FCC TEST REPORT

FCC ID : WLU-QC101100-1

Applicant : Living Independently Group, Inc.
Address of Applicant : 767 3th Avenue 14th floor New York, NY 10017,United States

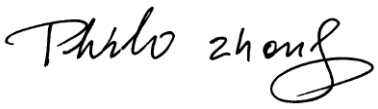
Equipment Under Test (EUT) :

Product description : QuietCarev3.0 ZigBee Mesh Router
Model No. : QC101100

Standards : FCC 15 Paragraph 15.247

Date of Test : May 28, 2011

Test Engineer : Olic huang/Engineer 

Reviewed By **:** Philo zhong/Manager 

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3 Test Summary

Test Items	Test Requirement	Test Method	Limit / Severity	Result
Maximum peak output power	FCC Part 15:2008	ANSI C63.4: 2003	20dBm	PASSED
Power Density	FCC Part 15:2008	ANSI C63.4: 2003	8dBm	PASSED
Restricted Band	FCC Part 15:2008	ANSI C63.4: 2003	Note	PASSED
Duty Cycle	FCC Part 15:2008	ANSI C63.4: 2003	Note	COMPLIED
6-dB BandWidth	FCC Part 15:2008	ANSI C63.4: 2003	Note	PASSED
RF Exposure Test	FCC Part 15:2008	ANSI C63.4: 2003	Note	PASSED
Mains Terminal Disturbance Voltage, 150kHz to 30MHz	FCC Part 15:2008	ANSI C63.4: 2003	Note	PASSED
Radiation Emission, 30MHz to 25GHz	FCC Part 15:2008	ANSI C63.4: 2003	N/A	PASSED

Note : denote that for more details of the EUT , please refer to the relating test items as below .

Remark : the methods of measurement in all the test items were according to the FCC Public Notice DA 00-705 .

4 General Information

4.1 Client Information

Applicant:	Living Independently Group, Inc.
Address of Applicant:	767 3th Avenue 14th floor New York, NY 10017,United States
Manufacturer:	RDI Technology (Shenzhen) Co., Ltd.
Address of Manufacturer:	Building C1 Xingtang Industrial Park,East Baishixia, Fuyong,Baoan, Shenzhen,PRC..

4.2 General Description of E.U.T.

Product description:	QuietCarev3.0 ZigBee Mesh Router
Model No.:	QC101100
Frequency Range:	2405MHz to 2480MHz
Channel Separation:	5MHz
Output Power:	0 dBm

4.3Details of E.U.T.

Power Supply:	AC 120.0V,60Hz

4.4Description of Support Units

The EUT has been tested as an independent unit.

4.5Standards Applicable for Testing

The customer requested FCC tests for a QuietCarev3.0 ZigBee Mesh Router. The standards used were FCC 15 Paragraph 15.247,Paragraph 15.205, Paragraph 15.207,Paragraph 15.209, Paragraph 15.31,Paragraph 15.33, Paragraph 15.35.

4.6 Test Facility

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

- **FCC – Registration No.: 880581**

  Waltek Services(Shenzhen) Co., Ltd. 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 our files. Registration 880581,May 26,2010.

- **IC – Registration No.: IC 7760A**

  Waltek Services(Shenzhen) Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the Industry Canada. The acceptance letter from the Industry Canada is maintained in our files. Registration IC7760A,Aug.03,2010.

4.7 Test Location

All Emissions testswere performed at:-
1/F, Fukangtai Building,West Baima Rd.,Songgang Street, Baoan District, Shenzhen 518105, Guangdong,China.

Remark : All the test results of the peripherals were conformed to the Fcc Verification requirements.

5 Equipment Used during Test

Equipment Name	Manufacturer Model	Equipment No	Internal No	Specification	Cal. Date	Due Date	Cert. No	Uncertainty
EMC Analyzer	Agilent/ E7405A	MY45114943	W2008001	9k-26.5GHz	Aug-03-10	Aug-02-11	Wws20081596	±1dB
Trilog Broadband Antenne	SCHWARZBECK MESS-ELEKTROM/ VULB9163	336	W2008002	30-3000 MHz	Aug-03-10	Aug-02-11		±1dB
Broad-band Horn Antenna	SCHWARZBECK MESS-ELEKTROM/ BBHA 9120D(1201)	667	W2008003	1-18GHz	Aug-03-10	Aug-02-11		f＜10 GHz：±1dB 10GHz＜f＜18 GHz：±1.5dB
Broadband Preamplifier	SCHWARZBECK MESS-ELEKTROM/ BBV 9718	9718-148	W2008004	0.5-18GHz	Aug-03-10	Aug-02-11		±1.2dB
10m Coaxial Cable with N-male Connectors	SCHWARZBECK MESS-ELEKTROM/ AK 9515 H	-	-	-	Aug-03-10	Aug-02-11		-
10m 50 Ohm Coaxial Cable with N-plug	SCHWARZBECK MESS-ELEKTROM/ AK 9513				Aug-03-10	Aug-02-11		
Positioning Controller	C&C LAB/ CC-C-IF				N/A	N/A		
Color Monitor	SUNSPO/ SP-14C				N/A	N/A		
Test Receiver	ROHDE&SCHWARZ/ ESPI	101155	W2005001	9k-3GHz	Aug-03-10	Aug-02-11	Wws20080942	±1dB
EMI Receiver	Beijingkehuan	KH3931		9k-1GHz	Aug-03-10	Aug-02-11		
Two-Line V-Network	ROHDE&SCHWARZ/ ENV216	100115	W2005002	50Ω/50μH	Aug-03-10	Aug-02-11	Wws20080941	±10%
Absorbing Clamp	ROHDE&SCHWARZ/ MDS-21	100205	W2005003	impandance50 Ω loss：17 dB	Aug-03-10	Aug-02-11	Wws20080943	±1dB
10m 50 Ohm Coaxial Cable with	SCHWARZBECK MESS-ELEKTROM/ AK 9514				Aug-03-10	Aug-02-11		

Equipment Name	Manufacturer Model	Equipment No	Internal No	Specification	Cal. Date	Due Date	Cert. No	Uncertainty
N-plug								
Digital Power Analyzer	Em Test AG/Switzerland/ DPA 500	V07451 03095	W2008012	Power：2000VA Vol-range：0-300V Freq_range：10-80Hz	Aug-03-10	Aug-02-11	Wwd200 81185	Voltage distinguish:0.025% Power_freq distinguish:0.02Hz
Power Source	Em Test AG/Switzerland/ ACS 500	V07451 03096	W2008013	Vol-range：0-300V Power_freq：10-80Hz				
RF Generator	TESEQ GmbH/ NSG4070	25781	W2008008	Fraq-range：9K-1GHz RF voltage：-60 dBm-+10dBm	Aug-03-10	Aug-02-11	Wws200 81890	Power_freq distinguish0.1Hz RFeletricity distinguish 0.1 B
CDN M-Type	TESEQ GmbH/ CDN M016	25112	W2008009	Voltage correct factor 9.5 dB	Aug-03-10	Aug-02-11	Wwc200 82396	150K-80MHz：±1dB 80-230MHz:-2-+3dB
EM-Clamp	TESEQ GmbH/ KEMZ 801	25453	W2008010	Freq_range：0.15-1000 MHz	Aug-03-10	Aug-02-11	Wwc200 82397	0.3-400 MHz：±4dB Other freq：±5dB
Attenuator 6dB	TESEQ GmbH/ ATN6050	25365			Aug-03-10	Aug-02-11	Wws200 81597	
All Modules Generator	SCHAFFNER /6150	34579	W2008006	voltage:200V-4.4KV Pulse current：100A-2.2KA	Aug-03-10	Aug-02-11	Wwc200 82401	voltage: ±10% Pulse current：±10%
Capacitive Coupling Clamp	SCHAFFNER / CDN 8014	25311			Aug-03-10	Aug-02-11	Wwc200 82398	-
Signal and Data Line Coupling Network	SCHAFFNER / CDN 117	25627	W2008011	1.2/50μS	Aug-03-10	Aug-02-11	Wwc200 82399	-
AC Power Supply	TONGYUN/ DTDGC-4				Aug-03-10	Aug-02-11	Wws200 80944	-
Active Loop Antenna 10kHz-30MHz	Beijing Dazhi / ZN30900A	-	-	10kHz-30MHz	Aug-03-10	Aug-02-11		±1dB

6 Conducted Emission Test

Test Requirement:	FCC Part15 Paragraph 15.207
Test Method:	Based on FCC Part15 Paragraph 15.207
Test Date:	May 28,2011
Frequency Range:	150kHz to 30MHz
Class:	Class B
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth) Quasi-Peak & Average if maximised peak within 6dB of Average Limit

6.1Test Equipment

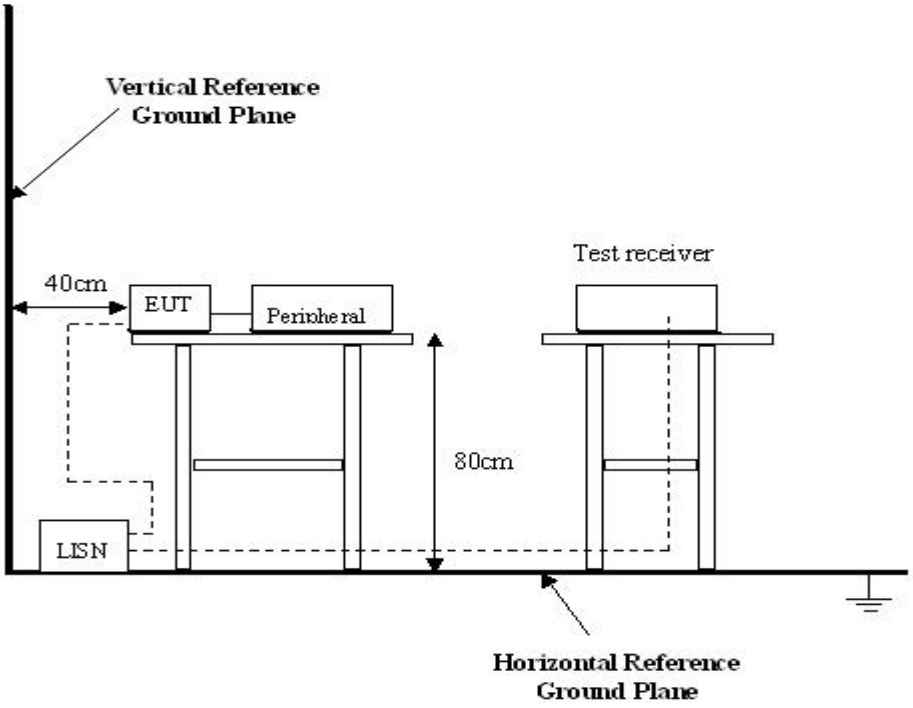
Please refer to Section 5 this report.

6.2Test Procedure

1. The EUT was connected to LISN and placed on a table. And the EUT was working in normal operatin mode.
2. The EUT was tested according to ANSI C63.4:2003. The frequency spectrum from 150kHz to 30MHz was investigated.
3. The maximised peak emissions from the EUT was scanned and measured for both the Live and Neutral Lines. Quasi-peak & average measurements were performed if peak emissions were within 6dB of the average limit line.

6.3 Conducted Test Setup

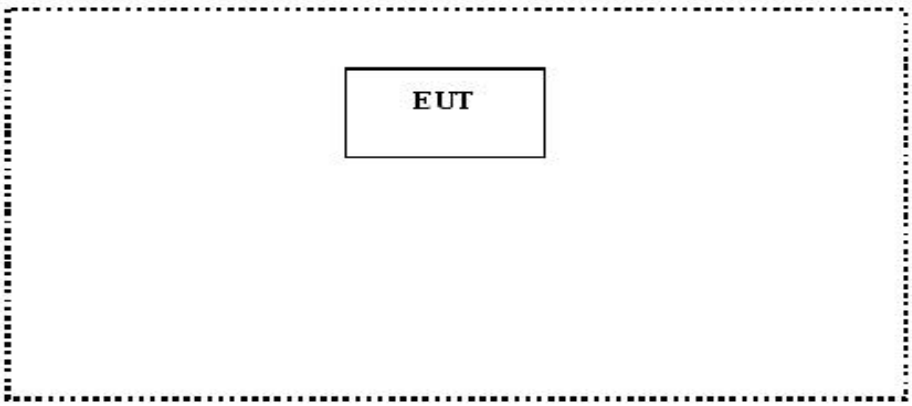
The conducted emission tests were performed using the setup accordance with the ANSI C63.4:2003, The specification used in this report was the FCC Part15 Paragraph 15.207 limits.



6.4EUT Operating Condition

Operating condition is according to ANSI C63.4:2003.

A. Setup the EUT and simulators as shown on follow.
B. Enable RF signal and confirm EUT active.
C. Modulate output capacity of EUT up to specification.



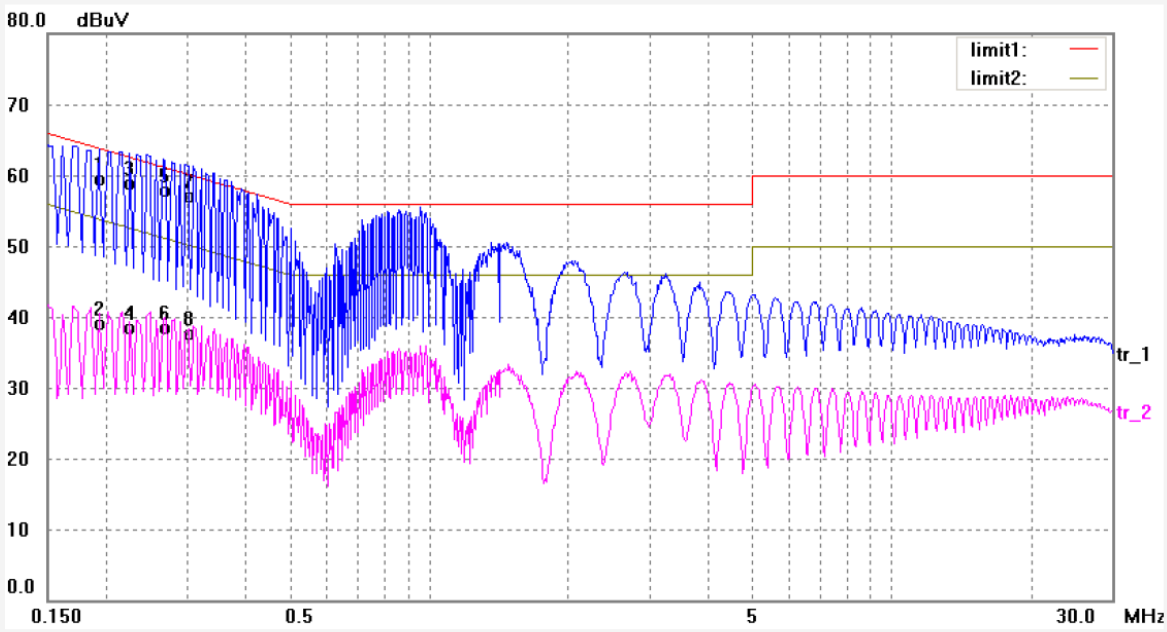
6.5Conducted Emission Limits

66-56 dBμV between 0.15MHz & 0.5MHz
56 dBμV between 0.5MHz & 5MHz
60 dBμV between 5MHz & 30MHz

Note: In the above limits, the tighter limit applies at the band edges.

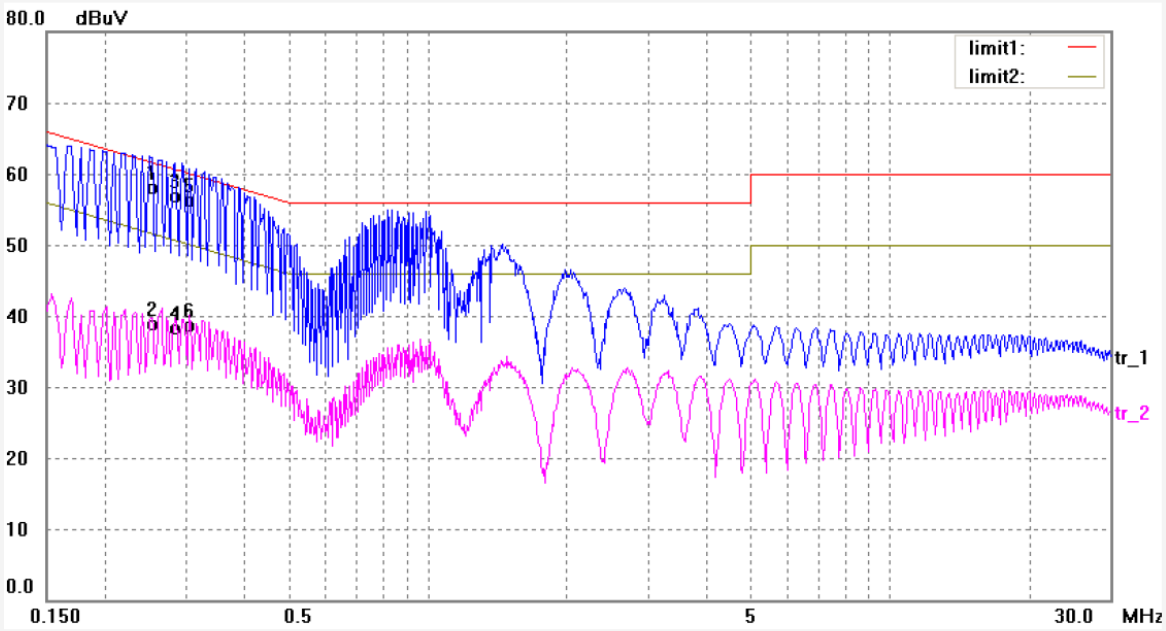
6.6 Conducted Emission Test Data

Live Line



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.1940	48.42	10.35	58.77	63.86	-5.09	QP	
2	0.1940	27.97	10.35	38.32	53.86	-15.54	AVG	
3	0.2260	47.74	10.35	58.09	62.59	-4.50	QP	
4	0.2260	27.44	10.35	37.79	52.59	-14.80	AVG	
5	0.2660	46.84	10.35	57.19	61.24	-4.05	QP	
6	0.2660	27.34	10.35	37.69	51.24	-13.55	AVG	
7	0.2987	45.94	10.35	56.29	60.28	-3.99	QP	
8	0.2987	26.55	10.35	36.90	50.28	-13.38	AVG	

Nenutral Line



No.	Freq. (MHz)	Reading (dBuV)	Factor (dB)	Result (dBuV)	Limit dBuV	Margin (dB)	Detector	Remark
1	0.2500	46.93	10.35	57.28	61.75	-4.47	QP	
2	0.2500	27.70	10.35	38.05	51.75	-13.70	AVG	
3	0.2860	45.77	10.35	56.12	60.64	-4.52	QP	
4	0.2860	27.17	10.35	37.52	50.64	-13.12	AVG	
5	0.3060	45.24	10.35	55.59	60.08	-4.49	QP	
6	0.3060	27.65	10.35	38.00	50.08	-12.08	AVG	

6.7 Conducted Emission Test Setup View

7 Radiation Emission Test

Test Requirement:	FCC Part15 Paragraph 15.247
Test Method:	Based on ANSI 63.4:2003
Test Date:	May 28,2011
Frequency Range:	30MHz to 25GHz
Measurement Distance:	3m
Detector:	Peak for pre-scan (120kHz resolution bandwidth)
	Quasi-Peak if maximised peak within 6dB of limit

7.1Test Equipment

Please refer to Section 5 this report.

7.2Measurement Uncertainty

All measurements involve certain levels of uncertainties, especially in the field of EMC. The factors contributing to uncertainties are spectrum analyzer, cable loss, antenna factor calibration, antenna directivity, antenna factor variation with height, antenna phase center variation, antenna factor frequency interpolation, measurement distance variation, site imperfections, mismatch (average), and system repeatability.

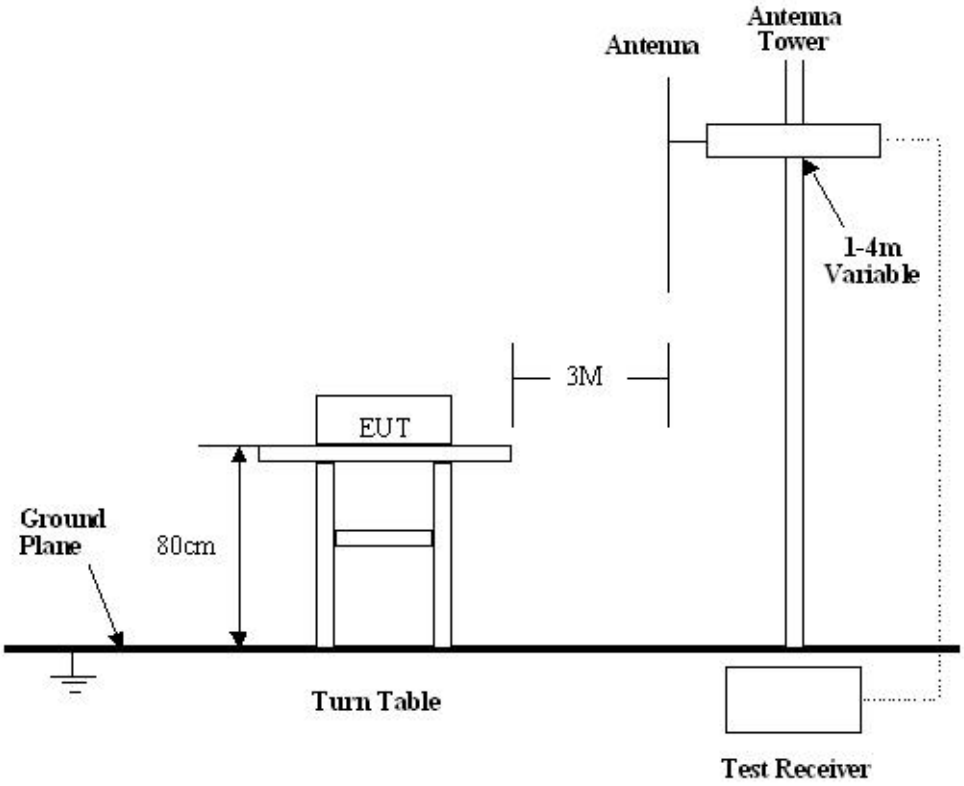
Based on ANSI C63.4:2003, The Treatment of Uncertainty in EMC Measurements, the best estimate of the uncertainty of a radiation emissions measurement at WALTEK SERVICES EMC Lab is +/-5.03 dB.

7.3Test Procedure

1. The AC 120V power was used in the equipment under test for radiated emissions test.
2. The radiation emission was test in normal working postion,which should be tested under X axises as the test setup view in the report.
3. Maximizing procedure was performed on the six (6) highest emissions to ensure EUT is compliant with all installation combinations.
4. All data was recorded in the peak and average detection mode.
5. The EUT was under working mode during the final qualification test and the configuration was used to represent the worst case results.

7.4Radiated Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4:2003, The specification used in this report was the FCC Part15 Paragraph 15.209 limits and Paragraph 15.247 limits.



7.5 Spectrum Analyzer Setup

According to FCC Part15 Paragraph 15.247 Rules, the system was tested to 25000 MHz.
Below 1GHz

Start Frequency.....30 MHz
Stop Frequency .....1000 MHz
Sweep Speed Auto
IF Bandwidth.....120 kHz
Video Bandwidth 100KHz
Quasi-Peak Adapter Bandwidth .....120 kHz
Quasi-Peak Adapter Mode.....Normal
Resolution Bandwidth 100KHz

Above 1GHz

Start Frequency.....1000 MHz
Stop Frequency 25000MHz
Sweep Speed Auto
IF Bandwidth.....120 kHz
Video Bandwidth.....1MHz
Quasi-Peak Adapter Bandwidth .....120 kHz
Quasi-Peak Adapter Mode.....Normal
Resolution Bandwidth 1MHz

7.6Corrected Amplitude & Margin Calculation

The Corrected Amplitude is calculated by adding the Antenna Factor and Cable Factor, and subtracting the Amplifier Gain from the Amplitude reading. The basic equation is as follows:

Corr. Ampl. = Indicated Reading + Antenna Factor + Cable Factor – Amplifier Gain

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

Margin = Corr. Ampl. – Class B Limit

7.7 Summary of Test Results

According to the data in section 7.11, the EUT complied with the FCC Part15 Paragraph 15.247 standards.

7.8 EUT Operating Condition

The same as section 6.4 of this report.

Let the EUT work in test mode and test it.

7.9 Radiated Emissions Limit on Paragraph 15.209

Frequency(MHZ)	Distance(m)	Field strength(dBuV/m)
30-88	3	40.0
88-216	3	43.5
216-960	3	46.0
Above 960	3	54.0

Note: (1) RF Voltage(dBuV)=20 log RF Voltage(uV)

(2) In the Above Table,the tighter limit applies at the band edges.

(3) Distance refers to the distance in meters between the measuring instrument antenna.

(4)The emission limit in this paragraph is based on measurement instrumentaion employing an average detector.Measurement using instrumentation with a peak detector function,corresponding to 20dB above the maximum permitted average limit.

(5)Above 1GHz, mark a Peak and average measurements for all emissions,Limit for peak is 74dBuV/m,According to Part15.35(b) and average is 54BuV/m.

7.10 Radiated Emissions Test Result

Formula of conversion factors:the field strength at 3m was egtablished by adding
The meter reading of the spectrum analyzer (which is set to read in units of dBuV/m)
To the antenna correction factor supplied by the antenna manufacturer. The antenna
Correction factors are stared in terms of dB.The gain of the pressletor was accounted
For in the spectrum analyser meter reading.

Example:

Freq(MHz)	Meter Reading +ACF=FS
33	20dBuV+10.36dB=30.36dBuV/m @3m

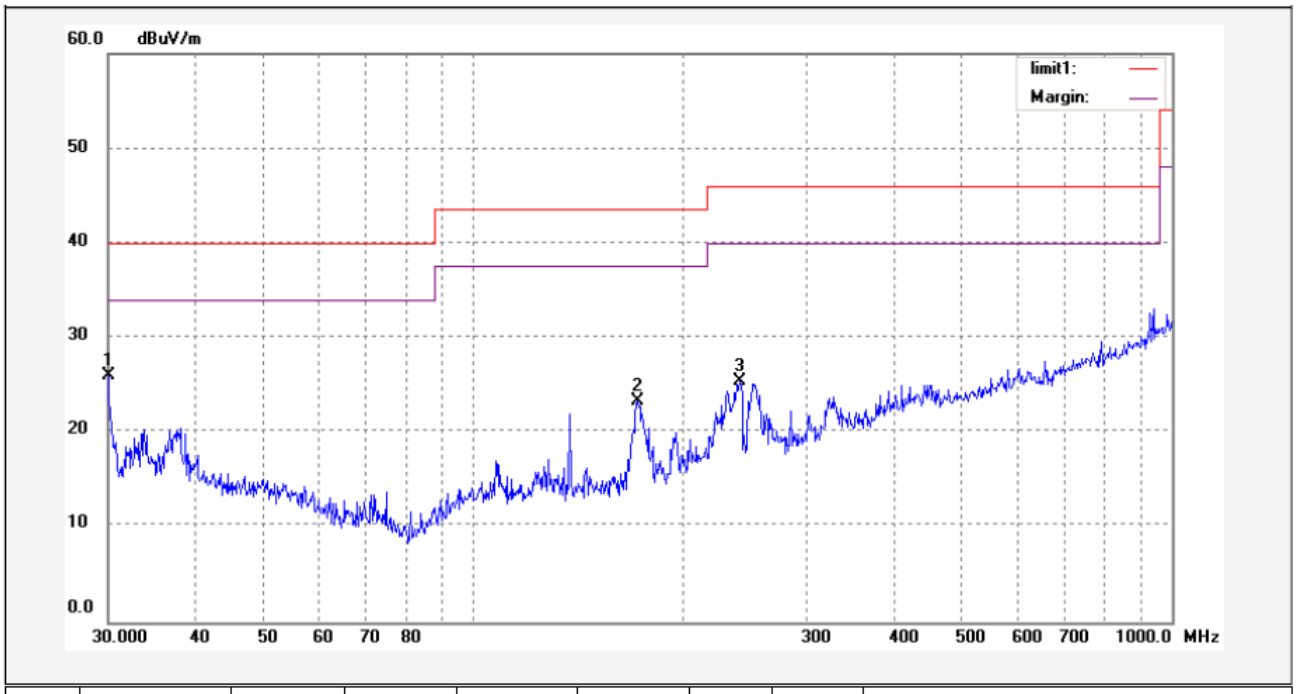
7.11 Radiated Emission Data

A. Test Item:	Radiated Emission Data
Test Voltage:	AC 120V
Test Mode:	CTX On
Temperature:	25.5 °C
Humidity:	51%RH
Test Result:	PASS

7.11.1 Test Frequency: Below 1GHz

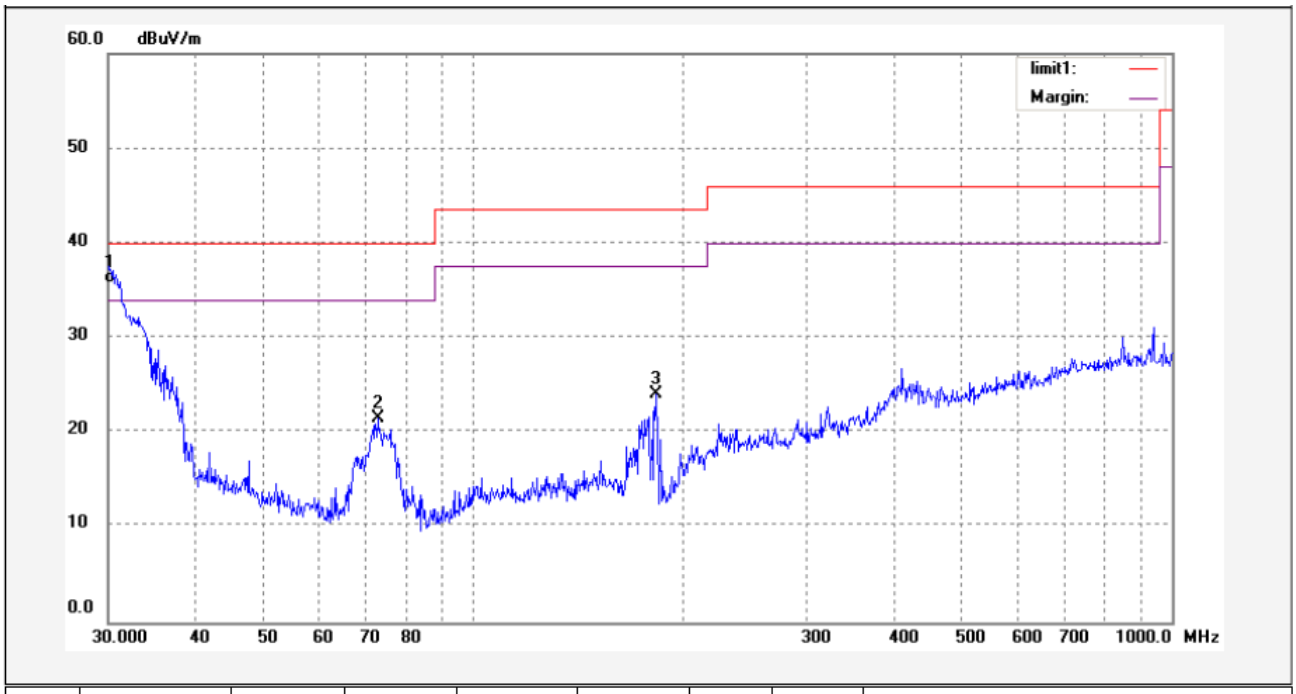
Remark: the EUT was tested in the continuously transmit and normal work mode.and the worse case was the continuously transmit mode, so the data show was the continuously transmit mode only.

Test frequency : 30-1000MHz radiation test data:
Vertical



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	30.0000	9.58	16.50	26.08	40.00	-13.92	peak	
2	171.9922	11.15	12.11	23.26	43.50	-20.24	peak	
3	240.9895	8.53	16.86	25.39	46.00	-20.61	peak	

Horizontal



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	30.1056	19.21	16.49	35.70	40.00	-4.30	QP	
2	72.9763	11.72	9.82	21.54	40.00	-18.46	peak	
3	182.5785	11.87	12.16	24.03	43.50	-19.47	peak	

7.11.2 Test Frequency: Above 1000MHz radiation Fundamental and Harmonic test data:

Frequency (MHz)	Detector	Antenna Polarization	Emission Level (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Antenna Height (m)	Turntable Angle (°)
Low frequency							
2405	AV	Vertical	86.51		(Fund.)	1.0	10
4810	AV	Vertical	44.82	54.00	9.18	1.1	50
7215	AV	Vertical	43.66	54.00	10.34	1.0	60
9620	AV	Vertical	42.65	54.00	11.35	1.1	60
12025	AV	Vertical	40.95	54.00	13.05	1.1	90
14430	AV	Vertical	40.69	54.00	13.31	1.0	120
16835	AV	Vertical	40.74	54.00	13.26	1.0	20
19240	AV	Vertical	39.44	54.00	14.56	1.1	10
21645	AV	Vertical	39.23	54.00	14.77	1.0	120
24050	AV	Vertical	38.89	54.00	15.11	1.0	15
2405	AV	Horizontal	83.65		(Fund.)	1.1	50
4810	AV	Horizontal	47.44	54.00	6.56	1.0	40
7215	AV	Horizontal	41.22	54.00	12.78	1.0	20
9620	AV	Horizontal	39.88	54.00	14.12	1.1	110
12025	AV	Horizontal	39.65	54.00	14.35	1.1	40
14430	AV	Horizonta	38.47	54.00	15.53	1.0	20
16835	AV	Horizontal	36.71	54.00	17.29	1.2	210
19240	AV	Horizontal	34.75	54.00	19.25	1.1	15
21645	AV	Horizontal	34.58	54.00	19.42	1.1	10
24050	AV	Horizontal	33.63	54.00	20.37	1.0	10
2405	PK	Vertical	96.75		(Fund.)	1.0	10
4810	PK	Vertical	54.43	74.00	19.57	1.0	230
7215	PK	Vertical	52.12	74.00	21.88	1.0	110
9620	PK	Vertical	49.25	74.00	24.75	1.1	100
12025	PK	Vertical	48.23	74.00	25.77	1.1	80
14430	PK	Vertical	47.78	74.00	26.22	1.1	60
16835	PK	Vertical	46.33	74.00	27.67	1.1	80
19240	PK	Vertical	46.30	74.00	27.70	1.1	70

21645	PK	Vertical	45.63	74.00	28.37	1.0	90
24050	PK	Vertical	42.12	74.00	31.88	1.1	135
2405	PK	Horizontal	98.54		(Fund.)	1.1	10
4810	PK	Horizontal	62.96	74.00	11.04	1.1	60
7215	PK	Horizontal	53.63	74.00	20.37	1.1	10
9620	PK	Horizontal	45.64	74.00	28.36	1.0	10
12025	PK	Horizontal	44.84	74.00	29.16	1.2	10
14430	PK	Horizontal	44.76	74.00	29.24	1.1	90
16835	PK	Horizontal	44.69	74.00	29.31	1.1	120
19240	PK	Horizontal	44.26	74.00	29.74	1.1	110
21645	PK	Horizontal	42.37	74.00	31.63	1.2	150
24050	PK	Horizontal	40.15	74.00	33.85	1.1	120
Middle frequency							
2440	AV	Vertical	86.85		(Fund.)	1.1	25
4880	AV	Vertical	46.99	54.00	7.01	1.1	10
7320	AV	Vertical	42.33	54.00	11.67	1.0	60
9760	AV	Vertical	39.66	54.00	14.34	1.1	10
12200	AV	Vertical	37.85	54.00	16.15	1.2	20
14640	AV	Vertical	36.66	54.00	17.34	1.1	100
17080	AV	Vertical	35.98	54.00	18.02	1.1	80
19520	AV	Vertical	35.32	54.00	18.68	1.1	10
21960	AV	Vertical	33.43	54.00	20.57	1.1	10
24400	AV	Vertical	31.66	54.00	22.34	1.2	90
2440	AV	Horizontal	84.26		(Fund.)	1.1	20
4880	AV	Horizontal	47.21	54.00	6.79	1.0	90
7320	AV	Horizontal	41.21	54.00	12.79	1.1	120
9760	AV	Horizontal	38.99	54.00	15.01	1.1	110
12200	AV	Horizontal	35.36	54.00	18.64	1.1	50
14640	AV	Horizontal	30.25	54.00	23.75	1.1	10
17080	AV	Horizontal	29.25	54.00	24.75	1.1	120
19520	AV	Horizontal	29.23	54.00	24.77	1.1	90
21960	AV	Horizontal	29.21	54.00	24.79	1.2	10
24400	AV	Horizontal	28.95	54.00	25.05	1.1	120
2440	PK	Vertical	97.85		(Fund.)	1.1	110

4880	PK	Vertical	55.36	74.00	18.64	1.1	80
7320	PK	Vertical	43.69	74.00	30.31	1.0	100
9760	PK	Vertical	40.35	74.00	33.65	1.1	120
12200	PK	Vertical	37.87	74.00	36.13	1.1	180
14640	PK	Vertical	36.10	74.00	38.90	1.0	110
17080	PK	Vertical	32.03	74.00	41.97	1.1	100
19520	PK	Vertical	30.21	74.00	43.79	1.0	120
21960	PK	Vertical	29.65	74.00	44.35	1.1	100
24400	PK	Vertical	28.25	74.00	45.75	1.1	120
2440	PK	Horizontal	94.25		(Fund.)	1.0	110
4880	PK	Horizontal	52.36	74.00	21.64	1.0	135
7320	PK	Horizontal	45.63	74.00	28.37	1.1	90
9760	PK	Horizontal	40.14	74.00	33.86	1.1	60
12200	PK	Horizontal	39.36	74.00	34.64	1.0	10
14640	PK	Horizontal	37.44	74.00	36.56	1.2	150
17080	PK	Horizontal	34.21	74.00	39.79	1.1	10
19520	PK	Horizontal	38.86	74.00	35.14	1.0	50
21960	PK	Horizontal	35.96	74.00	38.04	1.1	60
24400	PK	Horizontal	34.16	74.00	49.84	1.0	60
High frequency							
2480	AV	Vertical	85.62		(Fund.)	1.1	90
4960	AV	Vertical	43.34	54.00	10.66	1.1	40
7440	AV	Vertical	43.02	54.00	10.98	1.1	50
9920	AV	Vertical	38.69	54.00	15.31	1.0	40
12400	AV	Vertical	33.65	54.00	20.35	1.1	50
14880	AV	Vertical	32.26	54.00	21.74	1.0	60
17360	AV	Vertical	30.62	54.00	23.38	1.1	70
19840	AV	Vertical	30.13	54.00	23.87	1.1	80
22320	AV	Vertical	30.02	54.00	23.98	1.0	50
24800	AV	Vertical	29.25	54.00	24.75	1.1	120
2480	AV	Horizontal	83.64		(Fund.)	1.0	10
4960	AV	Horizontal	43.69	54.00	10.31	1.1	20
7440	AV	Horizontal	41.58	54.00	12.42	1.0	50
9920	AV	Horizontal	39.65	54.00	14.35	1.1	20

12400	AV	Horizontal	37.85	54.00	16.15	1.1	80
14880	AV	Horizontal	35.69	54.00	18.31	1.2	120
17360	AV	Horizontal	32.87	54.00	21.13	1.1	20
19840	AV	Horizontal	32.55	54.00	21.45	1.2	10
22320	AV	Horizontal	32.25	54.00	21.75	1.1	50
24800	AV	Horizontal	30.25	54.00	23.75	1.0	90
2480	PK	Vertical	96.77		(Fund.)	1.0	60
4960	PK	Vertical	54.79	74.00	19.21	1.1	40
7440	PK	Vertical	45.66	74.00	28.34	1.1	120
9920	PK	Vertical	43.21	74.00	31.79	1.1	60
12400	PK	Vertical	38.65	74.00	35.35	1.1	45
14880	PK	Vertical	36.87	74.00	37.13	1.1	90
17360	PK	Vertical	35.26	74.00	38.74	1.0	50
19840	PK	Vertical	34.98	74.00	39.02	1.1	80
22320	PK	Vertical	34.73	74.00	39.27	1.0	90
24800	PK	Vertical	32.36	74.00	41.64	1.1	90
2480	PK	Horizontal	94.21		(Fund.)	1.0	150
4960	PK	Horizontal	51.36	74.00	22.64	1.0	50
7440	PK	Horizontal	45.36	74.00	28.64	1.0	60
9920	PK	Horizontal	43.52	74.00	30.48	1.1	50
12400	PK	Horizontal	38.69	74.00	35.31	1.1	10
14880	PK	Horizontal	37.26	74.00	36.74	1.0	50
17360	PK	Horizontal	36.41	74.00	37.59	1.1	50
19840	PK	Horizontal	34.65	74.00	39.35	1.0	50
22320	PK	Horizontal	32.58	74.00	41.42	1.1	15
24800	PK	Horizontal	31.65	74.00	42.35	1.0	50

8 Antenna Requirement

According to the FCC Part 15 Paragraph 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 to the intentional radiator shall be considered sufficient to comply with the provisions of this section. This product has a permanent antenna, fulfill the requirement of this section.

9 Maximum Peak Output Power

Test Requirement:	FCC Part15 Paragraph 15.247
Test Method:	Based on ANSI 63.4:2003
Test Date:	May 28,2011
Test mode:	Compliance test in the worse case: Tx Lower/Tx Middle/Tx Upper
Requirements:	Regulation 15.247(b) The limit of Maximum Peak Output Power Measurement is 0.125W

Test procedure:

The following test procedure as below:

The transmitter output (antenna port) was connected to the spectrum analyzer.EUT and its simulators are placed on a table, let EUT working in test mode,then test it.

The bandwidth of the fundamental frequency was measured with the spectrum analyser using 1MRBW and 1MHz VBW.

Test Result: The unit does meet the FCC requirements.

Test Channel	Fundamental Frequency(MHz)	Output Power (mW)	Limit (W)	Power output level
Lower	2405	1.32	0.125	conducted
Middle	2440	1.32	0.125	conducted
Upper	2480	1.25	0.125	conducted

Note: The EUT was tested according to 47 CFR Part 15 Subpart C Section 15.247 (b),the the maximum allowable power for this device is 0.125W.

10 6-dB BandWidth

10.1Limit:

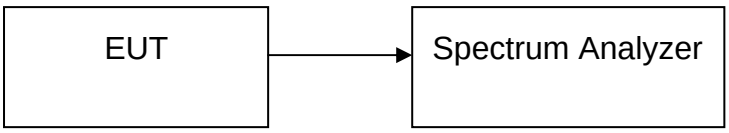
According to §15.247(a)(2), systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

The requirements in this clause are only applicable to equipment using frequency hopping spread spectrum (FHSS) modulation.

10.2Test Procedure:

1. Place the EUT on the table and set it in the transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as RBW = 100kHz, VBW = 300kHz,Sweep = auto.
4. Mark the peak frequency and –6dB (upper and lower) frequency.
5. Repeat until all the rest channels are investigated.

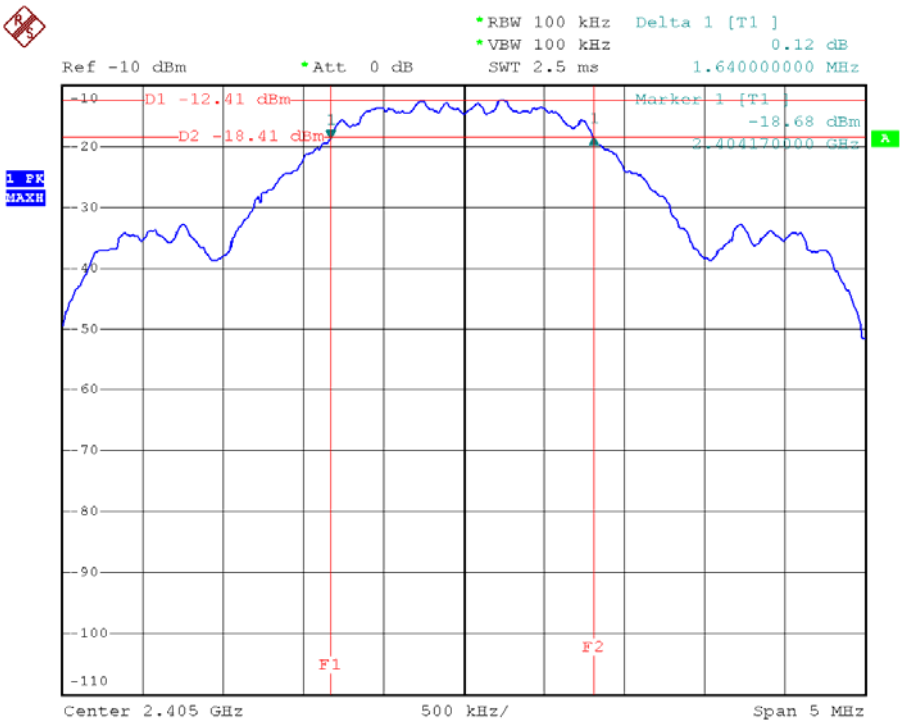
10.3Test Setup:



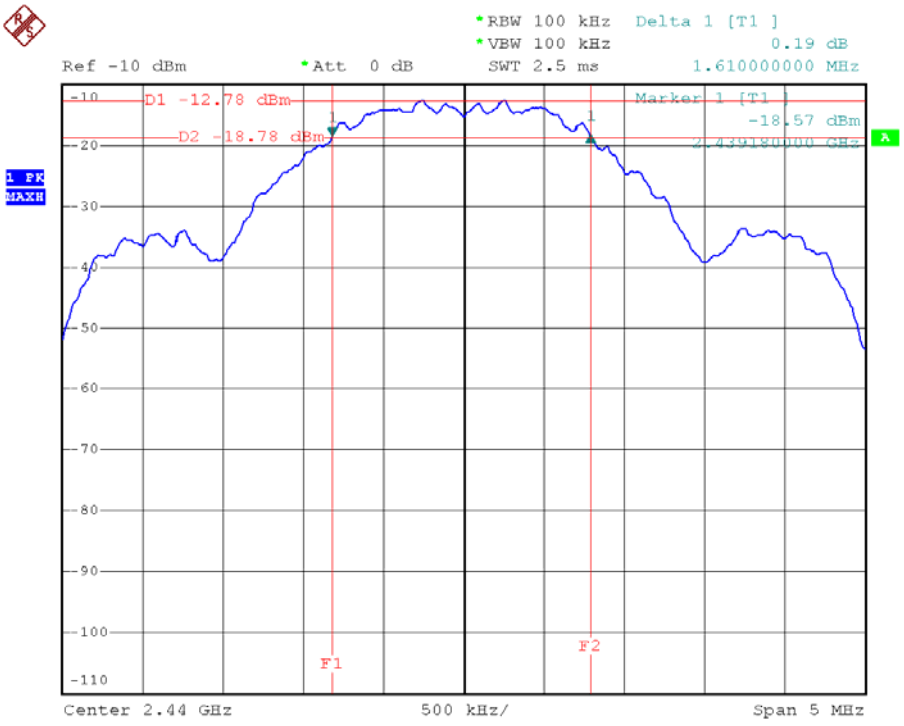
10.4Operating Environment:

Temperature:	25.50 °C
Humidity:	51 % RH
Barometric Pressure:	1012 mbar

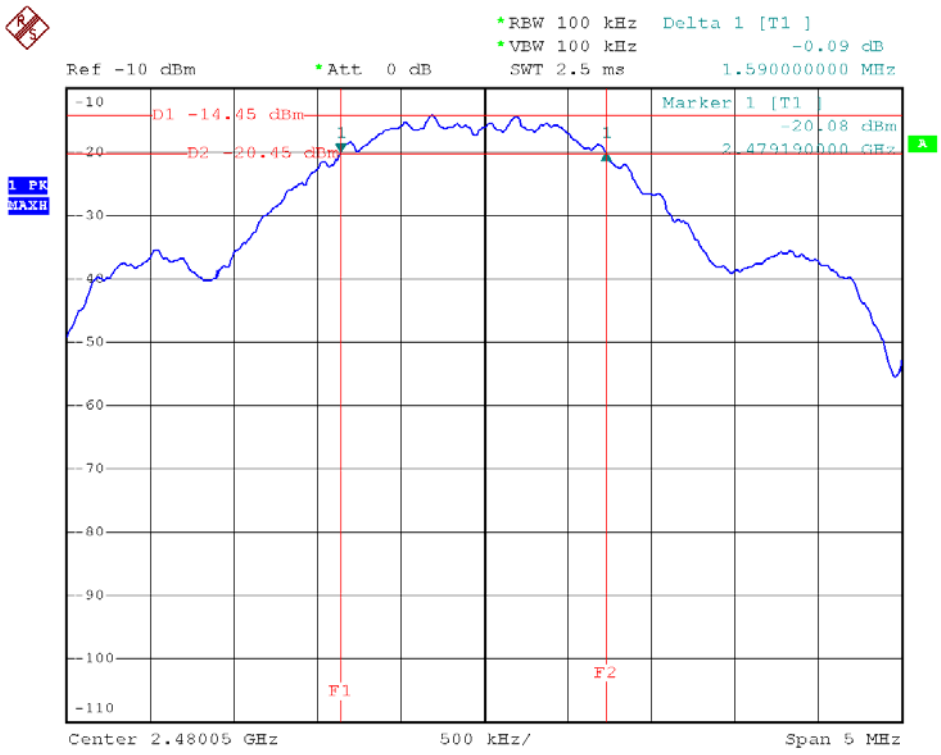
Lower Channel 2405MHz



Middle Channel 2440MHz



Upper Channel 2480MHz



11 Peak Power Spectral Density Measurement

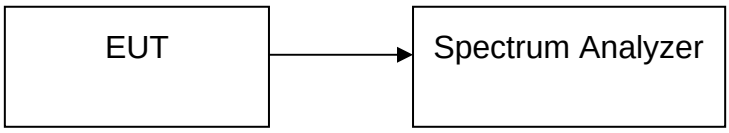
11.1 Limit:

According to §15.247(e), for digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission.
According to §15.247(f), the digital modulation operation of the hybrid system, with the frequency hopping turned off, shall comply with the power density requirements of paragraph (d) of this section.

11.2 Test Procedure:

1. Place the EUT on the table and set it in transmitting mode.
   Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set the spectrum analyzer as RBW = 30Hz, VBW = 100Hz, Span = 500kHz, Sweep=100s
3. Record the max. reading.
4. Repeat the above procedure until the measurements for all frequencies are completed.

11.3 Test Setup:



11.4 Operating Environment:

Temperature: 25.5 °C
Humidity: 51 % RH
Barometric Pressure: 1012 mbar

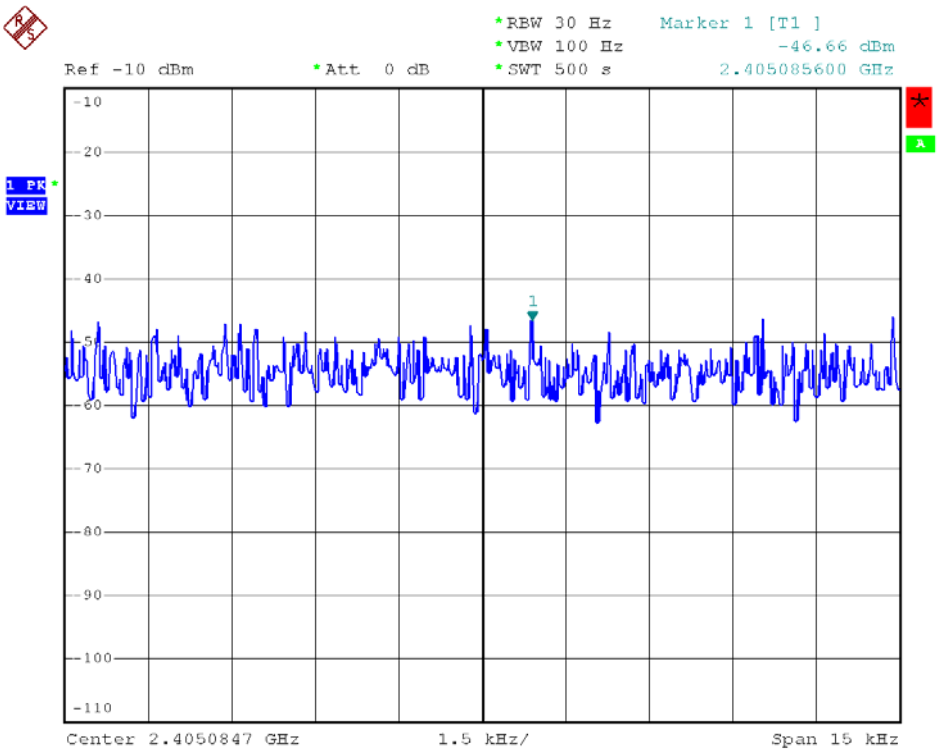
EUT Operation Condition:
The EUT was programmed to be in continuously transmitting mode.

11.5 Test Result:

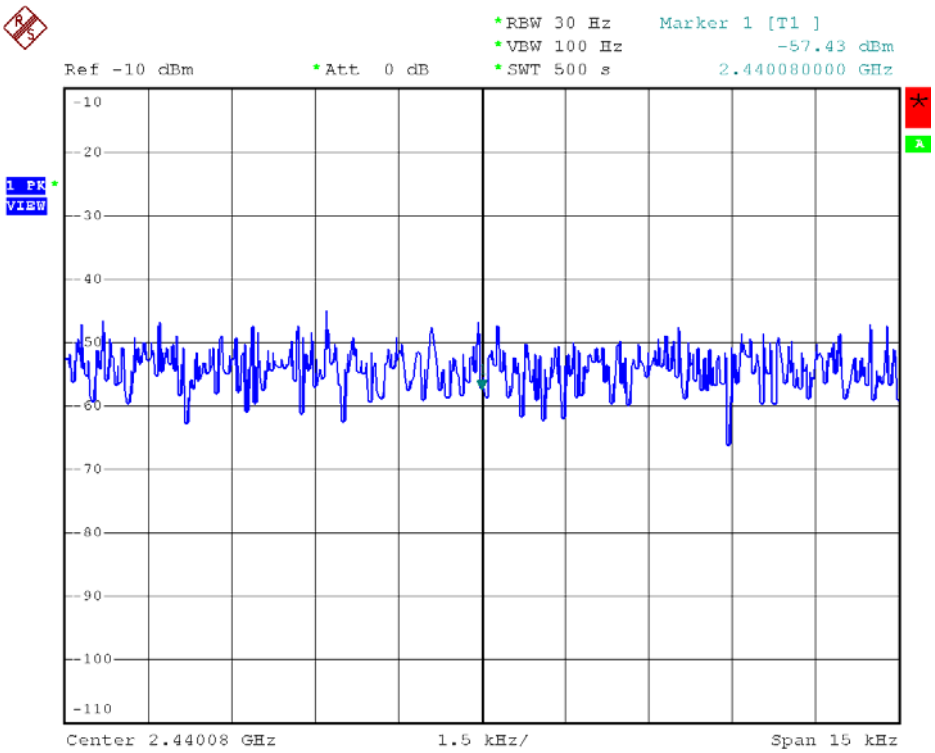
Test Result: PASS

Please refer to the below photos for more details.

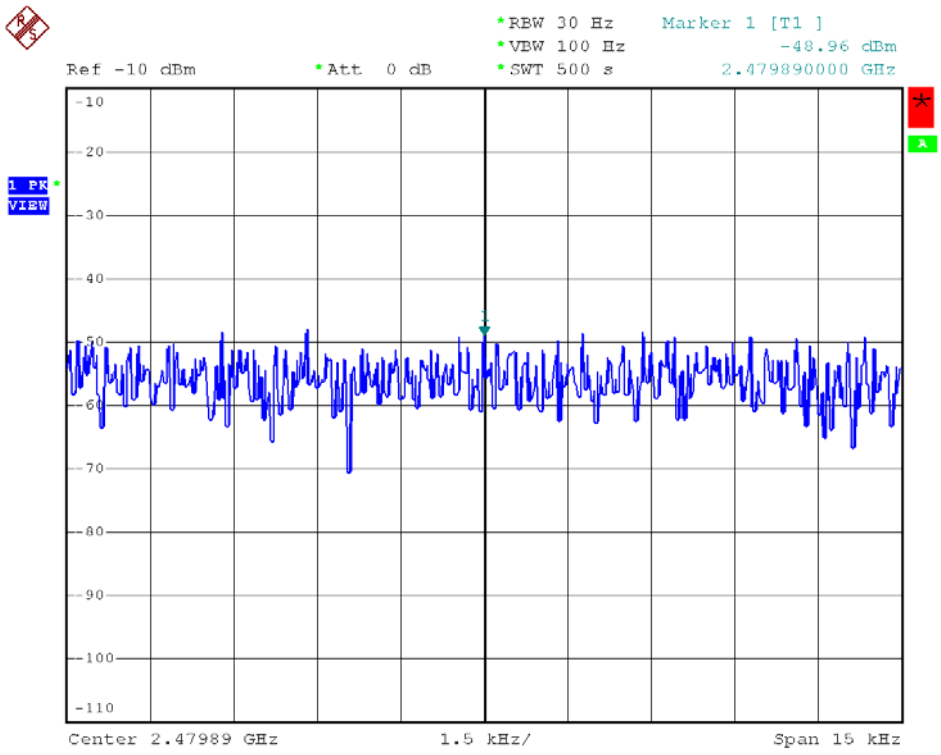
Low Channel



Middle Channel



High Channel



12 Periodic Operation

The duty cycle was determined by the following equation:
To calculate the actual field intensity, The duty cycle correction factor in decibel is needed for later use and can be obtained from following conversion

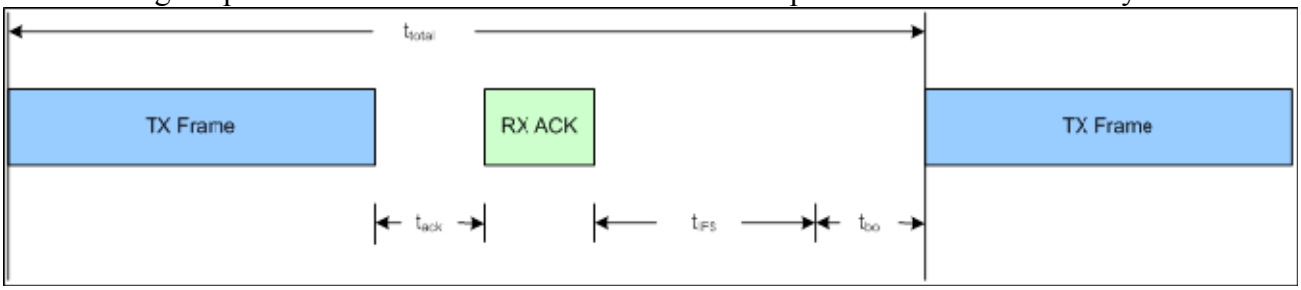
Duty Cycle(%)=
Total On interval in a complete pulse train/ Length of a complete pulse train * %

Duty Cycle Correction Factor(dB)=20 * Log_{10}(Duty Cycle(%))

Pulse Train	Number of Pulse	T(ms)	Total Time(ms)
Test Pulse on Tx Mode in 100ms	1	1.2 ms	1.2ms

And the duty cycle =28.87% is declared by the manufacture under the normal traffic load represents.and for more details of the calculations,please refer to the following:

The functionality of Zigbee power module is to relay data packets from other Zigbee Sensor nodes.So the duty cycle calculation is based on the worst case time a Zigbee power modulewill be in TX Mode in any 100ms time window. The following figure shows the worst case transmission scenario: Zigbee power module needs to forward sensor data packets in a saturation way.



The transmission time is calculated by packet lengthgenerated by sensor devices, which is 1.2ms=0.0012s (refer EUT's duty cycle calculation test). The none transmission time(RX or idle) is calculated by IEEE802.15.4 standard and TI cc2430 datasheet.

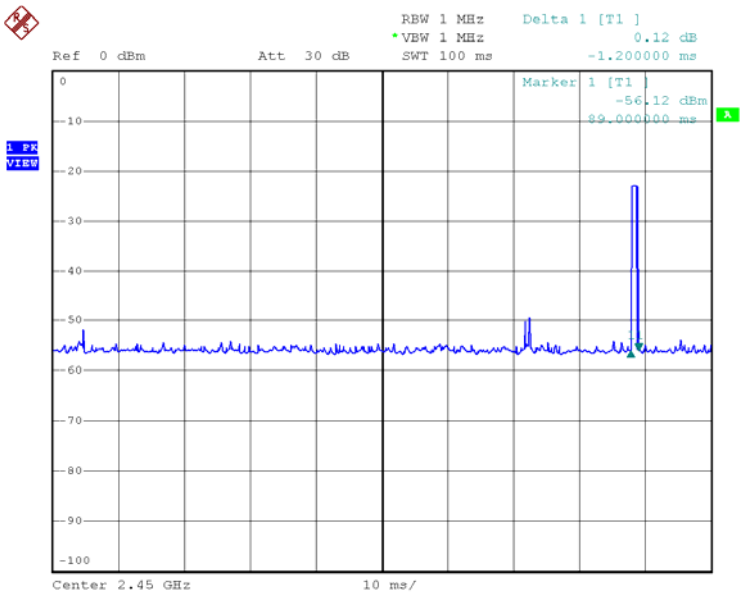
TX:Transmit Time	
TX Time (Packet)	0.0012
Total TX Time (sec)	0.0012
NOT Transmit time (RX or Idle)	
t_{bo}:Backoff Time	0.00192
t_{ack}:(minimum)	0.000192
RX Time (ACK)	0.000352
t_{IFS}:LIFS	0.00064
Total Off Time (sec)	0.003104

Total Time (t_{total})	0.0043
Number of periods in 100ms Window	23.2558
Worse Case (100ms window)	
TX Frame 24 times	0.0288
RX or IDLE 23 Times	0.0713
Total	0.1001

Duty Cycle (TX /total)	28.87%

Duty cycle correction factor: 20log(TX/total) = 20log(0.2887) =-10.79dB

Refer to the duty cycle plot (as below), This device does meet the FCC requirement.
Length of a complete pulse train and the transmit pulse in 100ms:



13 Radiated spurious emissions into adjacent restricted band

Test Requirement:	FCC Part15 Paragraph 15.205
Test Method:	Based on FCC Part 15 Paragraph 15.247
Test Date:	May 28,2011
Requirements:	The EUT work in test mode(Tx) and test it

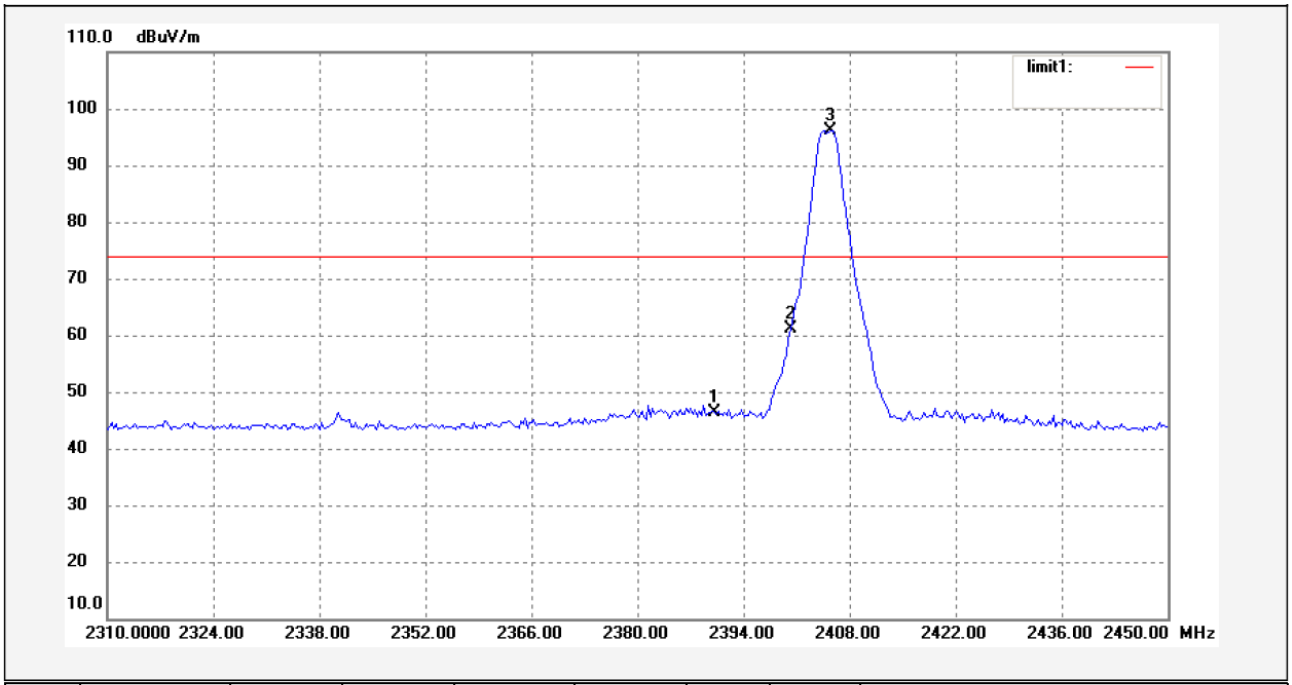
Requiments:

emissions that fall in the restricted bands(15.205).Above 1000MHz, compliance with the emissions limits in section 15.209 shall be demonstrated based on the average value of the measured emissions,The provisions in section 15.35 apply to these measurements.

Test procedure:

An in band field strength measurement of the fundamental emission using the RBW and detector function required by C63.4-2003 and FCC Rules.The procedure was repeated with an average detector and a plot made.The calculated field strength in the adjacent restricted band is presented below.

Lower bandedge/ restricted band (Peak Value)



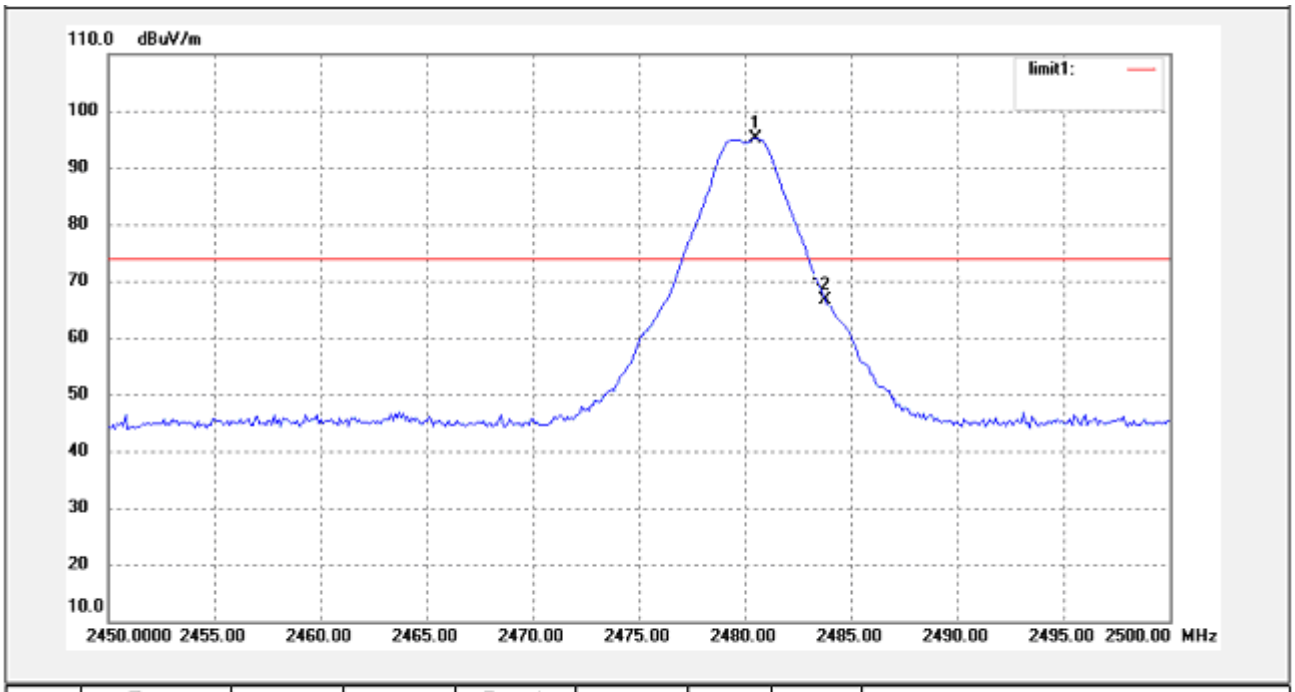
No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2390.000	53.81	-7.34	46.47	74.00	-27.53	peak	
2	2400.000	68.49	-7.31	61.18	74.00	-12.82	peak	
3	2405.480	103.40	-7.30	96.10	74.00	22.10	peak	

Remark: the mark3 is the fundamental in the test data.

And the duty cycle is -10.79dB, so the Average detector is equal to Peak detector minus the duty cycle, which the worse case is 61.18-10.79=50.39dBuV/m, less than the limit 54 dBuV/m.

Test Results: Passed.

Upper Bandedge/ Restricted Band (Peak Value)



No.	Freq. (MHz)	Reading (dBuV/m)	Factor (dB)	Result (dBuV/m)	Limit (dBuV/m)	Margin (dB)	Detector	Remark
1	2480.500	102.26	-7.13	95.13	74.00	21.13	peak	
2	2483.500	71.22	-7.13	64.09	74.00	-9.91	peak	

Remark: the mark1 is the fundamental in the test data.
And the duty cycle is -10.79dB, so the Average detector is equal to Peak detector minus the duty cycle, which the worse case is 64.09-10.79=53.3dBuV/m, less than the limit 54 dBuV/m.

Test Results: Passed.

14 RF Exposure Test

Test Requirement:	FCC Part 2 Subpart J
Test Method:	Based on FCC Part 15 Paragraph 15.247
Test Date:	May 28,2011
Requirements:	The EUT work in test mode(Tx) and test it

Requiments:

Systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy levels in excess limit for maximum permissible exposure. In accordance with 47 CFR FCC Part 2 Subpart J, section 2.1091 this device has been defined as a mobile device whereby a distance of 0.2 m normally can be maintained between the user and the device.

The procedures / limit

(A) Limits for Occupational / Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm^2)	Averaging Time $\|E\|^2$,$\|H\|^2$ or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842 / f	4.89 / f	(900 / f)*	6
30-300	61.4	0.163	1.0	6
300-1500			F/300	6
1500-100,000			5	6

(B) Limits for General Population / Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/ cm^2)	Averaging Time $\|E\|^2$,$\|H\|^2$ or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	(180/f)*	30
30-300	27.5	0.073	0.2	30
300-1500			F/1500	30
1500-100,000			1.0	30

Note: f = frequency in MHz ; *Plane-wave equivalent power density

MPE Calculation Method

$$E\ (V/m) = \frac{\sqrt{30 \times P \times G}}{d} \qquad \text{Power Density: } Pd\ (W/m^2) = \frac{E^2}{377}$$

E = Electric field (V/m)

P = Peak RF output power (W)

G = EUT Antenna numeric gain (numeric)

d = Separation distance between radiator and human body (m)

The formula can be changed to

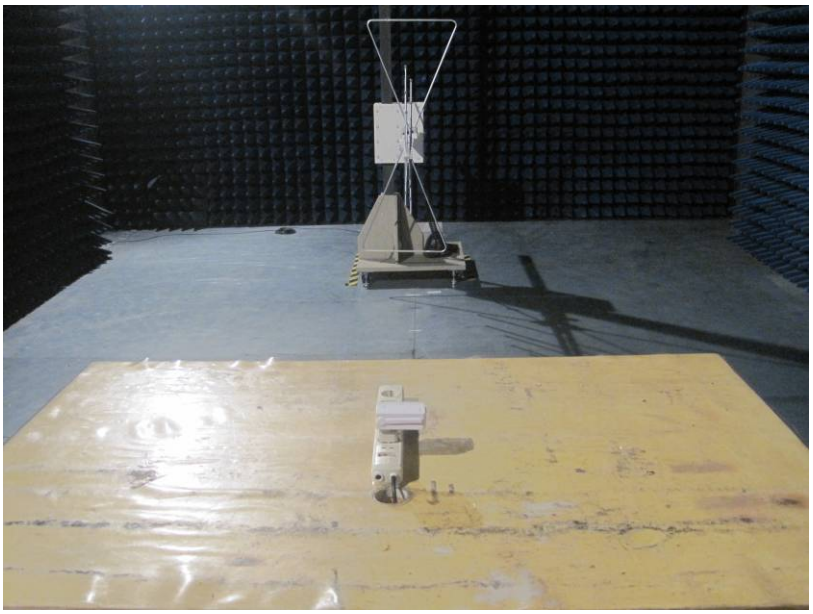
$$\boldsymbol{Pd} = \frac{30 \times P \times G}{377 \times d^2}$$

From the peak EUT RF output power, the minimum mobile separation distance, d=0.2m, as well as the gain of the used antenna, the RF power density can be obtained

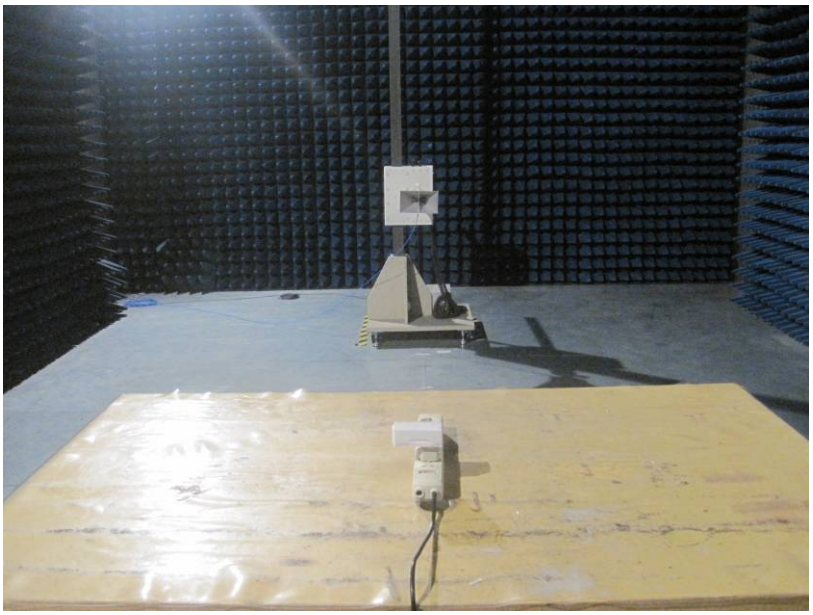
Antenna Gain (dBi)	Antenna Gain (numeric)	Peak Output Power (dBm)	Peak Output Power (mW)	Power Density (S) (mW/cm2)	Limit of Power Density (S) (mW/cm2)	Test Result
0	1	0.121	1.32	0.00026	1	Complies
0	1	0.121	1.32	0.00026	1	Complies
0	1	0.097	1.25	0.00025	1	Complies

15 Photographs of Test Setup for CTX

Radiation Emission Test View For 30MHz-1000MHz

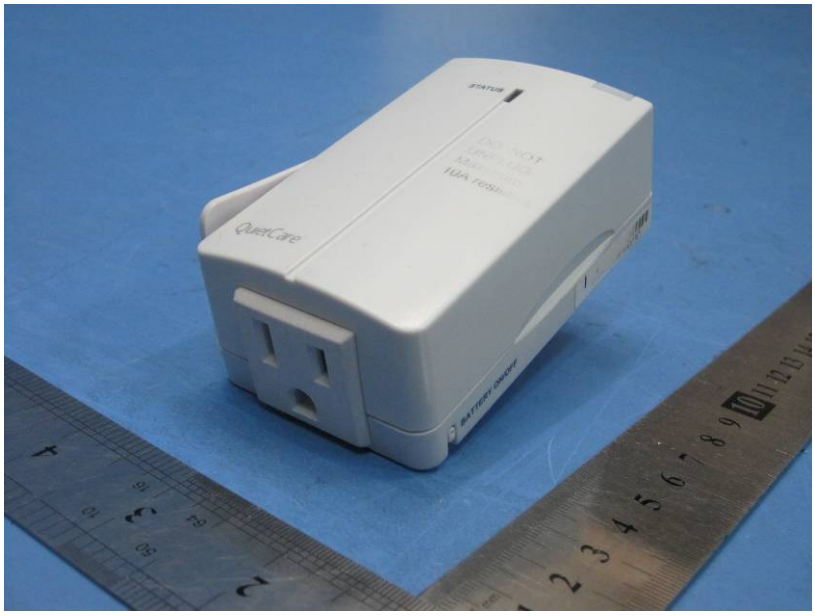


Radiation Emission Test View For 1GHz-25GHz

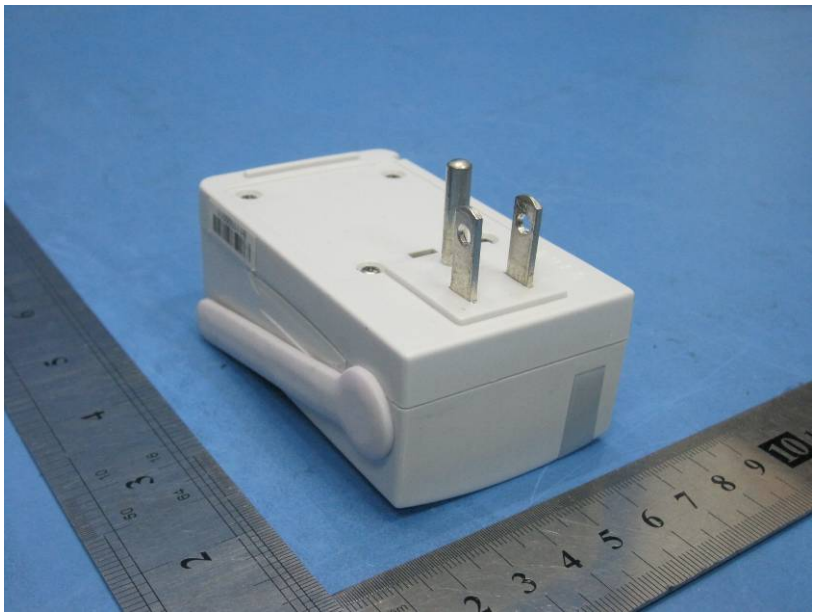


16 Photographs - Constructional Details

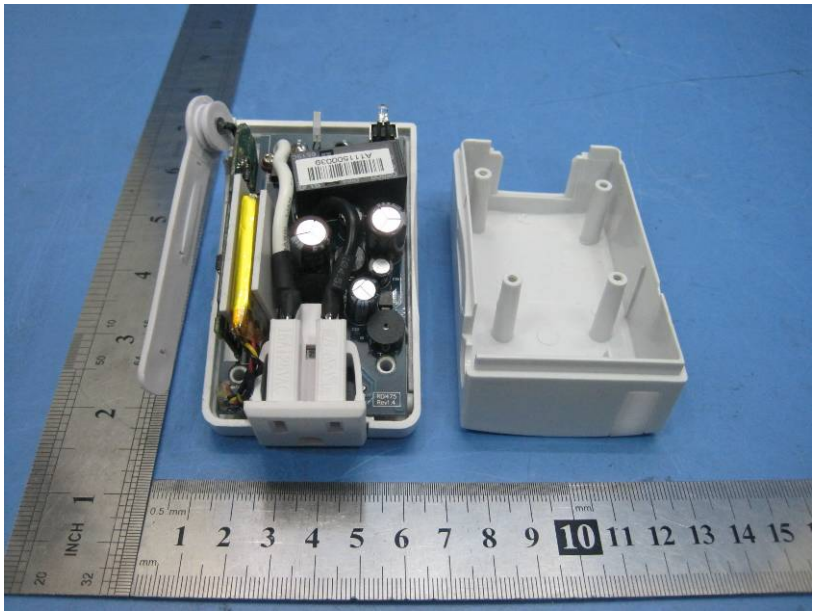
16.1 EUT – Front View



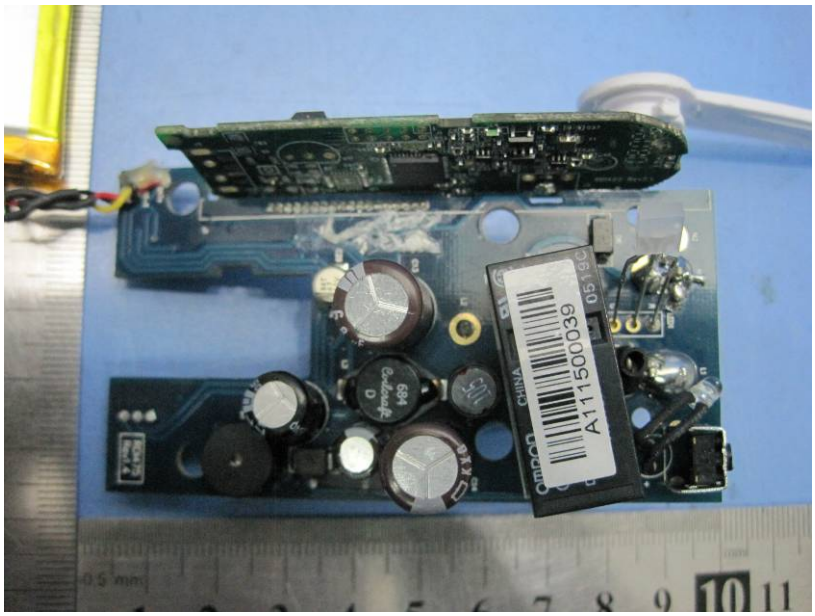
16.2 EUT - Back View



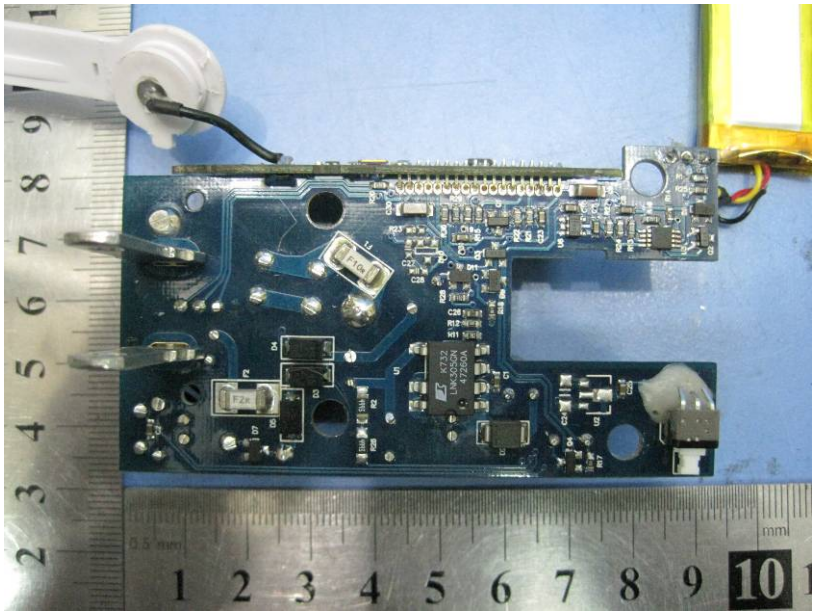
16.3 EUT – Open View



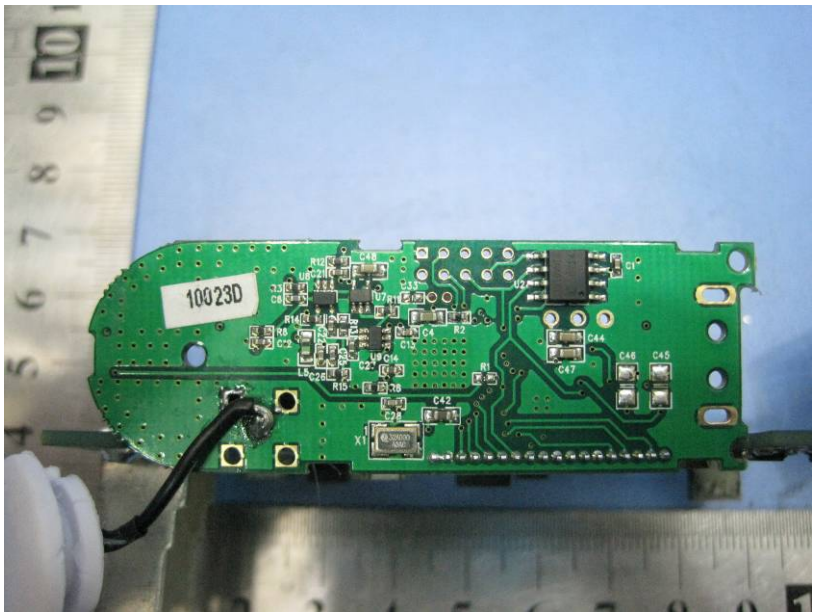
16.4 PCB 1 -Front View



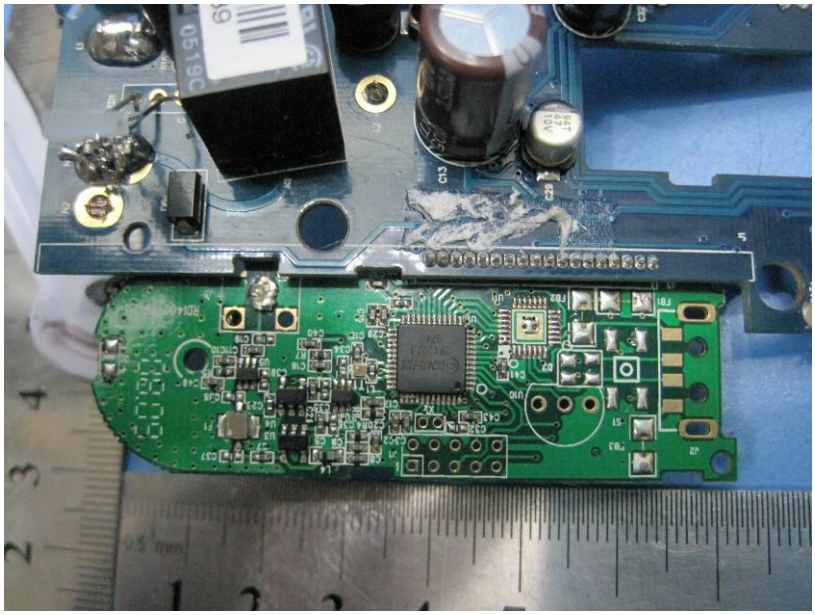
16.5 PCB 1 - Back View



16.6 PCB 2 -Front View



16.7 PCB 2 - Back View



17 FCC ID Label

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:(1)this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

The Label must not be a stick-on paper. The Label on these products must be permanently affixed to the product and readily visible at the time of purchase and must last the expected lifetime of the equipment not be readily detachable.

Proposed Label Location on EUT

EUT Top View/ proposed FCC Label Location