

**ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT
INTENTIONAL RADIATOR CERTIFICATION TO
FCC PART 15 SUBPART C REQUIREMENTS**

OF

Smart Plug

MODEL No.: SH320

FCC ID: S7JSH320

REPORT NO.: ES141224307E

ISSUE DATE: January 13, 2015

Prepared for

**SHENZHEN YIFANG DIGITAL TECHNOLOGY CO., LTD.
Building NO.22,23, Fifth Region, Baiwangxin Industrial Park, Songbai Rd.,
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Prepared by

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VERIFICATION OF COMPLIANCE


Applicant:	SHENZHEN YIFANG DIGITAL TECHNOLOGY CO., LTD. Building NO.22,23, Fifth Region, Baiwangxin Industrial Park, Songbai Rd., Nanshan, Shenzhen 518108, China
Manufacturer:	SHENZHEN YIFANG DIGITAL TECHNOLOGY CO., LTD. Building NO.22,23, Fifth Region, Baiwangxin Industrial Park, Songbai Rd., Nanshan, Shenzhen 518108, China
Product Description:	Smart Plug
Model Number:	SH320
File Number:	ES141224307E
Date of Test:	December 24, 2014 to January 13, 2015

We hereby certify that:

The above equipment was tested by SHENZHEN EMTEK CO., LTD. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4 (2009) and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.247.

The test results of this report relate only to the tested sample identified in this report.

Date of Test : December 24, 2014 to January 13, 2015

Test by : 
KingKong/Tester

Prepared by : 
Yaping Shen/Editor

Approve & Authorized Signer : 
Lisa Wang/Manager

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1. General Information

1.1 Product Description

A major technical descriptions of EUT is described as following:

- A). Standards: IEEE802.15.4
- B). Operation Frequency: 2405-2480MHz
- C). Modulation: QPSK
- D). Number of Channel: 16 Channels;
- D). Channel spacing: 5MHz
- E). Conducted Power: 0.36 dBm for Zigbee
- F). Antenna Gain: 2dBi for Zigbee
- G). Antenna Type: Integral Antenna
- H). Power Supply: 100V-240V~

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

Note:

1. This device is Zigbee transceiver function.
2. Test of channel was included the lowest middle and highest frequency in lowest data rate and to perform the test, then record on this report.

1.2 Related Submittal(s) / Grant(s)

This submittal(s) (test report) is intended for FCC ID: S7JSH320 filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

1.3 Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.4 (2009) and FCC Public Notice KDB 558074 v03r02. Radiated testing was performed at an antenna to EUT distance 3 meters.

1.4 Special Accessories

Not available for this EUT intended for grant.

1.5 Equipment Modifications

Not available for this EUT intended for grant.

1.6 Test Facility

Site Description

EMC Lab.

: Accredited by CNAS, 2013.10.29
The certificate is valid until 2016.10.28
The Laboratory has been assessed and proved to be in compliance with CNAS/CL01:2006(identical to ISO/IEC17025: 2005)
The Certificate Registration Number is L2291

Accredited by TUV Rheinland Shenzhen 2010.5.25
The Laboratory has been assessed according to the requirements ISO/IEC 17025

Accredited by FCC, April 17, 2014
The Certificate Registration Number is 406365.

Accredited by Industry Canada, March 5, 2010
The Certificate Registration Number is 4480A-2.

Name of Firm

Site Location

: SHENZHEN EMTEK CO., LTD.
: Bldg 69, Majialong Industry Zone,
Nanshan District, Shenzhen, Guangdong, China

2. System Test Configuration

2.1 EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2 EUT Exercise

The Transmitter was operated in the normal operating mode. the Tx frequency was fixed which was for the purpose of the measurements.

2.3 Test Procedure

2.3.1 Conducted Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. According to the requirements in Section 13.1.4.1 of ANSI C63.4-2009 Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30 MHz using CISPR Quasi-Peak and average detector mode.

2.3.2 Radiated Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter(EUT) was rotated through three orthogonal axes according to the requirements in Section 13.1.4.1 of ANSI C63.4-2009.

2.4 Configuration of Tested System

Fig. 2-1 Configuration of Tested System

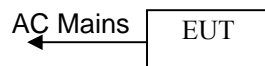


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Note
1.	Smart Plug	N/A	SH320	N/A	EUT
2.	Smart Gateway	N/A	SH101	N/A	Support equipment
3.	Router	TP-LINK	TL-WVR308	N/A	Support equipment
4.	iPhone	Apple	A1526	N/A	Support equipment

Note:

- (1) Unless otherwise denoted as EUT in 『Remark』 column, device(s) used in tested system is a support equipment.

3. Description of Test Modes

The Transmitter of EUT is a Smart Plug and powered by host equipment. This is Digital Transmission system(DTS) and have modulation DSSS. According exploratory test, EUT will have maximum output power in those data rate(IEEE802.15.4), so those data rate were used for all test.

The equipment enables high-speed access without wires to network assets. This adapter uses the ZIGBEE protocol to enable wireless communications between the host and Wireless router.

1. For lowest channel : 2405MHz (Channel 1)
2. For middle channel : 2440MHz (Channel 8)
3. For highest channel: 2480MHz (Channel 16)

EUT operating conditions:

The EUT exercise program used during conducted testing was designed to exercise the EUT in a manner similar to typical use, The exercise sequence is listed as below:

1. Setup the EUT and simulators as shown on 2.4.
2. The EUT started to work.

4. Summary of Test Results

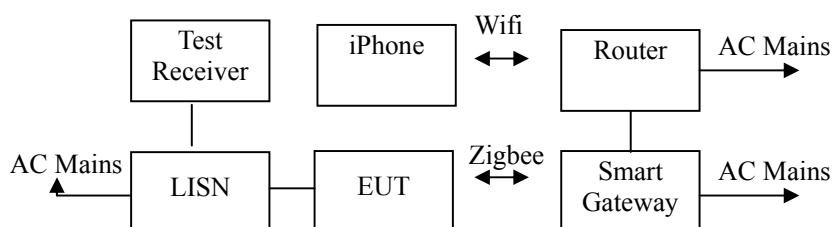
FCC Rules	Description Of Test	Result
§15.247(a)(2)	6dB bandwidth	PASS
§15.247(b)(3)	Max Peak output Power test	PASS
§15.247(e)	Power density	PASS
§15.247(d)	Band edge test	PASS
§15.207	AC Power Conducted Emission	PASS
§15.247(d), §15.209	Radiated Emission	PASS
§15.247(d)	Antenna Port Emission	PASS
§15.247(b)&§15.203	Antenna Application	PASS

5. Conducted Emissions Test

5.1 Measurement Procedure

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

5.2 Test SET-UP (Block Diagram of Configuration)



5.3 Measurement Equipment Used

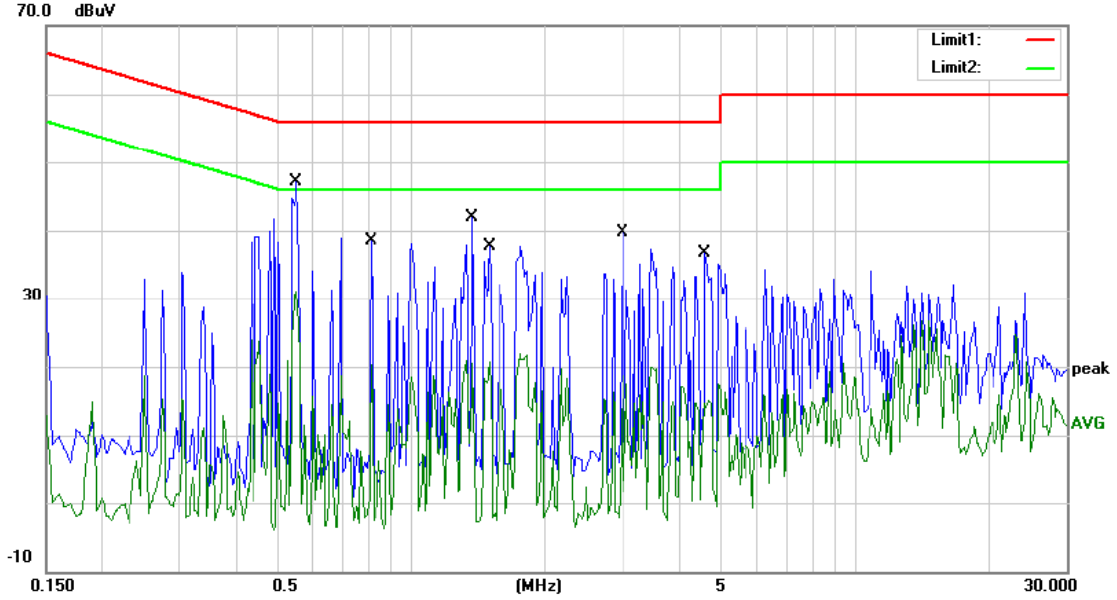
Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Test Receiver	Rohde & Schwarz	ESCS30	828985/018	05/17/2014	05/16/2015
L.I.S.N.	Schwarzbeck	NNLK8129	8129203	05/17/2014	05/16/2015
50Ω Coaxial Switch	Anritsu	MP59B	M20531	N/A	N/A
Pulse Limiter	Rohde & Schwarz	ESH3-Z2	100006	05/17/2014	05/16/2015
Voltage Probe	Rohde & Schwarz	TK9416	N/A	05/17/2014	05/16/2015
I.S.N	Rohde & Schwarz	ENY22	1109.9508.02	05/17/2014	05/16/2015

5.4 Conducted Emission Limit

Conducted Emission Frequency(MHz)	Quasi-peak	Average
0.15-0.5	66-56	56-46
0.5-5.0	56	46
5.0-30.0	60	50

- Note:**
1. The lower limit shall apply at the transition frequencies
 2. The limit decreases in line with the logarithm of the frequency in the range of 0.15 to 0.50MHz.

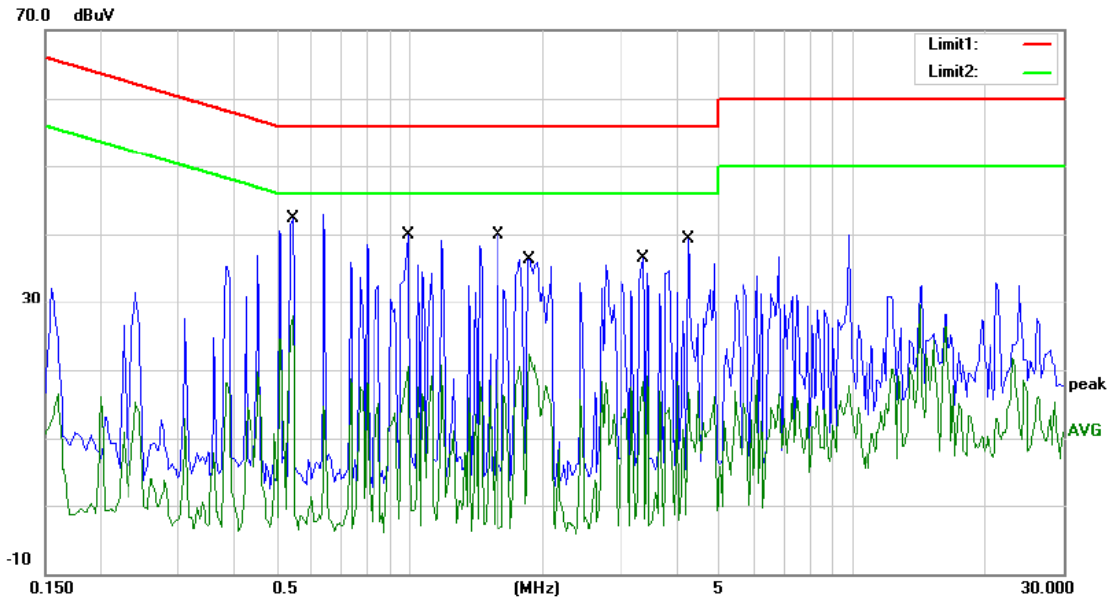
5.5 Measurement Result



Site Conducted #3 Phase: **L1** Temperature: 23
 Limit: (CE)FCC PART 15 C Power: AC 120V/60Hz Humidity: 55 %
 Mode: Zigbee ON
 Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	*	0.5500	47.02	0.00	47.02	56.00	-8.98	QP	
2		0.5500	31.04	0.00	31.04	46.00	-14.96	AVG	
3		0.8100	38.51	0.00	38.51	56.00	-17.49	QP	
4		0.8100	20.31	0.00	20.31	46.00	-25.69	AVG	
5		1.3700	41.84	0.00	41.84	56.00	-14.16	QP	
6		1.3700	20.88	0.00	20.88	46.00	-25.12	AVG	
7		1.5000	37.74	0.00	37.74	56.00	-18.26	QP	
8		1.5000	20.72	0.00	20.72	46.00	-25.28	AVG	
9		2.9800	39.62	0.00	39.62	56.00	-16.38	QP	
10		2.9800	18.64	0.00	18.64	46.00	-27.36	AVG	
11		4.5800	36.77	0.00	36.77	56.00	-19.23	QP	
12		4.5800	17.52	0.00	17.52	46.00	-28.48	AVG	

*:Maximum data x:Over limit !:over margin Comment: Factor build in receiver. Operator: KK



Site Conducted #3 Phase: **N** Temperature: 23
 Limit: (CE)FCC PART 15 C Power: AC 120V/60Hz Humidity: 55 %
 Mode: Zigbee ON
 Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	*	0.5450	42.34	0.00	42.34	56.00	-13.66	QP	
2		0.5450	27.88	0.00	27.88	46.00	-18.12	AVG	
3		0.9900	39.98	0.00	39.98	56.00	-16.02	QP	
4		0.9900	20.54	0.00	20.54	46.00	-25.46	AVG	
5		1.5850	39.91	0.00	39.91	56.00	-16.09	QP	
6		1.5850	19.91	0.00	19.91	46.00	-26.09	AVG	
7		1.8600	36.37	0.00	36.37	56.00	-19.63	QP	
8		1.8600	22.34	0.00	22.34	46.00	-23.66	AVG	
9		3.3700	36.45	0.00	36.45	56.00	-19.55	QP	
10		3.3700	19.10	0.00	19.10	46.00	-26.90	AVG	
11		4.2500	39.39	0.00	39.39	56.00	-16.61	QP	
12		4.2500	18.27	0.00	18.27	46.00	-27.73	AVG	

*:Maximum data x:Over limit !:over margin Comment: Factor build in receiver. Operator: KK

6. Radiated Emission Test

6.1 Measurement Procedure

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
4. Repeat above procedures until all frequency measured were complete.

When spectrum scanned from 30 MHz to 1GHz setting resolution bandwidth 120 kHz and video bandwidth 300kHz.

EMI Test Receiver	Setting
Attenuation	Auto
RB	120kHz
VB	300kHz
Detector	QP
Trace	Max hold

When spectrum scanned above 1GHz setting resolution bandwidth 1MHz, video bandwidth 3MHz.

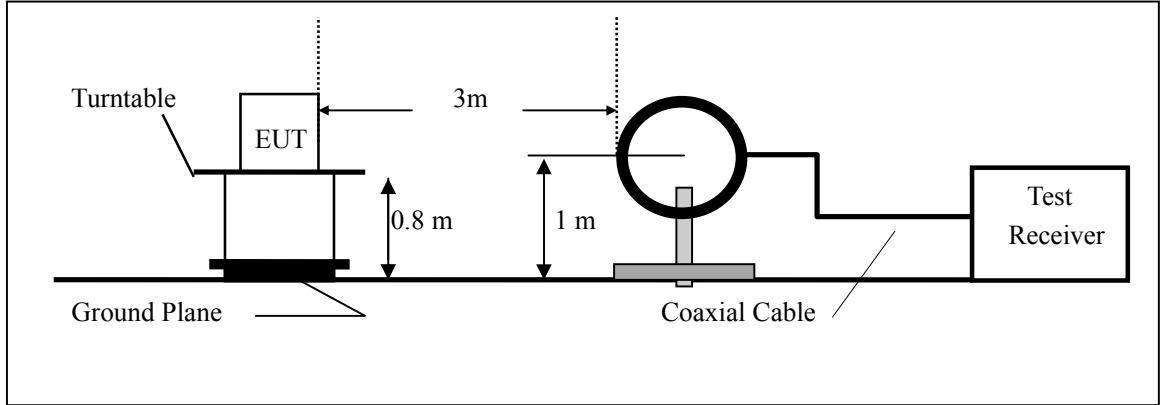
EMI Test Receiver	Setting
Attenuation	Auto
RB	1MHz
VB	3MHz
Detector	Peak
Trace	Max hold

When spectrum scanned above 1GHz setting resolution bandwidth 1MHz, video bandwidth 10Hz.

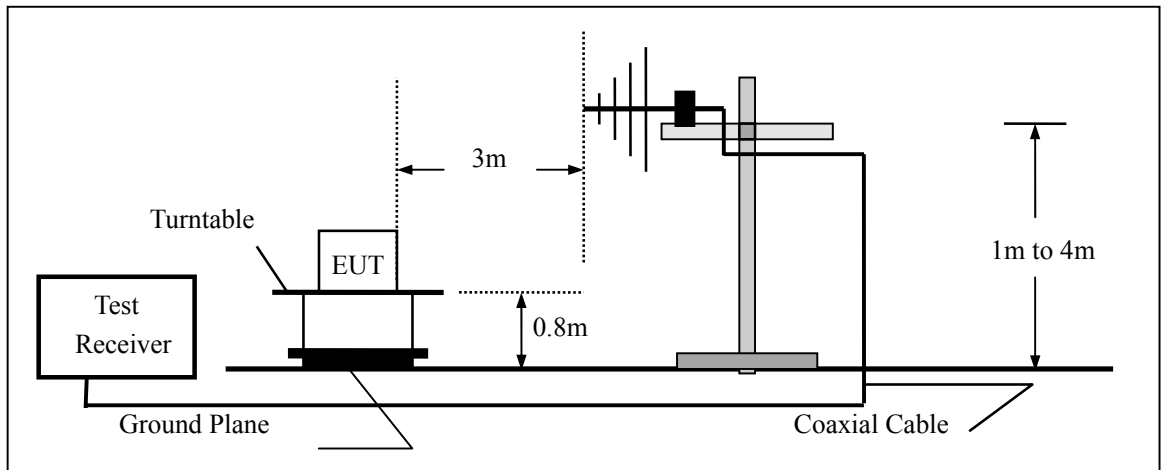
EMI Test Receiver	Setting
Attenuation	Auto
RB	1MHz
VB	10Hz
Detector	Peak
Trace	Max hold

6.2 Test SET-UP (Block Diagram of Configuration)

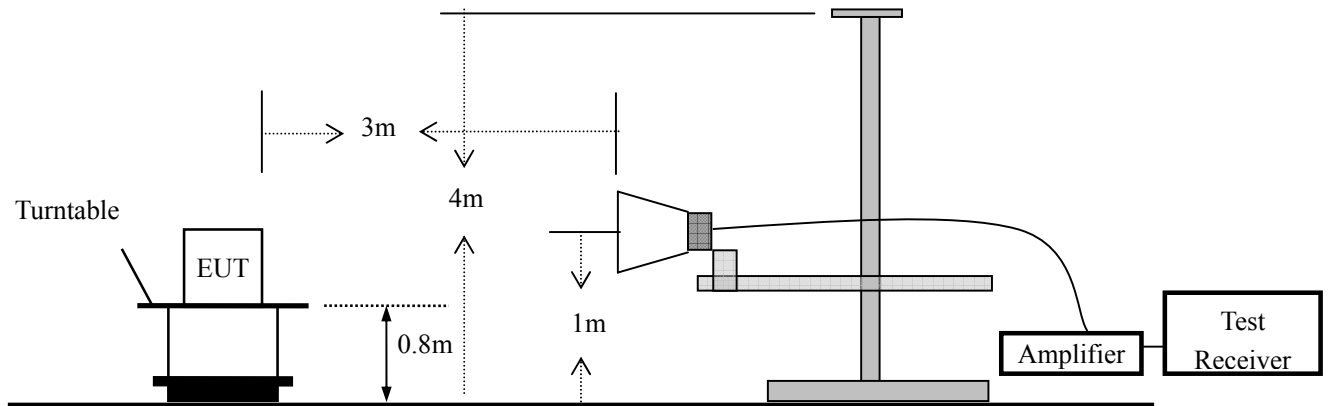
(A) Radiated Emission Test Set-Up, Frequency Below 30MHz



(B) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(C) Radiated Emission Test Set-Up, Frequency above 1000MHz



6.3 Measurement Equipment Used

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	Rohde & Schwarz	ESU	1302.6005.26	05/17/2014	05/16/2015
Pre-Amplifier	HP	8447D	2944A07999	05/17/2014	05/16/2015
Bilog Antenna	Schwarzbeck	VULB9163	142	05/17/2014	05/16/2015
Loop Antenna	ARA	PLA-1030/B	1029	05/17/2014	05/16/2015
Horn Antenna	Schwarzbeck	BBHA 9170	BBHA9170399	05/17/2014	05/16/2015
Horn Antenna	Schwarzbeck	BBHA 9120	D143	05/17/2014	05/16/2015
Cable	Schwarzbeck	AK9513	ACRX1	05/17/2014	05/16/2015
Cable	Rosenberger	N/A	FP2RX2	05/17/2014	05/16/2015
Cable	Schwarzbeck	AK9513	CRPX1	05/17/2014	05/16/2015
Cable	Schwarzbeck	AK9513	CRRX2	05/17/2014	05/16/2015

6.4 Radiated Emission Limit

The emissions from an intentional radiator shall not exceed the field strength levels specified in the following table 15.209(a):

Frequencies (MHz)	Field Strength (micovolts/meter)	Measurement Distance (meters)
0.009~0.490	2400/F(KHz)	300
0.490~1.705	24000/F(KHz)	30
1.705~30.0	30	30
30~88	100	3
88~216	150	3
216~960	200	3
Above 960	500	3

15.205 Restricted bands of operation

MHz	MHz	MHz	GHz
0.090 - 0.110	16.42 - 16.423	399.9 - 410	4.5 - 5.15
¹ 0.495 - 0.505	16.69475 - 16.69525	608 - 614	5.35 - 5.46
2.1735 - 2.1905	16.80425 - 16.80475	960 - 1240	7.25 - 7.75
4.125 - 4.128	25.5 - 25.67	1300 - 1427	8.025 - 8.5
4.17725 - 4.17775	37.5 - 38.25	1435 - 1626.5	9.0 - 9.2
4.20725 - 4.20775	73 - 74.6	1645.5 - 1646.5	9.3 - 9.5
6.215 - 6.218	74.8 - 75.2	1660 - 1710	10.6 - 12.7
6.26775 - 6.26825	108 - 121.94	1718.8 - 1722.2	13.25 - 13.4
6.31175 - 6.31225	123 - 138	2200 - 2300	14.47 - 14.5
8.291 - 8.294	149.9 - 150.05	2310 - 2390	15.35 - 16.2
8.362 - 8.366	156.52475 - 156.52525	2483.5 - 2500	17.7 - 21.4
8.37625 - 8.38675	156.7 - 156.9	2690 - 2900	22.01 - 23.12
8.41425 - 8.41475	162.0125 - 167.17	3260 - 3267	23.6 - 24.0
12.29 - 12.293	167.72 - 173.2	3332 - 3339	31.2 - 31.8
12.51975 - 12.52025	240 - 285	3345.8 - 3358	36.43 - 36.5
12.57675 - 12.57725	322 - 335.4	3600 - 4400	(²)

- Remark: 1. Emission level in dBuV/m=20 log (uV/m)
 2. Measurement was performed at an antenna to the closed point of EUT distance of meters.
 3. Only spurious frequency is permitted to locate within the Restricted Bands specified in provision of § 15.205, and the emissions located in restricted bands also comply with 15.209 limit.

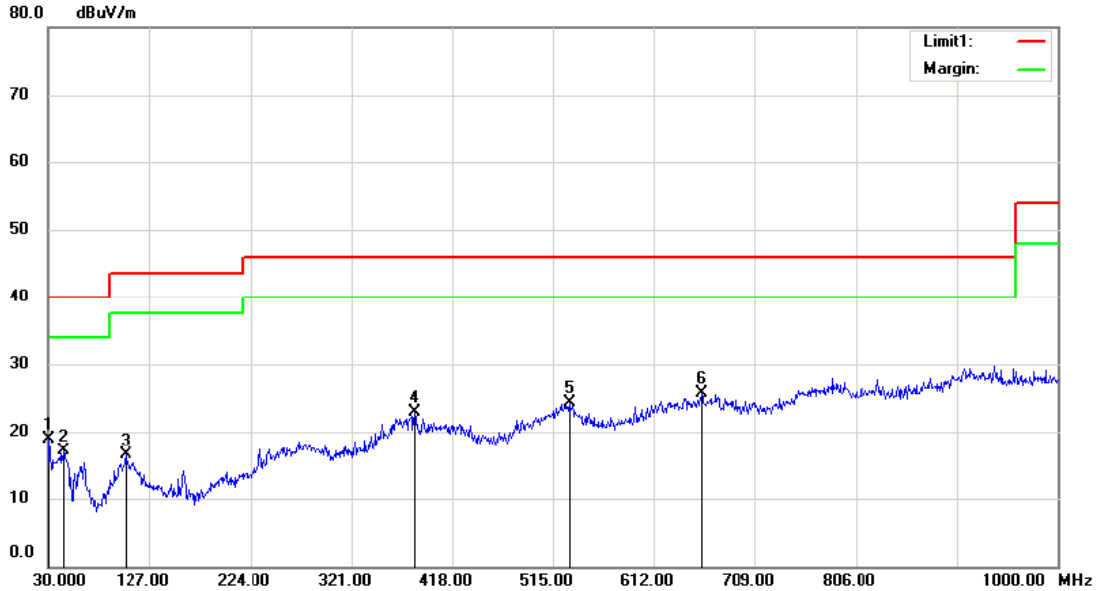
6.5 Measurement Result

Operation Mode: TX Mode Test Date : December 29, 2014
 Frequency Range: 9KHz~30MHz Temperature : 23°C
 Test Result: PASS Humidity : 50%
 Measured Distance: 3m Test By: KINGKONG

Freq. (MHz)	Ant.Pol. H/V	Emission Level (dBuV/m)	Limit 3m (dBuV/m)	Over (dB)
--	--	--	--	--

Note: the amplitude of spurious emission that is attenuated by more than 20dB below the permissible limit has no need to be reported.
 Distance extrapolation factor =40log(Specific distance/ test distance)(dB);
 Limit line=Specific limits(dBuV) + distance extrapolation factor.

Operation Mode: ZigBee Channel 1 Test Date : December 29, 2014
 Frequency Range: 30MHz-1GHz Temperature : 24°C
 Test Result: PASS Humidity : 53%
 Measured Distance: 3m Test By: KINGKONG

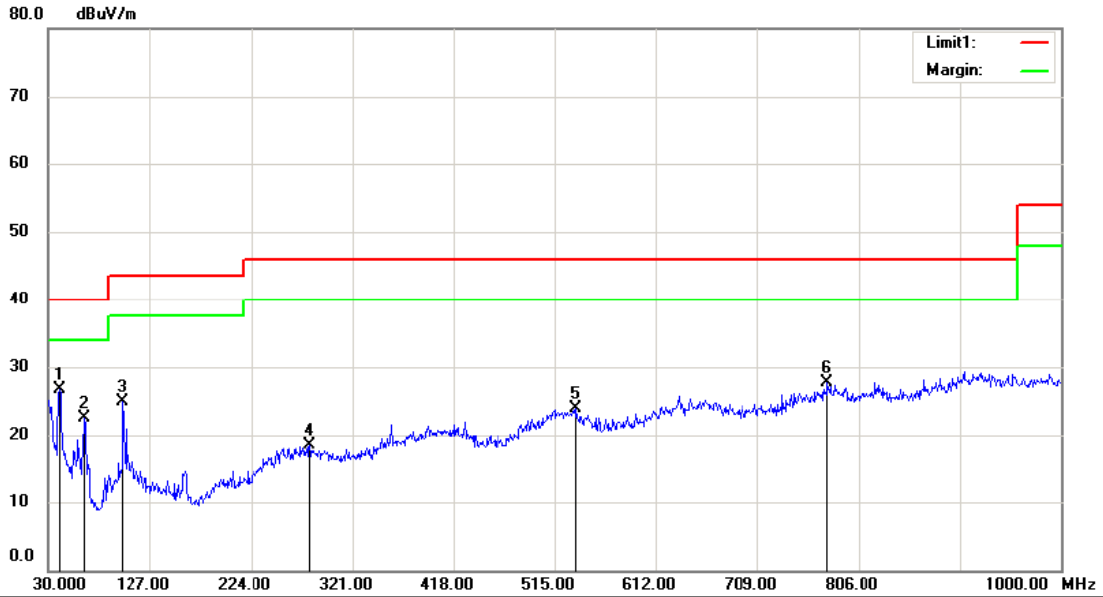


Site: 3m Chamber #1 Polarization: **Horizontal** Temperature: 24 C
 Limit: (RE)FCC PART 15 C Power: AC 120V/60Hz Humidity: 53 %
 Mode: TX 2405
 Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		30.9700	33.31	-14.39	18.92	40.00	-21.08	QP		
2		44.5500	28.72	-11.71	17.01	40.00	-22.99	QP		
3		103.7200	29.89	-13.46	16.43	43.50	-27.07	QP		
4		382.1100	31.65	-8.80	22.85	46.00	-23.15	QP		
5		530.5200	30.26	-5.96	24.30	46.00	-21.70	QP		
6	*	657.5900	30.52	-4.78	25.74	46.00	-20.26	QP		

*:Maximum data x:Over limit !:over margin

Operator: KK



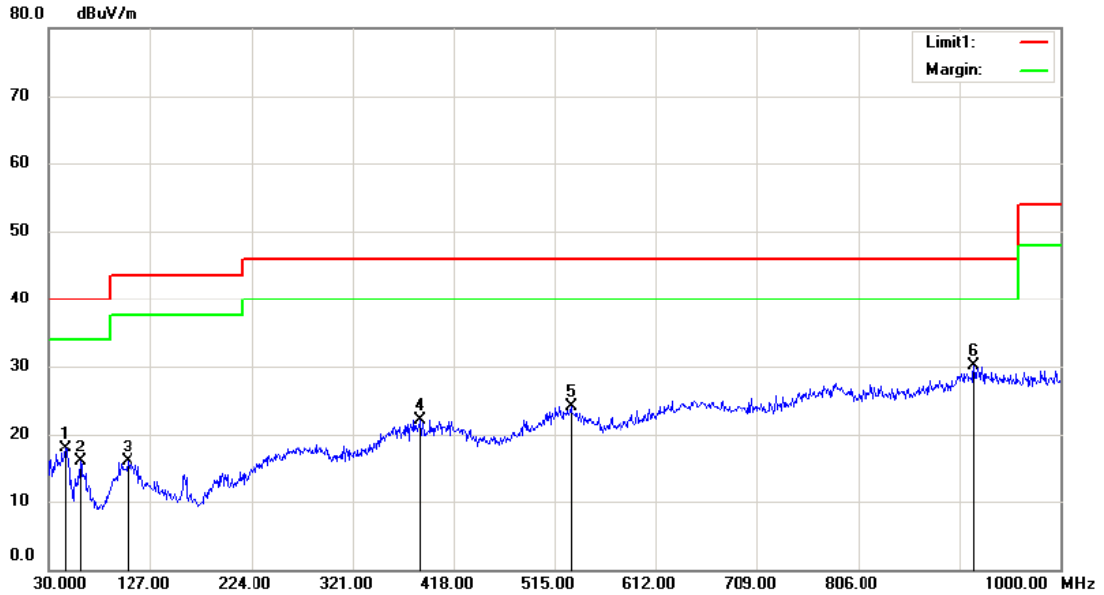
Site: 3m Chamber #1 Polarization: **Vertical** Temperature: 24 C
 Limit: (RE)FCC PART 15 C Power: AC 120V/60Hz Humidity: 53 %
 Mode: TX 2405
 Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Antenna Height cm	Table Degree	Detector	Comment
1	*	40.6700	39.05	-12.29	26.76	40.00	-13.24			QP	
2		63.9500	37.83	-15.39	22.44	40.00	-17.56			QP	
3		100.8100	38.41	-13.57	24.84	43.50	-18.66			QP	
4		280.2600	29.34	-10.87	18.47	46.00	-27.53			QP	
5		535.3700	30.21	-6.39	23.82	46.00	-22.18			QP	
6		775.9300	30.62	-2.90	27.72	46.00	-18.28			QP	

*:Maximum data x:Over limit !:over margin

Operator: KK

Operation Mode: ZigBee Channel 8 Test Date : December 29, 2014
 Frequency Range: 30MHz-1GHz Temperature : 24°C
 Test Result: PASS Humidity : 53%
 Measured Distance: 3m Test By: KINGKONG

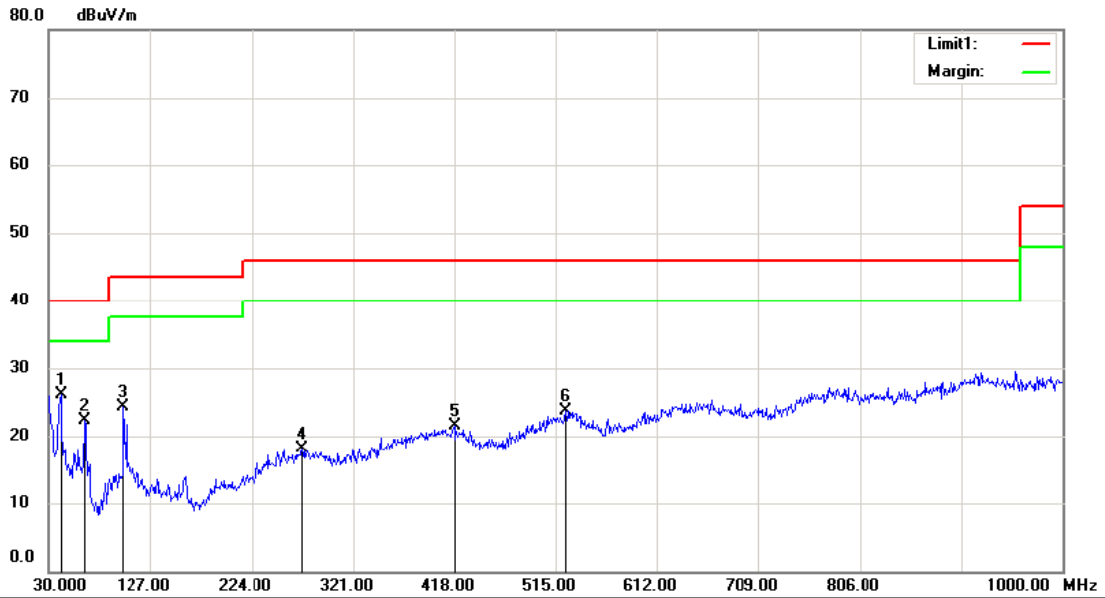


Site 3m Chamber #1 Polarization: **Horizontal** Temperature: 24 C
 Limit: (RE)FCC PART 15 C Power: AC 120V/60Hz Humidity: 53 %
 Mode: TX 2440
 Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Antenna Height cm	Table Degree degree	Comment
1		46.4900	30.66	-12.69	17.97	40.00	-22.03	QP			
2		60.0700	29.31	-13.43	15.88	40.00	-24.12	QP			
3		105.6600	29.40	-13.43	15.97	43.50	-27.53	QP			
4		385.9900	30.78	-8.59	22.19	46.00	-23.81	QP			
5		530.5200	30.02	-5.96	24.06	46.00	-21.94	QP			
6	*	916.5800	30.94	-0.88	30.06	46.00	-15.94	QP			

*:Maximum data x:Over limit !:over margin

Operator: KK



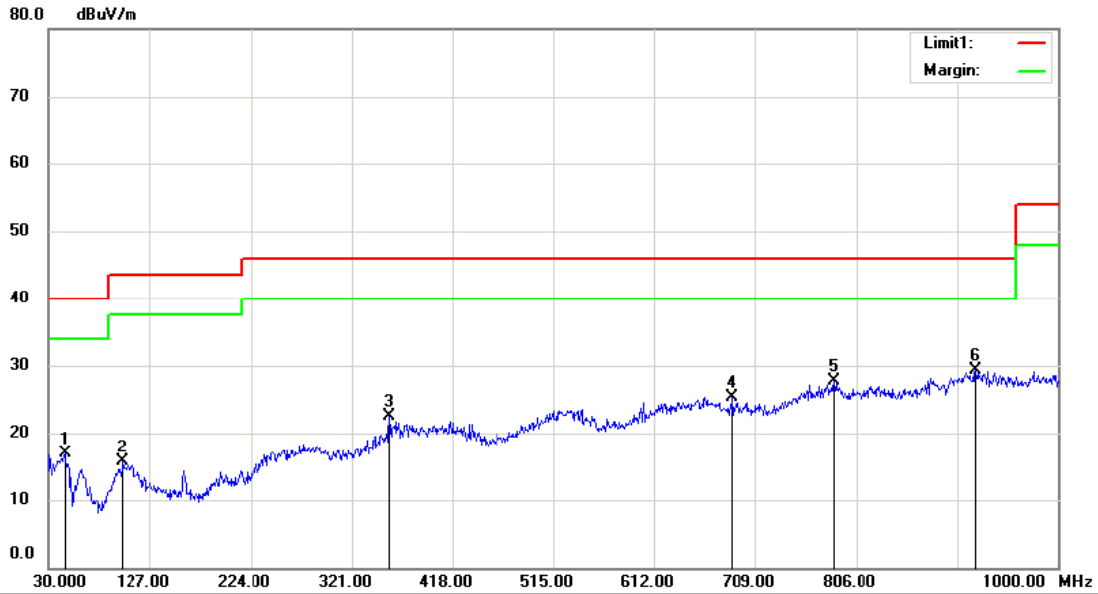
Site: 3m Chamber #1 Polarization: **Vertical** Temperature: 24 C
 Limit: (RE)FCC PART 15 C Power: AC 120V/60Hz Humidity: 53 %
 Mode: TX 2440
 Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Antenna Height cm	Table Degree	Comment
1	*	41.6400	37.92	-11.84	26.08	40.00	-13.92	QP		
2		63.9500	37.62	-15.39	22.23	40.00	-17.77	QP		
3		100.8100	37.80	-13.57	24.23	43.50	-19.27	QP		
4		272.5000	28.96	-10.82	18.14	46.00	-27.86	QP		
5		418.0000	29.73	-8.21	21.52	46.00	-24.48	QP		
6		524.7000	29.90	-6.12	23.78	46.00	-22.22	QP		

*:Maximum data x:Over limit !:over margin

Operator: KK

Operation Mode: ZigBee Channel 16 Test Date : December 29, 2014
 Frequency Range: 30MHz-1GHz Temperature : 24°C
 Test Result: PASS Humidity : 53%
 Measured Distance: 3m Test By: KINGKONG

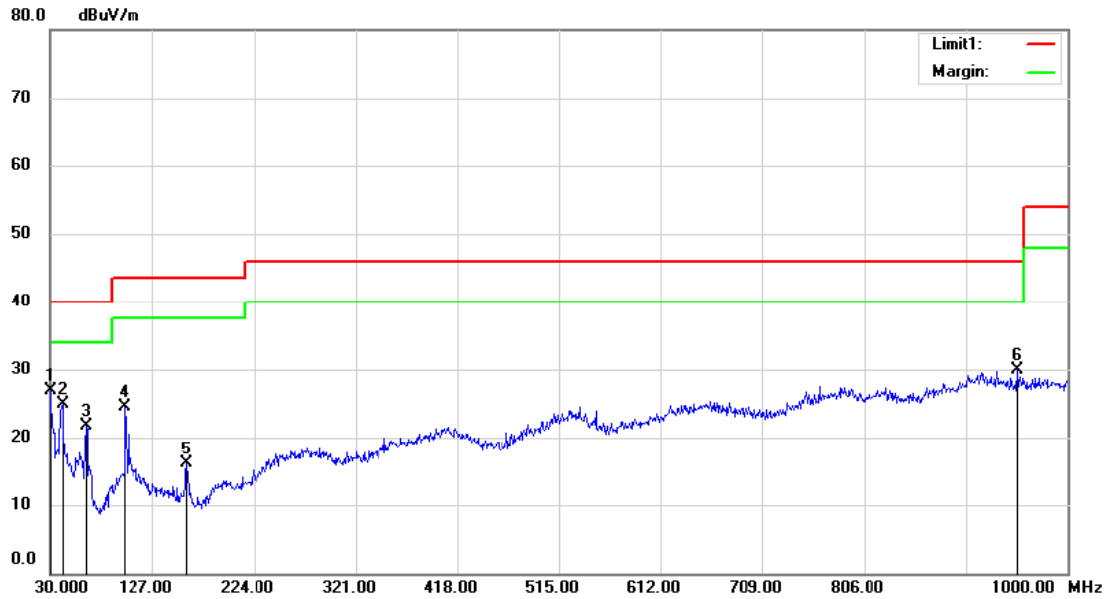


Site 3m Chamber #1 Polarization: **Horizontal** Temperature: 24 C
 Limit: (RE)FCC PART 15 C Power: AC 120V/60Hz Humidity: 53 %
 Mode: TX 2480
 Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Antenna Height cm	Table Degree degree	Comment
1		45.5200	29.32	-12.37	16.95	40.00	-23.05	QP			
2		100.8100	29.28	-13.57	15.71	43.50	-27.79	QP			
3		357.8600	31.90	-9.44	22.46	46.00	-23.54	QP			
4		686.6900	30.94	-5.62	25.32	46.00	-20.68	QP			
5		784.6600	30.46	-2.81	27.65	46.00	-18.35	QP			
6	*	920.4600	30.23	-0.88	29.35	46.00	-16.65	QP			

*:Maximum data x:Over limit !:over margin

Operator: KK



Site 3m Chamber #1 Polarization: **Vertical** Temperature: 24 C
 Limit: (RE)FCC PART 15 C Power: AC 120V/60Hz Humidity: 53 %
 Mode: TX 2480
 Note:

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV/m	Limit dBuV/m	Over dB	Detector	Antenna Height cm	Table Degree degree	Comment
1	*	30.0000	41.61	-14.70	26.91	40.00	-13.09	QP			
2		41.6400	36.83	-11.84	24.99	40.00	-15.01	QP			
3		63.9500	37.18	-15.39	21.79	40.00	-18.21	QP			
4		100.8100	38.14	-13.57	24.57	43.50	-18.93	QP			
5		159.9800	33.89	-17.87	16.02	43.50	-27.48	QP			
6		952.4700	31.39	-1.54	29.85	46.00	-16.15	QP			

*:Maximum data x:Over limit l:over margin

Operator: KK

Operation Mode: ZigBee Channel 1 Test Date : December 29, 2014
 Frequency Range: 1GHz-25GHz Temperature : 24°C
 Test Result: PASS Humidity : 53%
 Measured Distance: 3m Test By: KINGKONG

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
4705.13	V	46.58	29.13	74.00	54.00	-27.42	-24.87
8001.60	V	49.51	32.08	74.00	54.00	-24.49	-21.92
10181.09	V	51.85	34.45	74.00	54.00	-22.15	-19.55
5358.97	H	43.35	26.61	74.00	54.00	-30.65	-27.39
7293.27	H	46.81	29.21	74.00	54.00	-27.19	-24.79
7919.87	H	46.63	30.20	74.00	54.00	-27.37	-23.80

All emissions not reported were more than 20dB below the specified limit or in the noise floor.

- Note:**
- (1) All Readings are Peak Value and AV.
 - (2) Emission Level= Reading Level+Probe Factor +Cable Loss.
 - (3) Data of measurement within this frequency range shown “ -- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

Operation Mode: ZigBee Channel 8 Test Date : December 29, 2014
 Frequency Range: 1GHz-25GHz Temperature : 24°C
 Test Result: PASS Humidity : 53%
 Measured Distance: 3m Test By: KINGKONG

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
5358.97	V	44.85	27.61	74.00	54.00	-29.15	-26.39
7293.27	V	48.81	31.91	74.00	54.00	-25.19	-22.09
7919.87	V	49.13	31.20	74.00	54.00	-24.87	-22.80
4705.13	H	46.58	28.53	74.00	54.00	-27.42	-25.47
5331.73	H	46.75	29.60	74.00	54.00	-27.25	-24.40
7184.30	H	49.62	32.70	74.00	54.00	-24.38	-21.30

All emissions not reported were more than 20dB below the specified limit or in the noise floor.

- Note:**
- (1) All Readings are Peak Value and AV.
 - (2) Emission Level= Reading Level+Probe Factor +Cable Loss.
 - (3) Data of measurement within this frequency range shown “ -- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

Operation Mode: ZigBee Channel 16 Test Date : December 29, 2014
 Frequency Range: 1GHz-25GHz Temperature : 24°C
 Test Result: PASS Humidity : 53%
 Measured Distance: 3m Test By: KINGKONG

Freq. (MHz)	Ant.Pol. H/V	Emission Level(dBuV)		Limit 3m(dBuV/m)		Over(dB)	
		PK	AV	PK	AV	PK	AV
5331.73	V	44.25	27.90	74.00	54.00	-29.75	-26.10
6612.18	V	47.16	30.52	74.00	54.00	-26.84	-23.48
8001.60	V	50.01	33.18	74.00	54.00	-23.99	-20.82
6612.18	H	46.01	29.13	74.00	54.00	-27.99	-24.87
7293.27	H	48.31	31.31	74.00	54.00	-25.69	-22.69
7919.87	H	48.13	31.20	74.00	54.00	-25.87	-22.80

No others harmonics emissions are higher than 20dB below the limits of 47 CFR Part 15.247.

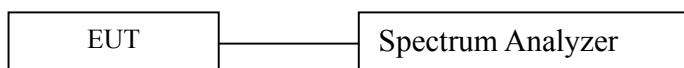
- Note:**
- (1) All Readings are Peak Value and AV.
 - (2) Emission Level= Reading Level+Probe Factor +Cable Loss.
 - (3) Data of measurement within this frequency range shown “ -- ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

7. Occupied Bandwidth Test

7.1 Measurement Procedure

1. The testing follows FCC KOB Publication No. 558074 OTS 001 Meas. Guidance v03r02
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT transmit continuously
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement The 6dB bandwidth must be greater than 500 kHz
5. Measure and record the results in the test report.

Test SET-UP (Block Diagram of Configuration)



7.2 Measurement Equipment Used

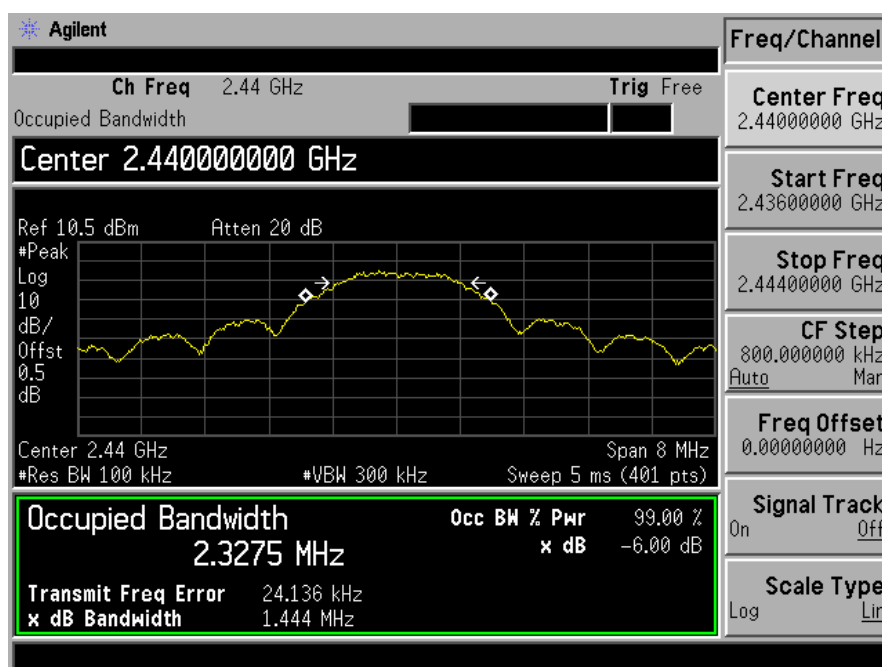
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	E4407B	88156318	05/17/2014	05/16/2015

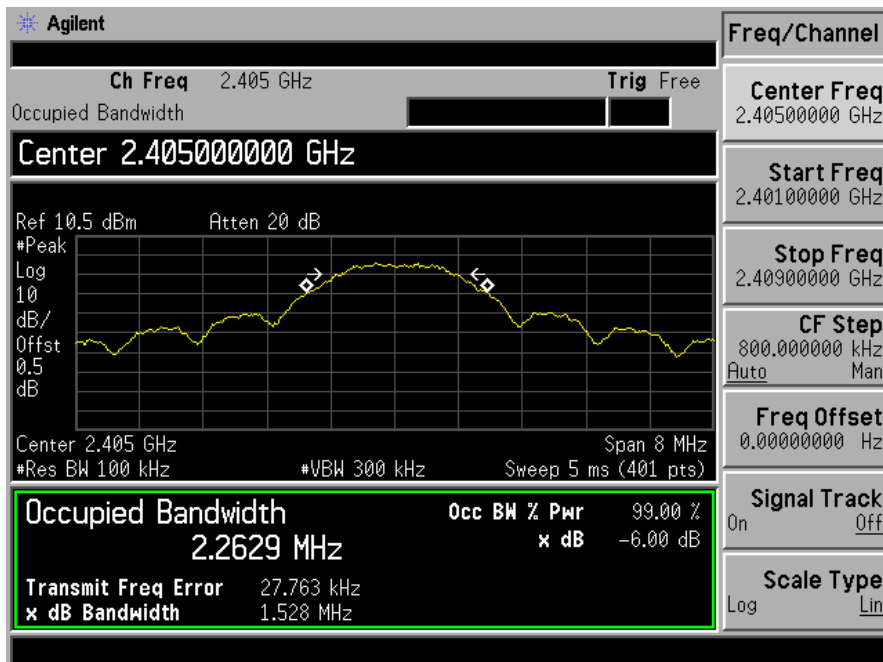
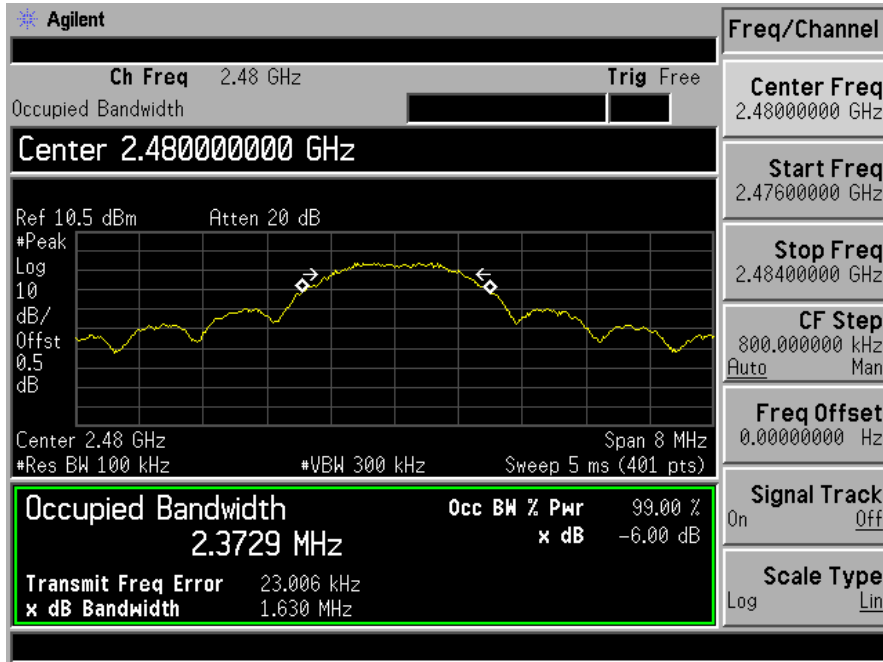
7.3 Measurement Results

6 dB Bandwidth Test Data Chart:
 Refer to attached data chart.

Spectrum Detector: PK Test Date : December 29, 2014
 Test By: KINGKONG Temperature : 23 °C
 Test Result: PASS Humidity : 50%
 Operation Mode: ZIGBEE

Channel number	Channel frequency (MHz)	Measurement level (MHz)	Required Limit (kHz)
1	2405	1.444	>500
8	2440	1.630	>500
16	2480	1.528	>500



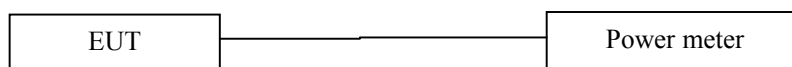


8. Maximum Peak Output Power Test

8.1 Measurement Procedure

- The Transmitter output (antenna port) was connected to the power meter.
- Turn on the EUT and power meter and then record the peak power value.
- Repeat above procedures on all channels needed to be tested.

8.2 Test SET-UP (Block Diagram of Configuration)



8.3 Measurement Equipment Used

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power meter	Boonton	4232A	29001	05/17/2014	05/16/2015
Power sensor	Boonton	51011-EMC	31184	05/17/2014	05/16/2015

8.4 Peak Power output limit

The maximum peak power shall be less 1Watt.

8.5 Measurement Results

Spectrum Detector: PK Test Date : December 29, 2014
 Test By: KINGKONG Temperature : 23°C
 Test Result: PASS Humidity : 50%
 Operation Mode: Zigbee

Channel number	Channel Frequency(MHz)	Peak Power output(dBm)	Peak Power Limit(W)	Pass/Fail
1	2405	0.36	1W(30dBm)	PASS
8	2440	-0.12	1W(30dBm)	PASS
16	2480	-0.49	1W(30dBm)	PASS

9. Band Edge Test

9.1 Measurement Procedure

1. The EUT was Operating in hopping mode or could be controlled its channel. Printed out test result from the spectrum by hard copy function.
2. The EUT was placed on a turn table which is 0.8m above ground plane.
3. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
4. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
5. Repeat above procedures until all frequency measured were complete.

EMI Test Receiver	Setting
Attenuation	Auto
RB	1MHz
VB	3MHz
Detector	Peak
Trace	Max hold

EMI Test Receiver	Setting
Attenuation	Auto
RB	1MHz
VB	10Hz
Detector	Peak
Trace	Max hold

9.2 Test SET-UP (Block Diagram of Configuration)

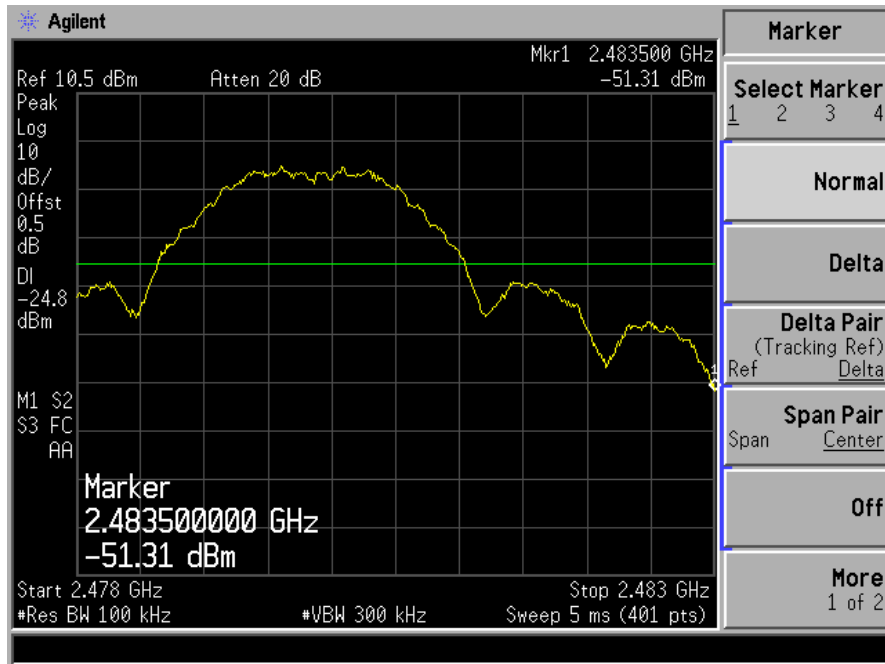
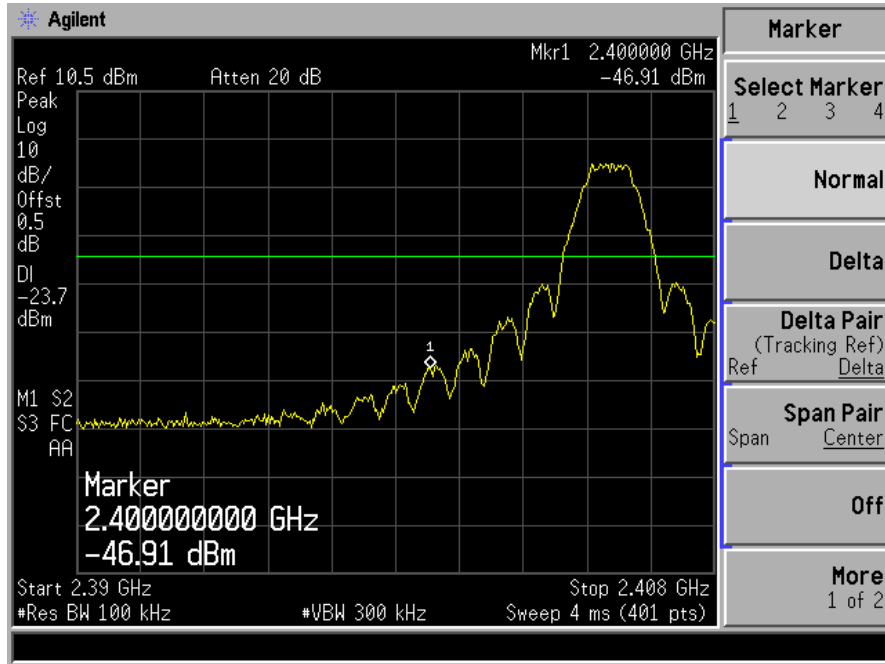
As 6.2 Test set up (B) and (C)

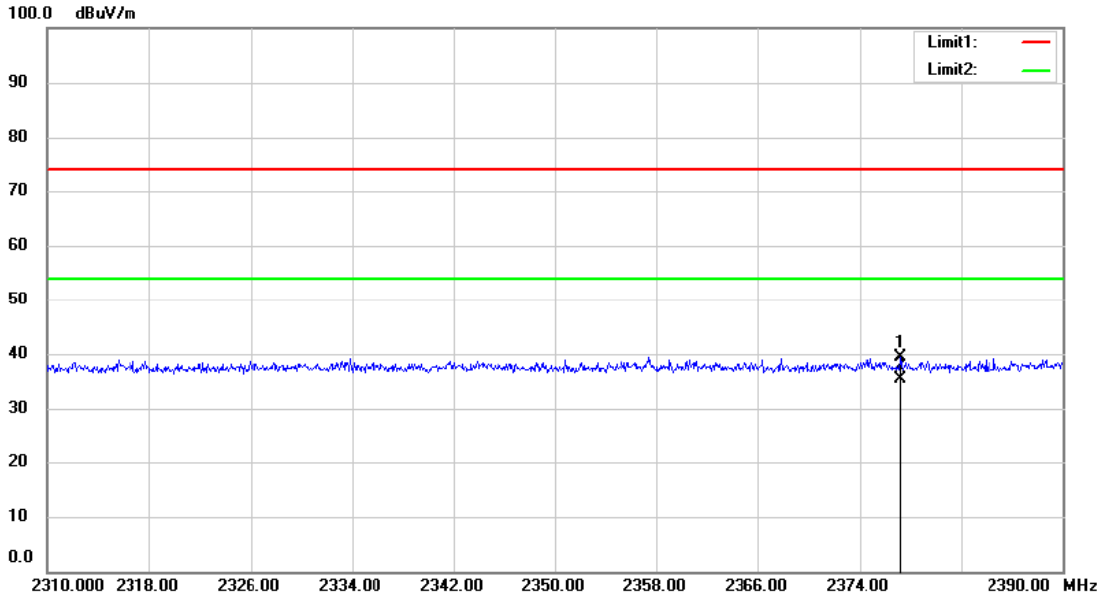
9.3 Measurement Equipment Used

Same as 6.3 Radiated Emission Measurement.

9.4 Measurement Results

Test mode: ZIGBEE



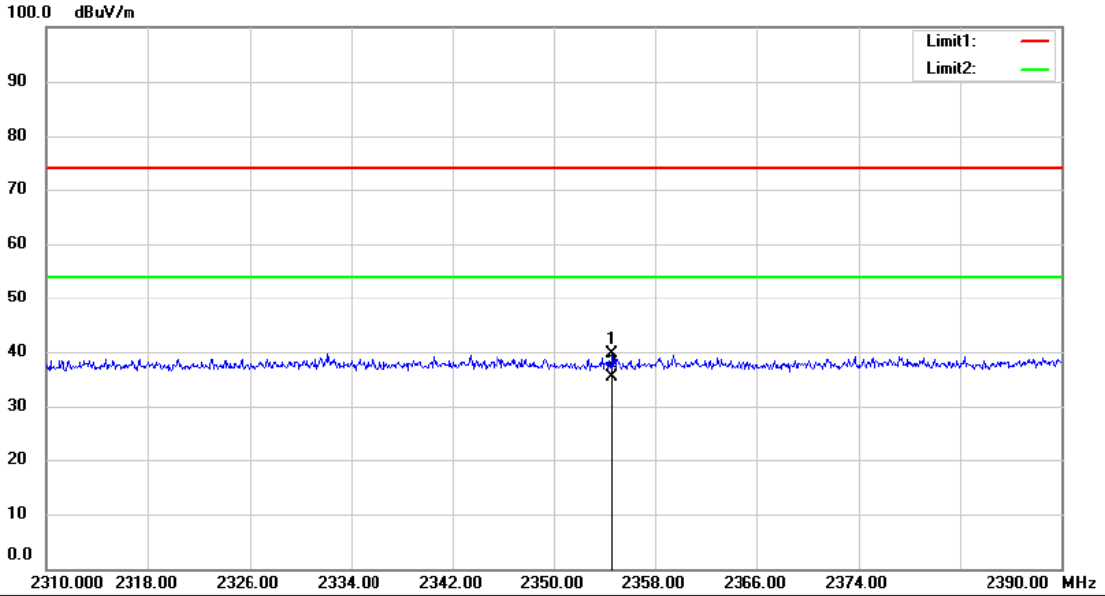


Site 3m Chamber #3 Polarization: **Horizontal** Temperature: 24 C
 Limit: (RE)FCC PART 15 C Power: Humidity: 53 %
 Mode: TX 2405
 Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		2377.280	62.52	-23.18	39.34	74.00	-34.66			peak
2	*	2377.280	58.48	-23.18	35.30	54.00	-18.70			AVG

*:Maximum data x:Over limit !:over margin

Operator: KK

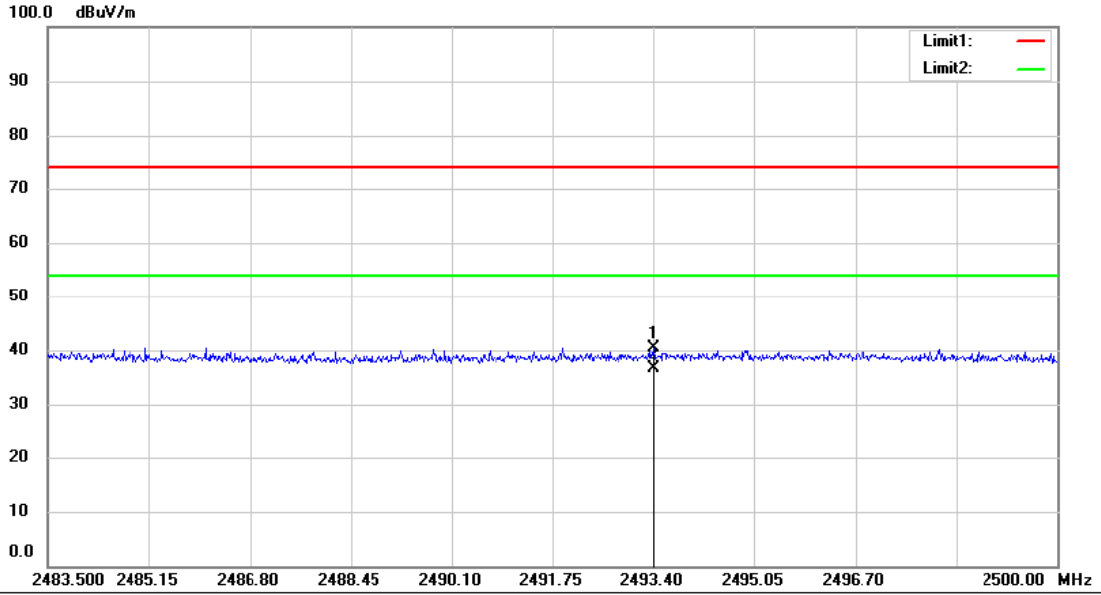


Site 3m Chamber #3 Polarization: **Vertical** Temperature: 24 C
 Limit: (RE)FCC PART 15 C Power: Humidity: 53 %
 Mode: TX 2405
 Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Over	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	
1		2354.560	62.94	-23.29	39.65	74.00	-34.35	peak		
2	*	2354.560	58.59	-23.29	35.30	54.00	-18.70	AVG		

*:Maximum data x:Over limit !:over margin

Operator: KK

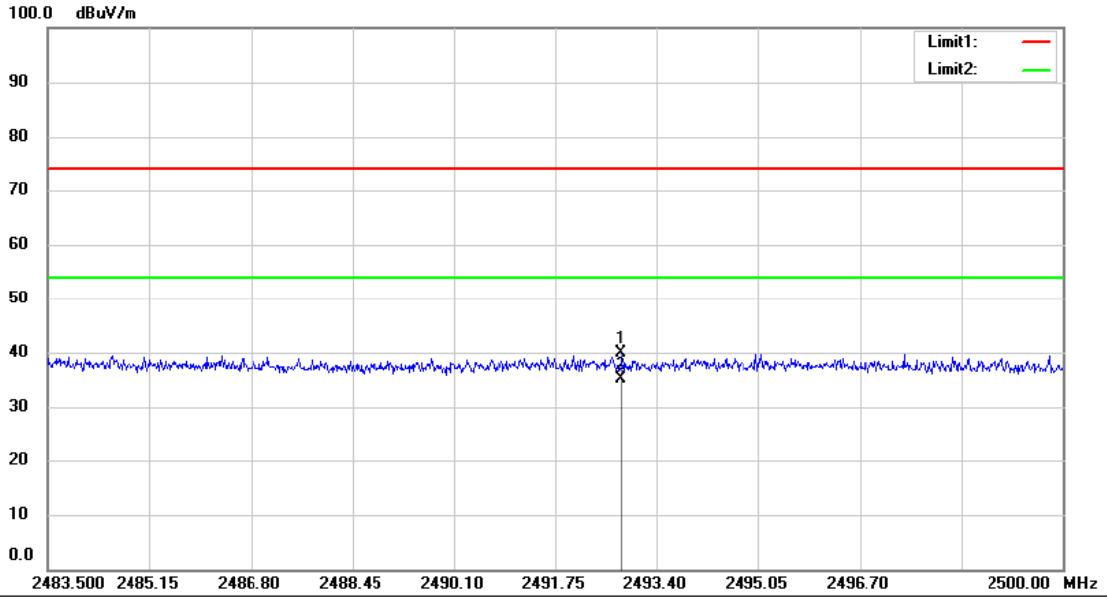


Site 3m Chamber #3 Polarization: **Horizontal** Temperature: 24 C
 Limit: (RE)FCC PART 15 C Power: Humidity: 53 %
 Mode: TX 2480
 Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		2493.400	62.98	-22.56	40.42	74.00	-33.58			peak
2	*	2493.400	59.26	-22.56	36.70	54.00	-17.30			AVG

*:Maximum data x:Over limit !:over margin

Operator: KK



Site 3m Chamber #3 Polarization: **Vertical** Temperature: 24 C
 Limit: (RE)FCC PART 15 C Power: Humidity: 53 %
 Mode: TX 2480
 Note:

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	Comment
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	
1		2492.823	62.40	-22.56	39.84	74.00	-34.16			peak
2	*	2492.823	57.76	-22.56	35.20	54.00	-18.80			AVG

*:Maximum data x:Over limit !:over margin Operator: KK

10. Power Density

10.1 Test Equipment

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	Rohde & Schwarz	ESCI	101045	05/17/2014	05/16/2015

10.2 Measuring Instruments and Setting

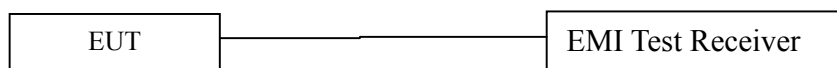
The following table is the setting of spectrum analyzer.

Spectrum analyzer	Setting
Attenuation	Auto
Span Frequency	300kHz
RB	3kHz
VB	10kHz
Detector	Peak
Trace	Max hold
Sweep Time	100s

10.3 Test Procedures

- The transmitter output (antenna port) was connected to the spectrum analyzer.
- Set RBW of spectrum analyzer to 3 kHz and VBW to 30 kHz, Set Detector to Peak, Trace to Max Hold.
- Mark the frequency with maximum peak power as the center of the display of the spectrum.
- Set the span to 300 kHz and the sweep time to 100s and record the maximum peak value.

10.4 Block Diagram of Test Setup



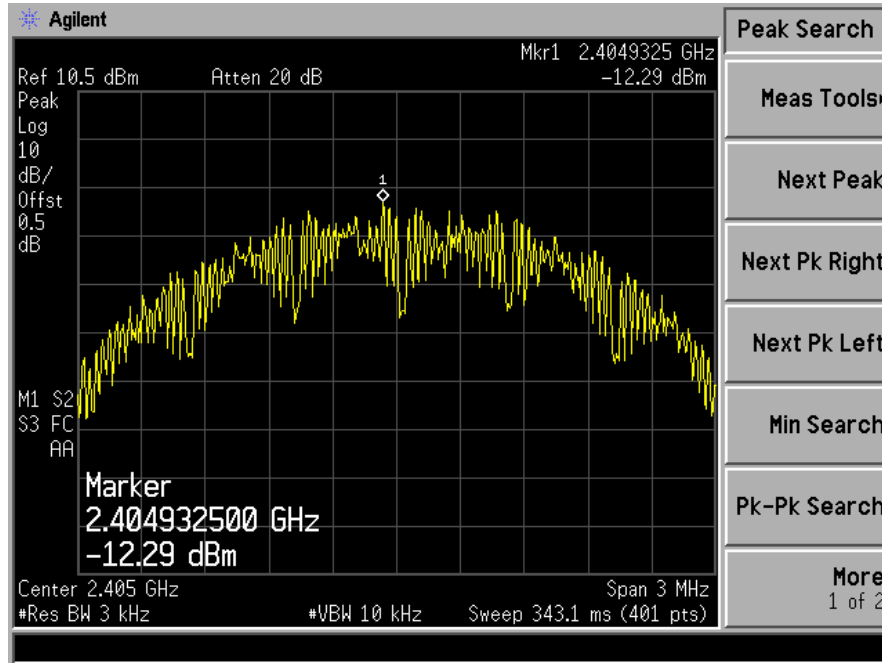
10.5 Limit

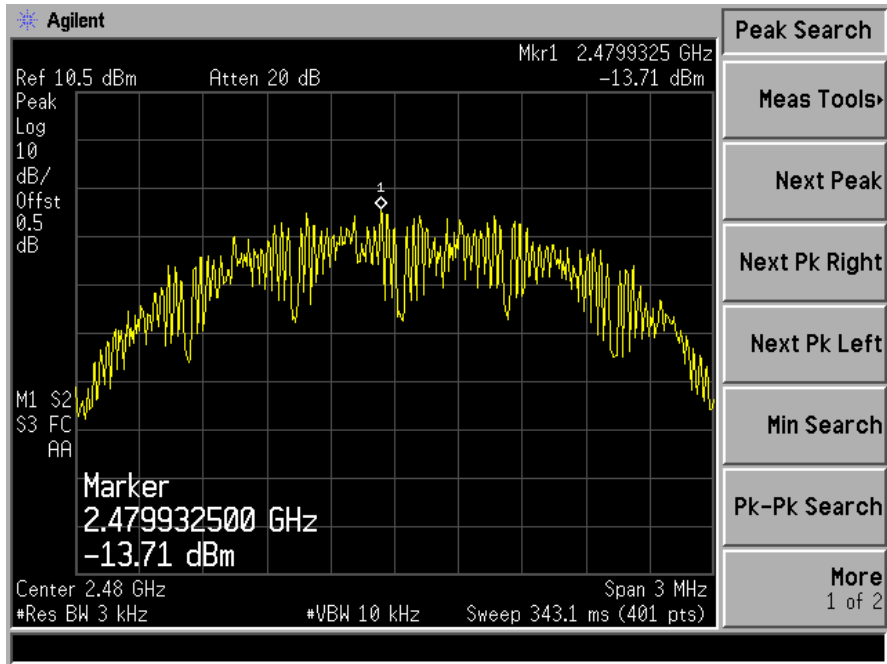
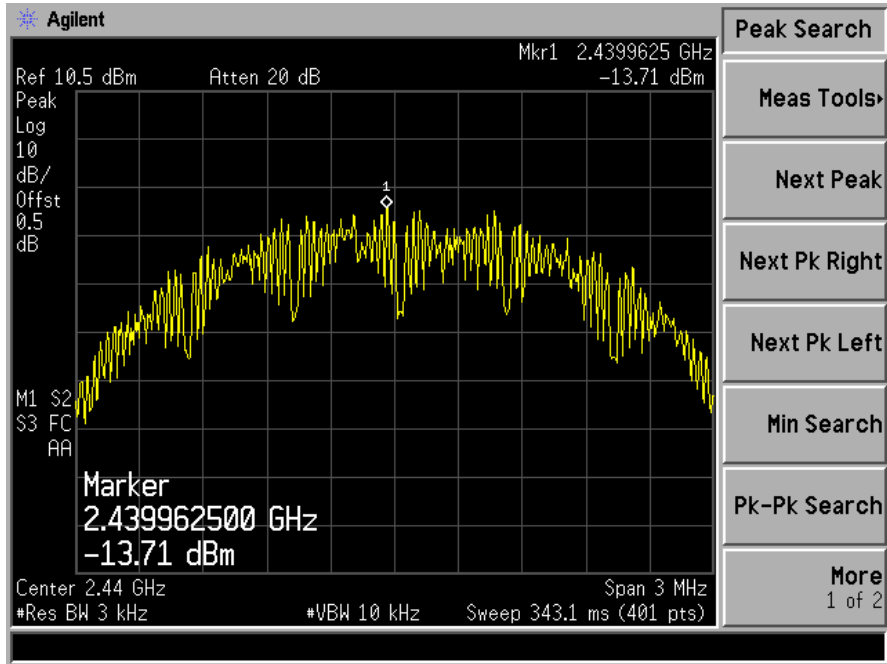
The transmitted power density averaged over any 1 second interval shall not be greater +8dBm in any 3 kHz bandwidth.

10.6 Test Result

Spectrum Detector: PK Test Date : December 29, 2014
 Test By: KINGKONG Temperature : 23°C
 Test Result: PASS Humidity : 50%
 Operation Mode: ZIGBEE

Channel	Measurement Level (dBm)	Required Limit (dBm)	Result
1	-12.29	<8dBm	PASS
8	-13.71	<8dBm	PASS
16	-13.71	<8dBm	PASS





11. Antenna Port Emission

11.1 Test Equipment

EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	Rohde & Schwarz	ESU	1302.6005.26	05/17/2014	05/16/2015

11.2 Measuring Instruments and Setting

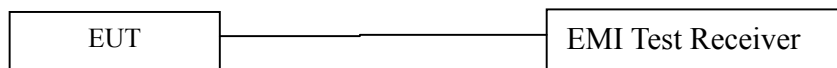
The following table is the setting of spectrum analyzer.

Spectrum analyzer	Setting
Attenuation	Auto
RB	100kHz for below 1GHz, 1MHz for Above 1GHz
VB	300kHz for below 1GHz, 3MHz for Above 1GHz
Detector	Peak
Trace	Max hold

11.3 Test Procedures

The conducted spurious emissions were measured conducted using a spectrum analyzer at low, Middle, and high channels, The limit was determined by attenuation 20dB of the RF peak power output.

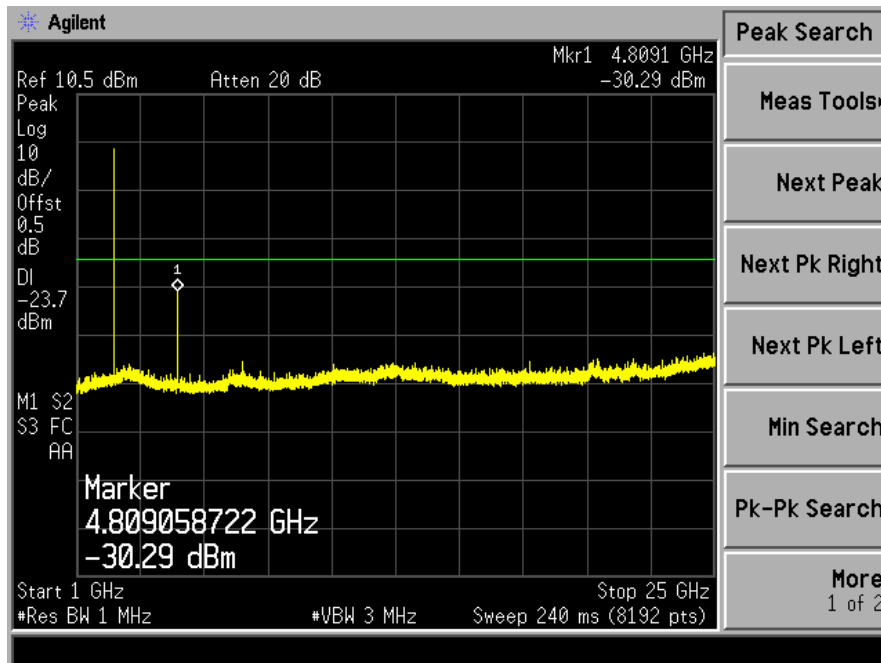
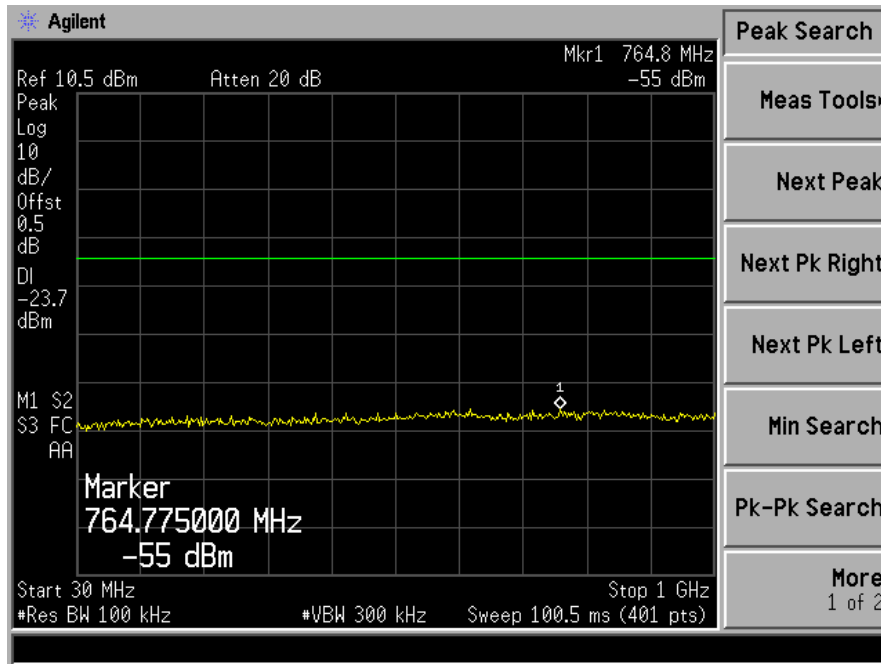
11.4 Block Diagram of Test setup



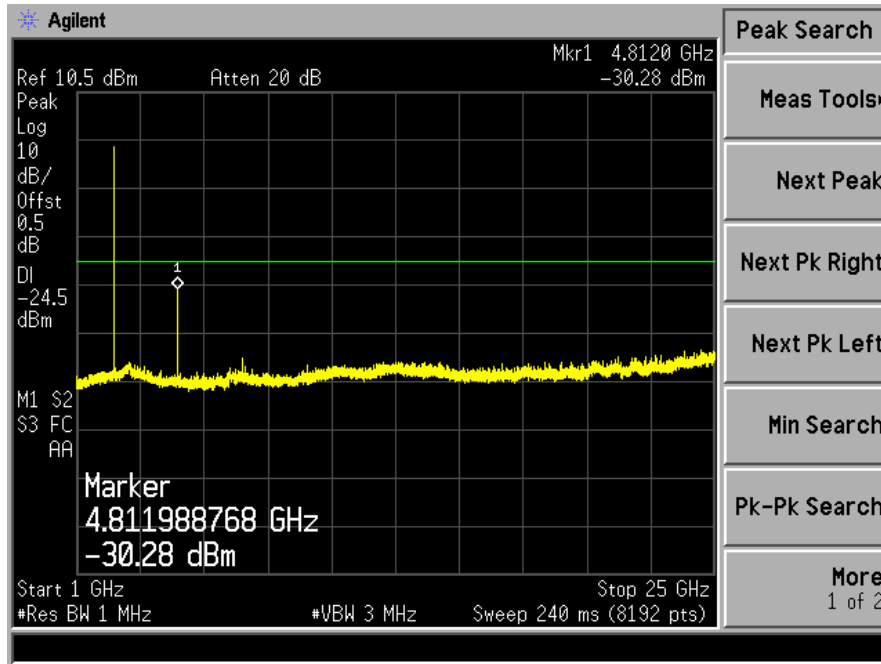
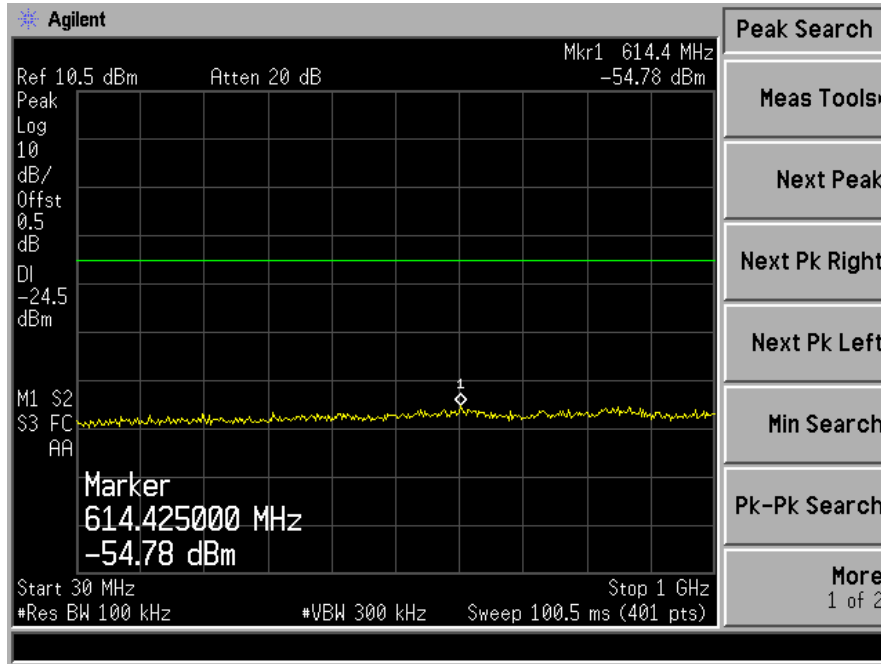
11.5 Test Result

PASS.

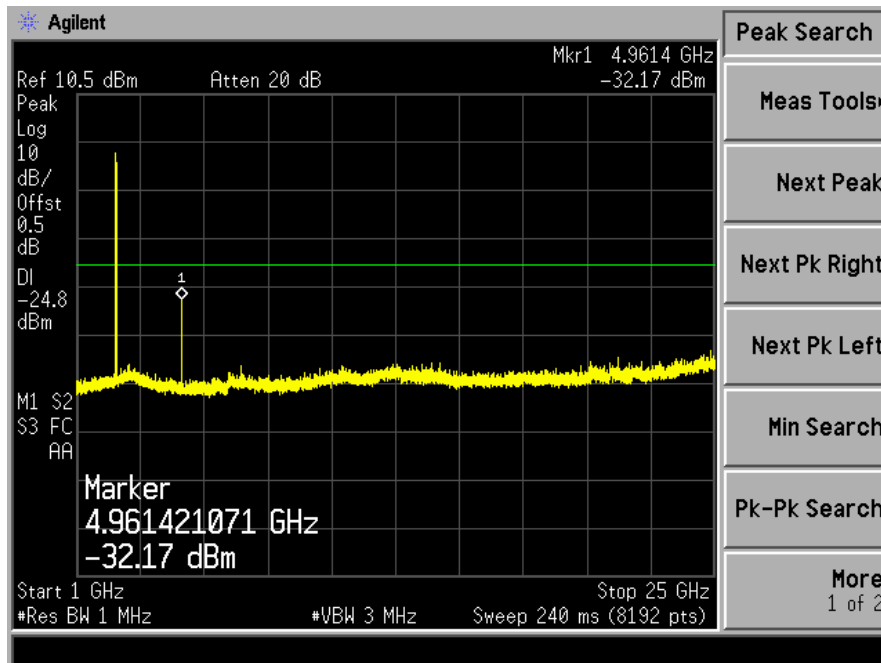
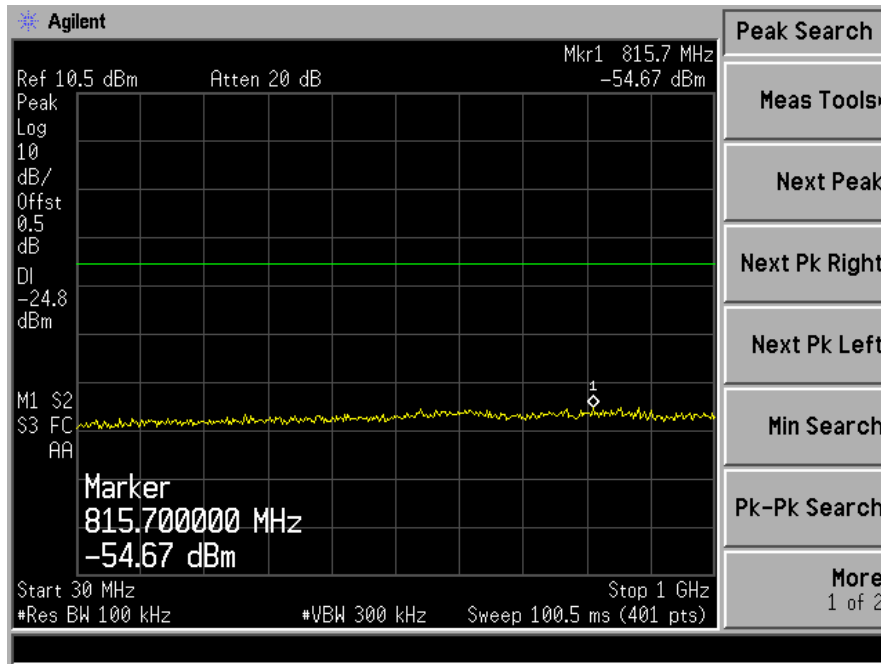
Low channel



Middle channel



High channel



12. Antenna Application

12.1 Antenna Requirement

Standard	Requirement
FCC CRF Part 15.203	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 shall be considered sufficient to comply with the provisions of this section. 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. This requirement does not apply to carrier current devices or to devices operated under the provisions of §15.211, §15.213, §15.217, §15.219, or §15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with §15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

For intentional device, according to FCC 47 CFR Section 15.203, 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. And according to FCC 47 CFR Section 15.247 (b), if transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6dBi.

12.2 Result

The EUT's antenna integrated on PCB, The antenna's gain is 2dBi and meets the requirement.

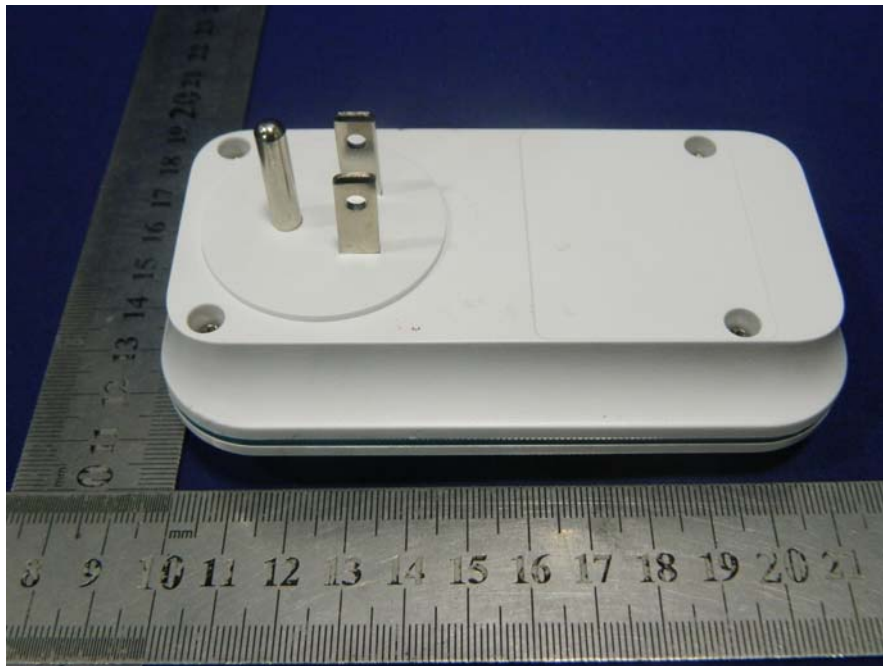
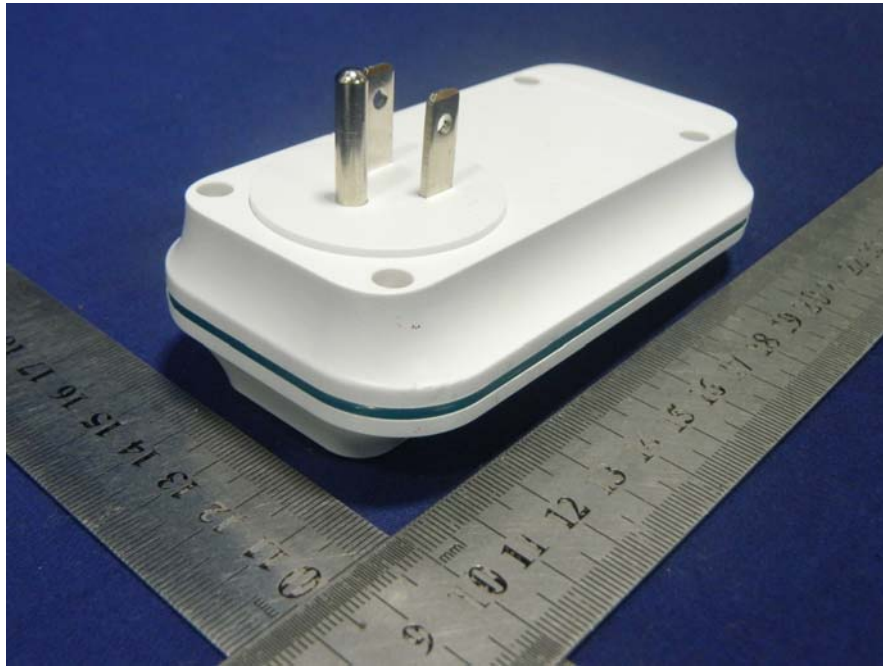
13. Uncertainty

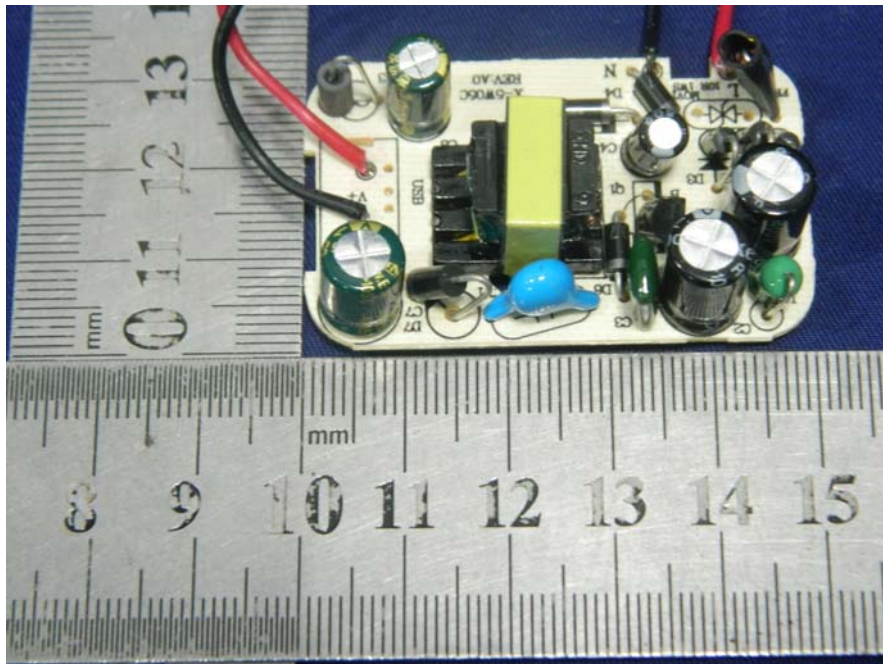
Measurement Uncertainty for a level of Confidence of 95%

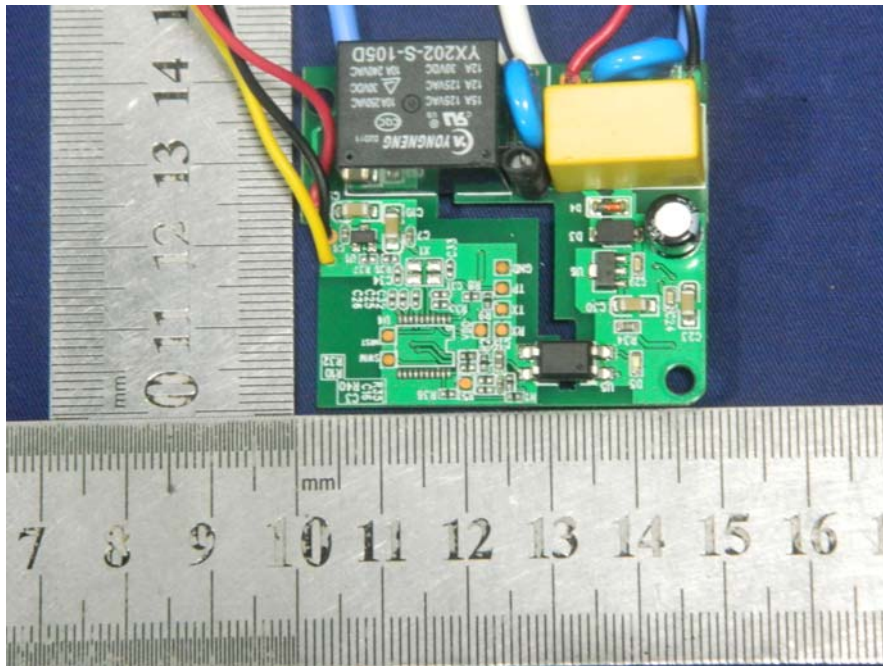
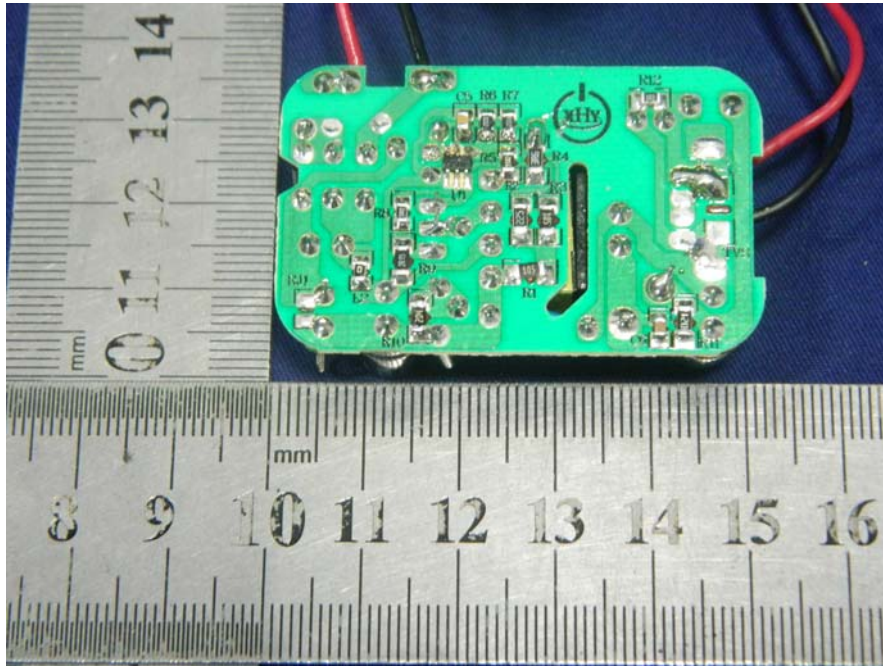
Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-5}$
Maximum Peak Output Power Test	$\pm 1.0\text{dB}$
Conducted Emissions Test	$\pm 2.0\text{dB}$
Radiated Emission Test	$\pm 2.0\text{dB}$
Power Density	$\pm 2.0\text{dB}$
Occupied Bandwidth Test	$\pm 1.0\text{dB}$
Band Edge Test	$\pm 3\text{dB}$
All emission, radiated	$\pm 3\text{dB}$
Antenna Port Emission	$\pm 3\text{dB}$
Temperature	$\pm 0.5^\circ\text{C}$
Humidity	$\pm 3\%$

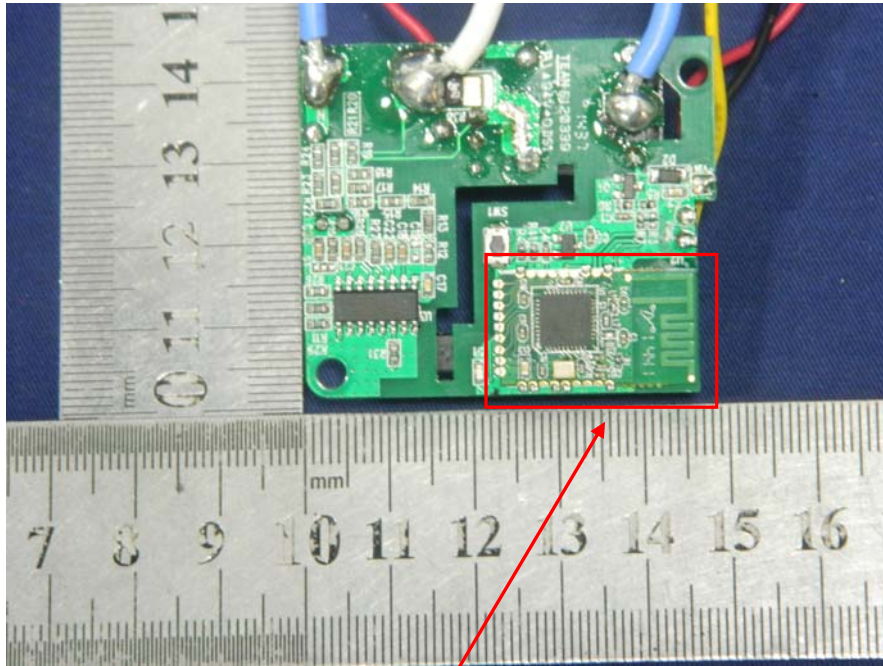
14. APPENDIX-Photos of EUT











Zigbee Module



Zigbee Module