

TEST REPORT

Reference No...... : WTF15S0425710E
FCC ID : BRWPRB13004
Applicant..... : Horizon Hobby Distributors Inc
Address..... : 4105 Fieldstone Road Champaign Illinois United States
Manufacturer : KATUMFEL INDUSTRY LIMITED (HK)
Address..... : FuCheng Industrial Town, Hong Tian, ShaJing, Shenzhen,Hong Kong
Product Name..... : 2.4GHz Stick Transmitter, 2-Channel V3
Model No...... : PRB13004
Brand..... : N/A
Standards..... : FCC CFR47 Part 15 Section 15.247:2014
Date of Receipt sample : Apr. 25, 2015
Date of Test : Apr. 26~May.20, 2015
Date of Issue..... : May.21, 2015
Test Result..... : Pass

Remarks:

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

Prepared By:

Waltek Services (Shenzhen) Co., Ltd.

Address: 1/F., Fukangtai Building, West Baima Road, Songgang Street, Baoan District, Shenzhen, Guangdong, China

Tel :+86-755-83551033

Fax:+86-755-83552400

Compiled by:



Zero Zhou / Project Engineer

Approved by:



Philo Zhong / Manager

2 Test Summary

Test Items	Test Requirement	Result
Radiated Spurious Emissions	15.205(a) 15.209 15.247(d)	PASS
Band edge	15.247(d) 15.205(a)	PASS
Conducted Emission	15.207	N/A
20dB Bandwidth	15.247(a)(1)	PASS
Maximum Peak Output Power	15.247(b)(1)	PASS
Frequency Separation	15.247(a)(1)	PASS
Number of Hopping Frequency	15.247(a)(1)(iii)	PASS
Dwell time	15.247(a)(1)(iii)	PASS
Maximum Permissible Exposure (Exposure of Humans to RF Fields)	1.1307(b)(1)	PASS

3 Contents

	Page
1 COVER PAGE.....	1
2 TEST SUMMARY	2
3 CONTENTS	3
4 GENERAL INFORMATION.....	5
4.1 GENERAL DESCRIPTION OF E.U.T.	5
4.2 DETAILS OF E.U.T.	5
4.3 CHANNEL LIST	5
4.4 TEST FACILITY	6
5 EQUIPMENT USED DURING TEST	7
5.1 EQUIPMENTS LIST	7
5.2 MEASUREMENT UNCERTAINTY	8
5.3 TEST EQUIPMENT CALIBRATION	8
6 CONDUCTED EMISSION	9
7 RADIATED SPURIOUS EMISSIONS.....	10
7.1 EUT OPERATION.....	10
7.2 TEST SETUP	11
7.3 SPECTRUM ANALYZER SETUP	12
7.4 TEST PROCEDURE	13
7.5 SUMMARY OF TEST RESULTS	14
8 BAND EDGE MEASUREMENT	18
8.1 TEST PROCEDURE	18
8.2 TEST RESULT	19
9 20 DB BANDWIDTH MEASUREMENT	21
9.1 TEST PROCEDURE	21
9.2 TEST RESULT	21
10 MAXIMUM PEAK OUTPUT POWER	23
10.1 TEST PROCEDURE.....	23
10.2 TEST RESULT	23
11 HOPPING CHANNEL SEPARATION	26
11.1 TEST PROCEDURE.....	26
11.2 TEST RESULT	26
12 NUMBER OF HOPPING FREQUENCY.....	29
12.1 TEST PROCEDURE.....	29
12.2 TEST RESULT	29
13 DWELL TIME	30
13.1 TEST PROCEDURE.....	30
13.2 TEST RESULT	30
14 ANTENNA REQUIREMENT	33
15 RF EXPOSURE.....	34
15.1 REQUIREMENTS.....	34
15.2 THE PROCEDURES / LIMIT	34
16 PHOTOGRAPHS – MODEL PRB13004 TEST SETUP	35

16.1 PHOTOGRAPH – RADIATION SPURIOUS EMISSION TEST SETUP.....35

17 **PHOTOGRAPHS - CONSTRUCTIONAL DETAILS37**

17.1 MODEL PRB13004 EXTERNAL VIEW37

17.2 MODEL PRB13004 INTERNAL VIEW.....40

4 General Information

4.1 General Description of E.U.T.

Product Name	: 2.4GHz Stick Transmitter, 2-Channel V3
Model No.	: PRB13004
Frequency Range	: 2405-2478MHz, 74 Channels in total
Antenna installation	: Integrated Antenna
Antenna Gain	: 3.0 dBi
Type of Modulation	: GFSK
The Lowest Oscillator	: 6.5MHz

4.2 Details of E.U.T.

Technical Data:	: 1.5VDC *4
-----------------	-------------

4.3 Channel List

Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)	Channel No.	Frequency (MHz)
0	2405	1	2406	2	2407	3	2408
4	2409	5	2410	6	2411	7	2412
8	2413	9	2414	10	2415	11	2416
12	2417	13	2418	14	2419	15	2420
16	2421	17	2422	18	2423	19	2424
20	2425	21	2426	22	2427	23	2428
24	2429	25	2430	26	2431	27	2432
28	2433	29	2434	30	2435	31	2436
32	2437	33	2438	34	2439	35	2440
36	2441	37	2442	38	2443	39	2444
40	2445	41	2446	42	2447	43	2448
44	2449	45	2450	46	2451	47	2452
48	2453	49	2454	50	2455	51	2456
52	2457	53	2458	54	2459	55	2460
56	2461	57	2462	58	2463	59	2464
60	2465	61	2466	62	2467	63	2468
64	2469	65	2470	66	2471	67	2472
68	2473	69	2474	70	2475	71	2476
72	2477	73	2478	74	/	75	/

4.4 Test Facility

The test facility has a test site registered with the following organizations:

- **IC – Registration No.: 7760A-1**

Waltek Services(Shenzhen) Co., Ltd. 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 7760A-1, July 12, 2012.

- **FCC Test Site 1#– 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, April 29, 2014.

- **FCC Test Site 2#– Registration No.: 328995**

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 328995, December 3, 2014.

5 Equipment Used during Test

5.1 Equipments List

Conducted Emissions Test Site 1#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMI Test Receiver	R&S	ESCI	100947	Sep.15,2014	Sep.14,2015
2.	LISN	R&S	ENV216	101215	Sep.15,2014	Sep.14,2015
3.	Cable	Top	TYPE16(3.5M)	-	Sep.15,2014	Sep.14,2015
Conducted Emissions Test Site 2#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMI Test Receiver	R&S	ESCI	101155	Sep.15,2014	Sep.14,2015
2.	LISN	SCHWARZBECK	NSLK 8128	8128-289	Sep.15,2014	Sep.14,2015
3.	Limiter	York	MTS-IMP-136	261115-001-0024	Sep.15,2014	Sep.14,2015
4.	Cable	LARGE	RF300	-	Sep.15,2014	Sep.14,2015
3m Semi-anechoic Chamber for Radiation Emissions Test site 1#						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1	EMC Analyzer	Agilent	E7405A	MY45114943	Sep.15,2014	Sep.14,2015
2	Active Loop Antenna	Beijing Dazhi	ZN30900A	-	Sep.15,2014	Sep.14,2015
3	Trilog Broadband Antenna	SCHWARZBECK	VULB9163	336	Apr.19,2015	Apr.18,2016
4	Coaxial Cable (below 1GHz)	Top	TYPE16(13M)	-	Sep.15,2014	Sep.14,2015
5	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9120 D	667	Apr.19,2015	Apr.18,2016
6	Broad-band Horn Antenna	SCHWARZBECK	BBHA 9170	335	Apr.19,2015	Apr.18,2016
7	Broadband Preamplifier	COMPLIANCE DIRECTION	PAP-1G18	2004	Mar.17,2015	Mar.16,2016
8	Coaxial Cable (above 1GHz)	Top	1GHz-25GHz	EW02014-7	Apr.10,2015	Apr.09,2016
3m Semi-anechoic Chamber for Radiation Emissions Test site 2#						
Item	Equipment	Manufacturer	Model No.	Serial No	Last Calibration Date	Calibration Due Date
1	Test Receiver	R&S	ESCI	101296	Sep.15,2014	Sep.14,2015
2	Trilog Broadband Antenna	SCHWARZBECK	VULB9160	9160-3325	Sep.15,2014	Sep.14,2015
3	Amplifier	Compliance pirection systems inc	PAP-0203	22024	Sep.15,2014	Sep.14,2015
4	Cable	HUBER+SUHNER	CBL2	525178	Sep.15,2014	Sep.14,2015

RF Conducted Testing						
Item	Equipment	Manufacturer	Model No.	Serial No.	Last Calibration Date	Calibration Due Date
1.	EMC Analyzer (9k~26.5GHz)	Agilent	E7405A	MY45114943	Sep.15,2014	Sep.14,2015
2.	Spectrum Analyzer (9k-6GHz)	R&S	FSL6	100959	Sep.15,2014	Sep.14,2015
3.	Signal Analyzer (9k~26.5GHz)	Agilent	N9010A	MY50520207	Sep.15,2014	Sep.14,2015

5.2 Measurement Uncertainty

Parameter	Uncertainty
Radio Frequency	$\pm 1 \times 10^{-6}$
RF Power	± 1.0 dB
RF Power Density	± 2.2 dB
Radiated Spurious Emissions test	± 5.03 dB (Bilog antenna 30M~1000MHz)
	± 5.47 dB (Horn antenna 1000M~25000MHz)
Conducted Spurious Emissions test	± 3.64 dB (AC mains 150KHz~30MHz)

5.3 Test Equipment Calibration

All the test equipments used are valid and calibrated by CEPREI Certification Body that address is No.110 Dongguan Zhuang RD. Guangzhou, P.R.China.

6 Conducted Emission

Test Requirement:	FCC CFR 47 Part 15 Section 15.207
Test Method:	ANSI C63.4:2003
Test Result:	N/A
Frequency Range:	150kHz to 30MHz
Class/Severity:	Class B
Limit:	66-56 dB μ V between 0.15MHz & 0.5MHz 56 dB μ V between 0.5MHz & 5MHz 60 dB μ V between 5MHz & 30MHz
Detector:	Peak for pre-scan (9kHz Resolution Bandwidth)

Re: Due to the EUT power from battery, this Item is not applicable.

7 Radiated Spurious Emissions

Test Requirement: FCC CFR47 Part 15 Section 15.209 & 15.247

Test Method: DA 00-705

Test Result: PASS

Measurement Distance: 3m

Limit:

Frequency (MHz)	Field Strength		Field Strength Limit at 3m Measurement Dist	
	uV/m	Distance (m)	uV/m	dBuV/m
0.009 ~ 0.490	2400/F(kHz)	300	$10000 * 2400/F(kHz)$	$20\log^{(2400/F(kHz))} + 80$
0.490 ~ 1.705	24000/F(kHz)	30	$100 * 24000/F(kHz)$	$20\log^{(24000/F(kHz))} + 40$
1.705 ~ 30	30	30	$100 * 30$	$20\log^{(30)} + 40$
30 ~ 88	100	3	100	$20\log^{(100)}$
88 ~ 216	150	3	150	$20\log^{(150)}$
216 ~ 960	200	3	200	$20\log^{(200)}$
Above 960	500	3	500	$20\log^{(500)}$

7.1 EUT Operation

Operating Environment :

Temperature: 23.5 °C

Humidity: 51.1 % RH

Atmospheric Pressure: 101.2kPa

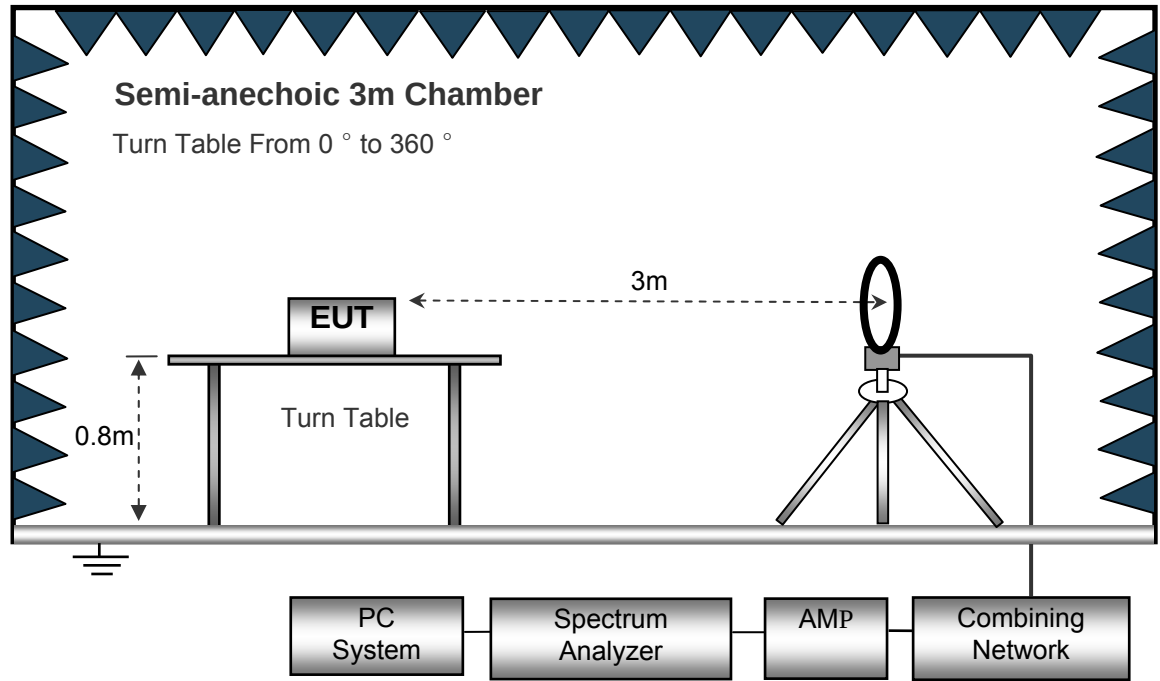
EUT Operation :

The test was performed in transmitting mode, the test data were shown in the report.

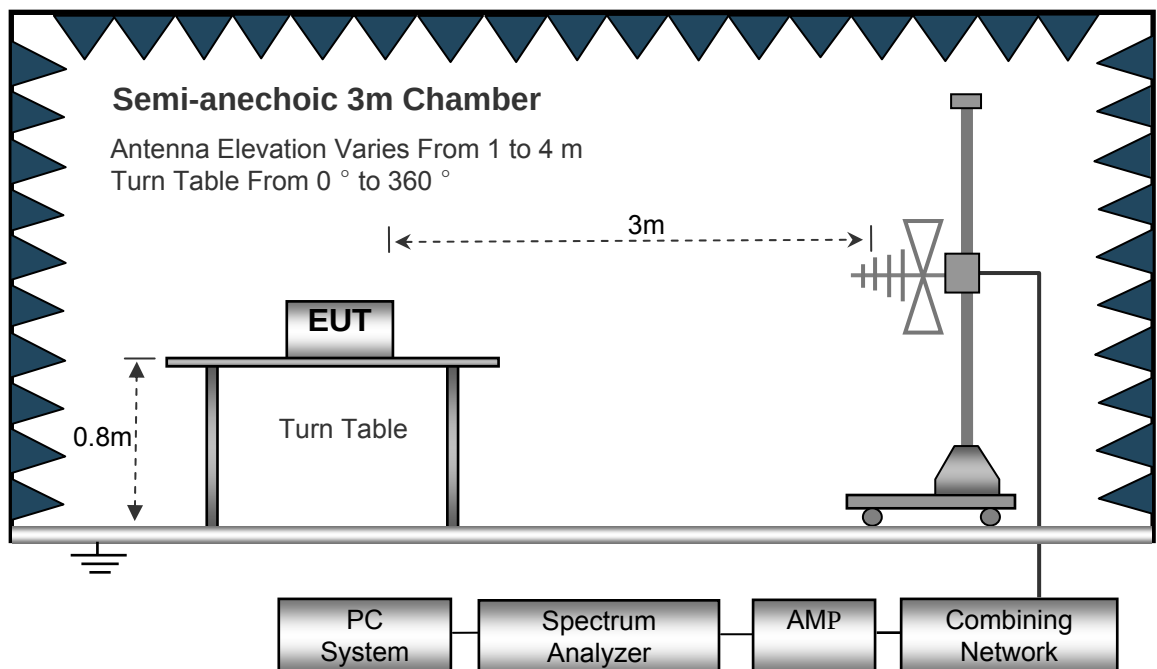
7.2 Test Setup

The radiated emission tests were performed in the 3m Semi- Anechoic Chamber test site, using the setup accordance with the ANSI C63.4: 2003.

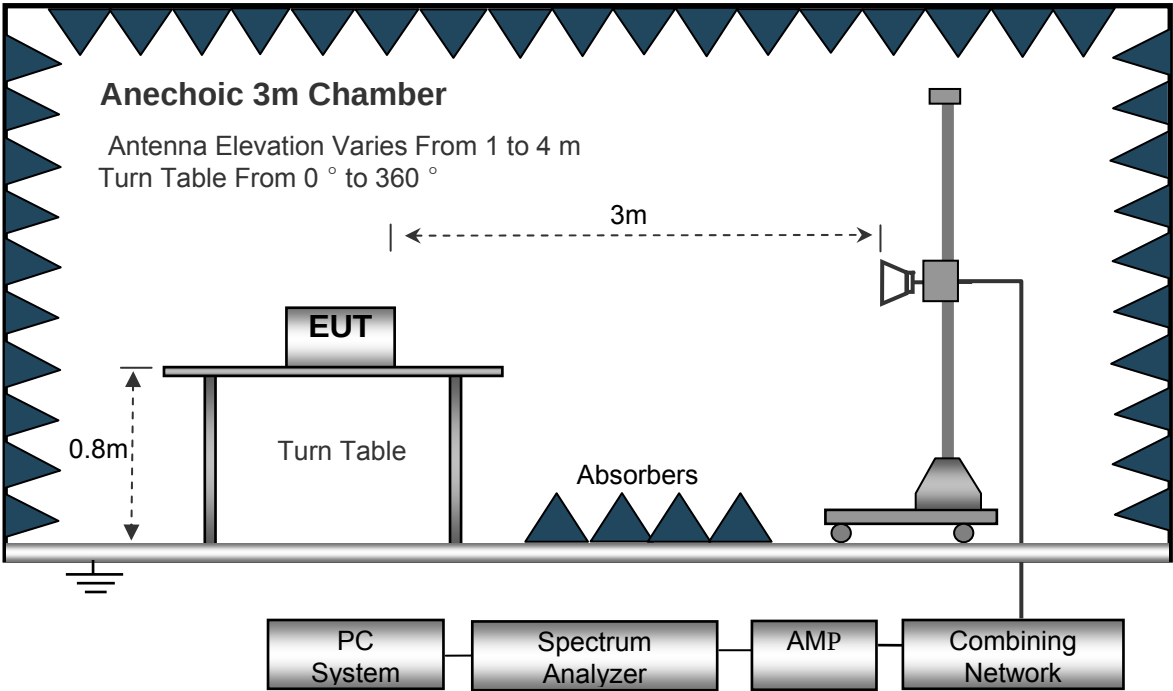
The test setup for emission measurement below 30MHz.



The test setup for emission measurement from 30 MHz to 1 GHz.



The test setup for emission measurement above 1 GHz.



7.3 Spectrum Analyzer Setup

Below 30MHz	
Sweep Speed	Auto
IF Bandwidth.....	10kHz
Video Bandwidth.....	10kHz
Resolution Bandwidth.....	10kHz
30MHz ~ 1GHz	
Sweep Speed	Auto
Detector	PK
Resolution Bandwidth.....	100kHz
Video Bandwidth.....	300kHz
Above 1GHz	
Sweep Speed	Auto
Detector	PK
Resolution Bandwidth.....	1MHz
Video Bandwidth.....	3MHz
Detector	Ave.
Resolution Bandwidth.....	1MHz
Video Bandwidth.....	10Hz

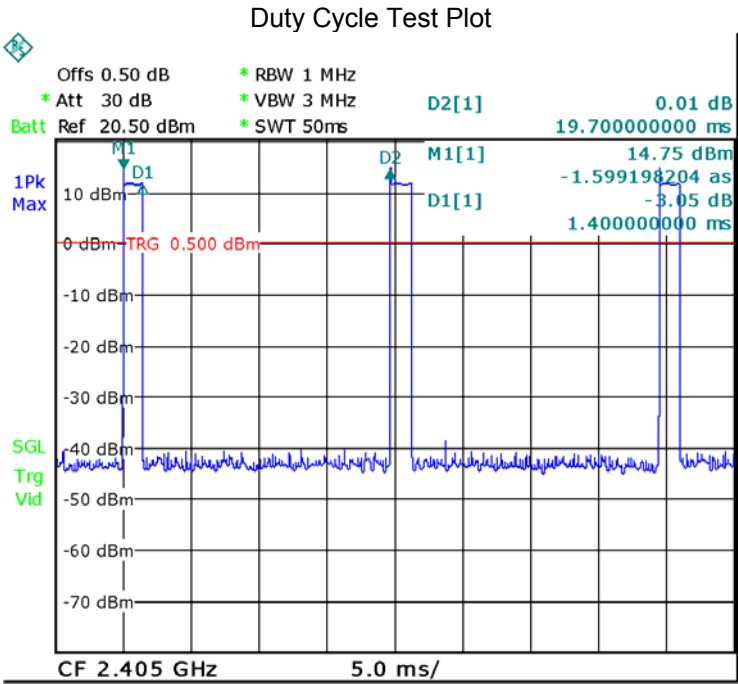
7.4 Test Procedure

1. The EUT is placed on a turntable, which is 0.8m above ground plane.
2. The turntable shall be rotated for 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna, which is moved from 1m to 4m to find out the maximum emissions. The spectrum was investigated from the lowest radio frequency signal generated in the device, without going below 9 kHz, up to the tenth harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower.
4. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
5. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
6. Repeat above procedures until the measurements for all frequencies are complete.
7. The radiation measurements are tested under 3-axes(X,Y,Z) position(X denotes lying on the table, Y denotes side stand and Z denotes vertical stand), After pre-test, It was found that the worse radiation emission was get at the X position. So the data shown was the X position only.

7.5 Summary of Test Results

$AV = \text{Peak} + 20\text{Log}_{10}(\text{duty cycle}) = \text{PK}-23$

$\text{Duty Cycle} = (1.4/19.7) * 100\% = 7.1\%$



Test Frequency: 6.5MHz to 30MHz

The measurements were more than 20 dB below the limit and not reported.

Test Frequency: 30MHz ~ 18GHz

Test mode: transmitting mode

Low Channel

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
322.60	15.61	PK	344	1.1	H	17.01	32.62	46.00	-13.38
322.60	17.22	PK	356	1.4	V	17.01	34.23	46.00	-11.77
4810.00	65.27	PK	118	1.4	H	-0.62	64.65	74.00	-9.35
4810.00	64.58	PK	164	1.3	V	-0.62	63.96	74.00	-10.04
7215.00	57.36	PK	314	1.9	H	2.21	59.57	74.00	-14.43
7215.00	56.81	PK	6	1.8	V	2.21	59.02	74.00	-14.98

Frequency	PK	Turn table Angle	RX Antenna		Duty cycle Factor	AV	FCC Part 15.247	
			Height	Polar			Limit	Margin
(MHz)	(dBμV/m)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
4810.00	64.65	0	1.7	H	-23.00	41.65	54.00	-12.35
4810.00	63.96	161	1.1	V	-23.00	40.96	54.00	-13.04
7215.00	59.57	34	1.5	H	-23.00	36.57	54.00	-17.43
7215.00	59.02	172	1.3	V	-23.00	36.02	54.00	-17.98

Middle Channel

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
322.60	14.68	PK	121	1.6	H	17.01	31.69	46.00	-14.31
322.60	16.87	PK	231	1.1	V	17.01	33.88	46.00	-12.12
4882.00	64.68	PK	5	1.1	H	-0.62	64.06	74.00	-9.94
4882.00	63.59	PK	158	1.1	V	-0.62	62.97	74.00	-11.03
7323.00	56.05	PK	120	1.6	H	2.21	58.26	74.00	-15.74
7323.00	55.62	PK	127	1.1	V	2.21	57.83	74.00	-16.17

Frequency	PK	Turn table Angle	RX Antenna		Duty cycle Factor	AV	FCC Part 15.247	
			Height	Polar			Limit	Margin
(MHz)	(dBμV/m)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
4882.00	64.06	313	1.5	H	-23.00	41.06	54.00	-12.94
4882.00	62.97	118	1.5	V	-23.00	39.97	54.00	-14.03
7323.00	58.26	188	1.5	H	-23.00	35.26	54.00	-18.74
7323.00	57.83	156	1.3	V	-23.00	34.83	54.00	-19.17

High Channel

Frequency	Receiver Reading	Detector	Turn table Angle	RX Antenna		Corrected Factor	Corrected Amplitude	FCC Part 15.247	
				Height	Polar			Limit	Margin
(MHz)	(dBμV)	(PK/Ave)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
322.60	14.94	PK	211	1.5	H	17.01	31.95	46.00	-14.05
322.60	16.36	PK	222	1.3	V	17.01	33.37	46.00	-12.63
4956.00	64.29	PK	199	1.6	H	-0.62	63.67	74.00	-10.33
4956.00	63.61	PK	295	1.2	V	-0.62	62.99	74.00	-11.01
7434.00	56.35	PK	44	1.4	H	2.21	58.56	74.00	-15.44
7434.00	55.24	PK	297	1.8	V	2.21	57.45	74.00	-16.55

Frequency	PK	Turn table Angle	RX Antenna		Duty cycle Factor	AV	FCC Part 15.247	
			Height	Polar			Limit	Margin
(MHz)	(dBμV/m)	Degree	(m)	(H/V)	(dB)	(dBμV/m)	(dBμV/m)	(dB)
4956.00	63.67	159	1.3	H	-23.00	40.67	54.00	-13.33
4956.00	62.99	176	2.0	V	-23.00	39.99	54.00	-14.01
7434.00	58.56	104	1.2	H	-23.00	35.56	54.00	-18.44
7434.00	57.45	229	1.9	V	-23.00	34.45	54.00	-19.55

Test Frequency :Above 18GHz

The measurements were more than 20 dB below the limit and not reported

8 Band Edge Measurement

Test Requirement:	Section 15.247(d) In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), must also comply with the radiated emission limits specified in Section 15.209(a) (see Section 15.205(c)).
Test Method:	DA 00-705
Test Limit:	Regulation 15.247 (d), In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).
Test Mode:	Transmitting and Hopping

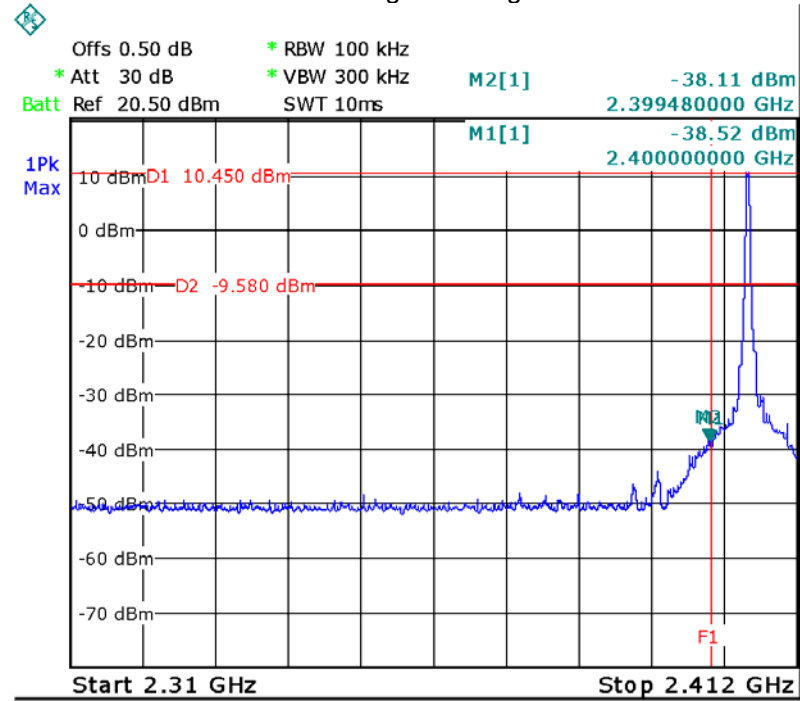
8.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 100kHz, VBW = 300kHz, Sweep = auto
Detector function = peak, Trace = max hold

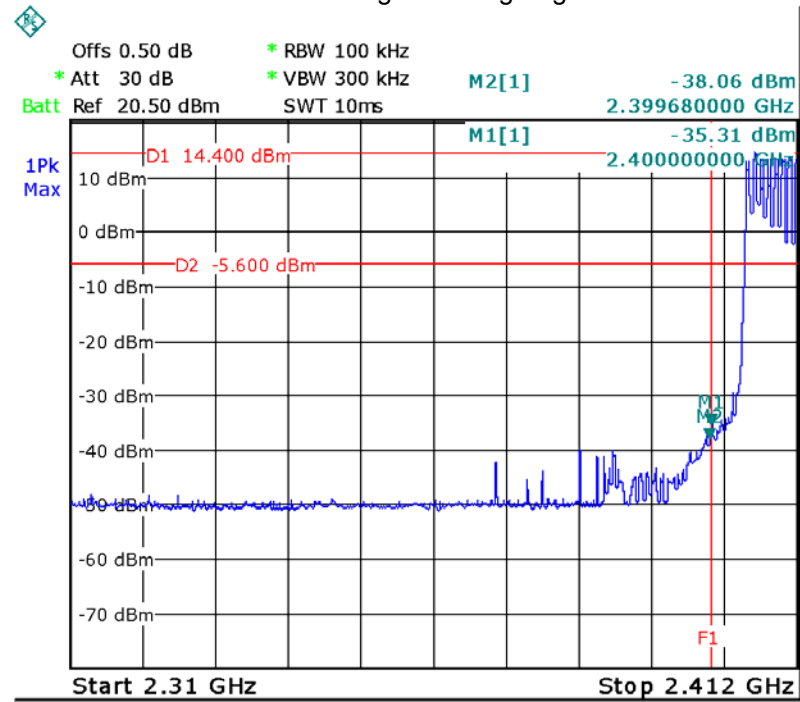
8.2 Test Result

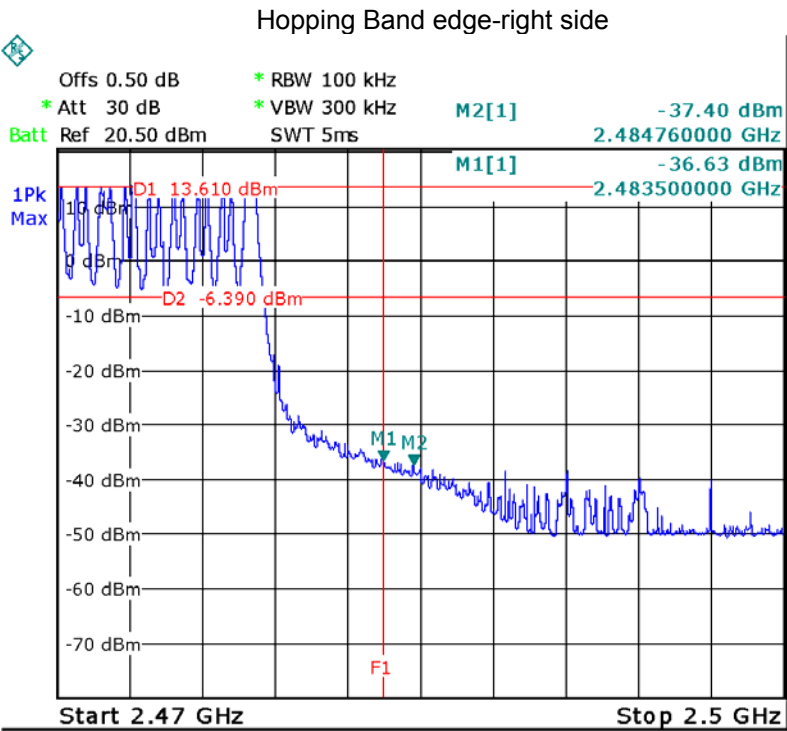
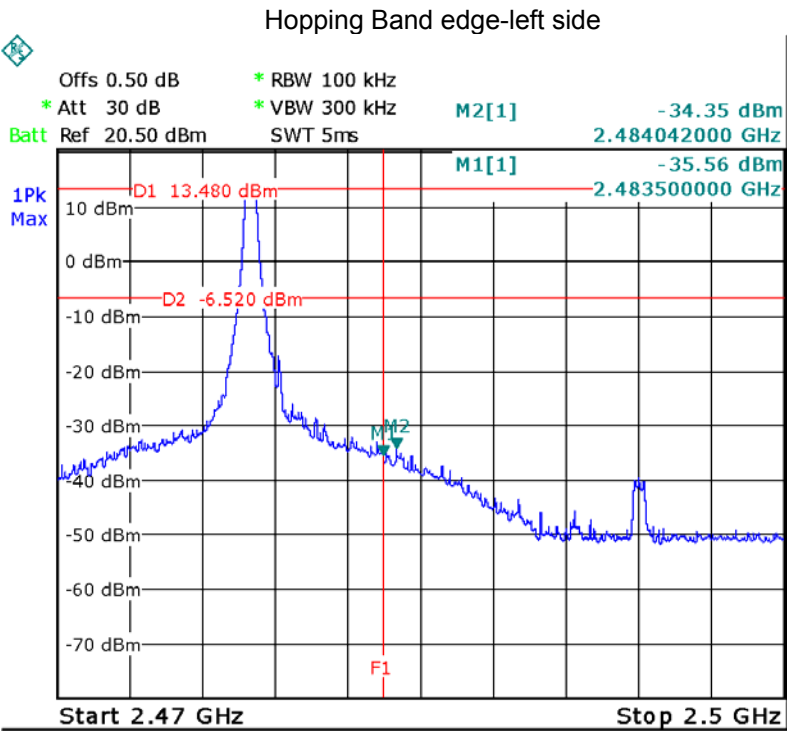
Test plots

Transmitting Band edge-left side



Transmitting Band edge-right side





9 20 dB Bandwidth Measurement

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	DA 00-705
Test Mode:	Test in fixing operating frequency at low, Middle, high channel.

9.1 Test Procedure

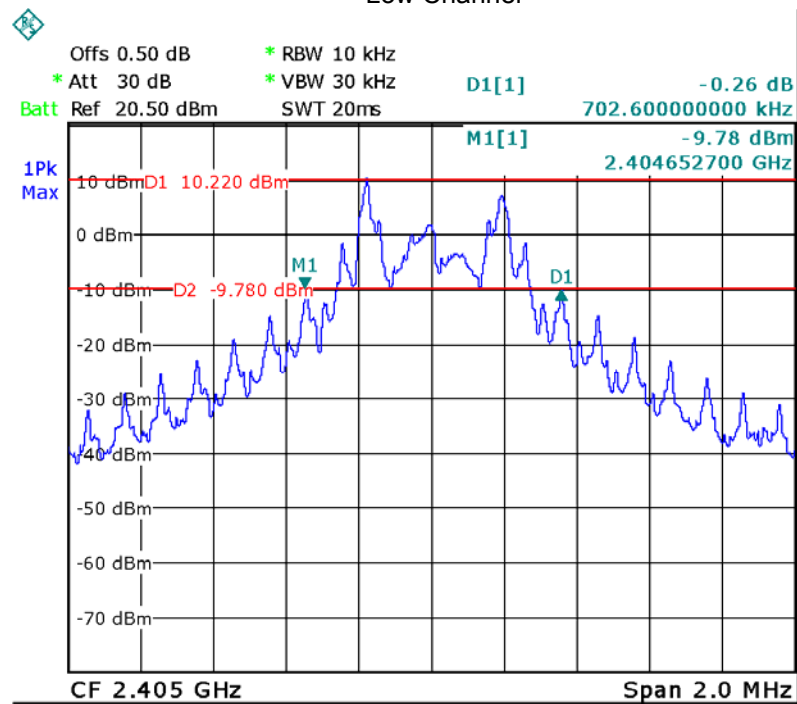
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum;
2. Set the spectrum analyzer: RBW = 10kHz, VBW = 30kHz

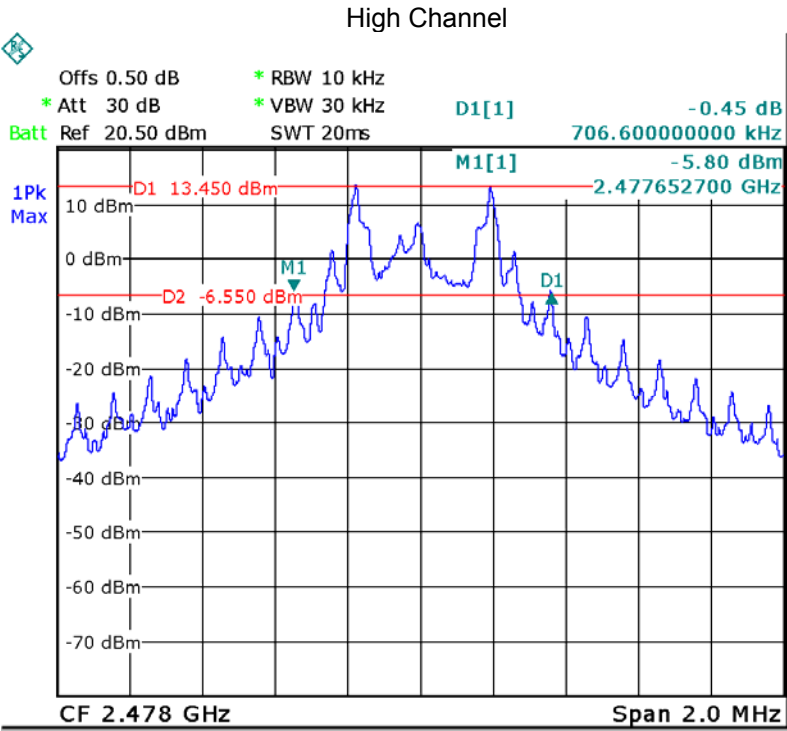
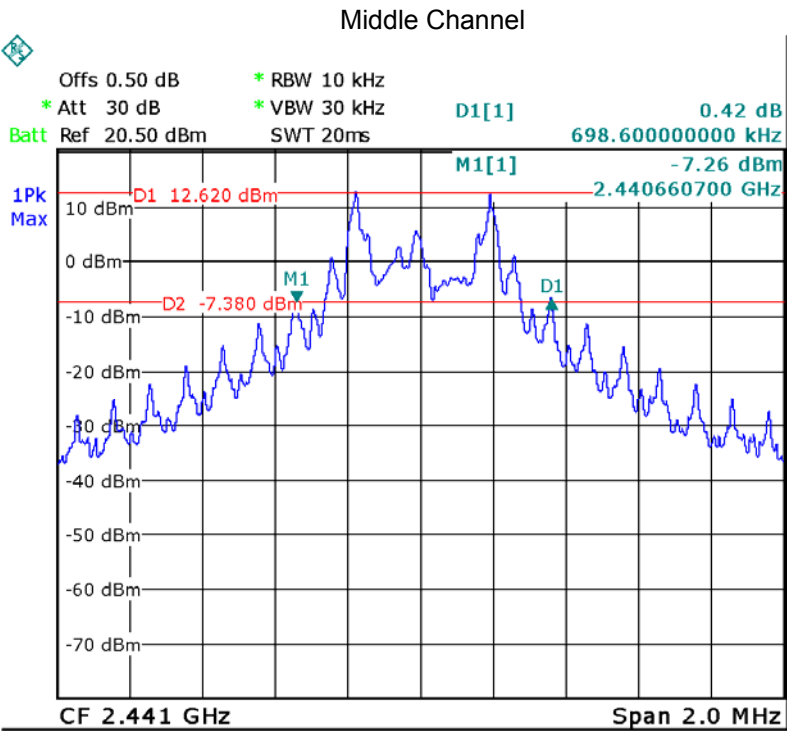
9.2 Test Result

Test Channel	Bandwidth
Low	0.703MHz
Middle	0.699MHz
High	0.707MHz

Test plots

Low Channel





10 Maximum Peak Output Power

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	DA 00-705
Test Limit:	Regulation 15.247 (b)(1), For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts. Refer to the result "Number of Hopping Frequency" of this document. The 0.125watts (20.97 dBm) limit applies.
Test mode:	Test in fixing frequency transmitting mode.

10.1 Test Procedure

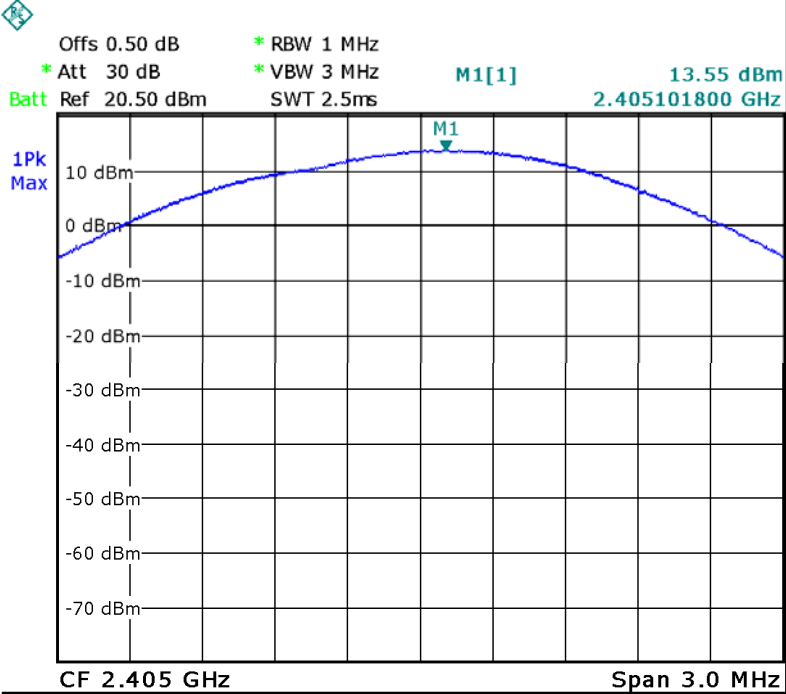
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 1MHz. VBW = 3MHz. Sweep = auto; Detector Function = Peak.
3. Keep the EUT in transmitting at lowest, medium and highest channel individually. Record the max value.

10.2 Test Result

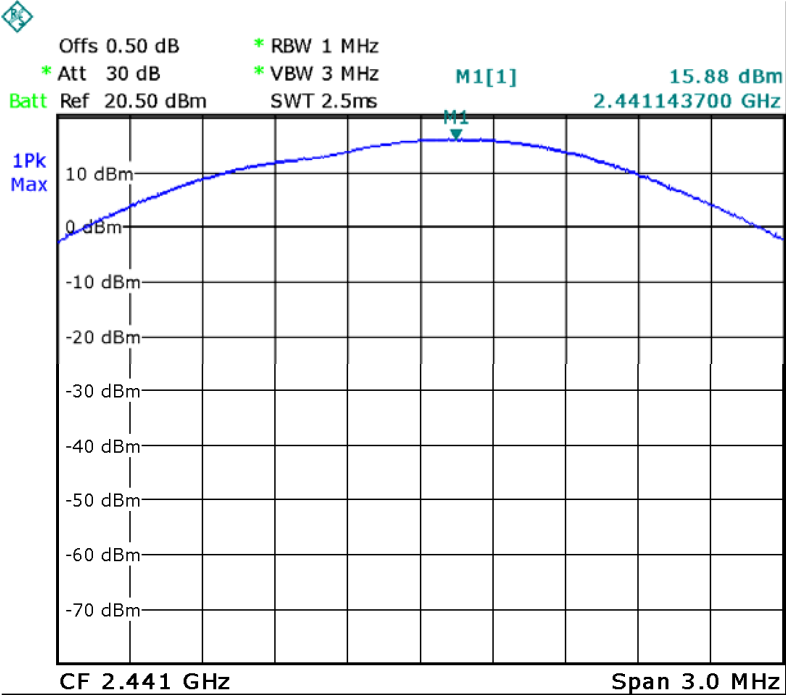
Test Channel	Output Power (dBm)	Limit (dBm)
Low	13.55	20.97
Middle	15.88	20.97
High	16.72	20.97

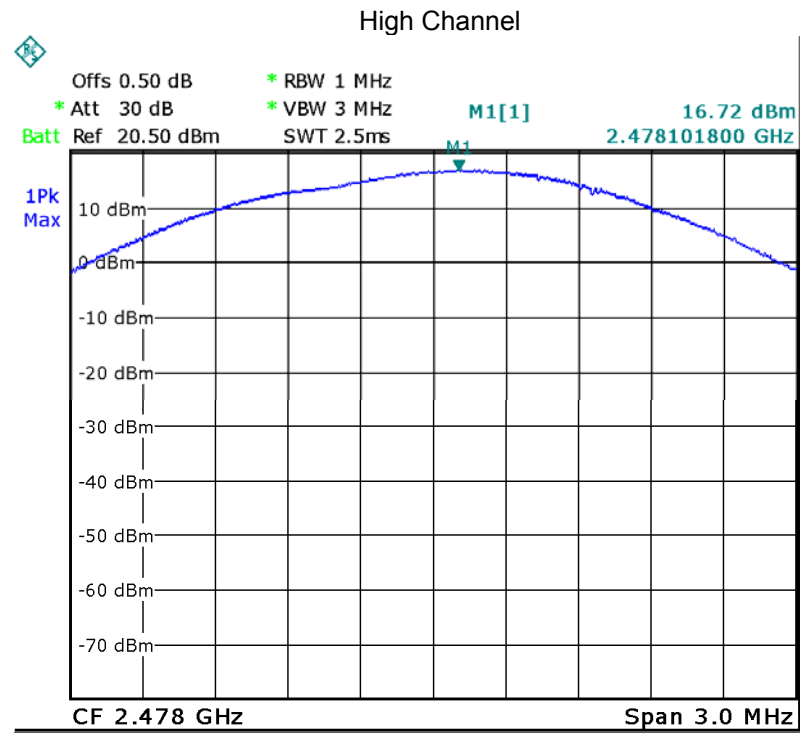
Test plots

Low Channel



Middle Channel





11 Hopping Channel Separation

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	DA 00-705
Test Limit:	Regulation 15.247(a)(1) Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 1W.
Test Mode:	Test in hopping transmitting operating mode.

11.1 Test Procedure

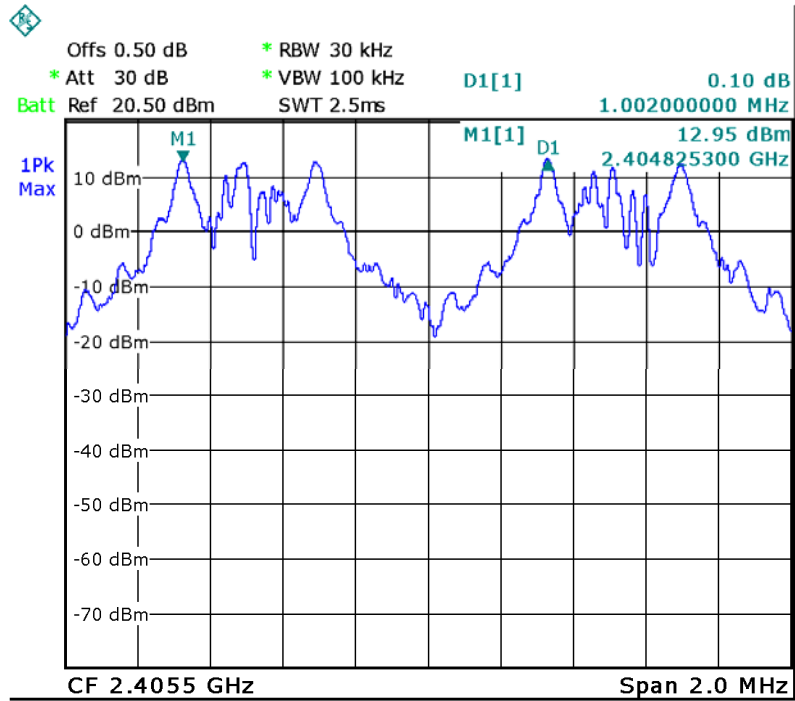
1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW = 30kHz. VBW = 100kHz , Span = 2.0MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels. The limit is specified in one of the subparagraphs of this Section Submit this plot.

11.2 Test Result

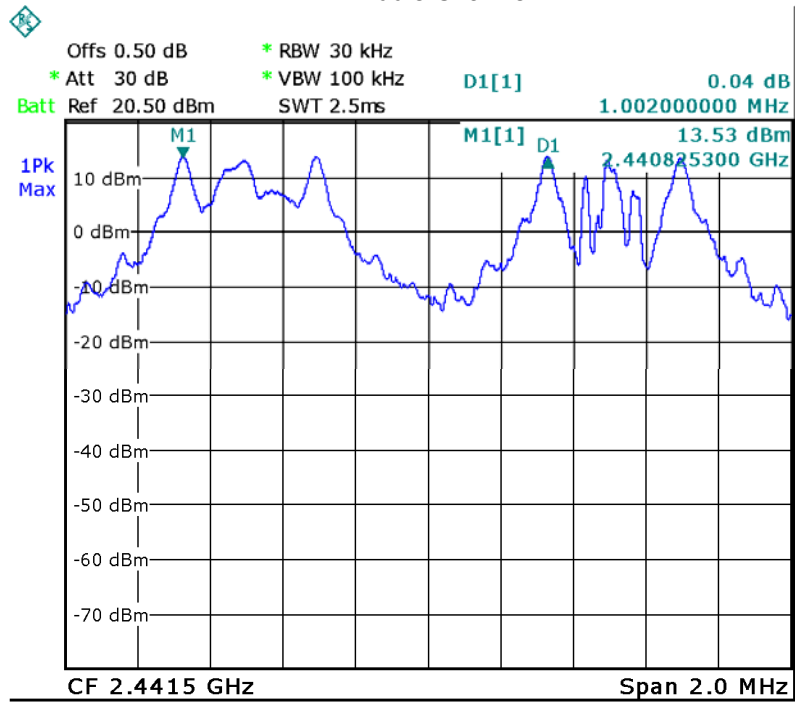
Test Channel	Separation (MHz)	Result
Low	1.002	PASS
Middle	1.002	PASS
High	1.002	PASS

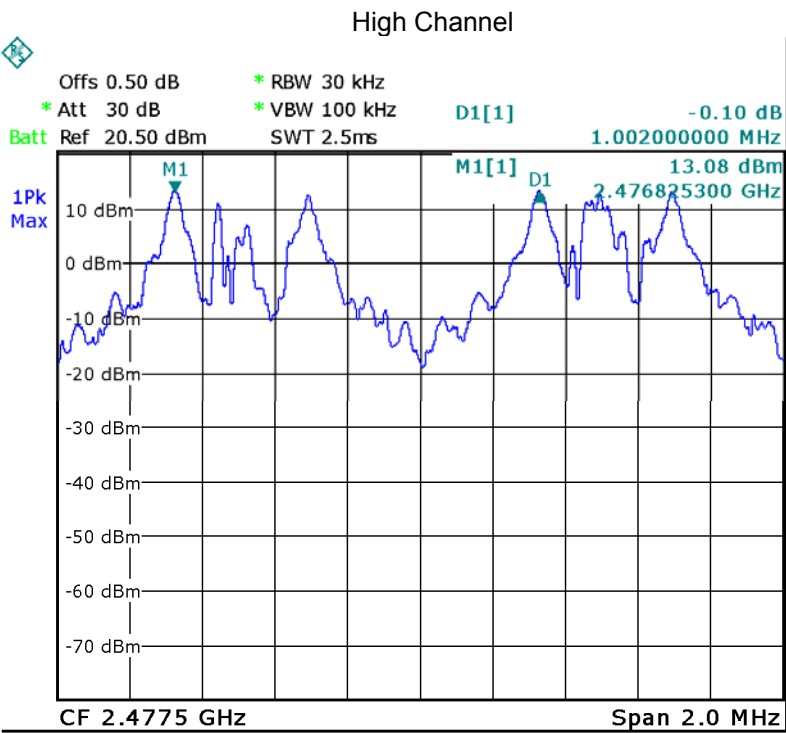
Test plots

Low Channel



Middle Channel





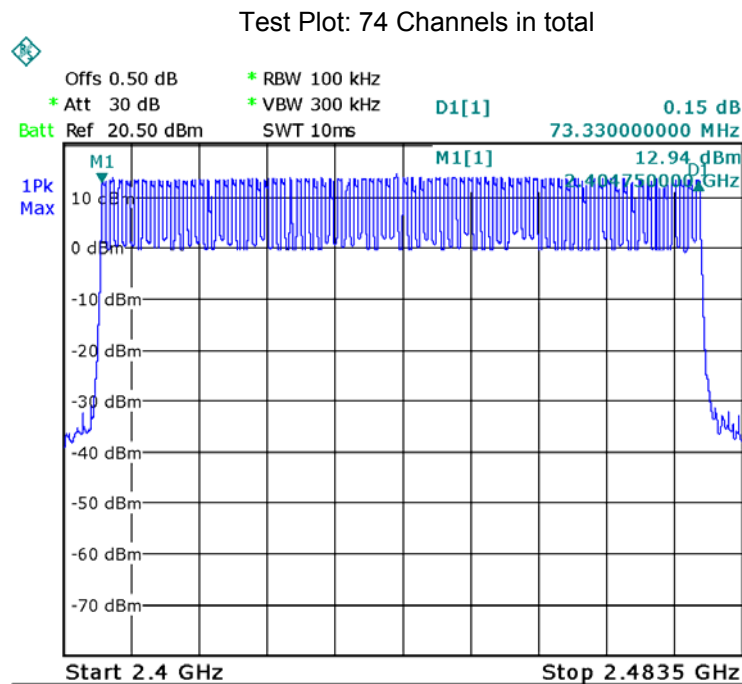
12 Number of Hopping Frequency

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	DA 00-705
Test Limit:	Regulation 15.247 (a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.
Test Mode:	Test in hopping transmitting operating mode.

12.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set the spectrum analyzer: RBW =100MHz. VBW =300MHz. Sweep = auto; Detector Function = Peak. Trace = Max hold.
3. Allow the trace to stabilize. It may prove necessary to break the span up to sections. in order to clearly show all of the hopping frequencies. The limit is specified in one of the subparagraphs of this Section.
4. Set the spectrum analyzer: Start Frequency = 2.4GHz, Stop Frequency = 2.483GHz. Sweep=auto;

12.2 Test Result



13 Dwell Time

Test Requirement:	FCC CFR47 Part 15 Section 15.247
Test Method:	DA 00-705
Test Limit:	Regulation 15.247(a)(1)(iii) Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels. The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.
Test Mode:	Test in hopping transmitting operating mode.

13.1 Test Procedure

1. Remove the antenna from the EUT and then connect a low RF cable from the antenna port to the spectrum.
2. Set spectrum analyzer span = 0. Centred on a hopping channel;
3. Set RBW = 1MHz and VBW = 3MHz. Sweep = as necessary to capture the entire dwell time per hopping channel.
4. Use the marker-delta function to determine the dwell time. If this value varies with different modes of operation (e.g.. data rate. modulation format. etc.). repeat this test for each variation. The limit is specified in one of the subparagraphs of this Section. Submit this plot(s).

13.2 Test Result

The test period: $T = 0.4(s) * 74 = 29.6 (s)$

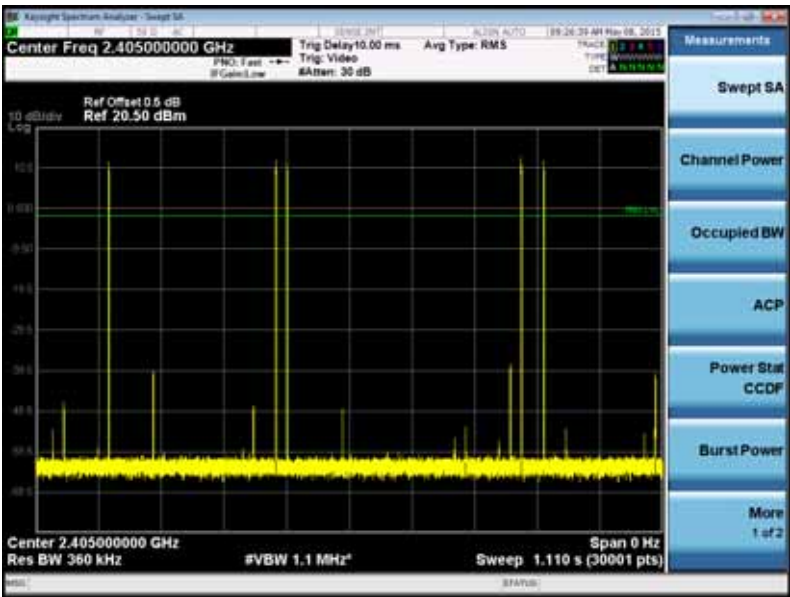
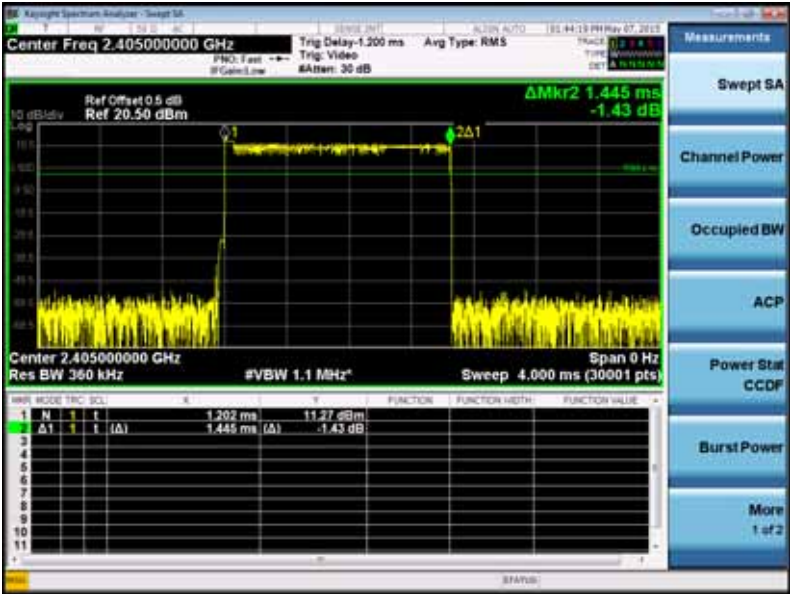
So, the Dwell Time can be calculated as follows:

Low channel: Dwell Time $= 4(\text{times}) / 1.11(s) * 1.446(\text{ms}) * 29.6(s) = 0.154(s)$

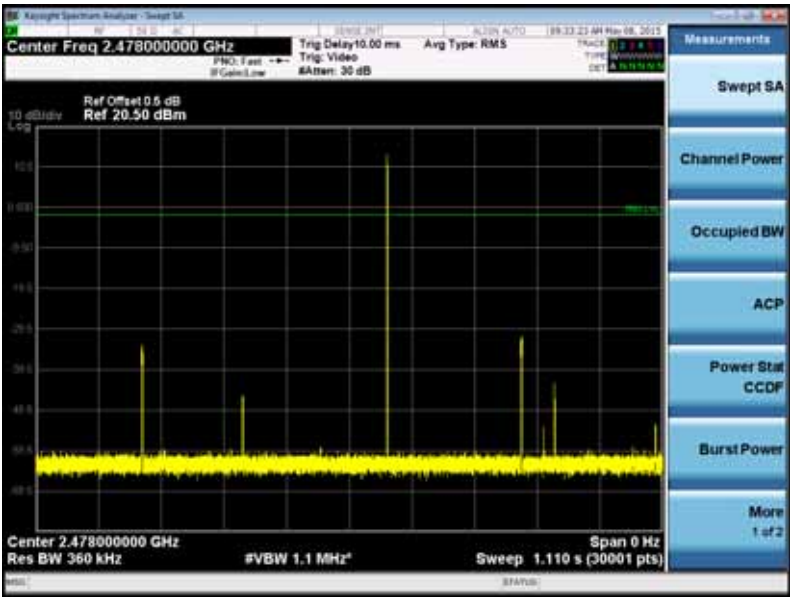
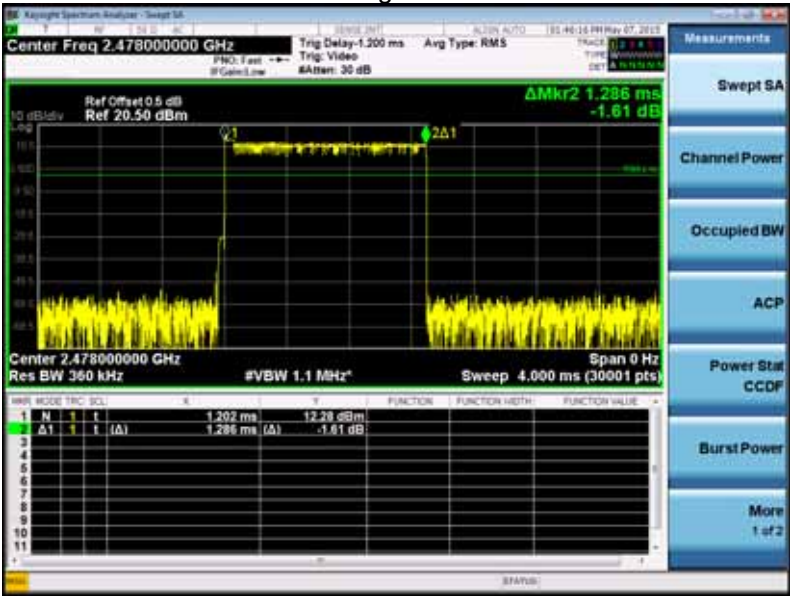
High Channel: Dwell Time $= 1(\text{times}) / 1.11(s) * 1.286(\text{ms}) * 29.6(s) = 0.034(s)$

Channel	Mkr Delta(ms)	Dwell Time(s)	Limits(s)	Result
Low	1.446	0.154	0.400	Pass
High	1.286	0.034	0.400	Pass

Test Plots
Low Channel



High Channel



14 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. This product has a internal permanent antenna, fulfil the requirement of this section.

15 RF Exposure

Test Requirement: FCC Part 1.1307

Evaluation Method 447498 D01 General RF Exposure Guidance v05r02

15.1 Requirements

1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$$\left[\frac{\text{max. power of channel, including tune-up tolerance, mW}}{\text{min. test separation distance, mm}} \right] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0 \text{ for 1-g SAR and } \leq 7.5 \text{ for 10-g extremity SAR where}$$

1. $f(\text{GHz})$ is the RF channel transmit frequency in GHz
2. Power and distance are rounded to the nearest mW and mm before calculation
3. The result is rounded to one decimal place for comparison

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

15.2 The procedures / limit

Conducted Peak power(dBm)	Conducted Peak power(mW)	Source-based time-averaged maximum conducted output power(mW)	Minimum test separation distance required for the exposure conditions (mm)	SAR Test Exclusion Thresholds(mW)
16.72	46.99	3.289	5	10

Remark: Max. duty factor is 0.07.

Calculation formula: Source-based time-averaged maximum conducted output power(mW) = Conducted peak power(mW)*0.07

The minimum test separation distance from extremity is 5mm.

16 Photographs – Model PRB13004 Test Setup

16.1 Photograph – Radiation Spurious Emission Test Setup

Below 30MHz at Test Site 2#



30MHz-1GHz at Test Site 2#



Above 1GHz at Test Site 1#



17 Photographs - Constructional Details

17.1 Model PRB13004 External View

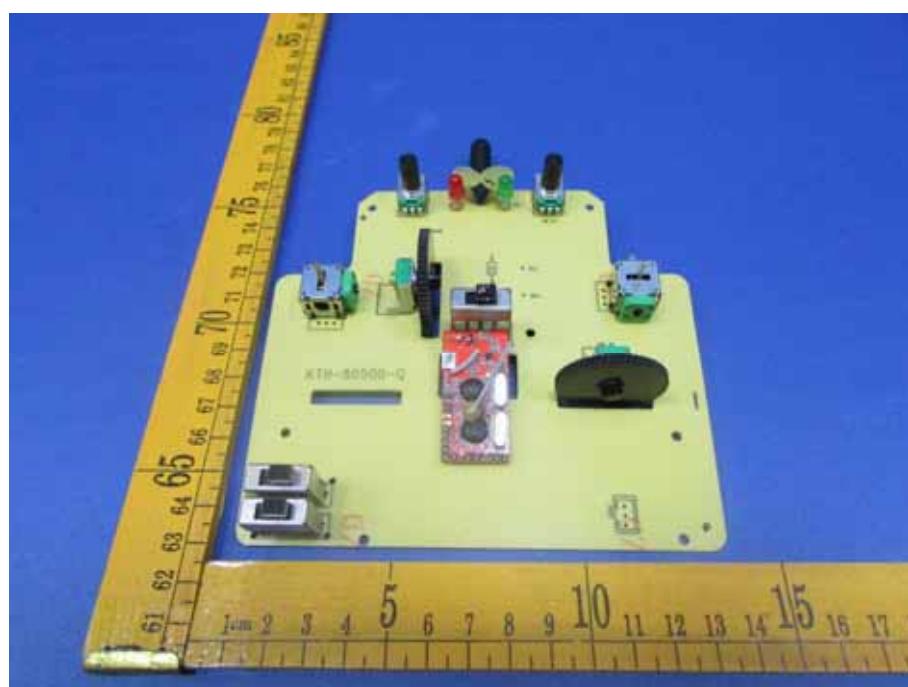


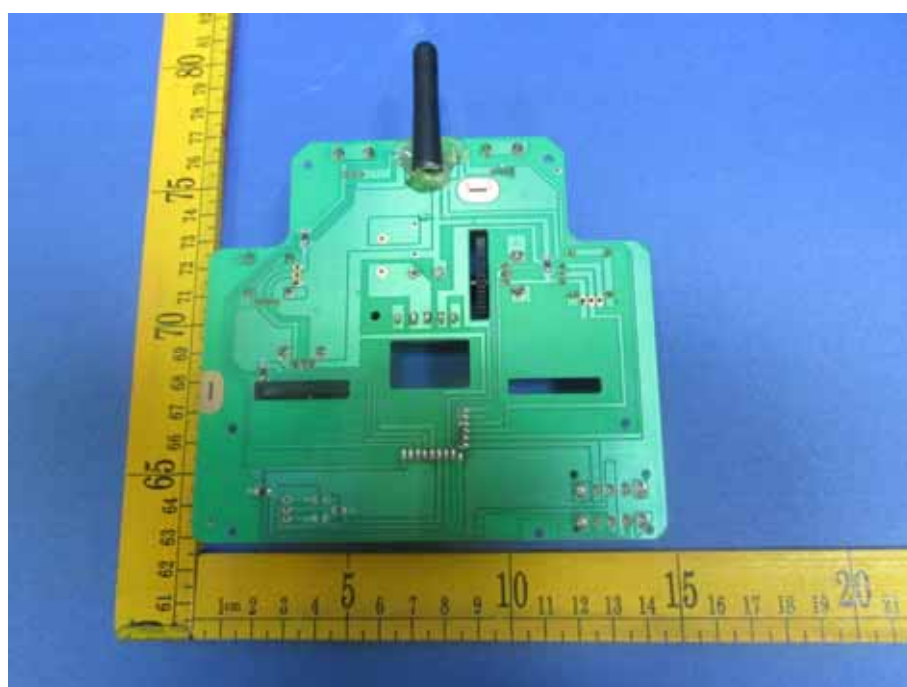
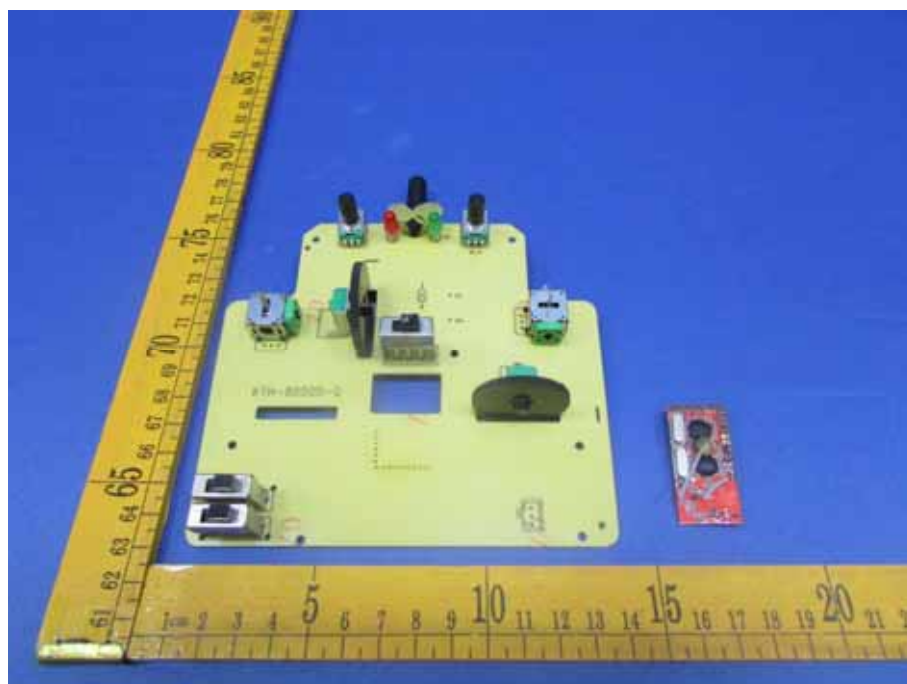




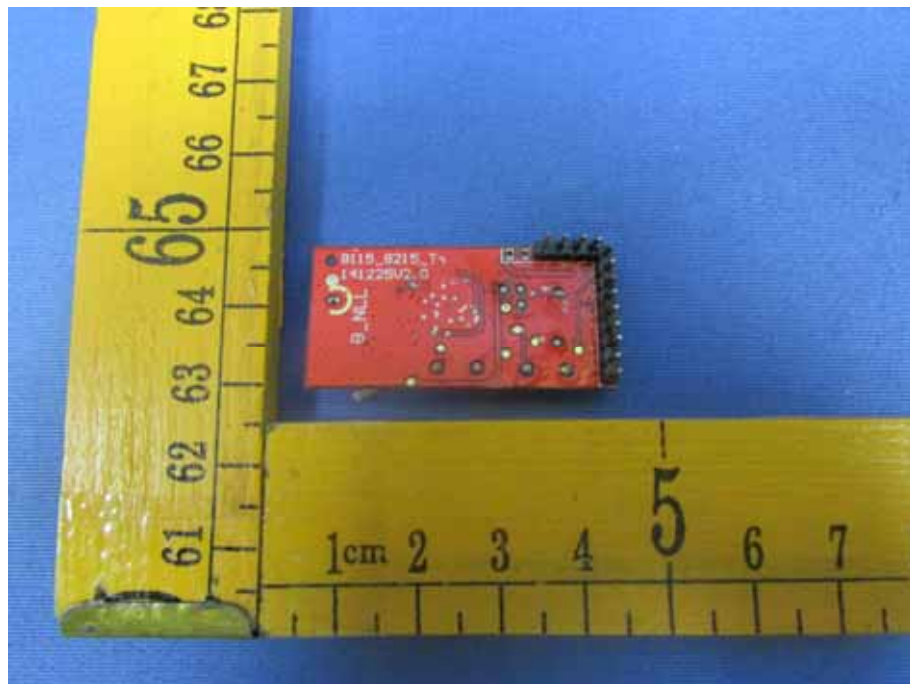
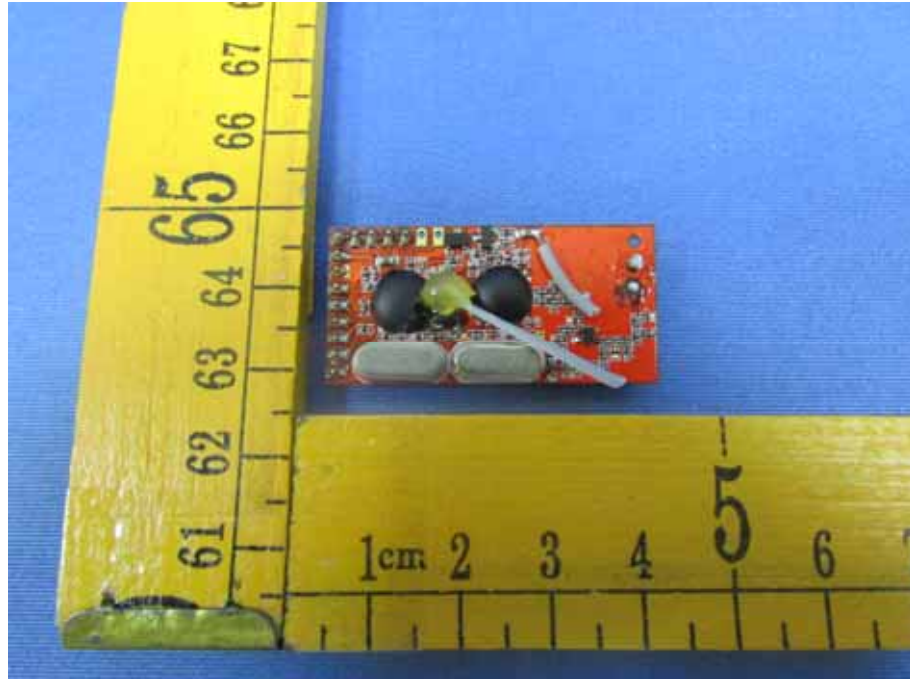
17.2 Model PRB13004 Internal View







RF module



===== End of Report =====