

## FCC REPORT

**Applicant:** SALUS North America, Inc.

**Address of Applicant:** 850 Main Street, Redwood City, California 94063, United States

**Equipment Under Test (EUT)**

Product Name: ZigBee Zone Wiring Center

Model No.: SAA6MI1, AKL08RF

**FCC ID:** 2AG86-AKL08RF

**Applicable standards:** FCC CFR Title 47 Part 15 Subpart C Section 15.247:2016

**Date of sample receipt:** December 06, 2016

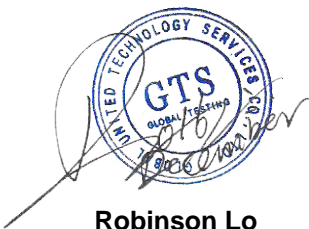
**Date of Test:** December 07-12, 2016

**Date of report issued:** December 14, 2016

**Test Result :** PASS \*

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

Authorized Signature:

A circular logo for GTS (Global United Technology Services Co., Ltd.) is stamped in blue ink. The logo contains the text "GTS" in large letters, "GLOBAL TESTING" in smaller letters below it, and "UNITED TECHNOLOGY SERVICES CO., LTD." around the perimeter. A handwritten signature in black ink is written over the logo.

**Robinson Lo**  
**Laboratory Manager**

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product and does not permit the use of the GTS product certification mark. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

This report may only be reproduced and distributed in full. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of GTS or testing done by GTS in connection with, distribution or use of the product described in this report must be approved by GTS in writing.

This document cannot be reproduced except in full, without prior written approval of the Company. Any unauthorized alteration, forgery or falsification of the content or appearance of this document is unlawful and offenders may be prosecuted to the fullest extent of the law. Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.

## 2 Version

Version No.	Date	Description
00	December 14, 2016	Original

**Prepared By:**

*Edward.Pan*

**Date:**

*December 14, 2016*

**Project Engineer**

**Check By:**

*Andy. wa*

**Date:**

*December 14, 2016*

**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 CLIENT INFORMATION .....	5
5.2 GENERAL DESCRIPTION OF EUT .....	5
5.3 TEST MODE .....	6
5.4 DESCRIPTION OF SUPPORT UNITS .....	6
5.5 TEST FACILITY.....	7
5.6 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 .....	39
9 EUT CONSTRUCTIONAL DETAILS .....	41

## 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 C63.10:2013*

### 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 Client Information

Applicant:	SALUS North America, Inc.
Address of Applicant:	850 Main Street, Redwood City, California 94063, United States
Manufacturer:	SALUS North America, Inc.
Address of Manufacturer:	850 Main Street, Redwood City, California 94063, United States
Factory:	Computime Electronics (shenzhen) Company Limited
Address of Factory:	Yuekenguangyu Industrial Park, Kangqiao Road 88#, Danzhutou Community, Nanwan Street Office, Longgang District, Shenzhen 518114

### 5.2 General Description of EUT

Product Name:	ZigBee Zone Wiring Center
Model No.:	SAA6MI1, AKL08RF
Operation Frequency:	2405MHz~2480MHz
Channel numbers:	16
Channel separation:	5MHz
Modulation type:	O-QPSK
Antenna Type:	Internal Antenna External Antenna
Antenna gain:	Internal Antenna 0.5dBi (declare by Applicant) External Antenna 2.15dBi(declare by Applicant)
Power supply:	AC 120V, 60Hz

NOTE: Internal antenna and External antenna can not transmit simultaneously

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	2440MHz
The Highest channel	2480MHz

### 5.3 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>	

### 5.4 Description of Support Units

N/A
-----

## 5.5 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.

## 5.6 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	9.2(L)*6.2(W)* 6.4(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	Spectrum Analyzer	Agilent	E4440A	GTS533	June 29 2016	June 28 2017
4	EMI Test Receiver	Rohde & Schwarz	ESU26	GTS203	June 29 2016	June 28 2017
5	BiConiLog Antenna	SCHWARZBECK MESS-ELEKTRONIK	VULB9163	GTS214	June 29 2016	June 28 2017
6	Double -ridged waveguide horn	SCHWARZBECK MESS-ELEKTRONIK	9120D-829	GTS208	June 29 2016	June 28 2017
7	Horn Antenna	ETS-LINDGREN	3160	GTS217	June 29 2016	June 28 2017
8	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
9	Coaxial Cable	GTS	N/A	GTS213	June 29 2016	June 28 2017
10	Coaxial Cable	GTS	N/A	GTS211	June 29 2016	June 28 2017
11	Coaxial cable	GTS	N/A	GTS210	June 29 2016	June 28 2017
12	Coaxial Cable	GTS	N/A	GTS212	June 29 2016	June 28 2017
13	Amplifier(100kHz-3GHz)	HP	8347A	GTS204	June 29 2016	June 28 2017
14	Amplifier(2GHz-20GHz)	HP	8349B	GTS206	June 29 2016	June 28 2017
15	Amplifier (18-26GHz)	Rohde & Schwarz	AFS33-18002 650-30-8P-44	GTS218	June 29 2016	June 28 2017
16	Band filter	Amindeon	82346	GTS219	June 29 2016	June 28 2017

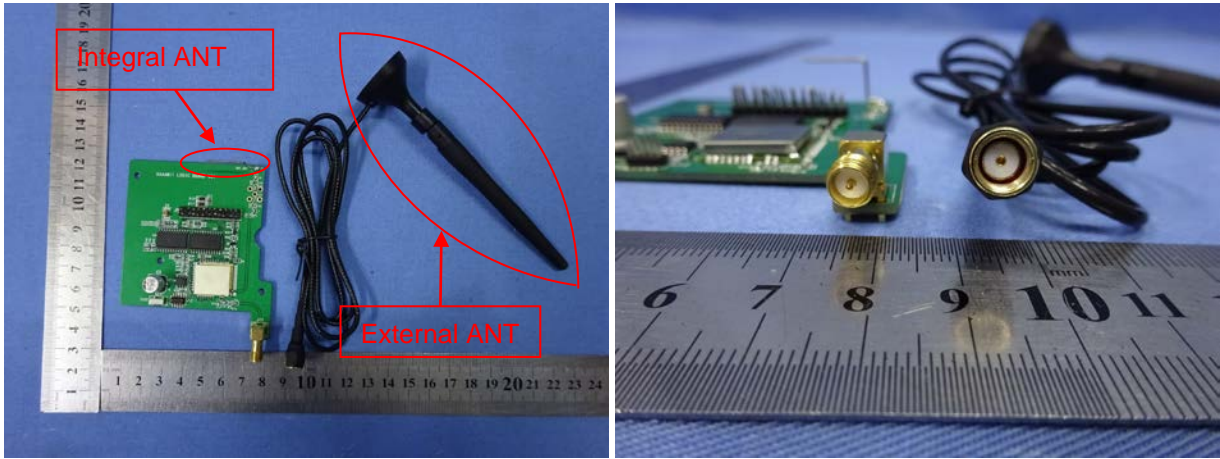
Conducted Emission:						
Item	Test Equipment	Manufacturer	Model No.	Inventory No.	Cal.Date (mm-dd-yy)	Cal.Due date (mm-dd-yy)
1	Shielding Room	ZhongYu Electron	7.3(L)x3.1(W)x2.9(H)	GTS252	May 16 2014	May 15 2019
2	EMI Test Receiver	R&S	ESCI 7	GTS552	June 29 2016	June 28 2017
3	Pulse Limiter	R&S	ESH3-Z2	GTS224	June 29 2016	June 28 2017
4	Coaxial Switch	ANRITSU CORP	MP59B	GTS225	June 29 2016	June 28 2017
5	Artificial Mains Network	SCHWARZBECK MESS	NSLK8127	GTS226	June 29 2016	June 28 2017
6	Coaxial Cable	GTS	N/A	GTS227	June 29 2016	June 28 2017
7	EMI Test Software	AUDIX	E3	N/A	N/A	N/A
8	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

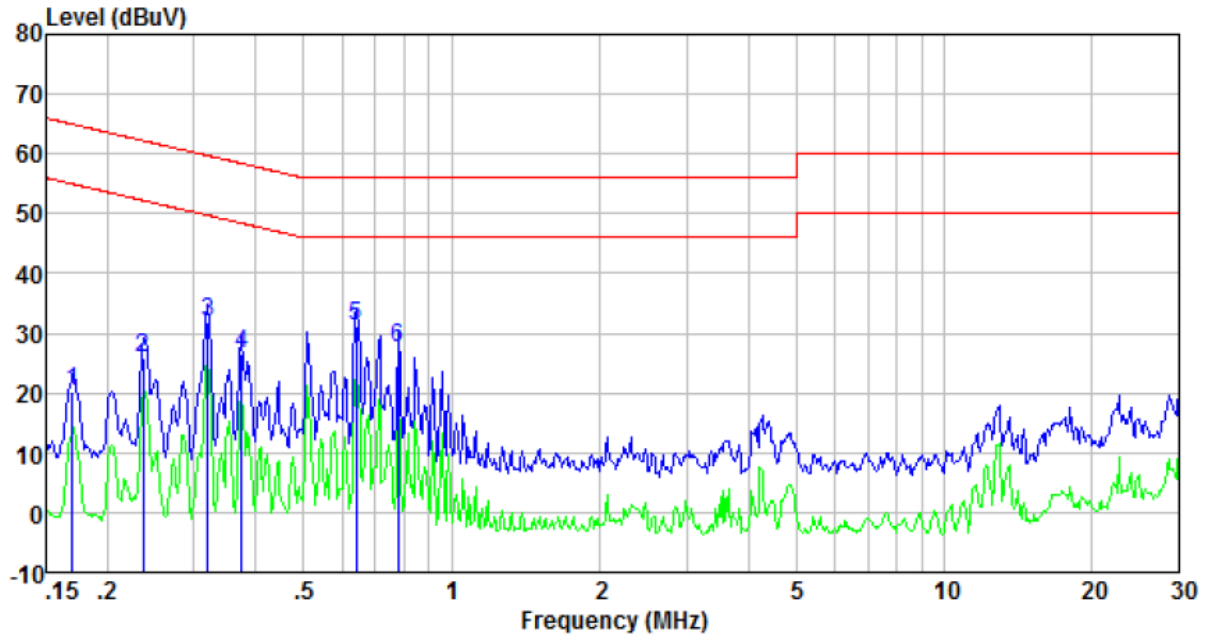
<b>Standard requirement:</b>	FCC Part15 C Section 15.203 /247(c)
<p><b>15.203 requirement:</b></p> <p>An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an 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><b>15.247(c) (1)(i) requirement:</b></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>	
<b>EUT Antenna:</b>	
<p><i>External antenna is with reversed polarity non standard antenna port, the best case gain of the internal antenna is 0.5 dBi, The best case gain of the external antenna is 2.15dBi.</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"> <li>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.</li> <li>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).</li> <li>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.</li> </ol>														
Test Instruments:	Refer to section 6.0 for details														
Test mode:	Refer to section 5.3 for details														
Test results:	Pass														

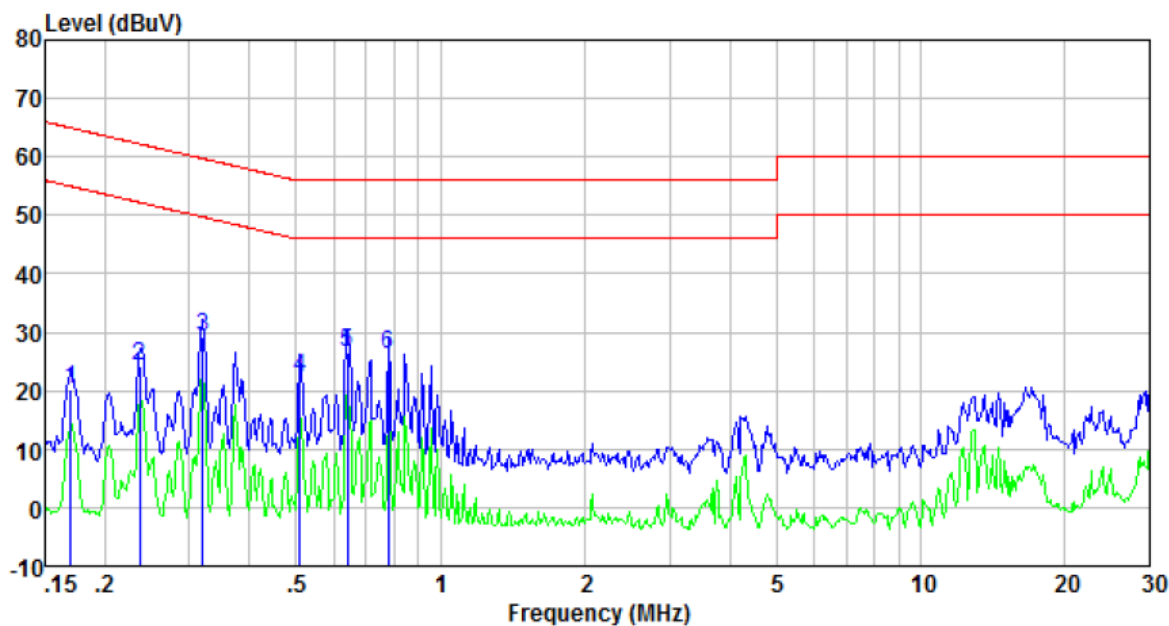
**Measurement data**

Line:



Freq MHz	Reading level dBuV	lISN/ISN factor dB	Cable loss dB	level dBuV	Limit level dBuV	Over limit dB	Remark
0.17	19.61	0.42	0.12	20.15	64.99	-44.84	QP
0.24	25.46	0.44	0.12	26.02	62.22	-36.20	QP
0.32	31.42	0.44	0.10	31.96	59.71	-27.75	QP
0.38	26.05	0.42	0.10	26.57	58.39	-31.82	QP
0.64	30.61	0.30	0.13	31.04	56.00	-24.96	QP
0.78	27.26	0.27	0.13	27.66	56.00	-28.34	QP

Neutral:

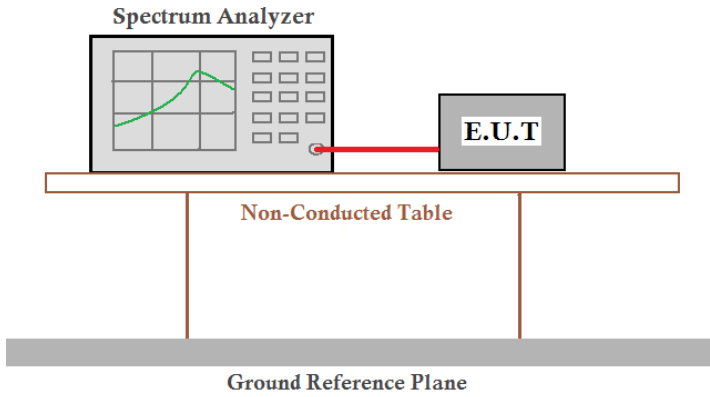


Freq MHz	Reading level dBuV	LISN/ISN factor dE	Cable loss dBuV	level dBuV	Limit level dB	Over limit dB	Remark
0.17	19.85	0.41	0.12	20.38	64.99	-44.61	QP
0.24	23.79	0.42	0.12	24.33	62.22	-37.89	QP
0.32	28.64	0.42	0.10	29.16	59.71	-30.55	QP
0.51	21.89	0.34	0.11	22.34	56.00	-33.66	QP
0.64	26.03	0.26	0.13	26.42	56.00	-29.58	QP
0.78	25.86	0.23	0.13	26.22	56.00	-29.78	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 V03
Limit:	30dBm
Test setup:	 <p>The diagram shows a Spectrum Analyzer and an E.U.T. connected by a red cable. They are positioned on a table labeled '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 5.3 for details
Test results:	Pass

#### Measurement Data

##### Internal Antenna:

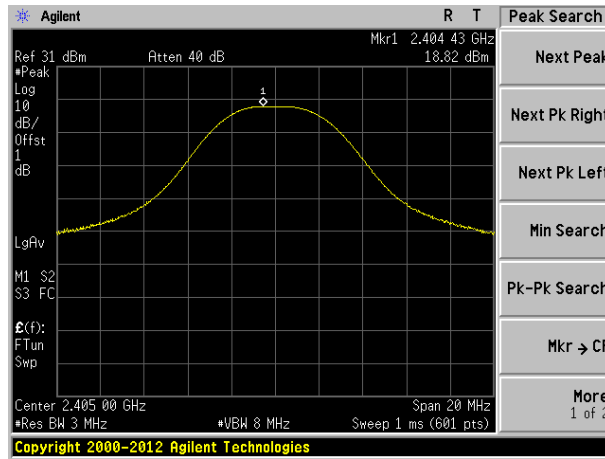
Frequency (MHz)	Peak Output Power (dBm)	Limit(dBm)	Result
2405	18.82	30	PASS
2440	18.22		
2480	16.83		

##### External Antenna:

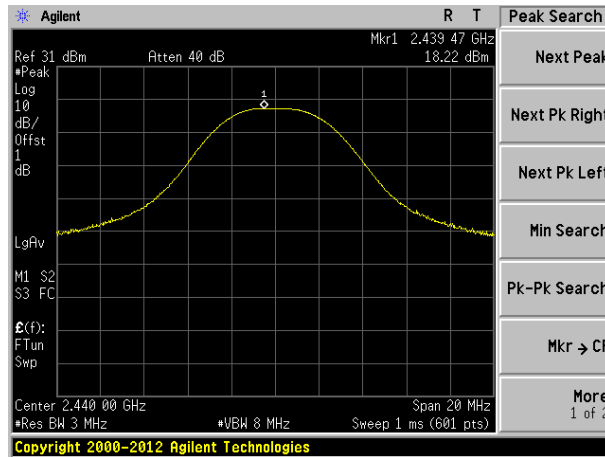
Frequency (MHz)	Peak Output Power (dBm)	Limit(dBm)	Result
2405	19.23	30	PASS
2440	18.42		
2480	16.96		

Test plot as follows:

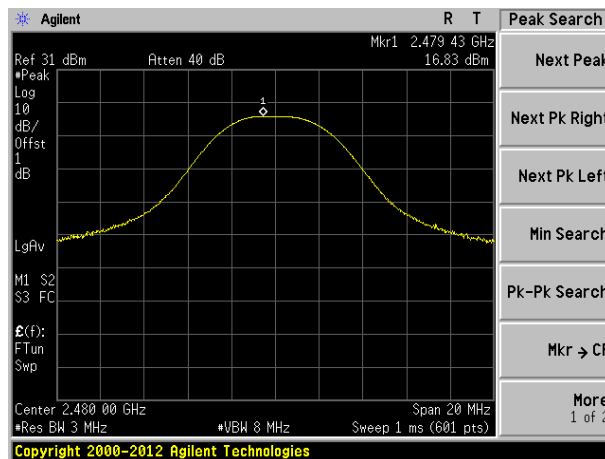
**Internal Antenna:**



2405MHz

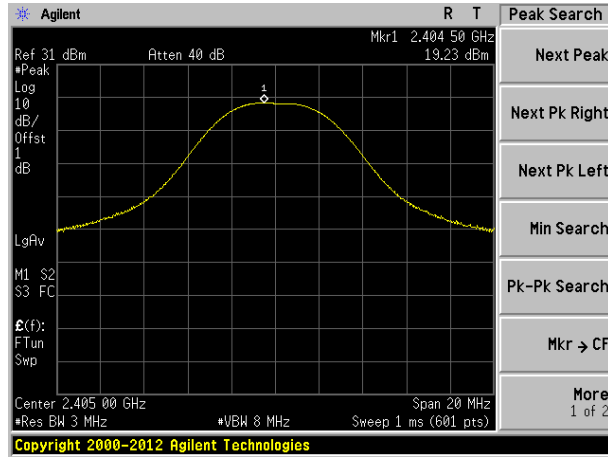


2440MHz

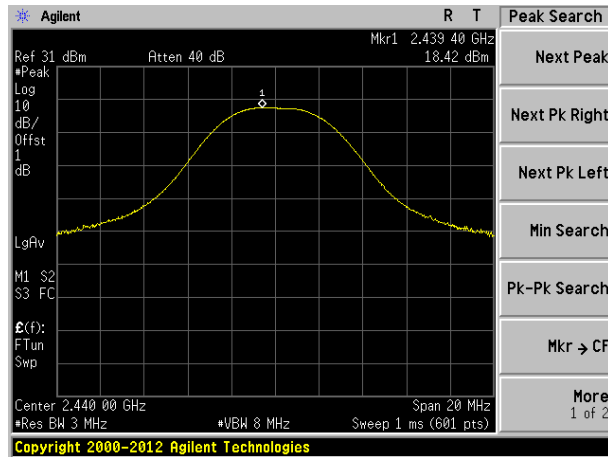


2480MHz

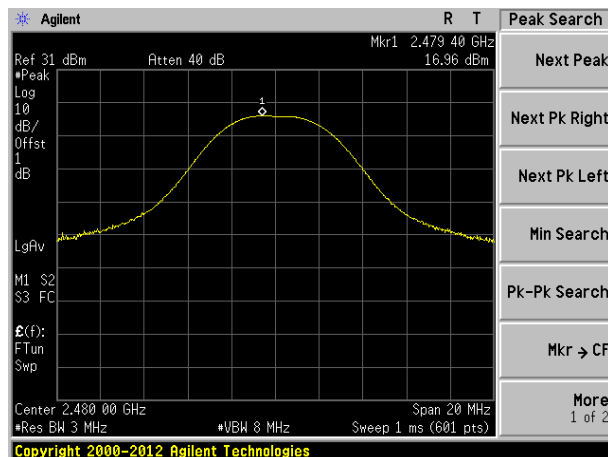
## External Antenna



2405MHz

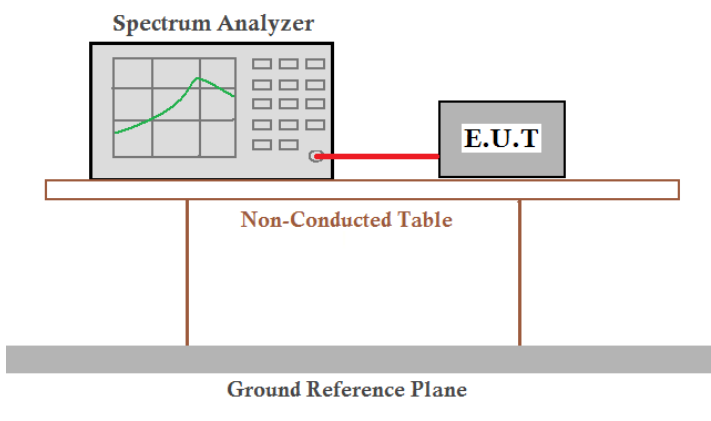


2440MHz



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 V03
Limit:	>500KHz
Test setup:	 <p>The diagram shows a Spectrum Analyzer on the left and an E.U.T. on the right, connected by a red cable. They are both on a table labeled '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 5.3 for details
Test results:	Pass

### Measurement Data

#### Internal Antenna:

Frequency (MHz)	Channel Bandwidth (MHz)	Limit(KHz)	Result
2405	1.647	>500	Pass
2440	1.603		
2480	1.615		

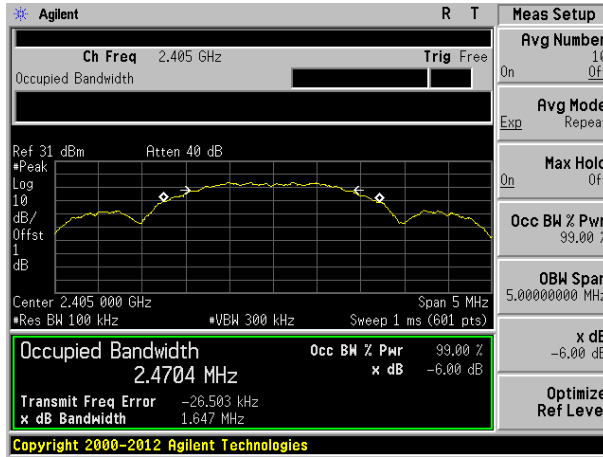
#### External Antenna:

Frequency (MHz)	Channel Bandwidth (MHz)	Limit(KHz)	Result
2405	1.646	>500	Pass
2440	1.634		
2480	1.619		

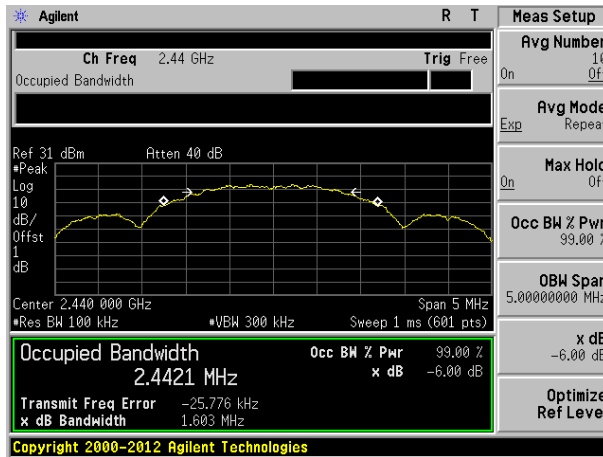
#### Test plot as follows:



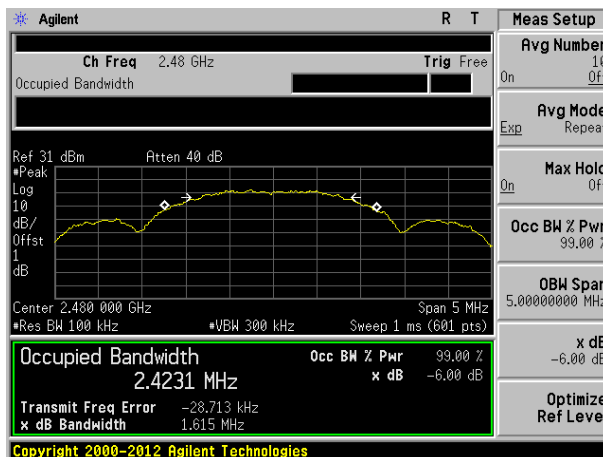
**Internal Antenna:**



2405MHz

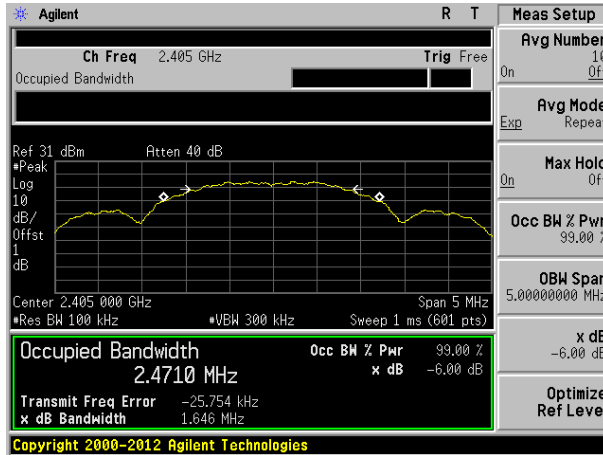


2440MHz

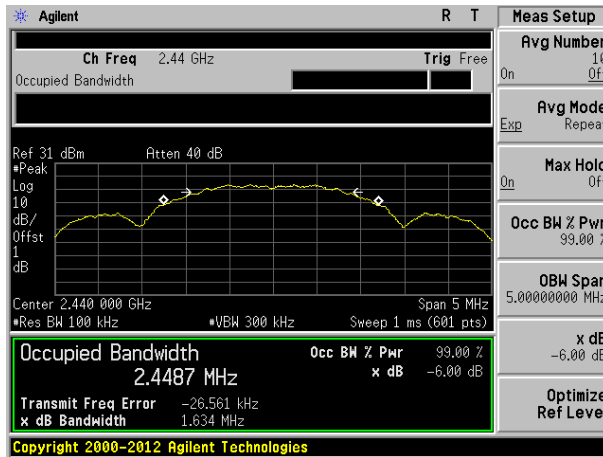


2480MHz

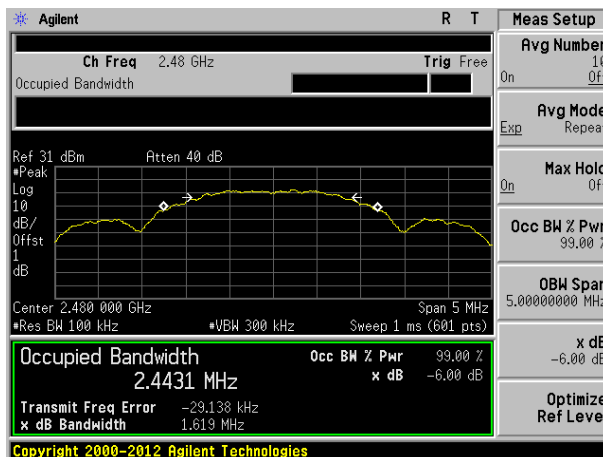
**External Antenna:**



2405MHz

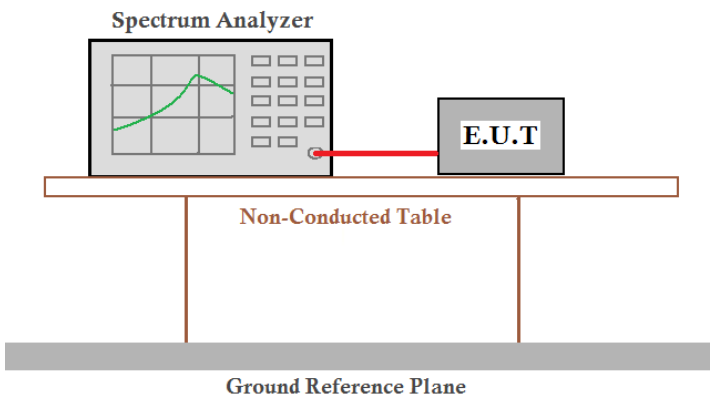


2440MHz



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 V03
Limit:	8dBm/3kHz
Test setup:	
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

### Measurement Data

#### Internal Antenna:

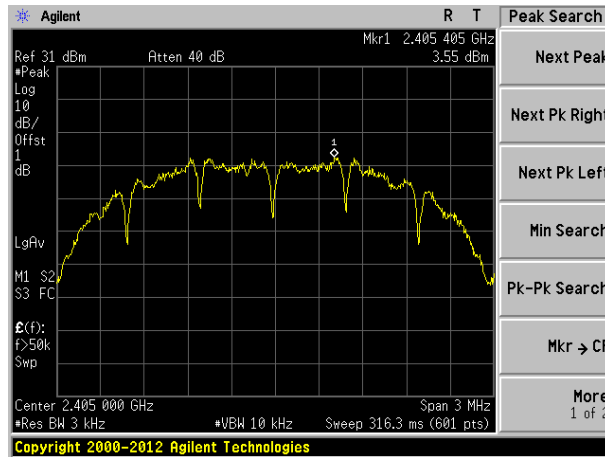
Frequency (MHz)	Power Spectral Density (dBm)	Limit (dBm/3kHz)	Result
2405	3.55	8.00	Pass
2440	2.75		
2480	1.81		

#### External Antenna:

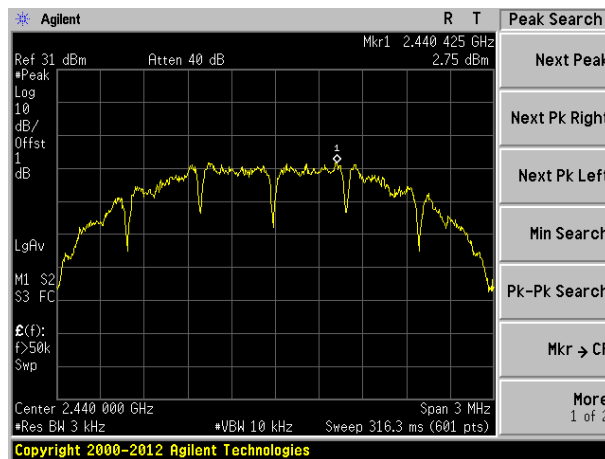
Frequency (MHz)	Power Spectral Density (dBm)	Limit (dBm/3kHz)	Result
2405	4.63	8.00	Pass
2440	3.53		
2480	1.97		

#### Test plot as follows:

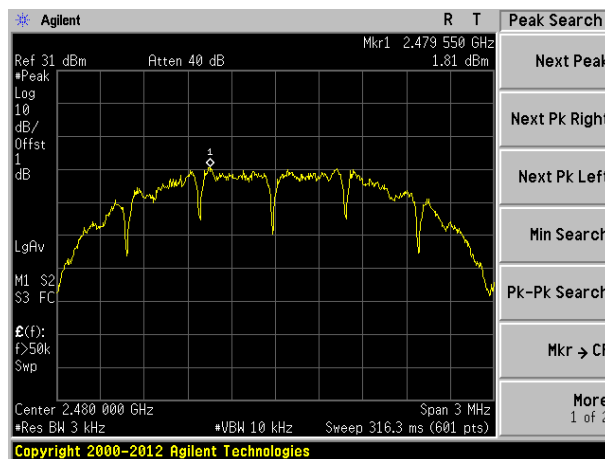
**Internal Antenna:**



2405MHz

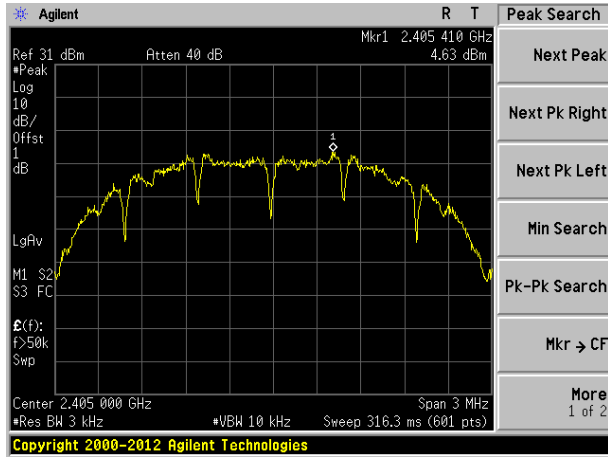


2440MHz

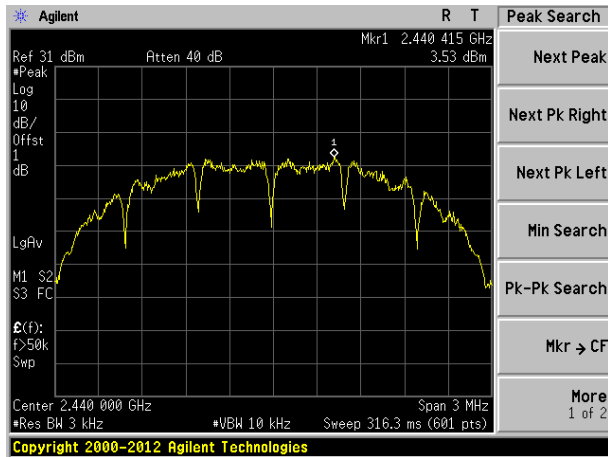


2480MHz

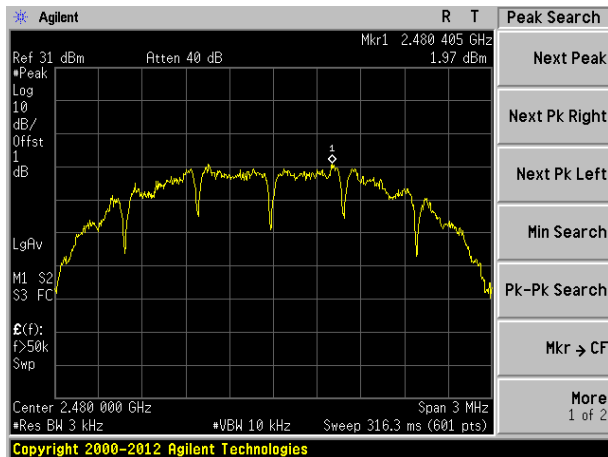
**External Antenna:**



2405MHz



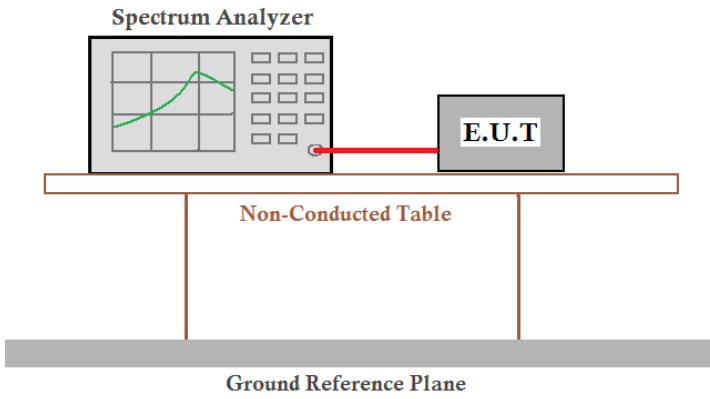
2440MHz



2480MHz

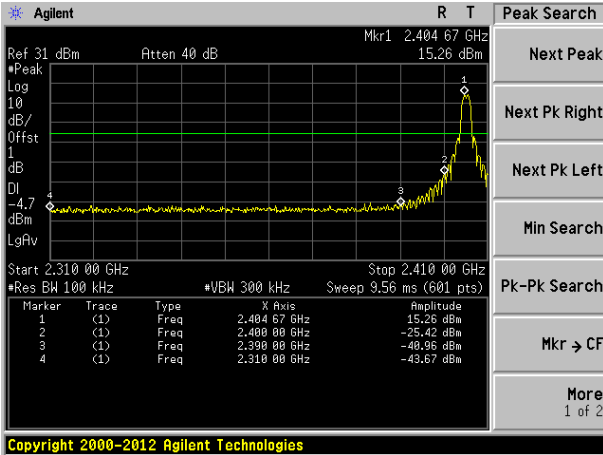
## 7.6 Band edges

### 7.6.1 Conducted Emission Method

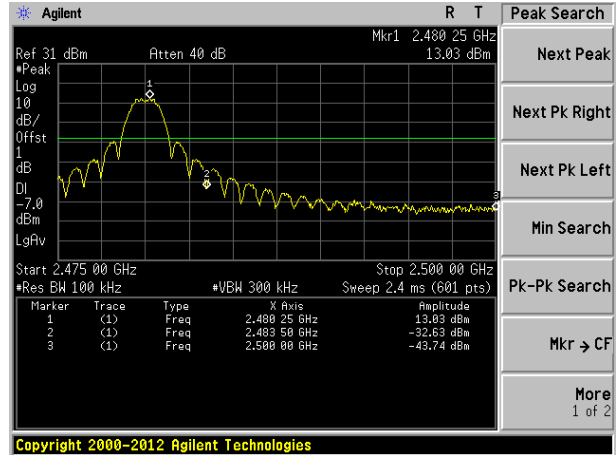
Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 DTS Meas Guidance V03
Limit:	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional 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 5.3 for details
Test results:	Pass

Test plot as follows:

**Internal Antenna:**

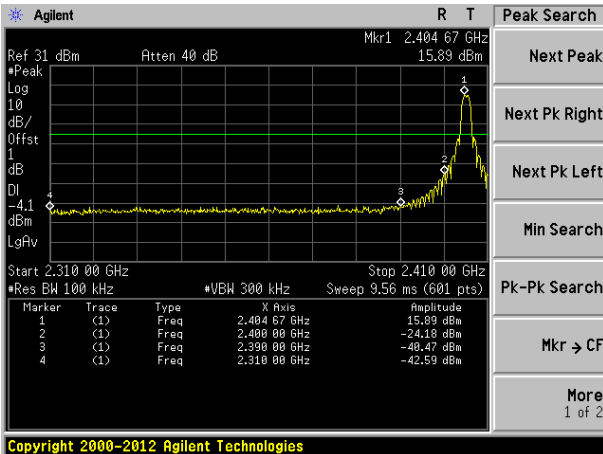


Lowest channel

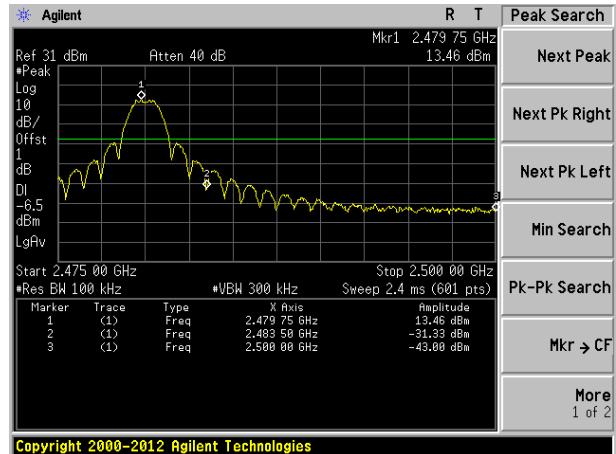


Highest channel

**External Antenna:**



Lowest channel



Highest channel

## 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"> <li>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.</li> <li>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.</li> <li>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.</li> <li>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.</li> <li>5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</li> <li>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.</li> <li>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.</li> </ol>				
Test Instruments:	Refer to section 6.0 for details				
Test mode:	Refer to section 5.3 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.

**Internal Antenna:**

Test channel:	2405MHz
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**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	36.39	27.91	5.30	24.64	44.96	74.00	-29.04	Horizontal
2390.00	34.57	27.59	5.38	24.71	42.83	74.00	-31.17	Horizontal
2310.00	38.19	27.91	5.30	24.64	46.76	74.00	-27.25	Vertical
2390.00	35.02	27.59	5.38	24.71	43.28	74.00	-30.72	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	26.86	27.91	5.30	24.64	35.43	54.00	-18.57	Horizontal
2390.00	25.89	27.59	5.38	24.71	34.15	54.00	-19.86	Horizontal
2310.00	29.09	27.91	5.30	24.64	37.66	54.00	-16.35	Vertical
2390.00	25.61	27.59	5.38	24.71	33.87	54.00	-20.13	Vertical

Test channel:	2480MHz
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**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	35.98	27.53	5.47	24.80	44.18	74.00	-29.82	Horizontal
2500.00	27.15	27.55	5.49	24.86	35.33	74.00	-38.67	Horizontal
2483.50	42.99	27.53	5.47	24.80	51.19	74.00	-22.81	Vertical
2500.00	33.84	27.55	5.49	24.86	42.02	74.00	-31.98	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	24.45	27.53	5.47	24.80	32.65	54.00	-21.35	Horizontal
2500.00	17.89	27.55	5.49	24.86	26.07	54.00	-27.93	Horizontal
2483.50	33.84	27.53	5.47	24.80	42.04	54.00	-11.96	Vertical
2500.00	23.89	27.55	5.49	24.86	32.07	54.00	-21.93	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.

**External Antenna:**

Test channel:	2405MHz
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**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	36.68	27.91	5.30	24.64	45.25	74.00	-28.75	Horizontal
2390.00	34.92	27.59	5.38	24.71	43.18	74.00	-30.82	Horizontal
2310.00	38.53	27.91	5.30	24.64	47.10	74.00	-26.90	Vertical
2390.00	35.33	27.59	5.38	24.71	43.59	74.00	-30.41	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	27.13	27.91	5.30	24.64	35.70	54.00	-18.30	Horizontal
2390.00	26.21	27.59	5.38	24.71	34.47	54.00	-19.53	Horizontal
2310.00	29.39	27.91	5.30	24.64	37.96	54.00	-16.04	Vertical
2390.00	25.88	27.59	5.38	24.71	34.14	54.00	-19.86	Vertical

Test channel:	2480MHz
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**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	36.22	27.53	5.47	24.80	44.42	74.00	-29.58	Horizontal
2500.00	27.34	27.55	5.49	24.86	35.52	74.00	-38.48	Horizontal
2483.50	43.22	27.53	5.47	24.80	51.42	74.00	-22.58	Vertical
2500.00	34.05	27.55	5.49	24.86	42.23	74.00	-31.77	Vertical

**Average value:**

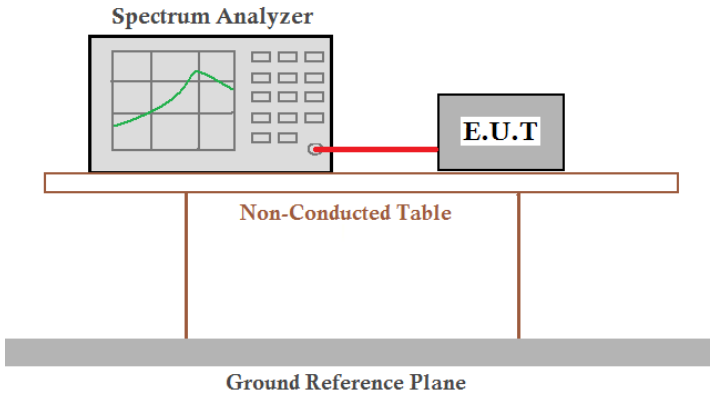
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.50	24.60	27.53	5.47	24.80	32.80	54.00	-21.20	Horizontal
2500.00	18.05	27.55	5.49	24.86	26.23	54.00	-27.77	Horizontal
2483.50	34.01	27.53	5.47	24.80	42.21	54.00	-11.79	Vertical
2500.00	24.05	27.55	5.49	24.86	32.23	54.00	-21.77	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

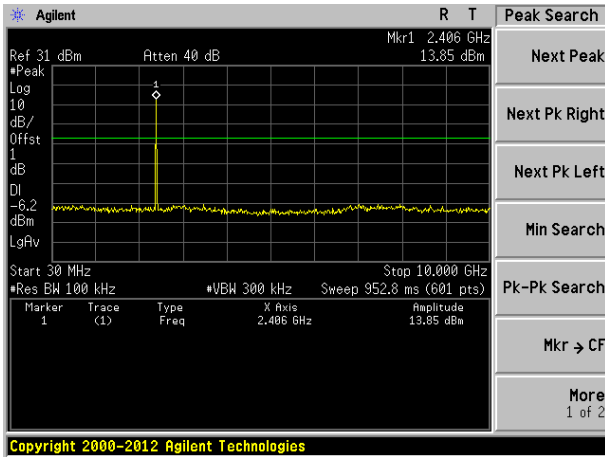
### 7.7.1 Conducted Emission Method

Test Requirement:	FCC Part15 C Section 15.247 (d)
Test Method:	ANSI C63.10:2013 and KDB558074 D01 DTS Meas Guidance V03
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 the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. The table is supported by a Ground Reference Plane.</p>
Test Instruments:	Refer to section 6.0 for details
Test mode:	Refer to section 5.3 for details
Test results:	Pass

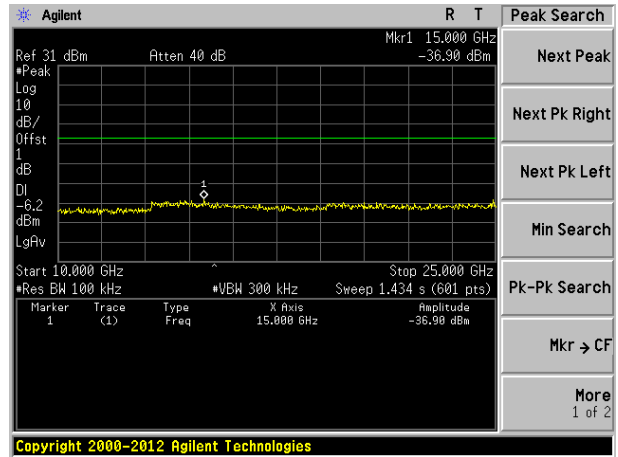
Test plot as follows:

## Internal Antenna:

### Lowest channel

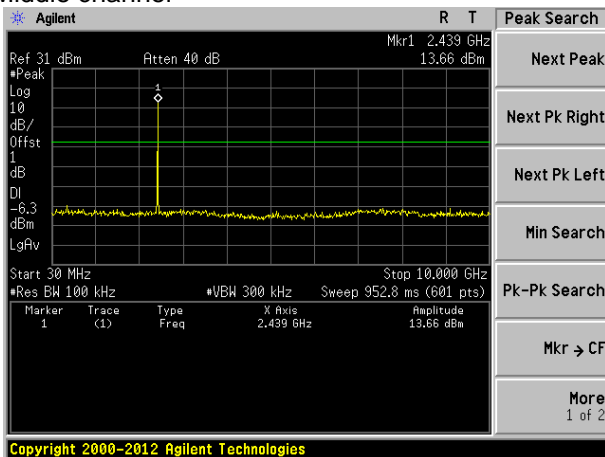


30MHz~10GHz

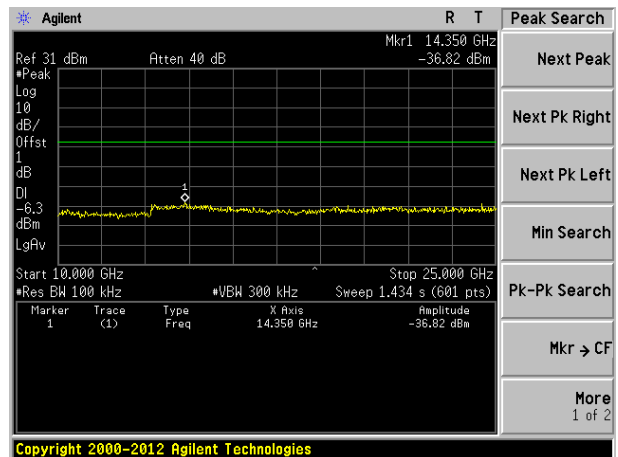


10GHz~25GHz

### Middle channel

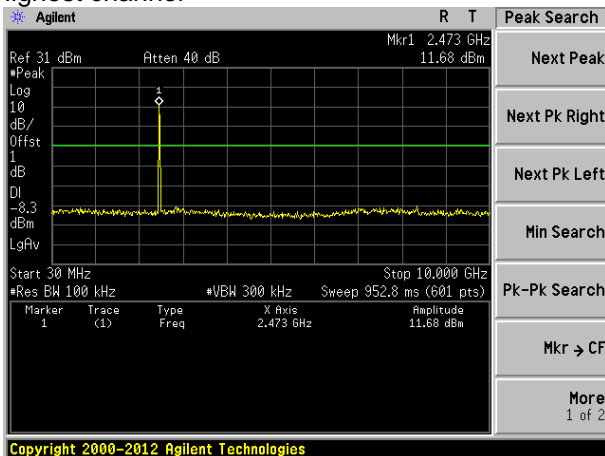


30MHz~10GHz

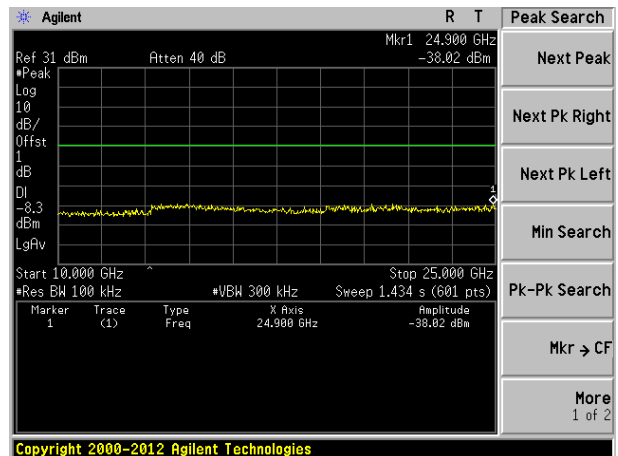


10GHz~25GHz

### Highest channel



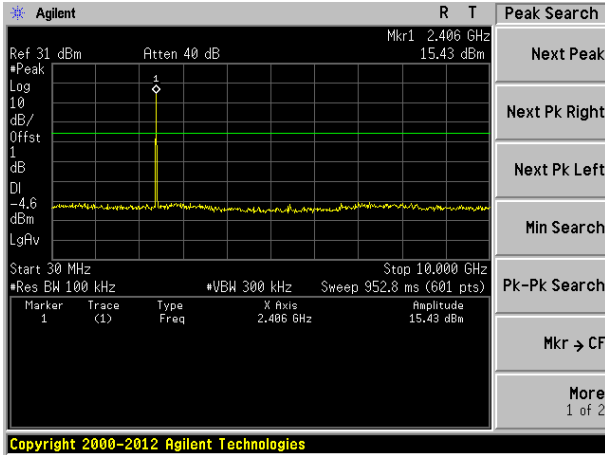
30MHz~10GHz



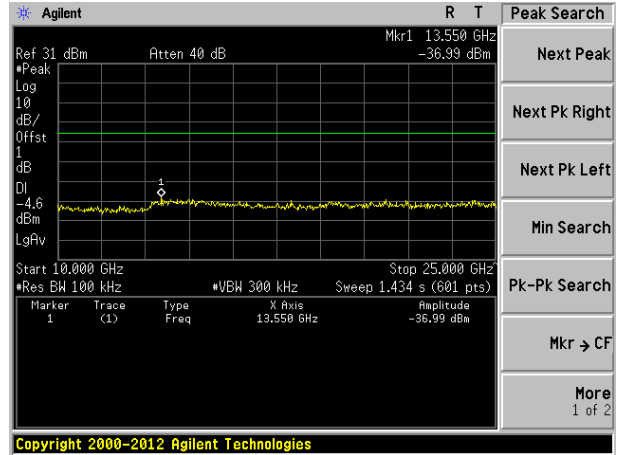
10GHz~25GHz

## External Antenna:

### Lowest channel

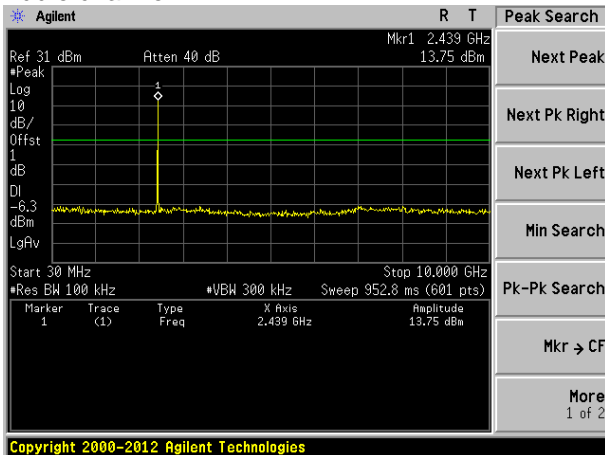


30MHz~10GHz

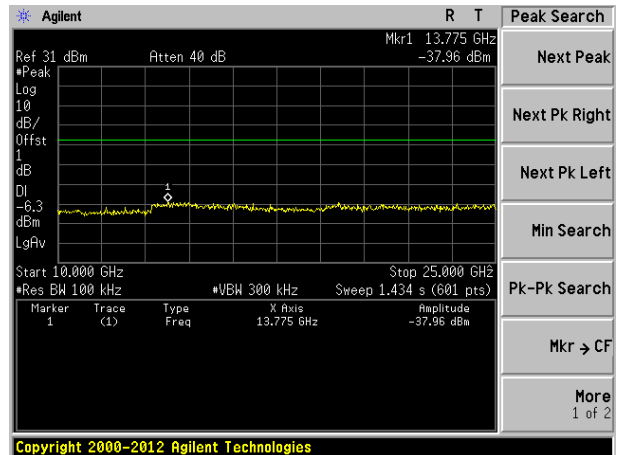


10GHz~25GHz

### Middle channel

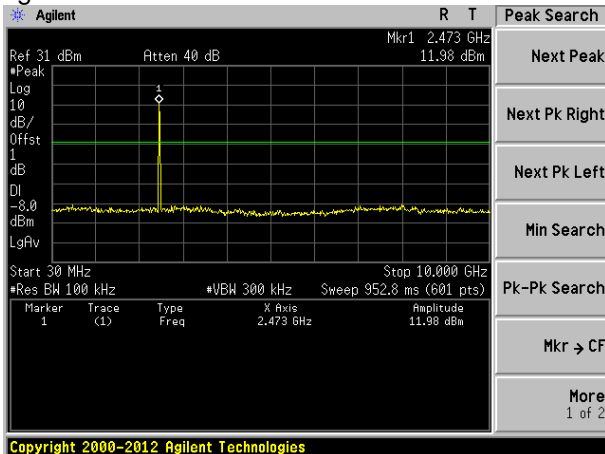


30MHz~10GHz

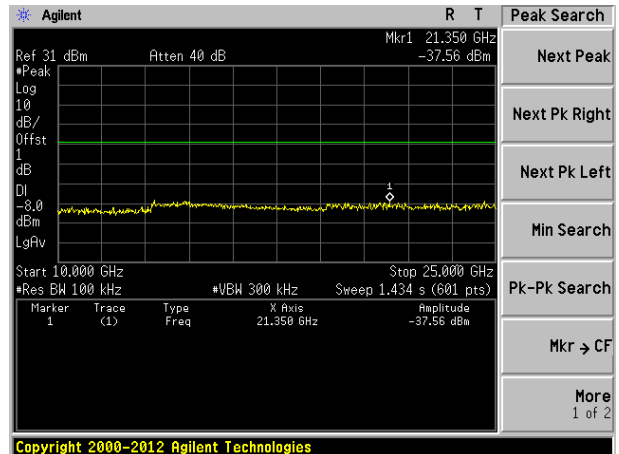


10GHz~25GHz

### Highest channel



30MHz~10GHz



10GHz~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
	30MHz-1GHz	Quasi-peak	120KHz	300KHz
	Above 1GHz	Peak	1MHz	3MHz
RMS		1MHz	3MHz	
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			
Test setup:	Above 1GHz			

<p>Test Procedure:</p>	<ol style="list-style-type: none"> <li>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.</li> <li>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.</li> <li>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.</li> <li>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.</li> <li>5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.</li> <li>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.</li> <li>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.</li> </ol>
<p>Test Instruments:</p>	<p>Refer to section 6.0 for details</p>
<p>Test mode:</p>	<p>Refer to section 5.3 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
32.75	29.71	14.31	0.58	30.08	14.52	40.00	-25.48	Vertical
44.12	28.15	15.56	0.71	30.02	14.40	40.00	-25.60	Vertical
99.18	26.37	15.13	1.18	29.70	12.98	43.50	-30.52	Vertical
173.81	32.36	11.23	1.71	29.30	16.00	43.50	-27.50	Vertical
423.54	25.90	17.49	2.96	29.45	16.90	46.00	-29.10	Vertical
793.40	25.91	21.96	4.43	29.20	23.10	46.00	-22.90	Vertical
34.52	28.96	14.30	0.60	30.07	13.79	40.00	-26.21	Horizontal
86.50	28.18	12.89	1.08	29.76	12.39	40.00	-27.61	Horizontal
170.79	32.51	11.03	1.69	29.31	15.92	43.50	-27.58	Horizontal
387.99	24.94	16.78	2.79	29.56	14.95	46.00	-31.05	Horizontal
566.62	26.34	19.88	3.59	29.30	20.51	46.00	-25.49	Horizontal
900.15	26.35	23.09	4.85	29.10	25.19	46.00	-20.81	Horizontal



**Internal Antenna:**

■ **Above 1GHz**

Test channel:	Lowest
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**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	50.66	31.17	8.60	37.66	52.77	74.00	-21.23	Vertical
7215.00	39.63	36.09	11.66	35.69	51.69	74.00	-22.31	Vertical
9620.00	31.27	37.84	14.14	34.91	48.34	74.00	-25.66	Vertical
12025.00	*					74.00		Vertical
14430.00	*					74.00		Vertical
4810.00	49.72	31.17	8.60	37.66	51.83	74.00	-22.17	Horizontal
7215.00	42.03	36.09	11.66	35.69	54.09	74.00	-19.91	Horizontal
9620.00	28.51	37.84	14.14	34.91	45.58	74.00	-28.42	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	44.81	31.17	8.60	37.66	46.92	54.00	-7.08	Vertical
7215.00	30.84	36.09	11.66	35.69	42.90	54.00	-11.10	Vertical
9620.00	20.49	37.84	14.14	34.91	37.56	54.00	-16.44	Vertical
12025.00	*					54.00		Vertical
14430.00	*					54.00		Vertical
4810.00	43.86	31.17	8.60	37.66	45.97	54.00	-8.03	Horizontal
7215.00	31.70	36.09	11.66	35.69	43.76	54.00	-10.24	Horizontal
9620.00	18.69	37.84	14.14	34.91	35.76	54.00	-18.24	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
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**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	50.29	31.26	8.66	37.68	52.53	74.00	-21.47	Vertical
7320.00	40.58	36.32	11.72	35.64	52.98	74.00	-21.02	Vertical
9760.00	29.76	38.01	14.25	34.98	47.04	74.00	-26.96	Vertical
12200.00	*					74.00		Vertical
14640.00	*					74.00		Vertical
4880.00	49.00	31.26	8.66	37.68	51.24	74.00	-22.76	Horizontal
7320.00	39.96	36.32	11.72	35.64	52.36	74.00	-21.64	Horizontal
9760.00	28.92	38.01	14.25	34.98	46.20	74.00	-27.80	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	42.74	31.26	8.66	37.68	44.98	54.00	-9.02	Vertical
7320.00	32.86	36.32	11.72	35.64	45.26	54.00	-8.74	Vertical
9760.00	22.79	38.01	14.25	34.98	40.07	54.00	-13.93	Vertical
12200.00	*					54.00		Vertical
14640.00	*					54.00		Vertical
4880.00	40.12	31.26	8.66	37.68	42.36	54.00	-11.64	Horizontal
7320.00	22.68	36.32	11.72	35.64	35.08	54.00	-18.92	Horizontal
9760.00	21.70	38.01	14.25	34.98	38.98	54.00	-15.02	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
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**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	50.61	31.36	8.73	37.69	53.01	74.00	-20.99	Vertical
7440.00	39.90	36.59	11.79	35.58	52.70	74.00	-21.30	Vertical
9920.00	29.31	38.22	14.38	35.07	46.84	74.00	-27.16	Vertical
12400.00	*					74.00		Vertical
14880.00	*					74.00		Vertical
4960.00	48.91	31.36	8.73	37.69	51.31	74.00	-22.69	Horizontal
7440.00	39.72	36.59	11.79	35.58	52.52	74.00	-21.48	Horizontal
9920.00	28.97	38.22	14.38	35.07	46.50	74.00	-27.50	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	42.74	31.36	8.73	37.69	45.14	54.00	-8.86	Vertical
7440.00	31.83	36.59	11.79	35.58	44.63	54.00	-9.37	Vertical
9920.00	20.84	38.22	14.38	35.07	38.37	54.00	-15.63	Vertical
12400.00	*					54.00		Vertical
14880.00	*					54.00		Vertical
4960.00	40.51	31.36	8.73	37.69	42.91	54.00	-11.09	Horizontal
7440.00	32.00	36.59	11.79	35.58	44.80	54.00	-9.20	Horizontal
9920.00	20.62	38.22	14.38	35.07	38.15	54.00	-15.85	Horizontal
12400.00	*					54.00		Horizontal
14880.00	*					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.

**External Antenna:**

■ **Above 1GHz**

Test channel:	Lowest
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**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	50.37	31.17	8.60	37.66	52.48	74.00	-21.52	Vertical
7215.00	39.34	36.09	11.66	35.69	51.40	74.00	-22.60	Vertical
9620.00	30.82	37.84	14.14	34.91	47.89	74.00	-26.11	Vertical
12025.00	*					74.00		Vertical
14430.00	*					74.00		Vertical
4810.00	49.43	31.17	8.60	37.66	51.54	74.00	-22.46	Horizontal
7215.00	41.93	36.09	11.66	35.69	53.99	74.00	-20.01	Horizontal
9620.00	28.25	37.84	14.14	34.91	45.32	74.00	-28.68	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	44.52	31.17	8.60	37.66	46.63	54.00	-7.37	Vertical
7215.00	30.64	36.09	11.66	35.69	42.70	54.00	-11.30	Vertical
9620.00	20.25	37.84	14.14	34.91	37.32	54.00	-16.68	Vertical
12025.00	*					54.00		Vertical
14430.00	*					54.00		Vertical
4810.00	43.67	31.17	8.60	37.66	45.78	54.00	-8.22	Horizontal
7215.00	31.46	36.09	11.66	35.69	43.52	54.00	-10.48	Horizontal
9620.00	18.46	37.84	14.14	34.91	35.53	54.00	-18.47	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
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**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	50.16	31.26	8.66	37.68	52.40	74.00	-21.60	Vertical
7320.00	40.44	36.32	11.72	35.64	52.84	74.00	-21.16	Vertical
9760.00	29.55	38.01	14.25	34.98	46.83	74.00	-27.17	Vertical
12200.00	*					74.00		Vertical
14640.00	*					74.00		Vertical
4880.00	48.86	31.26	8.66	37.68	51.10	74.00	-22.90	Horizontal
7320.00	39.91	36.32	11.72	35.64	52.31	74.00	-21.69	Horizontal
9760.00	28.79	38.01	14.25	34.98	46.07	74.00	-27.93	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	42.53	31.26	8.66	37.68	44.77	54.00	-9.23	Vertical
7320.00	32.71	36.32	11.72	35.64	45.11	54.00	-8.89	Vertical
9760.00	22.62	38.01	14.25	34.98	39.90	54.00	-14.10	Vertical
12200.00	*					54.00		Vertical
14640.00	*					54.00		Vertical
4880.00	39.98	31.26	8.66	37.68	42.22	54.00	-11.78	Horizontal
7320.00	22.50	36.32	11.72	35.64	34.90	54.00	-19.10	Horizontal
9760.00	21.53	38.01	14.25	34.98	38.81	54.00	-15.19	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
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**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	50.48	31.36	8.73	37.69	52.88	74.00	-21.12	Vertical
7440.00	39.78	36.59	11.79	35.58	52.58	74.00	-21.42	Vertical
9920.00	29.12	38.22	14.38	35.07	46.65	74.00	-27.35	Vertical
12400.00	*					74.00		Vertical
14880.00	*					74.00		Vertical
4960.00	48.79	31.36	8.73	37.69	51.19	74.00	-22.81	Horizontal
7440.00	39.68	36.59	11.79	35.58	52.48	74.00	-21.52	Horizontal
9920.00	28.86	38.22	14.38	35.07	46.39	74.00	-27.61	Horizontal
12400.00	*					74.00		Horizontal
14880.00	*					74.00		Horizontal

**Average value:**

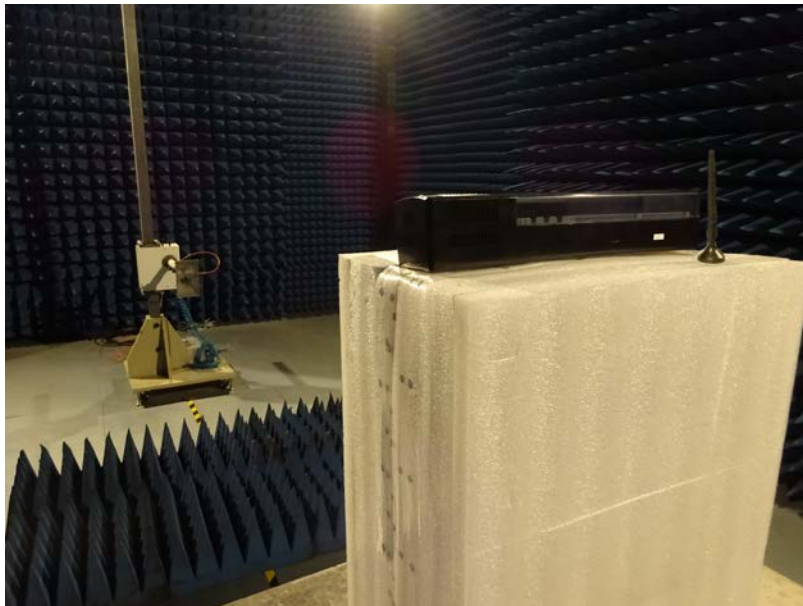
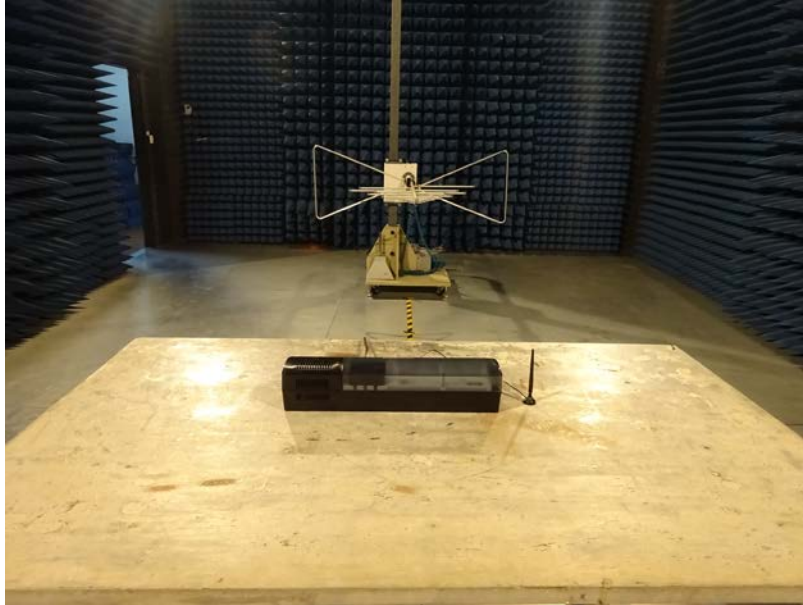
Frequency (MHz)	Read Level (dBuV)	Antenna Factor (dB/m)	Cable Loss (dB)	Preamp Factor (dB)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	polarization
4960.00	42.54	31.36	8.73	37.69	44.94	54.00	-9.06	Vertical
7440.00	31.69	36.59	11.79	35.58	44.49	54.00	-9.51	Vertical
9920.00	20.68	38.22	14.38	35.07	38.21	54.00	-15.79	Vertical
12400.00	*					54.00		Vertical
14880.00	*					54.00		Vertical
4960.00	40.38	31.36	8.73	37.69	42.78	54.00	-11.22	Horizontal
7440.00	31.83	36.59	11.79	35.58	44.63	54.00	-9.37	Horizontal
9920.00	20.46	38.22	14.38	35.07	37.99	54.00	-16.01	Horizontal
12400.00	*					54.00		Horizontal
14880.00	*					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.*

## 8 Test Setup Photo

Radiated Emission

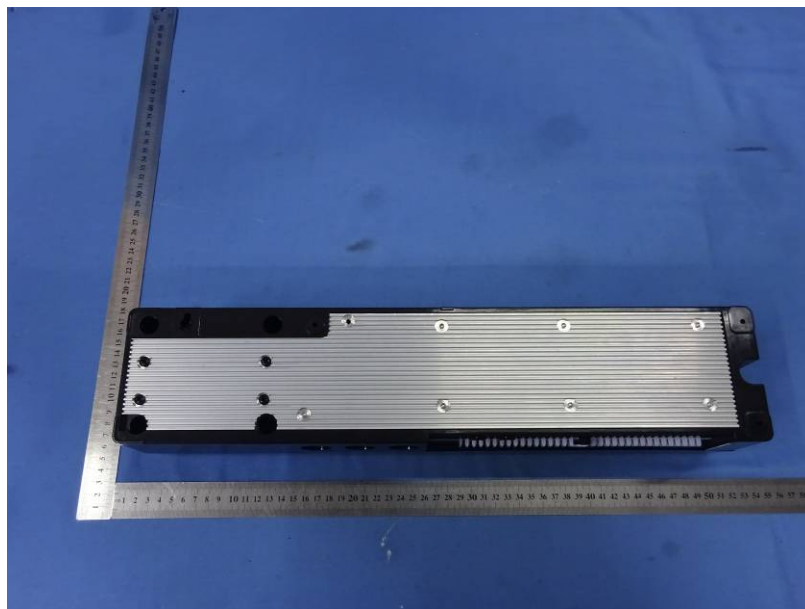
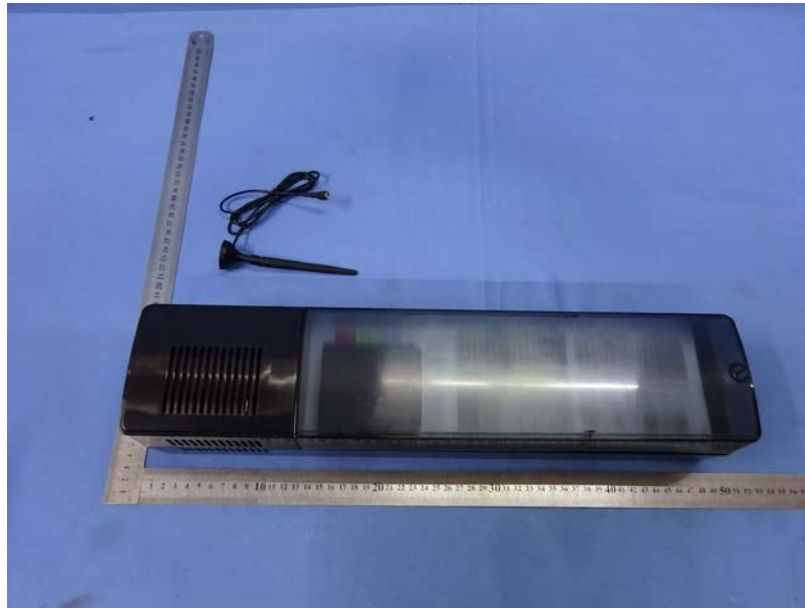


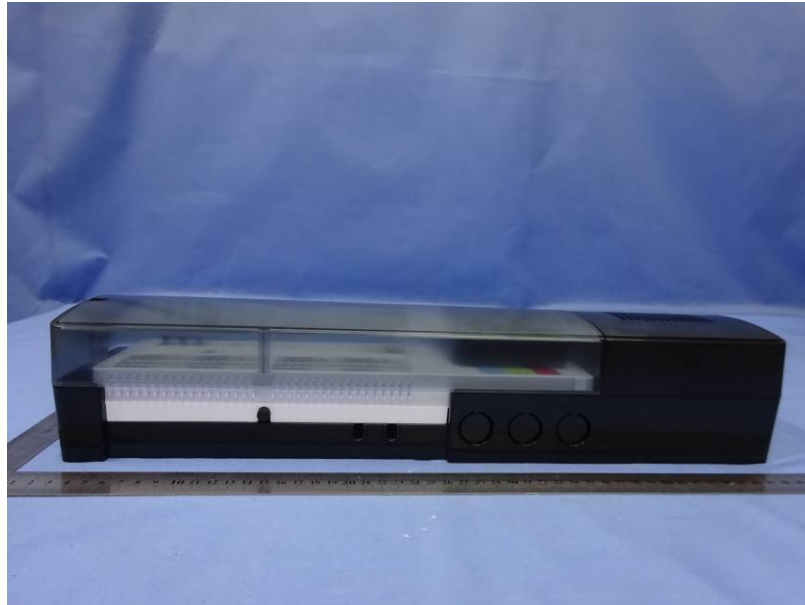
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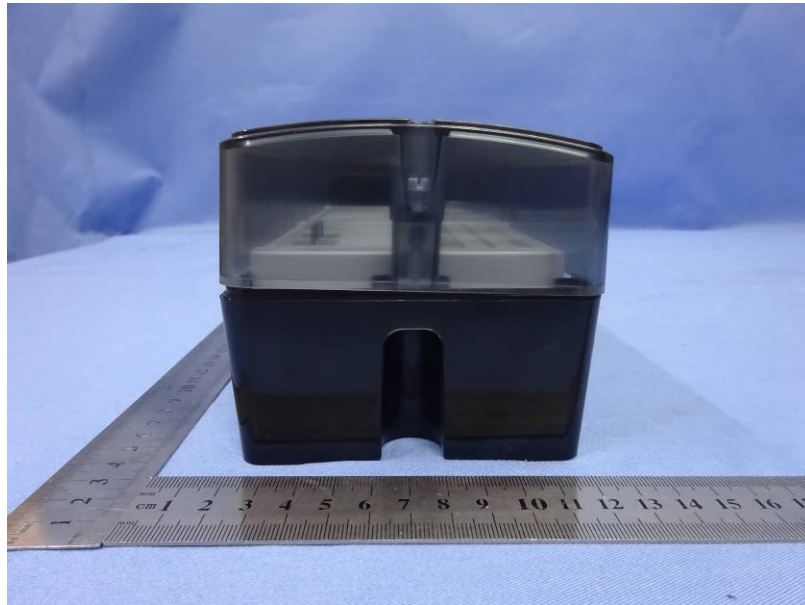
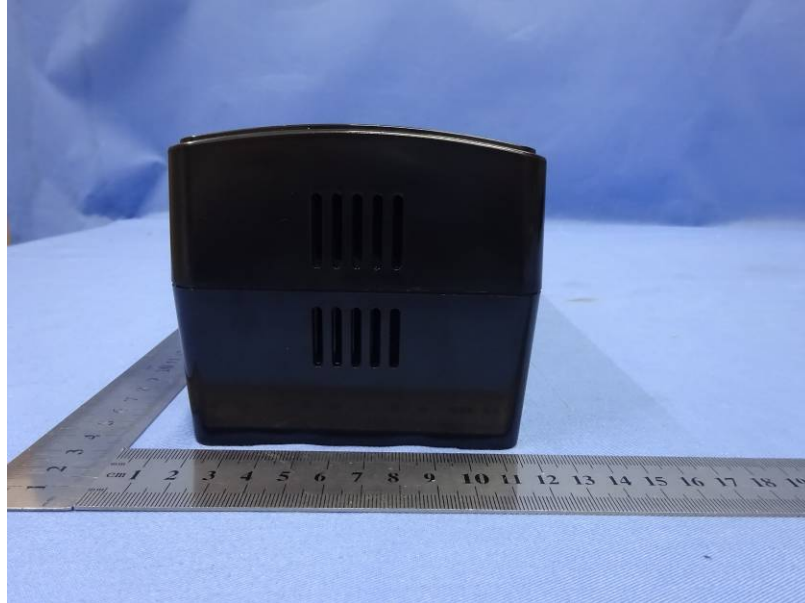


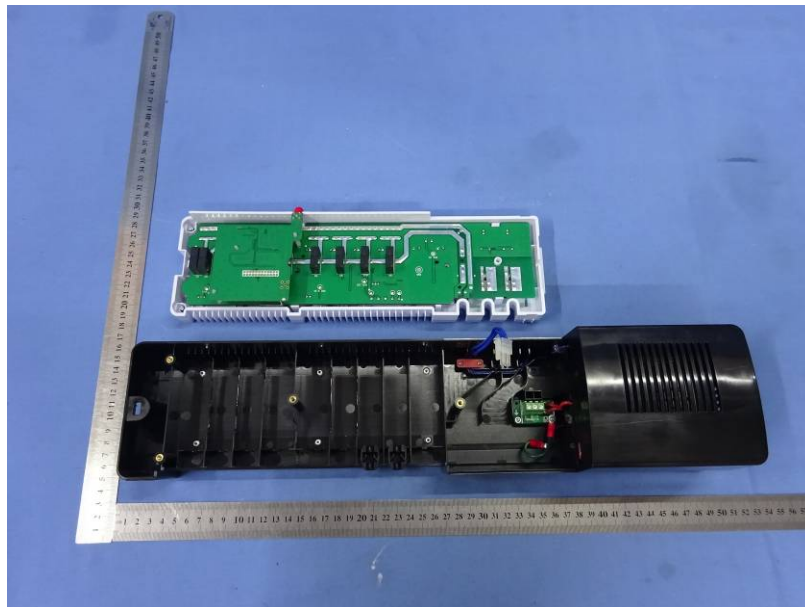
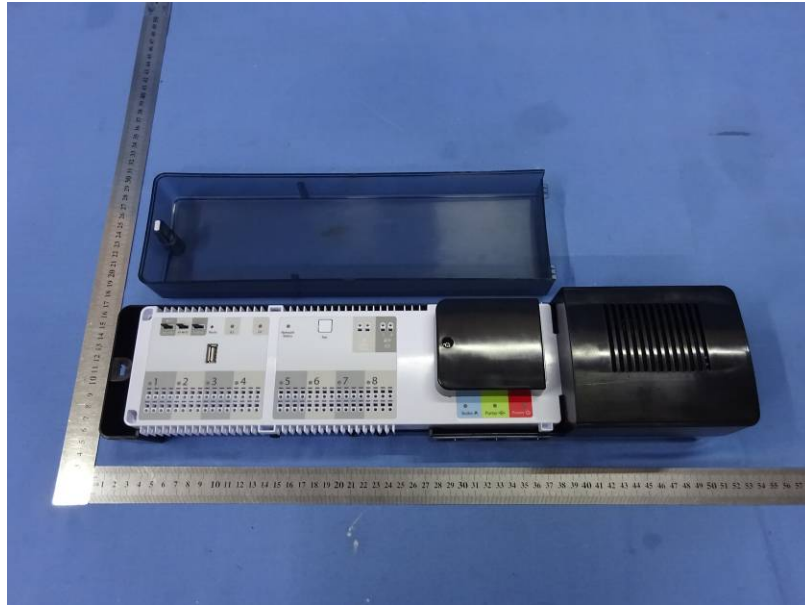


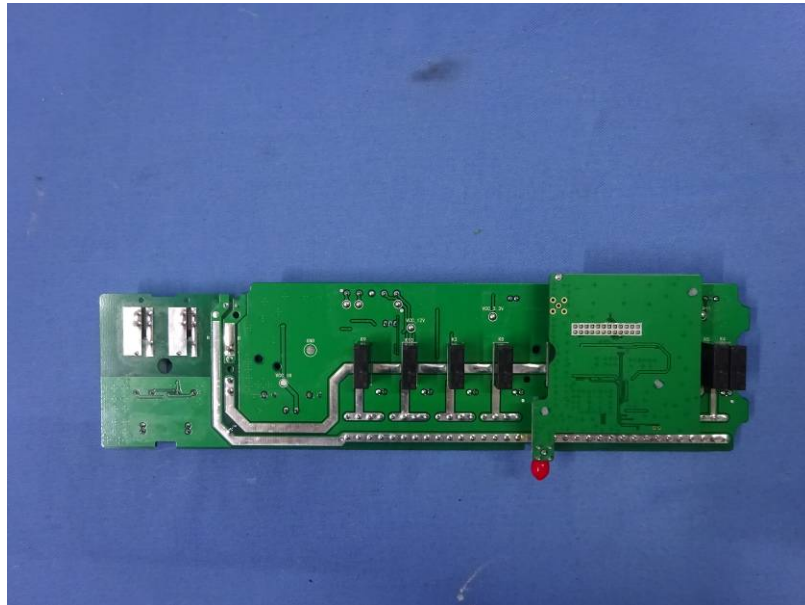
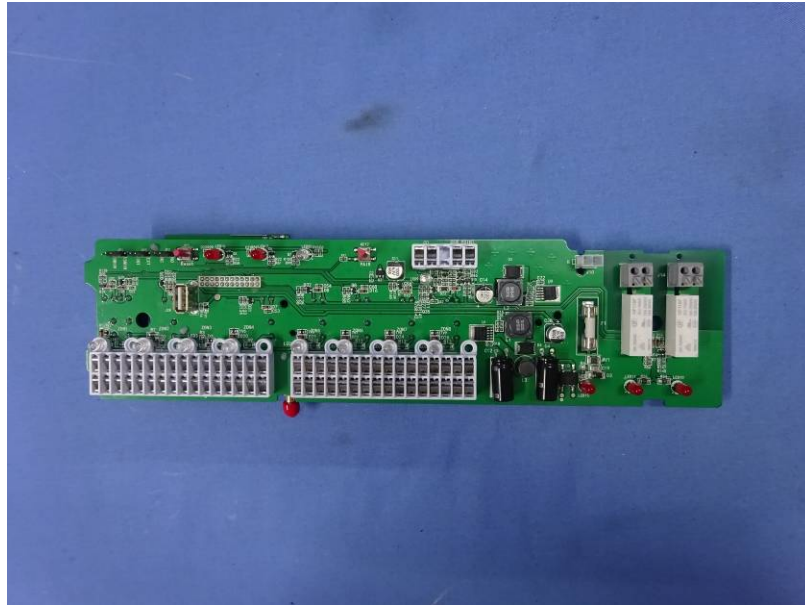
## 9 EUT Constructional Details

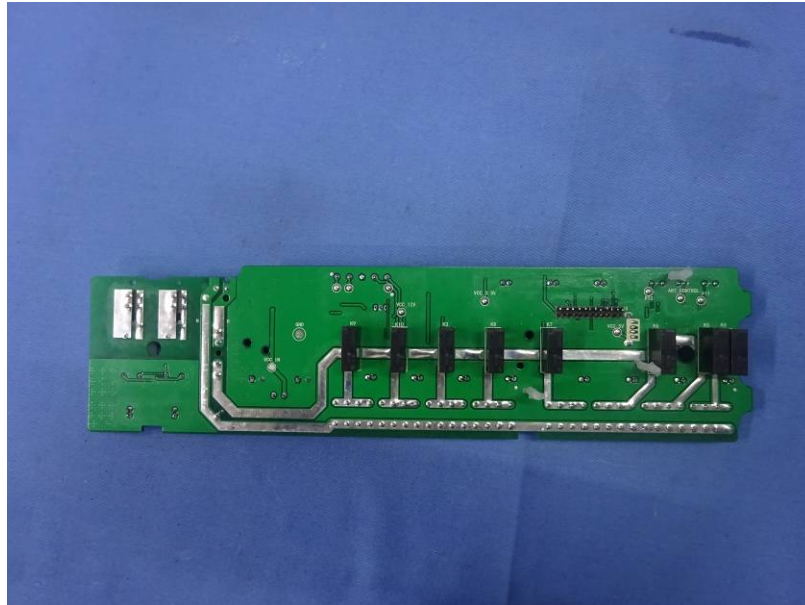


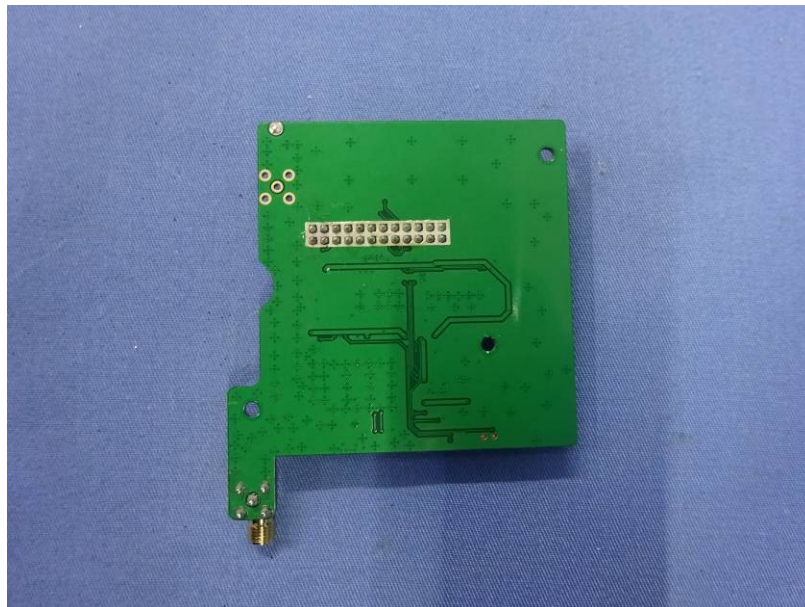
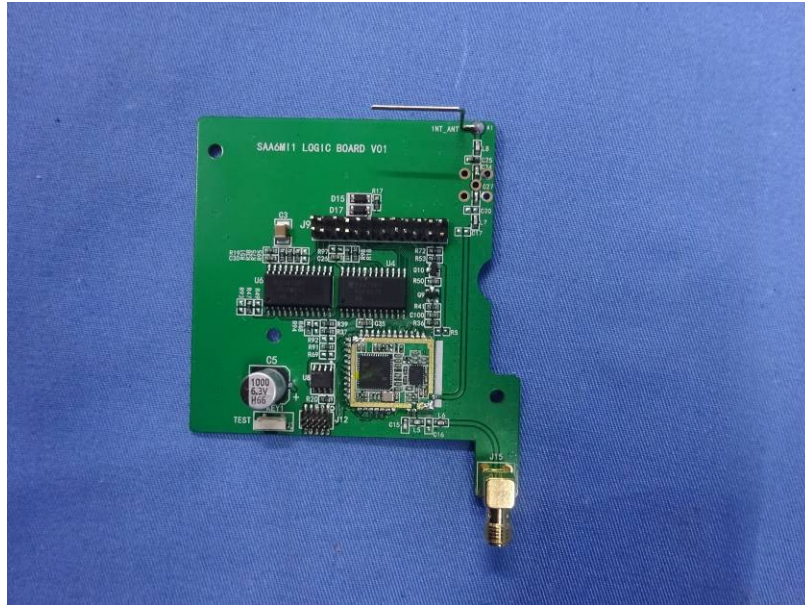


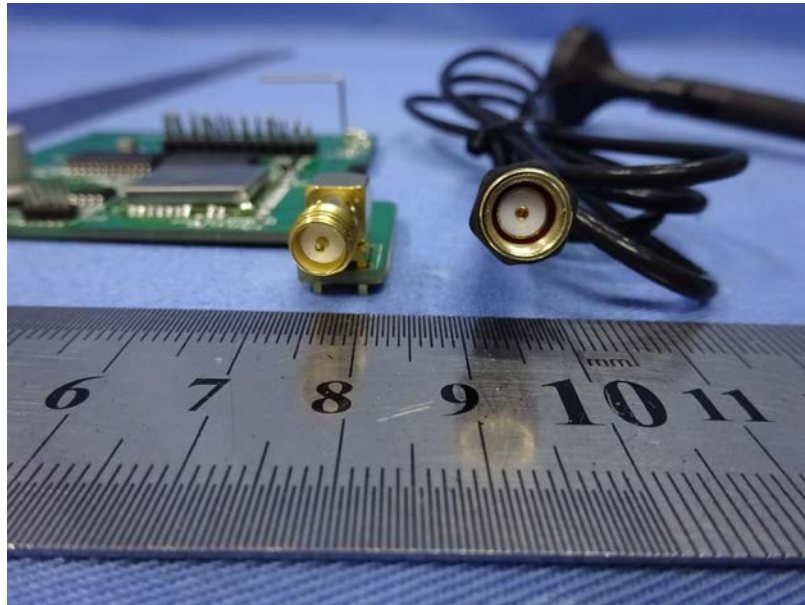












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