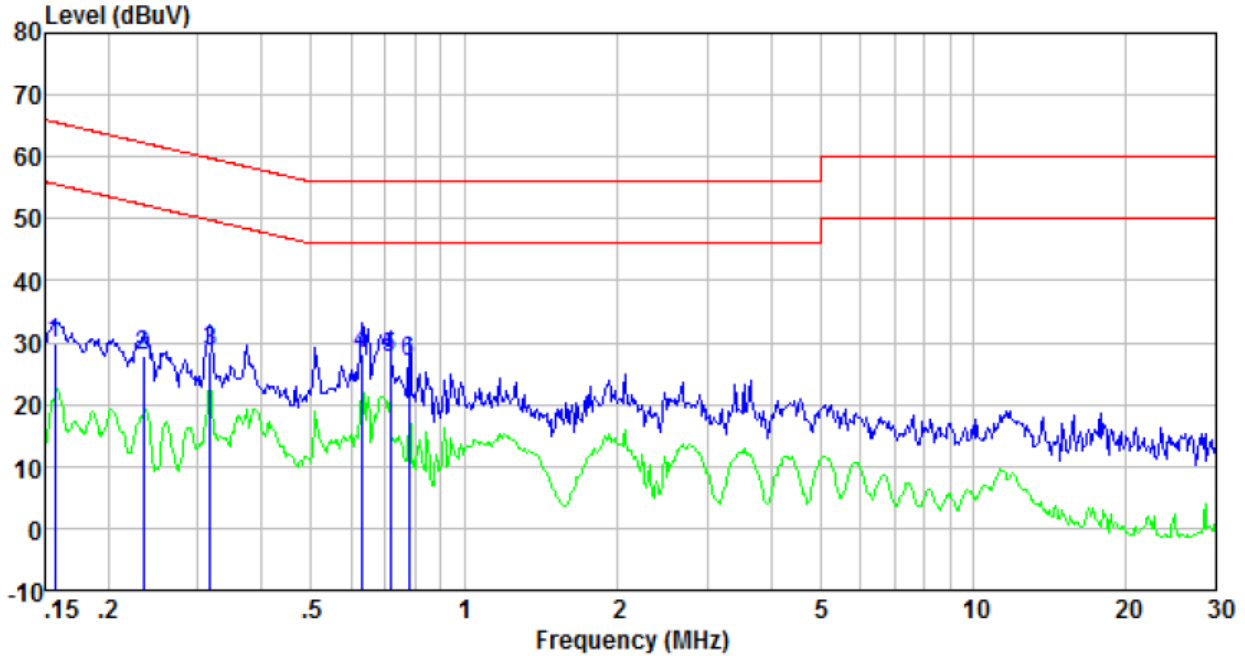
Measurement data

Line:



Freq MHz	Reading level dBuV	lISN/ISN factor dB	Cable loss dB	level dBuV	Limit level dBuV	Over limit dB	Remark
0.16	29.55	0.15	0.12	29.82	65.60	-35.78	QP
0.31	27.65	0.11	0.10	27.86	59.84	-31.98	QP
0.51	27.13	0.12	0.11	27.36	56.00	-28.64	QP
0.63	29.33	0.13	0.12	29.58	56.00	-26.42	QP
0.70	30.26	0.14	0.13	30.53	56.00	-25.47	QP
2.04	23.84	0.12	0.15	24.11	56.00	-31.89	QP

Neutral:

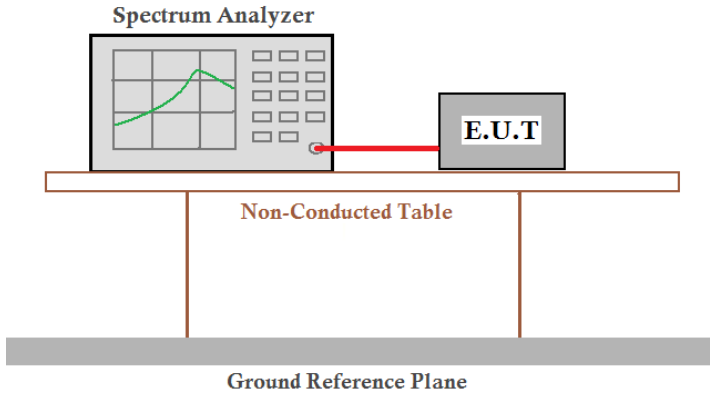


Freq MHz	Reading level dBuV	LISN/ISN factor dB	Cable loss dB	level dBuV	Limit level dBuV	Over limit dB	Remark
0.16	29.81	0.07	0.12	30.00	65.65	-35.65	QP
0.23	27.65	0.06	0.12	27.83	62.30	-34.47	QP
0.32	28.35	0.06	0.10	28.51	59.80	-31.29	QP
0.63	28.16	0.07	0.12	28.35	56.00	-27.65	QP
0.72	27.33	0.07	0.13	27.53	56.00	-28.47	QP
0.78	26.54	0.07	0.13	26.74	56.00	-29.26	QP

Notes:

1. An initial pre-scan was performed on the line and neutral lines with peak detector.
2. Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.
3. Final Level = Receiver Read level + LISN Factor + Cable Loss
4. If the average limit is met when using a quasi-peak detector receiver, the EUT shall be deemed to meet both limits and measurement with the average detector receiver is unnecessary.

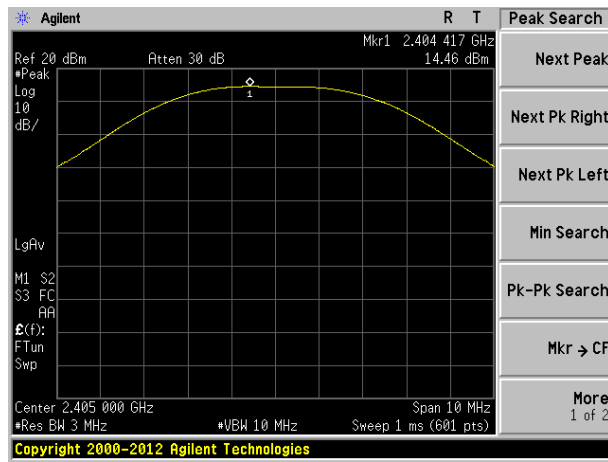
7.3 Conducted Peak Output Power

Test Requirement:	FCC Part15 C Section 15.247 (b)(3)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 DTS Meas Guidance V04
Limit:	30dBm
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both are placed on a Non-Conducted Table, which sits on a Ground Reference Plane.</p>
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

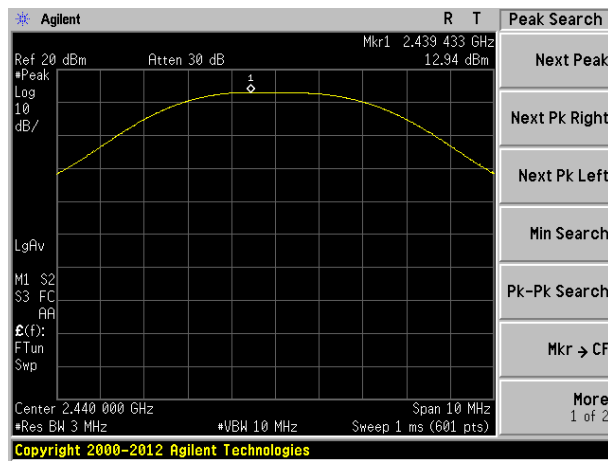
Measurement Data

Frequency (MHz)	Peak Output Power (dBm)	Limit(dBm)	Result
2405	14.46	30	PASS
2440	12.94		
2475	9.03		
2480	-1.71		

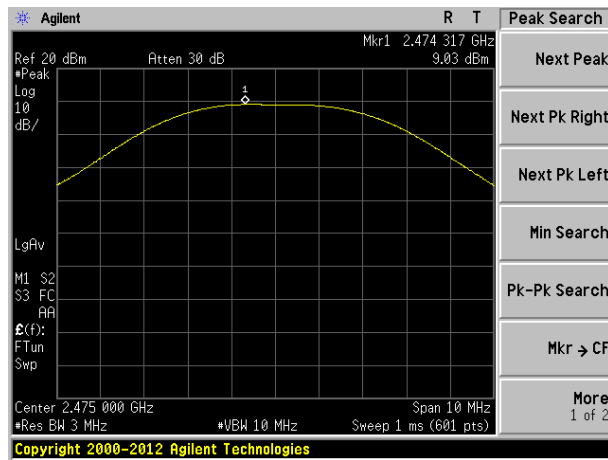
Test plot as follows:



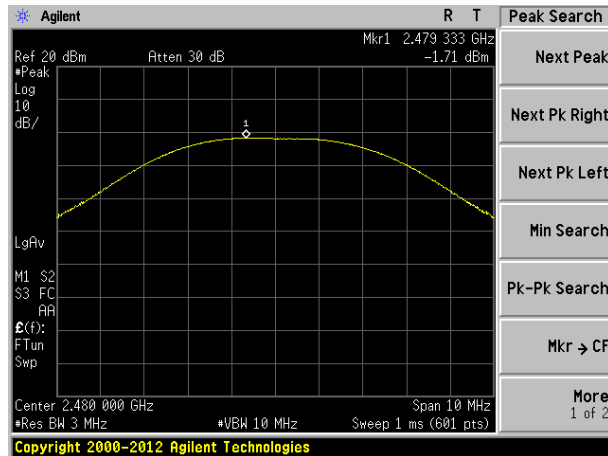
2405MHz



2440MHz

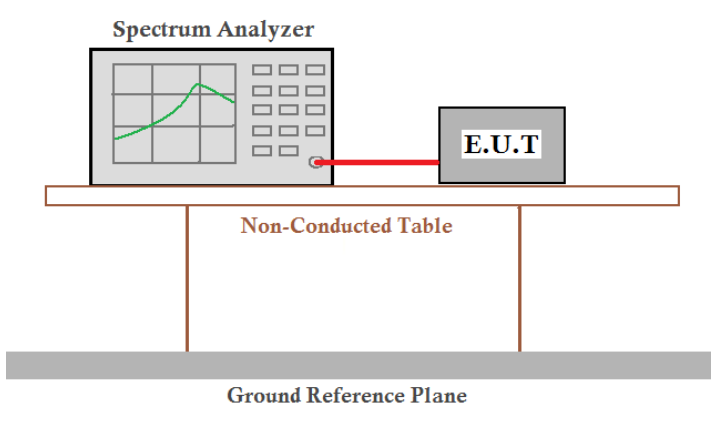


2475MHz



2480MHz

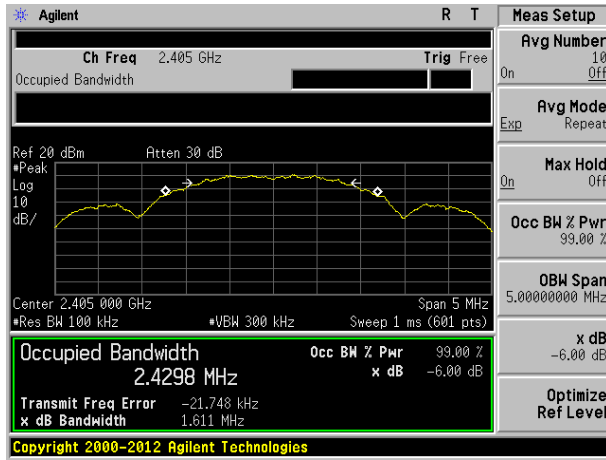
7.4 Channel Bandwidth

Test Requirement:	FCC Part15 C Section 15.247 (a)(2)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 DTS Meas Guidance V04
Limit:	>500KHz
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both are placed on a Non-Conducted Table, which is supported by a Ground Reference Plane.</p>
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

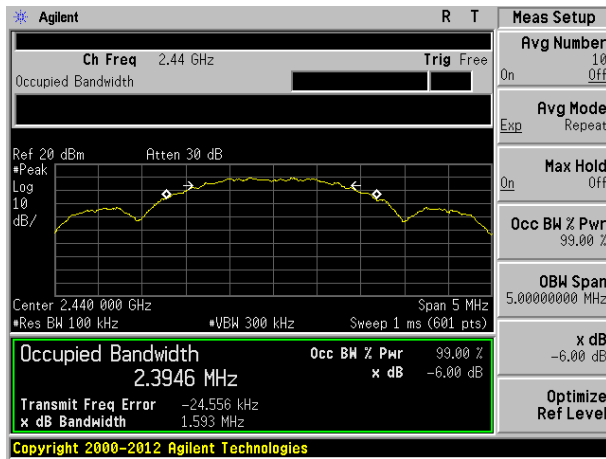
Measurement Data

Frequency (MHz)	Channel Bandwidth (MHz)	Limit(KHz)	Result
2405	1.611	>500	Pass
2440	1.593		
2475	1.614		
2480	1.625		

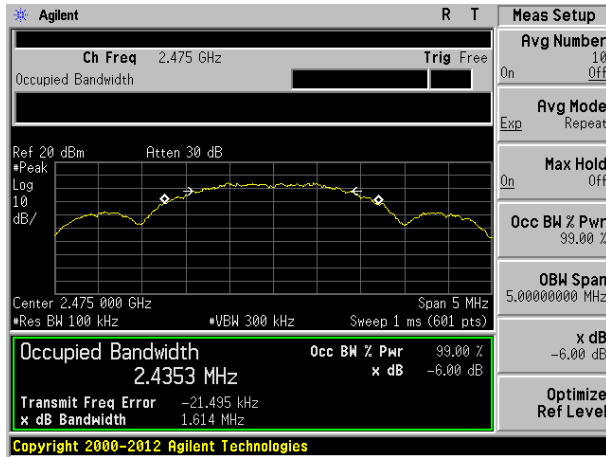
Test plot as follows:



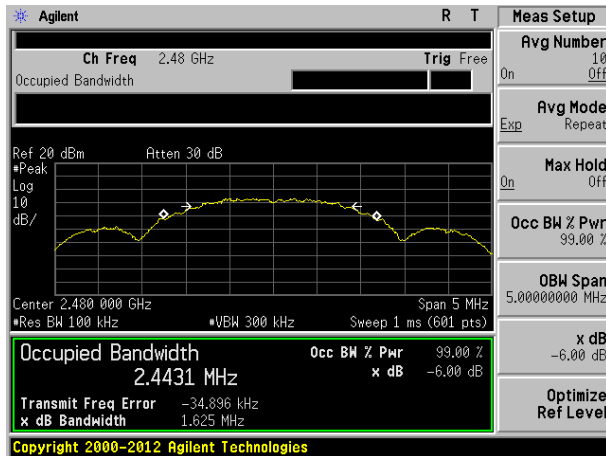
2405MHz



2440MHz

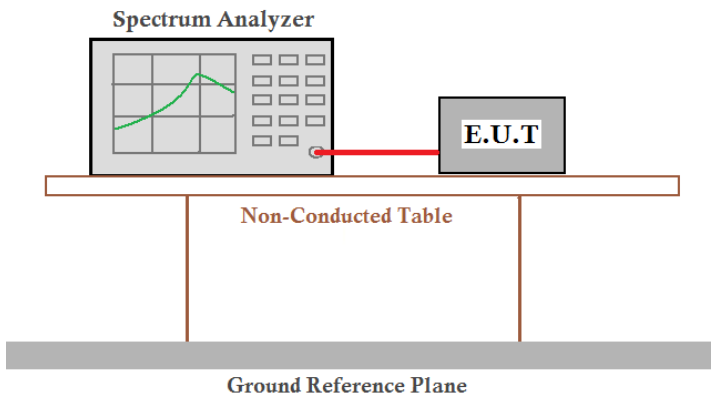


2475MHz



2480MHz

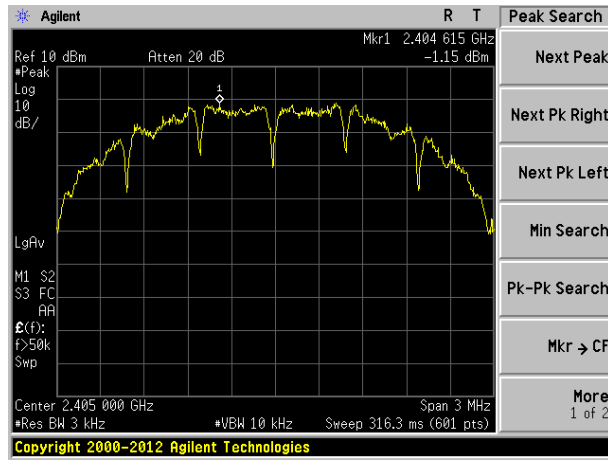
7.5 Power Spectral Density

Test Requirement:	FCC Part15 C Section 15.247 (e)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 DTS Meas Guidance V04
Limit:	8dBm/3kHz
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both are placed on a Non-Conducted Table, which is supported by a Ground Reference Plane.</p>
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

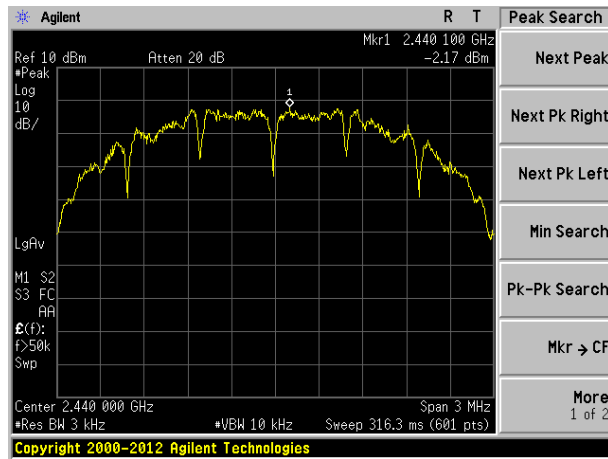
Measurement Data

Frequency (MHz)	Power Spectral Density (dBm)	Limit (dBm/3kHz)	Result
2405	-1.15	8.00	Pass
2440	-2.17		
2475	-6.97		
2480	-17.31		

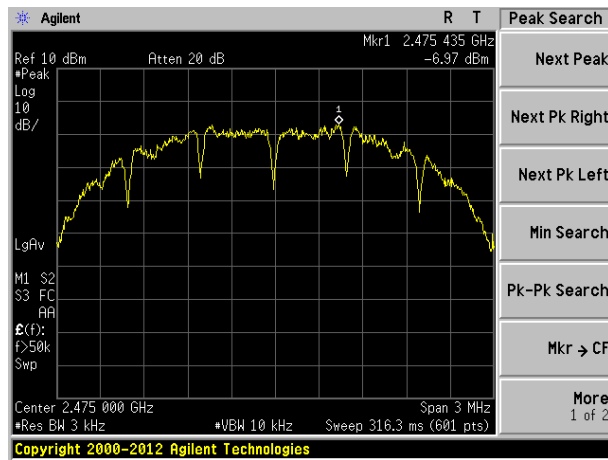
Test plot as follows:



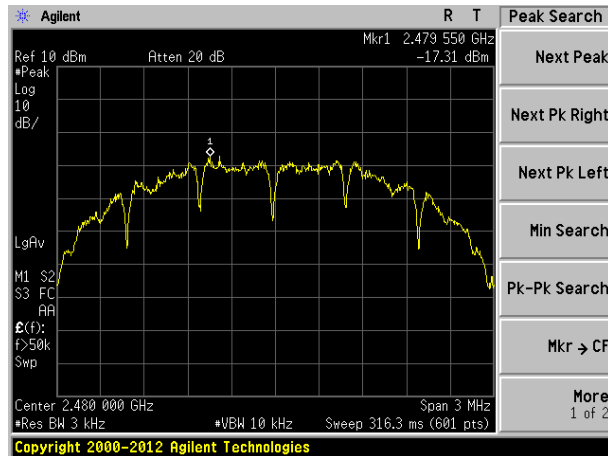
2405MHz



2440MHz



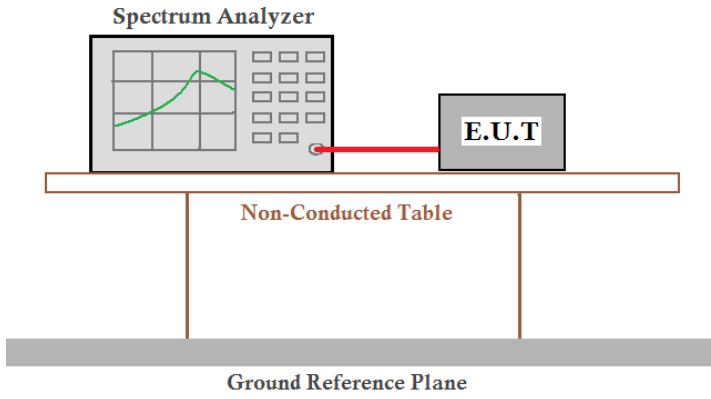
2475MHz



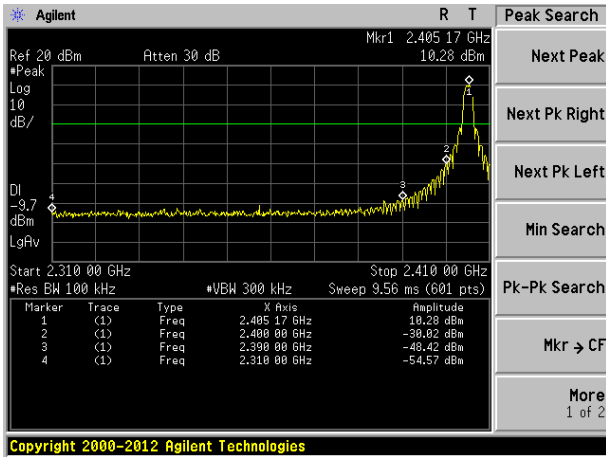
2480MHz

7.6 Band edges

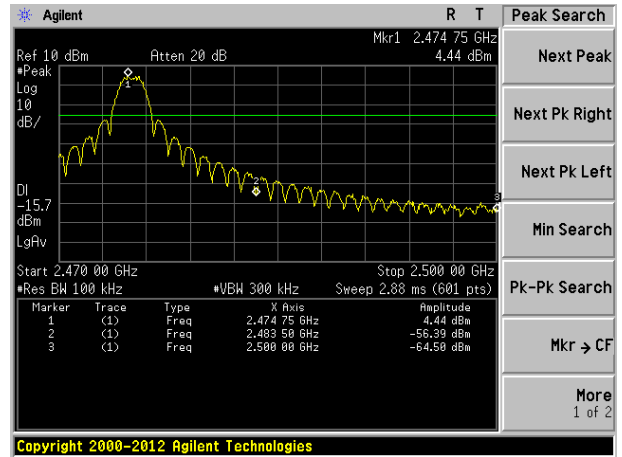
7.6.1 Conducted Emission Method

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 DTS Meas Guidance V04
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both are placed on a Non-Conducted Table, which is supported by a Ground Reference Plane.</p>
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

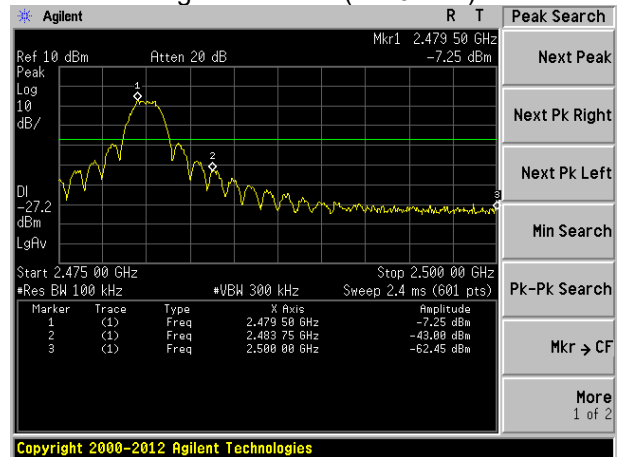
Test plot as follows:



Lowest channel



Highest channel(2475MHz)



Highest channel(2480MHz)

7.6.2 Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209 and 15.205				
Test Method:	ANSI C63.10:2013				
Test Frequency Range:	All of the restrict bands were tested, only the worst band's (2310MHz to 2500MHz) data was showed.				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Value
	Above 1GHz	Peak	1MHz	3MHz	Peak
		RMS	1MHz	3MHz	Average
Limit:	Frequency	Limit (dBuV/m @3m)		Value	
	Above 1GHz	54.00		Average	
		74.00		Peak	
Test setup:					
Test Procedure:	<ol style="list-style-type: none"> 1. The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. 4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. 7. The radiation measurements are performed in X, Y, Z axis positioning. And found the Y axis positioning which it is worse case, only the test worst case mode is recorded in the report. 				
Test Instruments:	Refer to section 6.0 for details				
Test mode:	Refer to section 5.2 for details				
Test results:	Pass				

Measurement data:

Remark: The pre-test were performed on lowest, middle and highest frequencies, only the worst case's (lowest and highest frequencies) data was showed.

Test channel:	2405MHz
---------------	---------

Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2310.00	46.70	27.91	5.30	30.37	49.54	74.00	-24.46	Horizontal
2390.00	47.96	27.59	5.38	30.18	50.75	74.00	-23.25	Horizontal
2310.00	43.20	27.91	5.30	30.37	46.04	74.00	-27.96	Vertical
2390.00	43.67	27.59	5.38	30.18	46.46	74.00	-27.54	Vertical

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2310.00	33.45	27.91	5.30	30.37	36.29	54.00	-17.71	Horizontal
2390.00	37.56	27.59	5.38	30.18	40.35	54.00	-13.65	Horizontal
2310.00	33.74	27.91	5.30	30.37	36.58	54.00	-17.42	Vertical
2390.00	33.65	27.59	5.38	30.18	36.44	54.00	-17.56	Vertical

Test channel:	2475MHz
---------------	---------

Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.50	50.21	27.53	5.47	29.93	53.28	74.00	-20.72	Horizontal
2500.00	43.34	27.55	5.49	29.93	46.45	74.00	-27.55	Horizontal
2483.50	48.59	27.53	5.47	29.93	51.66	74.00	-22.34	Vertical
2500.00	44.01	27.55	5.49	29.93	47.12	74.00	-26.88	Vertical

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.50	39.65	27.53	5.47	29.93	42.72	54.00	-11.28	Horizontal
2500.00	32.24	27.55	5.49	29.93	35.35	54.00	-18.65	Horizontal
2483.50	36.94	27.53	5.47	29.93	40.01	54.00	-13.99	Vertical
2500.00	32.16	27.55	5.49	29.93	35.27	54.00	-18.73	Vertical

Test channel:	2480MHz
---------------	---------

Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.50	55.39	27.53	5.47	29.93	58.46	74.00	-15.54	Horizontal
2500.00	43.27	27.55	5.49	29.93	46.38	74.00	-27.62	Horizontal
2483.50	50.75	27.53	5.47	29.93	53.82	74.00	-20.18	Vertical
2500.00	43.86	27.55	5.49	29.93	46.97	74.00	-27.03	Vertical

Average value:

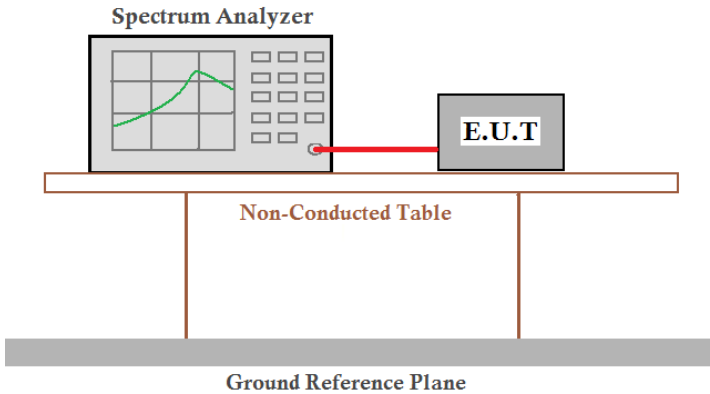
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.50	45.97	27.53	5.47	29.93	49.04	54.00	-4.96	Horizontal
2500.00	32.27	27.55	5.49	29.93	35.38	54.00	-18.62	Horizontal
2483.50	41.33	27.53	5.47	29.93	44.40	54.00	-9.60	Vertical
2500.00	32.40	27.55	5.49	29.93	35.51	54.00	-18.49	Vertical

Remark:

1. *Final Level = Receiver Read level + Antenna Factor + Cable Loss – Pre-amplifier Factor*
2. *The emission levels of other frequencies are very lower than the limit and not show in test report.*

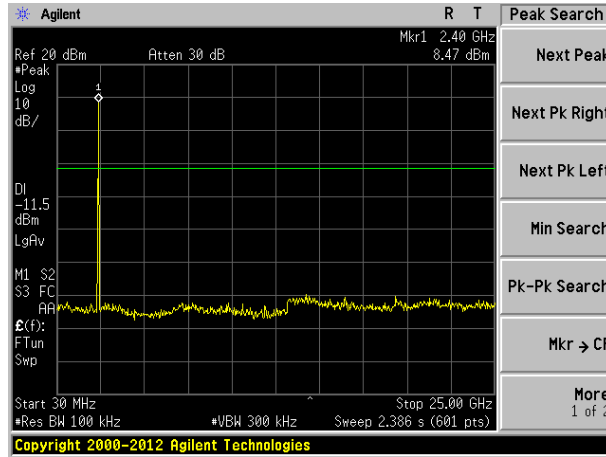
7.7 Spurious Emission

7.7.1 Conducted Emission Method

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 DTS Meas Guidance V04
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.
Test setup:	 <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both are placed on a Non-Conducted Table. Below the table is a Ground Reference Plane.</p>
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.2 for details
Test results:	Pass

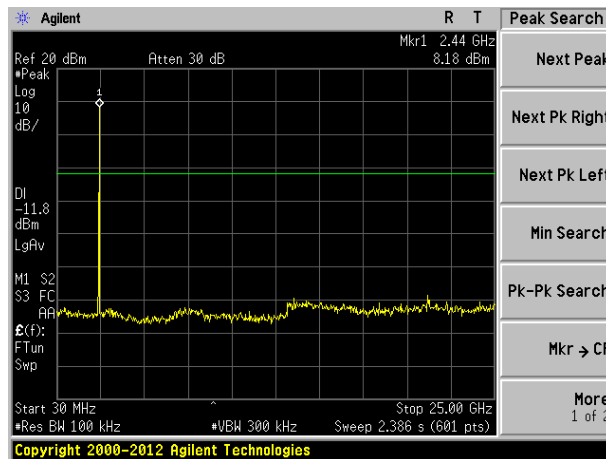
Test plot as follows:

Lowest channel



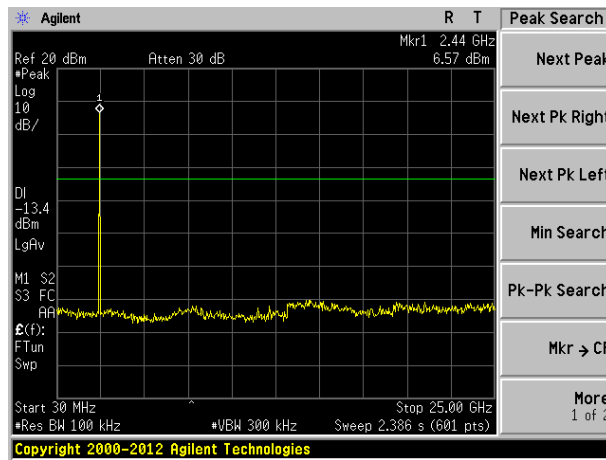
30MHz~25GHz

Middle channel



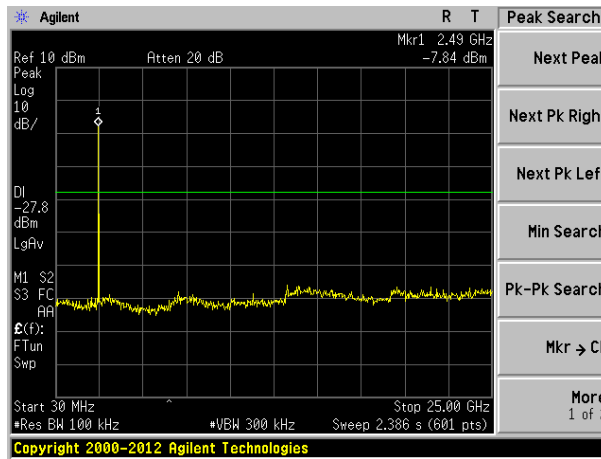
30MHz~25GHz

Highest channel (2475MHz)



30MHz~25GHz

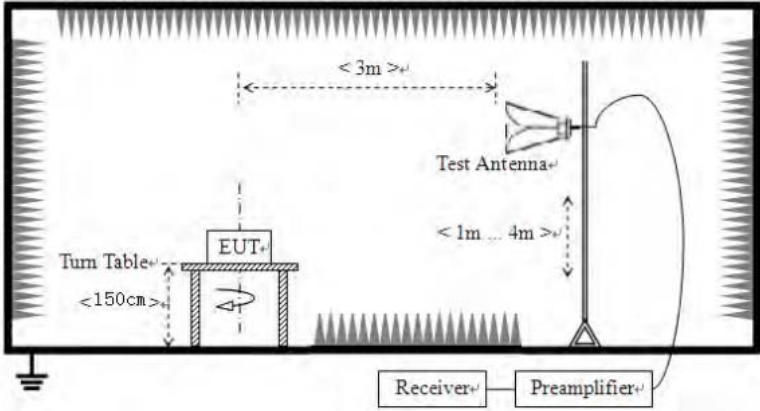
Highest channel (2480MHz)



30MHz~25GHz

7.7.2 Radiated Emission Method

Test Requirement:	FCC Part15 C Section 15.209				
Test Method:	ANSI C63.10: 2013				
Test Frequency Range:	30MHz to 25GHz				
Test site:	Measurement Distance: 3m				
Receiver setup:	Frequency	Detector	RBW	VBW	Value
	30MHz-1GHz	Quasi-peak	120KHz	300KHz	Quasi-peak
	Above 1GHz	Peak	1MHz	3MHz	Peak
RMS		1MHz	3MHz	Average	
Limit:	Frequency	Limit (dBuV/m @3m)		Value	
	30MHz-88MHz	40.00		Quasi-peak	
	88MHz-216MHz	43.50		Quasi-peak	
	216MHz-960MHz	46.00		Quasi-peak	
	960MHz-1GHz	54.00		Quasi-peak	
	Above 1GHz	54.00		Average	
74.00		Peak			
Test setup:	Below 1GHz				
	<p>The diagram illustrates the test setup for frequencies below 1GHz. It shows an Equipment Under Test (EUT) placed on a turntable. The EUT is positioned at a height of less than 80cm. The test antenna is positioned at a distance of less than 3m from the EUT and at a height of between 1m and 4m. The antenna is connected to a receiver and a preamplifier. The setup is enclosed in a shielded area, indicated by the hatched lines on the walls.</p>				
Above 1GHz					

	
<p>Test Procedure:</p>	<ol style="list-style-type: none"> 1. The EUT was placed on the top of a rotating table (0.8 meters for below 1GHz and 1.5 meters for above 1GHz) above the ground at a 3 meter camber. The table was rotated 360 degrees to determine the position of the highest radiation. 2. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower. 3. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement. 4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rota table was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet. 7. The radiation measurements are performed in X, Y, Z axis positioning. And found the Y axis positioning which it is worse case, only the test worst case mode is recorded in the report.
<p>Test Instruments:</p>	<p>Refer to section 6.0 for details</p>
<p>Test mode:</p>	<p>Refer to section 5.2 for details</p>
<p>Test results:</p>	<p>Pass</p>

Remark:

Pre-scan all kind of the place mode (X-axis, Y-axis, Z-axis), and found the Y-axis which it is worse case.

Measurement Data

■ Below 1GHz

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
30.64	31.08	14.33	0.56	30.10	15.87	40.00	-24.13	Vertical
99.88	29.29	15.16	1.19	29.70	15.94	43.50	-27.56	Vertical
236.65	26.81	13.93	2.05	29.54	13.25	46.00	-32.75	Vertical
373.31	28.23	16.54	2.73	29.62	17.88	46.00	-28.12	Vertical
570.61	26.50	19.93	3.60	29.30	20.73	46.00	-25.27	Vertical
842.13	27.54	22.51	4.63	29.16	25.52	46.00	-20.48	Vertical
32.07	29.63	14.32	0.57	30.09	14.43	40.00	-25.57	Horizontal
94.43	28.53	14.75	1.15	29.72	14.71	43.50	-28.79	Horizontal
210.79	33.24	12.90	1.90	29.30	18.74	43.50	-24.76	Horizontal
294.11	32.40	14.95	2.33	29.97	19.71	46.00	-26.29	Horizontal
473.84	28.13	17.95	3.20	29.35	19.93	46.00	-26.07	Horizontal
742.26	28.52	21.34	4.24	29.20	24.90	46.00	-21.10	Horizontal

■ Above 1GHz

Test channel:	Lowest
---------------	--------

Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4810.00	38.65	31.78	8.60	32.09	46.94	74.00	-27.06	Vertical
7215.00	28.01	36.15	11.66	31.99	43.83	74.00	-30.17	Vertical
9620.00	26.45	38.01	14.14	31.60	47.00	74.00	-27.00	Vertical
12025.00	*					74.00		Vertical
14430.00	*					74.00		Vertical
4810.00	40.13	31.78	8.60	32.09	48.42	74.00	-25.58	Horizontal
7215.00	27.35	36.15	11.66	31.99	43.17	74.00	-30.83	Horizontal
9620.00	25.33	38.01	14.14	31.60	45.88	74.00	-28.12	Horizontal
12025.00	*					74.00		Horizontal
14430.00	*					74.00		Horizontal

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4810.00	29.39	31.78	8.60	32.09	37.68	54.00	-16.32	Vertical
7215.00	20.64	36.15	11.66	31.99	36.46	54.00	-17.54	Vertical
9620.00	19.20	38.01	14.14	31.60	39.75	54.00	-14.25	Vertical
12025.00	*					54.00		Vertical
14430.00	*					54.00		Vertical
4810.00	28.45	31.78	8.60	32.09	36.74	54.00	-17.26	Horizontal
7215.00	22.40	36.15	11.66	31.99	38.22	54.00	-15.78	Horizontal
9620.00	18.51	38.01	14.14	31.60	39.06	54.00	-14.94	Horizontal
12025.00	*					54.00		Horizontal
14430.00	*					54.00		Horizontal

Remark:

1. *Final Level = Receiver Read level + Antenna Factor + Cable Loss – Pre-amplifier Factor*
2. *“*”*, means this data is the too weak instrument of signal is unable to test.

Test channel:	Middle
---------------	--------

Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4880.00	37.86	31.85	8.66	32.12	46.25	74.00	-27.75	Vertical
7320.00	27.68	36.37	11.72	31.89	43.88	74.00	-30.12	Vertical
9760.00	26.03	38.35	14.25	31.59	47.04	74.00	-26.96	Vertical
12200.00	*					74.00		Vertical
14640.00	*					74.00		Vertical
4880.00	38.67	31.85	8.66	32.12	47.06	74.00	-26.94	Horizontal
7320.00	29.10	36.37	11.72	31.89	45.30	74.00	-28.70	Horizontal
9760.00	26.84	38.35	14.25	31.59	47.85	74.00	-26.15	Horizontal
12200.00	*					74.00		Horizontal
14640.00	*					74.00		Horizontal

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4880.00	29.69	31.85	8.66	32.12	38.08	54.00	-15.92	Vertical
7320.00	22.88	36.37	11.72	31.89	39.08	54.00	-14.92	Vertical
9760.00	20.95	38.35	14.25	31.59	41.96	54.00	-12.04	Vertical
12200.00	*					54.00		Vertical
14640.00	*					54.00		Vertical
4880.00	29.35	31.85	8.66	32.12	37.74	54.00	-16.26	Horizontal
7320.00	21.89	36.37	11.72	31.89	38.09	54.00	-15.91	Horizontal
9760.00	18.35	38.35	14.25	31.59	39.36	54.00	-14.64	Horizontal
12200.00	*					54.00		Horizontal
14640.00	*					54.00		Horizontal

Remark:

1. *Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *“*” , means this data is the too weak instrument of signal is unable to test.*

Test channel:	Highest (2475MHz)
---------------	-------------------

Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4950.00	36.28	31.91	8.71	32.16	44.74	74.00	-29.26	Vertical
7425.00	27.15	36.56	11.79	31.80	43.70	74.00	-30.30	Vertical
9900.00	25.98	38.81	14.35	31.85	47.29	74.00	-26.71	Vertical
12375.00	*					74.00		Vertical
14850.00	*					74.00		Vertical
4950.00	38.65	31.91	8.71	32.16	47.11	74.00	-26.89	Horizontal
7425.00	25.86	36.56	11.79	31.80	42.41	74.00	-31.59	Horizontal
9900.00	26.35	38.81	14.35	31.85	47.66	74.00	-26.34	Horizontal
12375.00	*					74.00		Horizontal
14850.00	*					74.00		Horizontal

Average value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4950.00	29.20	31.91	8.71	32.16	37.66	54.00	-16.34	Vertical
7425.00	22.83	36.56	11.79	31.80	39.38	54.00	-14.62	Vertical
9900.00	19.02	38.81	14.35	31.85	40.33	54.00	-13.67	Vertical
12375.00	*					54.00		Vertical
14850.00	*					54.00		Vertical
4950.00	29.31	31.91	8.71	32.16	37.77	54.00	-16.23	Horizontal
7425.00	22.15	36.56	11.79	31.80	38.70	54.00	-15.30	Horizontal
9900.00	19.53	38.81	14.35	31.85	40.84	54.00	-13.16	Horizontal
12375.00	*					54.00		Horizontal
14850.00	*					54.00		Horizontal

Test channel:	Highest (2480MHz)
---------------	-------------------

Peak value:

Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4960.00	30.26	31.93	8.73	32.16	38.76	74.00	-35.24	Vertical
7440.00	26.86	36.59	11.79	31.78	43.46	74.00	-30.54	Vertical
9920.00	27.00	38.81	14.38	31.88	48.31	74.00	-25.69	Vertical
12400.00	*					74.00		Vertical
14880.00	*					74.00		Vertical
4960.00	29.53	31.93	8.73	32.16	38.03	74.00	-35.97	Horizontal
7440.00	26.38	36.59	11.79	31.78	42.98	74.00	-31.02	Horizontal
9920.00	25.69	38.81	14.38	31.88	47.00	74.00	-27.00	Horizontal
12400.00	*					74.00		Horizontal
14880.00	*					74.00		Horizontal

Average value:

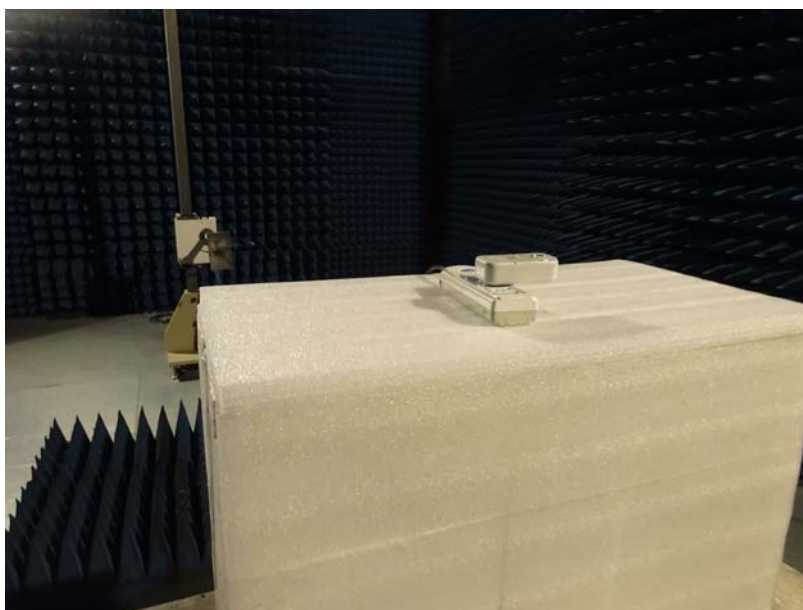
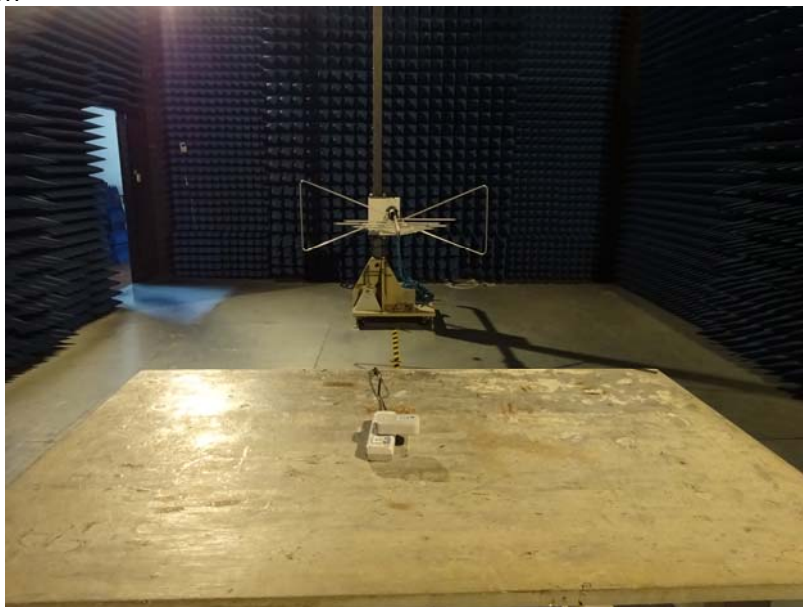
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4960.00	29.35	31.93	8.73	32.16	37.85	54.00	-16.15	Vertical
7440.00	22.41	36.59	11.79	31.78	39.01	54.00	-14.99	Vertical
9920.00	18.35	38.81	14.38	31.88	39.66	54.00	-14.34	Vertical
12400.00	*					54.00		Vertical
14880.00	*					54.00		Vertical
4960.00	27.45	31.93	8.73	32.16	35.95	54.00	-18.05	Horizontal
7440.00	20.97	36.59	11.79	31.78	37.57	54.00	-16.43	Horizontal
9920.00	17.25	38.81	14.38	31.88	38.56	54.00	-15.44	Horizontal
12400.00	*					54.00		Horizontal
14880.00	*					54.00		Horizontal

Remark:

1. *Final Level = Receiver Read level + Antenna Factor + Cable Loss – Preamplifier Factor*
2. *“*” , means this data is the too weak instrument of signal is unable to test.*

8 Test Setup Photo

Radiated Emission

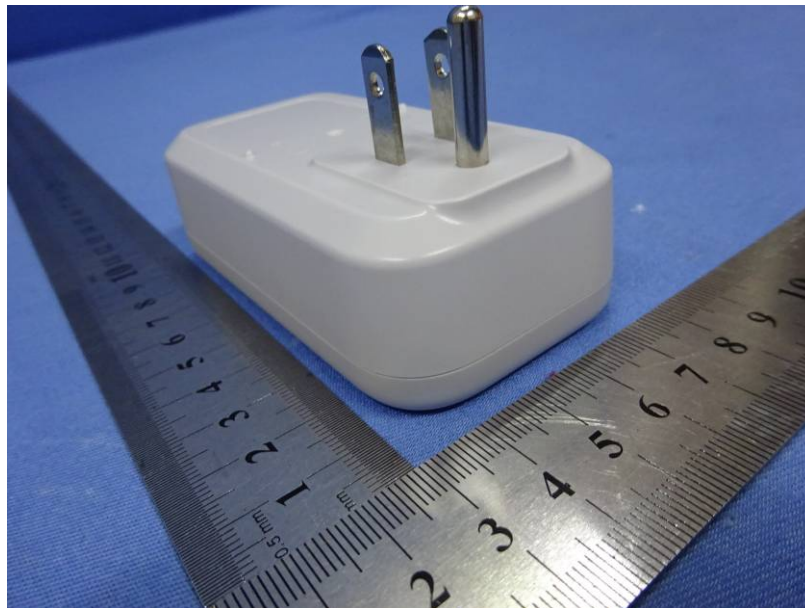
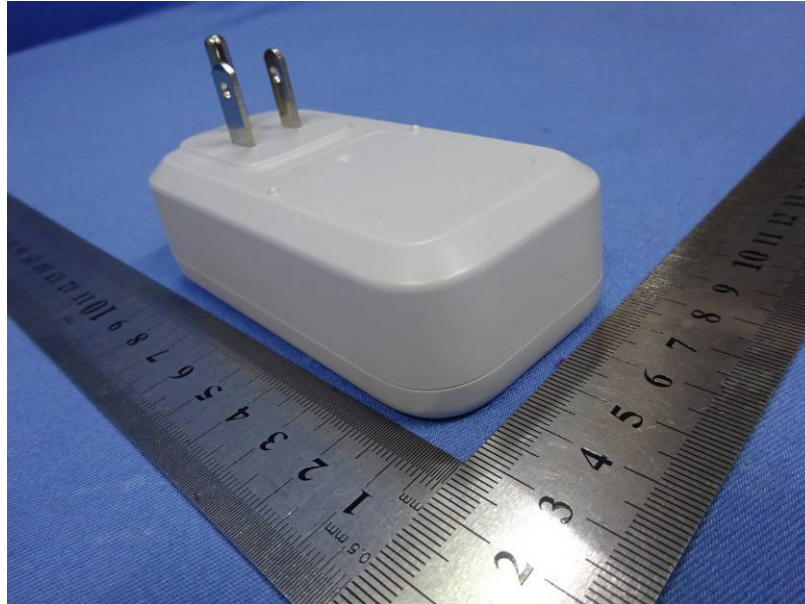


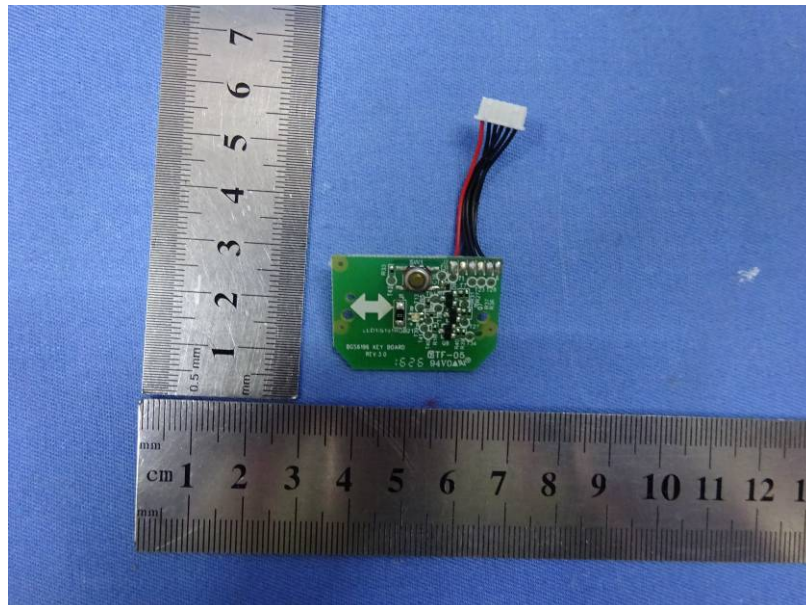
Conducted Emission

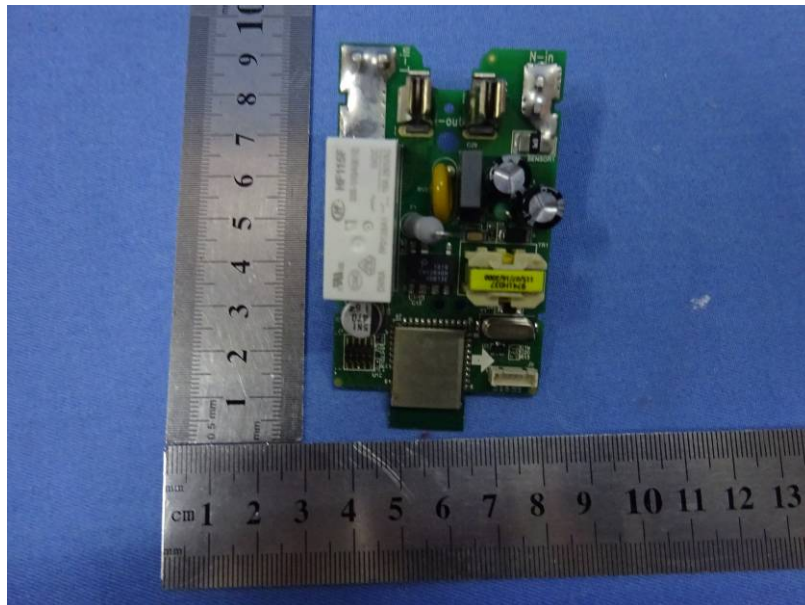
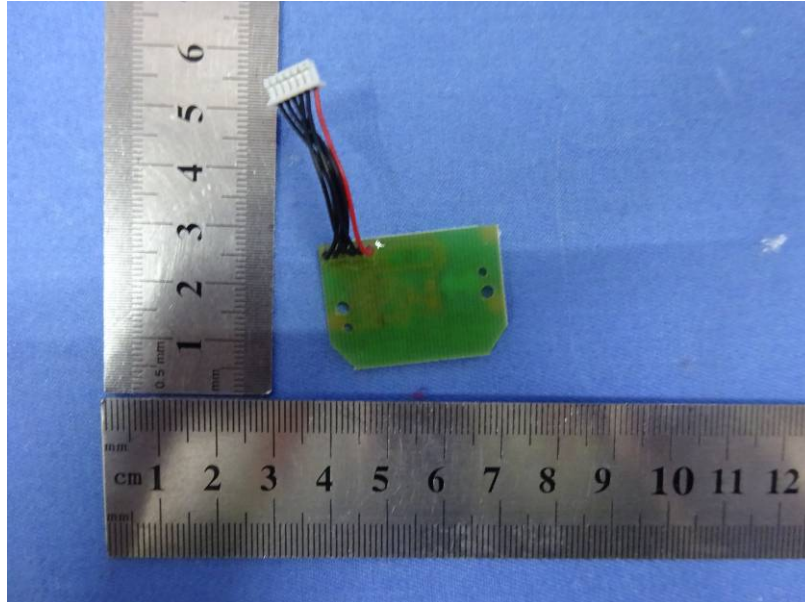


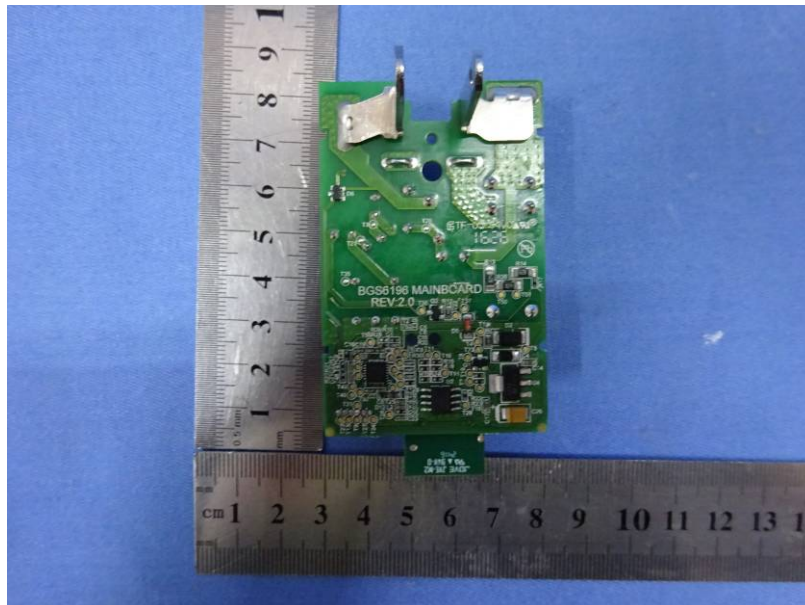
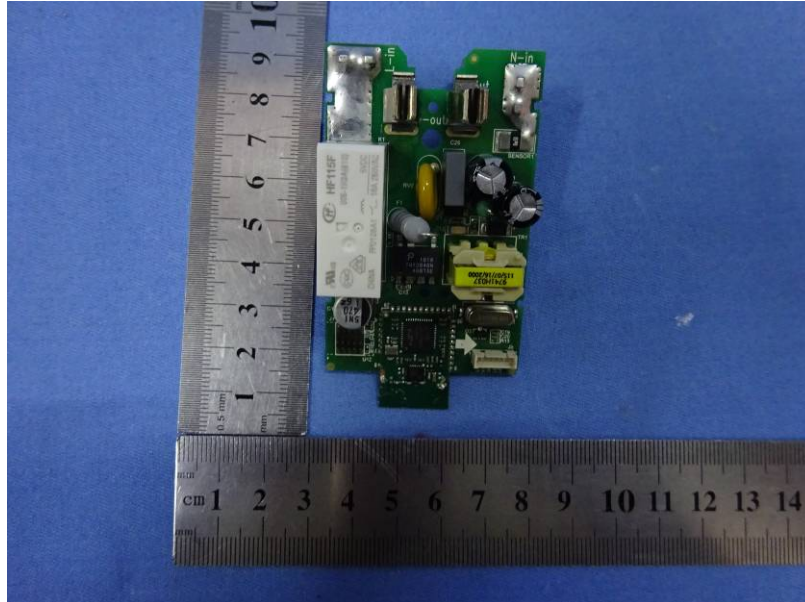
9 EUT Constructional Details











-----End-----