FCC PART 15.247

EMI MEASUREMENT AND TEST REPORT

For

Hobby Products International Inc.

70 Icon Street Foothill Ranch, CA 92610-3000 USA

FCC ID: Y9XHPIRACING00002

March 24, 2012

This Report Concerns: Original Report	Equipment Type： 3CH 2.4GHz FHSS RADIO SYSTEM
Test Engineer:	Jack Liu
Report No.:	BST12020234Y-1ER-3
Receive EUT Date/Test Date:	March 19, 2012/ March 20-24, 2012
Reviewed By:	Christina
Prepared By:	**Shenzhen BST Technology Co.,Ltd.** 3F,Weames Technology Building, No. 10 Kefa Road,Science Park, Nanshan District,Shenzhen,Guangdong,China Tel: 0755-26747751～3 Fax: 0755-26747751～3 ext.826

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1. GENERAL INFORMATION

1.1. Report information

1.1.1.This report is not a certificate of quality; it only applies to the sample of the specific product/equipment given at the time of its testing. The results are not used to indicate or imply that they are application to the similar items. In addition, such results must not be used to indicate or imply that BST approves recommends or endorses the manufacture, supplier or use of such product/equipment, or that BST in any way guarantees the later performance of the product/equipment.

1.1.2.The sample/s mentioned in this report is/are supplied by Applicant, BST therefore assumes no responsibility for the accuracy of information on the brand name, model number, origin of manufacture or any information supplied.

Additional copies of the report are available to the Applicant at an additional fee. No third part can obtain a copy of this report through BST, unless the applicant has authorized BST in writing to do so.

1.1.3.The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in fcc test method **DA 00-705** and the energy emitted by the sample EUT tested as described in this report is in compliance with FCC Rules Part 15.247.

Test Facility -
The test site used to collect the radiated data is located on the address of
SinTek Laboratory Co.,Ltd.
(FCC Registered Test Site Number: 963441) on
No.7, Xinshidai Industrial, Guantian Village, Shiyan Town, Baoan District, Shenzhen, Guangdong 518108, China
The Test Site is constructed and calibrated to meet the FCC requirements.

1.2. Measurement Uncertainty

Available upon request.

2. PRODUCT DESCRIPTION

2.1. EUT Description

Applicant	:	Hobby Products International Inc.
Address	:	70 Icon Street Foothill Ranch, CA 92610-3000 USA
Manufacturer	:	Shanghai Merit Technology Corp.
Address	:	NO.1058 TAOGAN ROAD, SHESHAN, SONGJIANG, SHANGHAI, CHINA
EUT Description	:	3CH 2.4GHz FHSS RADIO SYSTEM
Power Supply	:	DC 6V (“AA” batteries 4×)
Trade Name	:	HPI RACING
Modulation	:	FHSS
Frequency Range	:	2407-2477MHz
Number of Channels	:	71
Model Number	:	TF-40
Antenna Type	:	Integral Antenna
Antenna gain	:	2dBi

2.2. Block Diagram of EUT Configuration

Figure 1 EUT Setup of TX mode

2.3. Support Equipment List

Table 2 Ancillary Equipment

Name	Model No	S/N	Manufacturer	Used "√"
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2.4. Test Conditions

Temperature: 23~25℃
Relative Humidity: 50~63 %

3. FCC ID LABEL

Label size:57.7x31mm

Label Location on EUT

EUT View/ FCC ID Label Location

4. TEST RESULTS SUMMARY

FCC 15 Subpart C,Paragraph 15.247

FCC Rules	Description of Test	Result
§15.247 (i), §1.1307 (b)(1)	Maximum Permissible Exposure (MPE)	Compliant
§15.203	Antenna Requirement	Compliant
§15.207 (a)	Conducted Emissions	N/A
§15.205, §15.209, §15.247(d)	Radiated Emissions	Compliant
§15.247 (a)(1)	20 dB Bandwidth	Compliant
§15.247(a)(1)	Channel Separation Test	Compliant
§15.247(a)(1)(iii)	Time of Occupancy (Dwell Time)	Compliant
§15.247(a)(1)(iii)	Quantity of hopping channel Test	Compliant
§15.247(b)(1)	Peak Output Power Measurement	Compliant
§15.247(d)	Band Edges	Compliant

Remark: “N/A” means “Not applicable”.

Statement: All testing was performed using the test procedures found in ANSI C63.4-2003.

Modifications

No modification was made.

5. TEST EQUIPMENT USED

Equipment/Facilities	Manufacturer	Model #	Serial no.	Date of Cal.	Cal. Interval
Cable	Resenberger	N/A	NO.1	Mar 10，2012	1 Year
Cable	SCHWARZBECK	N/A	NO.2	Mar 10，2012	1 Year
Cable	SCHWARZBECK	N/A	NO.3	Mar 10，2012	1 Year
LISN	Rohde＆Schwarz	ESH3-Z5	100305	Mar 10，2012	1 Year
50Ω Coaxial Switch	ANRITSU CORP	MP59B	6200283933	Mar 10，2012	1 Year
EMI Test Receiver	Rohde＆Schwarz	ESP13	100180	Oct.11,2011	1 Year
Spectrum Analyzer	Rohde＆Schwarz	FSP40	100273	Sep.10,2011	1 Year
3m Semi-Anechoic Chamber	Albatross Projects	9m×6m×6m	N/A	Feb.20,2012	1 Year
Signal Generator	FLUKE	PM5418 + Y/C	LO747012	Feb.20,2012	1 Year
Signal Generator	FLUKE	PM5418TX	LO738007	Feb.20,2012	1 Year
Loop Antenna	SCHWARZBECK	FMZB1516	113	Jan.30,2012	1 Year
Trilog-Super Broadband Antenna	SCHWARZBECK	VULB9161	9161-4079	Sep.22,2011	1 Year
Broad-Band Horn Antenna	SCHWARZBECK	BBHA9120D	9120D-564	Sep.22,2011	1 Year
Ultra Broadband Antenna	Rohde＆Schwarz	HL-562	100110	June.15,2011	1 Year
Horn Antenna	Schwarzbeck	BBHA9170	208 279	May 12, 2011	1 Year
AMN	Rohde＆Schwarz	ESH3-Z5	100196	Oct.11,2011	1 Year
AMN	Rohde＆Schwarz	ESH3-Z5	100197	Oct.11,2011	1 Year
Pulse Limiter	Rohde＆Schwarz	ESH3-Z2	N/A	N/A	N/A
Power Meter	Rohde＆Schwarz	NRVD	100041	Feb.20,2012	1 Year
EMI Test Receiver	Rohde＆Schwarz	ESCS30	100003	Feb.20,2012	1 Year
Coaxial Cable with N-connectors	SCHWARZBECK	AK9515H	95549	Sep.22,2011	1 Year
Radio Communication Test Set	Rohde＆Schwarz	CMS 54	846621/024	Feb.20,2012	1 Year
Modulation Analyzer	Hewlett-Packard	8901B	2303A00362	Feb.20,2012	1 Year
Absorbing clamp	Rohde＆Schwarz	MDS-21	N/A	Oct.11,2011	1 Year

6. SECTIONS 15.247 (I), 1.1307 (B) (1) - MaximuM Permissible exposure (MPE)

6.1. Standard Applicable

According to subpart 15.247 (i) and subpart 1.1307 (b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

Limits for General Population/Uncontrolled Exposure

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Averaging Time (minute)
Limits for General Population/Uncontrolled Exposure				
0.3–3.0	614	1.63	*(100)	30
3.0–30	824/f	2.19/f	*(180/f2)	30
30–300	27.5	0.073	0.2	30
300–1500	/	/	f/1500	30
1500–100,000	/	/	1.0	30

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

6.2. Test Data

Prediction of MPE limit at a given distance

Equation from page 18 of OET Bulletin 65, Edition 97-01

$S = PG/4\pi R^2$
S: Power density, in mW/cm^2
P: Power input to the antenna, in mW
G: numeric gain of the antenna
R: distance to the center of the antenna, in cm

Maximum peak output power at antenna input terminal (dBm):	11.92
Maximum peak output power at antenna input terminal (mW):	15.56
Prediction distance (cm):	20
Prediction frequency (MHz):	2477
Antenna Gain, typical (dBi):	2
Maximum Antenna Gain (numeric):	1.58
Power density at predication frequency and distance (mW/cm^2):	0.0049
MPE limit for Occupational exposure at predication frequency (mW/cm^2):	1.0

6.3. Test Result

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, Human proximity to the antenna shall not be less than 20cm(8 inches) during normal operation.

7. SECTION 15.203 - ANTENNA REQUIREMENT

7.1. Standard Applicable

According to § 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 user of a standard antenna jack or electrical connector is prohibited. The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

a. Antenna must be permanently attached to the unit.
b. Antenna must use a unique type of connector to attach to the EUT.

Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

And according to FCC 47 CFR section 15.247 (b), if the 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 6 dBi.

7.2. Antenna Connector Construction

The antenna is soldered to PCB. The antenna is permanently attached and unique antenna. Refer to the product photo.

8. SECTION 15.207 - CONDUCTED EMISSIONS

8.1. Applicable Standard

The specification used was with the FCC Part 15.207 limits.

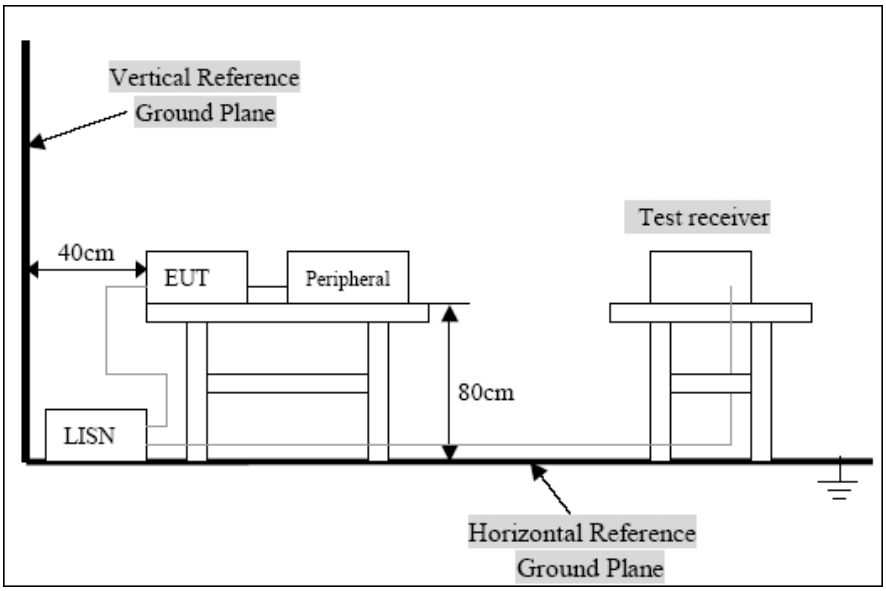
8.2. Test Procedure

During the conducted emission test, the EUT was connected to the outlet of the LISN. Maximizing procedure was performed on the six (6) highest emissions of the EUT. All data was recorded in the Quasi-peak and average detection mode.

8.3. Conducted Power line Emission Limits

FCC Part 15 Paragraph 15.207 (dBuV)		
Frequency Range (MHZ)	Class A QP/AV	Class B QP/AV
0.15-0.5	79/66	65-56/56-46
0.5-5.0	73/60	56-46
5.0-3.0	73/60	60-50

8.4. Block Diagram of Test Setup



8.5. Test Result

N/A.

The EUT has no connection to AC mains. Therefore, the test is not applicable.

9. SECTIONS 15.209, 15.205, 15.247(D) - RADIATED EMISSIONS

9.1. Test Equipment

Please refer to section 5 this report.

9.2. Test Procedure

The EUT and its simulators are placed on a turntable, which is 0.8 meter high above ground. The turntable can rotate 360 degrees to determine the position of the maximum emission level. EUT is set 3.0 meters away from the receiving antenna, which is mounted on an antenna tower. The antenna can be moved up and down between 1.0 meter and 4 meters to find out the maximum emission level. Broadband antenna (calibrated bilog antenna) is used as receiving antenna. Both horizontal and vertical polarizations of the antenna are set on measurement. In order to find the maximum emission levels, all of the interface cables must be manipulated according to ANSI C63.4: 2003 on radiated emission measurement.

The bandwidth of test receiver is set at 9kHz in below 30MHz. and set at 120kHz in 30-1000MHz, and 1MHz in above 1000MHz.

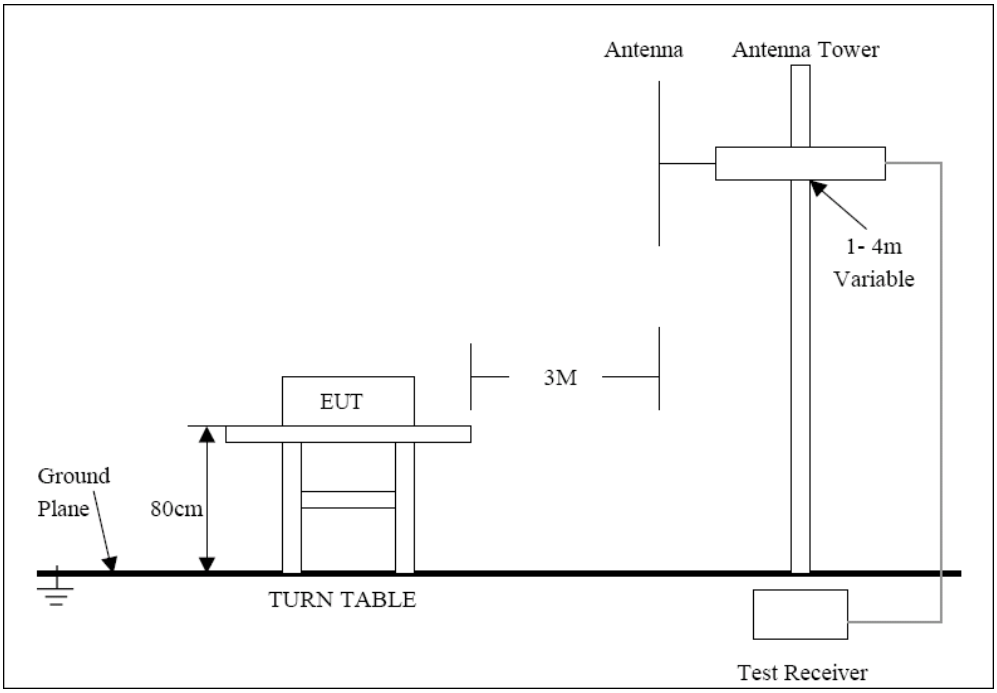
The frequency range from 9kHz to 25GHz is checked.

The final measurement in band 9-90kHz, 110-490kHz and above 1000MHz is performed with Peak detector and Average detector. Except those frequency bands mention above, the final measurement for frequencies below 1000MHz is performed with Quasi Peak detector.

Through three orthogonal axes to determine which attitude and equipment arrangement produces the highest emission relative to the limit.

The out of band emission tests were performed in the 3-meter chamber test site, using the setup accordance with the ANSI C63.4-2003. The specification used was the FCC Part Subpart C limits. The EUT was tested in 3 orthogonal planes.

9.3. Radiated Test Setup



For the accrual test configuration,pleas refer to the related items-photos of Testing.

9.4. Radiated Emission Limit

Frequency (MHz)	Limit			
	Field Strength of Quasi-peak Value (microvolts/m)	Field Strength of Quasi-peak Value (dBμV/m)	Measurement distance (m)	The final measurement in band 9-90kHz, 110-490kHz and above 1000MHz is performed with Average detector. Except those frequency bands mention above, the final measurement for frequencies below 1000MHz is performed with Quasi Peak detector.
0.009 - 0.490	2400/F(kHz)	/	300	
0.490 - 1.705	24000/F(kHz)	/	30	
1.705-30	30	29.5	30	
30 - 88	100	40	3	
88 - 216	150	43.5	3	
216 - 960	200	46	3	
Above 960	500	54	3	

Note: (1) RF Voltage (dBuV)=20 log Voltage(uV)
(2) In the Above Table,the tighter limit applies at the band edges.
(3) Distaqnce refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system

9.5. Radiated Emission Test Result

Pass

The frequency range from 9kHz to 25GHz is checked.

The final measurement in band 9-90kHz, 110-490kHz and above 1000MHz is performed with Peak detector and Average detector. Except those frequency bands mention above, the final measurement for frequencies below 1000MHz is performed with Quasi Peak detector.

Date of Test:	March 22, 2012	Temperature:	25°C
EUT:	3CH 2.4GHz FHSS RADIO SYSTEM	Humidity:	52%
Model No.:	TF-40	Power Supply:	DC 6V
Test Mode:	Normal Link	Test Engineer:	Jack Liu

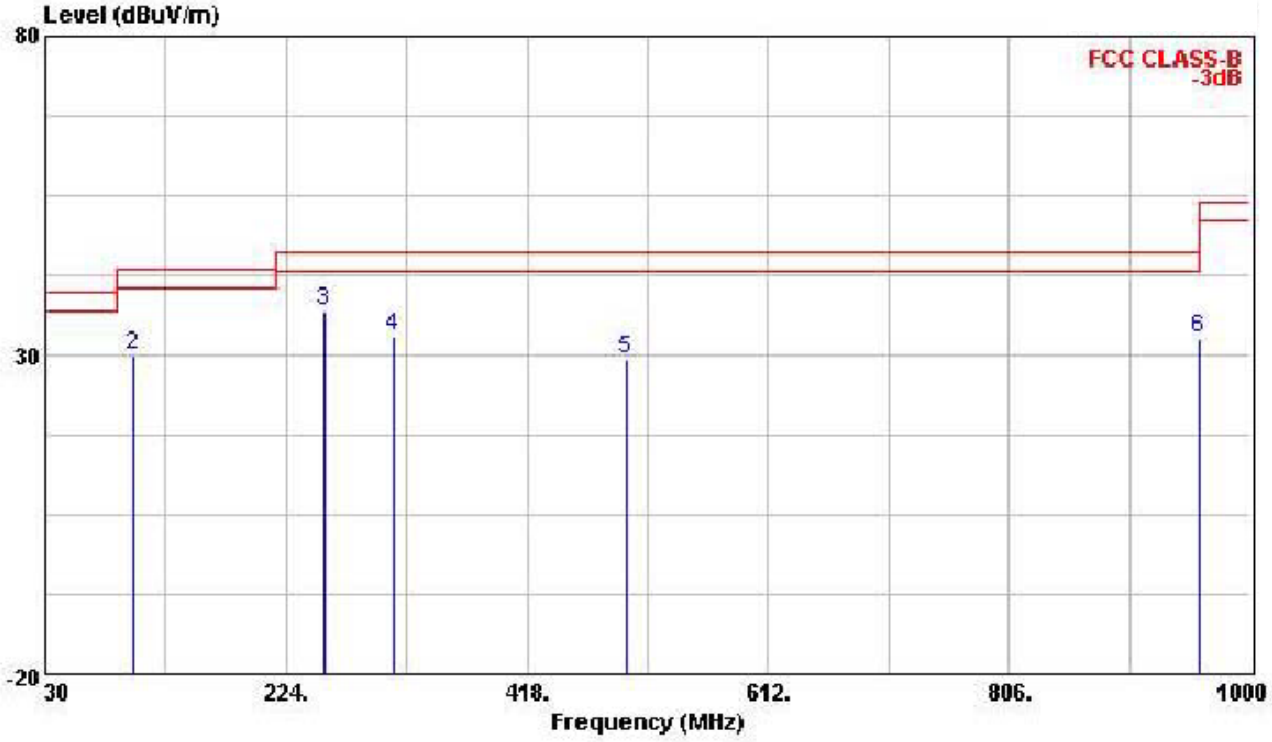
For Below 1000MHz

Corrected Factor = Antenna Factor + Cable Loss – Amplifier Gain

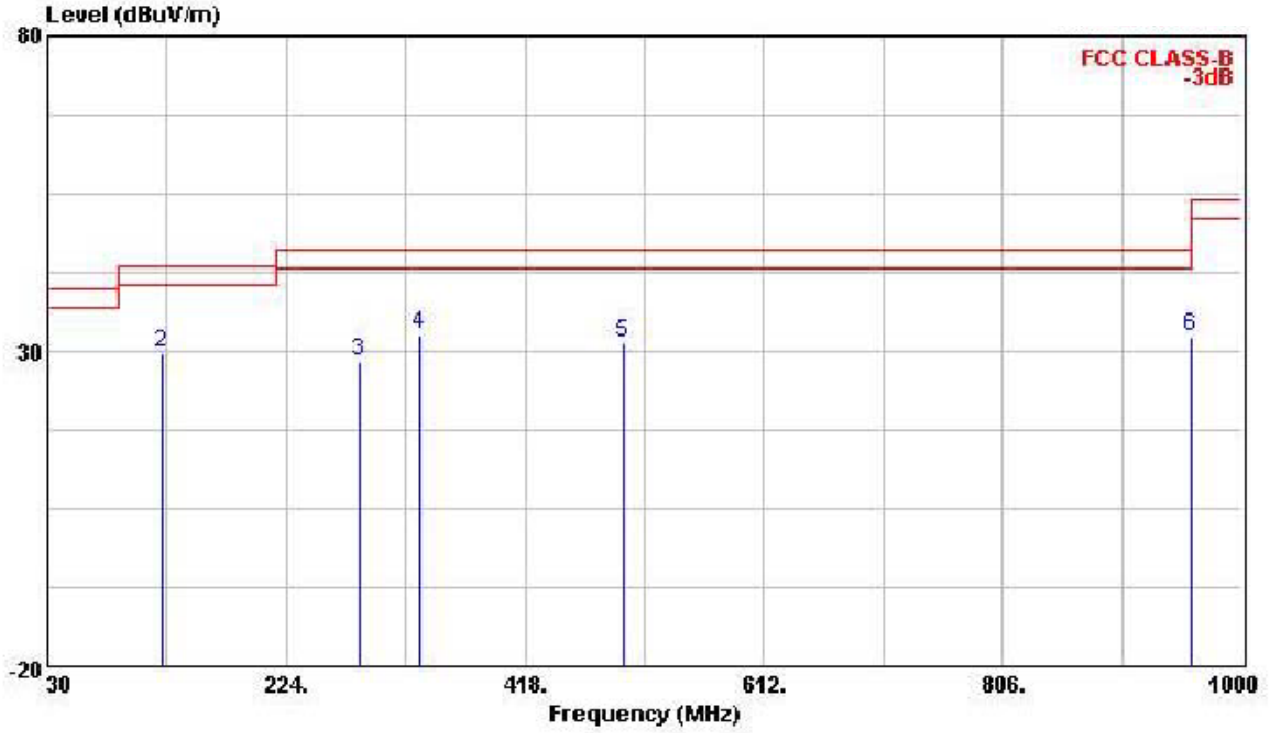
Frequency (MHz)	Reading (dBμV/m)	Factor Corr. (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Polarization
	QP		QP	QP	QP	
30.000	43.34	-8.19	35.15	40.00	-4.85	Vertical
101.780	44.69	-14.64	30.05	43.50	-13.45	Vertical
254.070	49.30	-3.30	36.83	46.00	-9.17	Vertical
311.300	44.24	-1.76	32.81	46.00	-13.19	Vertical
498.510	36.25	-7.07	29.18	46.00	-16.82	Vertical
959.260	35.47	-2.69	32.78	46.00	-13.22	Vertical
30.000	42.35	-8.19	34.16	40.00	-5.84	Horizontal
122.150	43.19	-13.41	29.78	43.50	-13.72	Horizontal
284.140	40.69	-12.24	28.45	46.00	-17.55	Horizontal
331.670	43.58	-10.94	32.64	46.00	-13.36	Horizontal
497.540	38.37	-7.11	31.26	46.00	-14.74	Horizontal
959.260	34.93	-2.69	32.24	46.00	-13.76	Horizontal

Note: 1. Emissions attenuated more than 20 dB below the permissible value are not reported.

Vertical



Horizontal



Date of Test:	March 22, 2012	Temperature:	25°C
EUT:	3CH 2.4GHz FHSS RADIO SYSTEM	Humidity:	52%
Model No.:	TF-40	Power Supply:	DC 6V
Test Mode:	TX 2407MHz	Test Engineer:	Jack Liu

For Below 1000MHz

Corrected Factor = Antenna Factor + Cable Loss – Amplifier Gain

Frequency (MHz)	Reading (dBμV/m)	Factor Corr. (dB)	Result (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Polarization
	QP		QP	QP	QP	
--	--	--	--	--	--	Vertical
--	--	--	--	--	--	Horizontal

For 1GHz-25GHz

Corrected Factor = Antenna Factor + Cable Loss – Amplifier Gain

Frequency (MHz)	Reading(dBμV/m)		Factor Corr. (dB)	Result(dBμV/m)		Limit(dBμV/m)		Margin(dBμV/m)		Polarization
	AV	PEAK		AV	PEAK	AV	PEAK	AV	PEAK	
4814.000	44.24	61.60	4.57	48.81	66.17	54.00	74.00	-5.19	-7.83	Vertical
7221.000	38.15	61.36	6.44	44.59	67.80	54.00	74.00	-9.41	-6.20	Vertical
9628.000	39.47	56.88	10.54	50.01	67.42	54.00	74.00	-3.99	-6.58	Vertical
4814.000	42.17	60.58	4.57	46.74	65.16	54.00	74.00	-7.26	-8.84	Horizontal
7221.000	41.43	64.71	6.44	47.87	71.15	54.00	74.00	-6.16	-2.85	Horizontal
9628.000	38.68	56.64	10.54	49.22	67.18	54.00	74.00	-4.78	-6.82	Horizontal

Note: 1. Emissions attenuated more than 20 dB below the permissible value are not reported.

Date of Test:	March 22, 2012	Temperature:	25°C
EUT:	3CH 2.4GHz FHSS RADIO SYSTEM	Humidity:	52%
Model No.:	TF-40	Power Supply:	DC 6V
Test Mode:	TX 2442MHz	Test Engineer:	Jack Liu

For Below 1000MHz

Corrected Factor = Antenna Factor + Cable Loss – Amplifier Gain

Frequency (MHz)	Reading (dBμV/m) QP	Factor Corr. (dB)	Result (dBμV/m) QP	Limit (dBμV/m) QP	Margin (dB) QP	Polarization
--	--	--	--	--	--	Vertical
--	--	--	--	--	--	Horizontal

For 1GHz-25GHz

Corrected Factor = Antenna Factor + Cable Loss – Amplifier Gain

Frequency (MHz)	Reading(dBμV/m)		Factor Corr. (dB)	Result(dBμV/m)		Limit(dBμV/m)		Margin(dBμV/m)		Polarization
	AV	PEAK		AV	PEAK	AV	PEAK	AV	PEAK	
4884.000	42.63	65.91	4.71	47.34	70.62	54.00	74.00	-6.66	-3.38	Vertical
7326.000	33.65	56.93	7.03	40.68	63.96	54.00	74.00	-13.32	-10.0	Vertical
9768.000	34.24	57.52	11.06	45.30	68.58	54.00	74.00	-8.70	-5.42	Vertical
4884.000	43.35	66.63	4.71	48.06	71.34	54.00	74.00	-5.94	-2.66	Horizontal
7326.000	41.93	64.21	7.03	48.96	71.24	54.00	74.00	-5.04	-2.76	Horizontal
9768.000	32.97	56.25	11.06	44.04	67.32	54.00	74.00	-9.96	-6.68	Horizontal

Note: 1. Emissions attenuated more than 20 dB below the permissible value are not reported.

Date of Test:	March 22, 2012	Temperature:	25°C
EUT:	3CH 2.4GHz FHSS RADIO SYSTEM	Humidity:	52%
Model No.:	TF-40	Power Supply:	DC 6V
Test Mode:	TX 2477MHz	Test Engineer:	Jack Liu

For Below 1000MHz

Corrected Factor = Antenna Factor + Cable Loss – Amplifier Gain

Frequency (MHz)	Reading (dBμV/m) QP	Factor Corr. (dB)	Result (dBμV/m) QP	Limit (dBμV/m) QP	Margin (dB) QP	Polarization
--	--	--	--	--	--	Vertical
--	--	--	--	--	--	Horizontal

For 1GHz-25GHz

Corrected Factor = Antenna Factor + Cable Loss – Amplifier Gain

Frequency (MHz)	Reading(dBμV/m) AV	Reading(dBμV/m) PEAK	Factor Corr. (dB)	Result(dBμV/m) AV	Result(dBμV/m) PEAK	Limit(dBμV/m) AV	Limit(dBμV/m) PEAK	Margin(dBμV/m) AV	Margin(dBμV/m) PEAK	Polarization
4954.000	43.44	66.72	4.89	48.33	71.61	54.00	74.00	-5.67	-2.39	Vertical
7431.000	39.88	63.16	7.62	47.50	70.78	54.00	74.00	-6.50	-3.22	Vertical
9908.000	30.61	53.89	11.62	42.23	65.51	54.00	74.00	-11.77	-8.49	Vertical
4954.000	43.29	66.57	4.89	48.18	71.46	54.00	74.00	-5.82	-2.54	Horizontal
7431.000	41.64	63.92	7.58	49.22	71.50	54.00	74.00	-4.78	-2.50	Horizontal
9908.000	31.08	54.35	11.56	42.64	65.92	54.00	74.00	-11.36	-8.08	Horizontal

Note: 1. Emissions attenuated more than 20 dB below the permissible value are not reported.

10. SECTION 15.247(A) (1) –20DB BANWIDTH TESTING

10.1. Test Equipment

Please refer to Section 2 this report.

10.2.Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.
3. Measure the frequency difference of two frequencies that were attenuated 20 dB from the reference level. Record the frequency difference as the emission bandwidth.
4. Repeat above procedures until all frequencies measured were complete.

10.3.Applicable Standard

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 125mW.

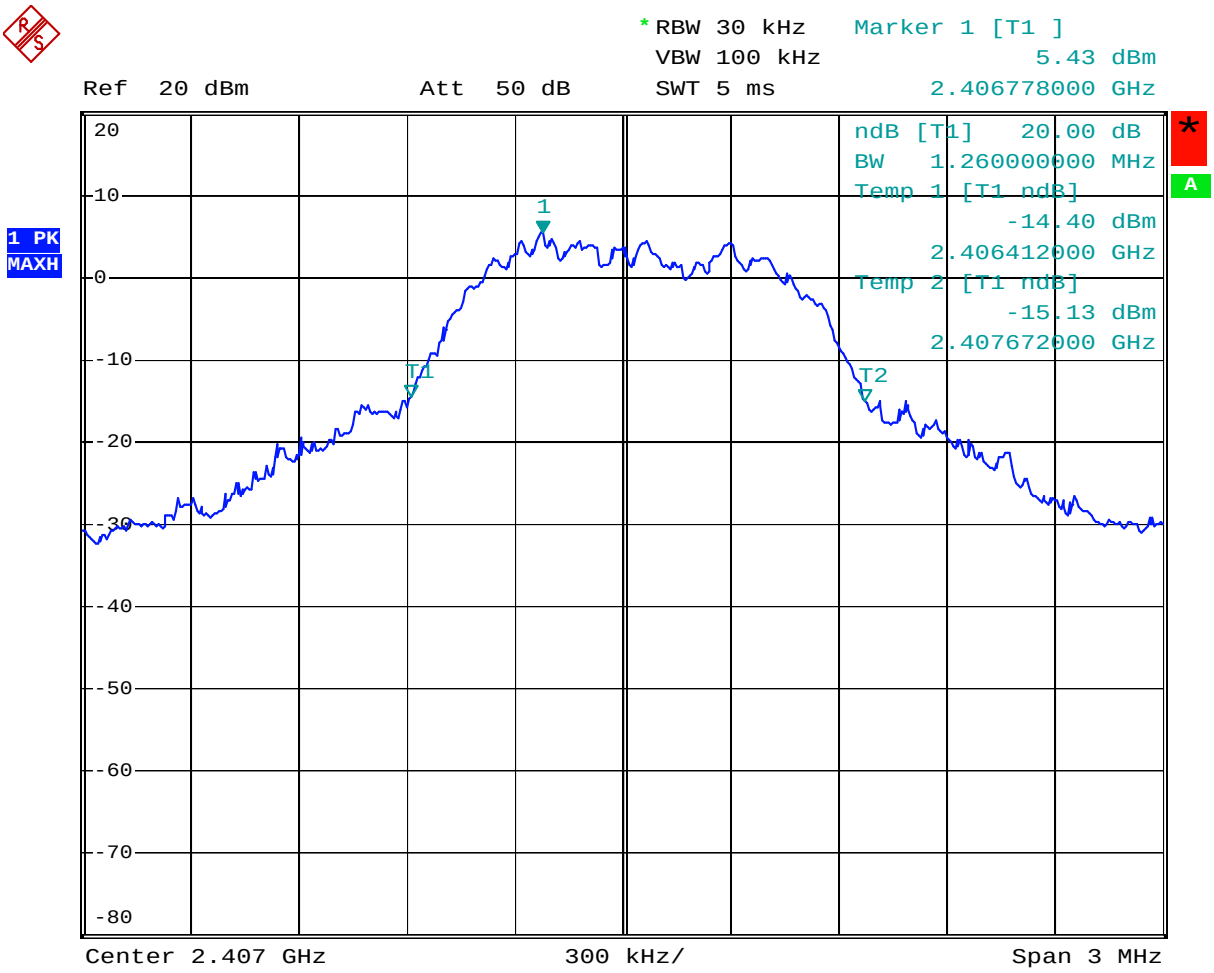
10.4. Test Result:

Pass.

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Limit (MHz)
Low	2407	1.260	---
Middle	2442	1.230	---
High	2477	1.284	---

The spectrum analyzer plots are attached as below.

Low Channel



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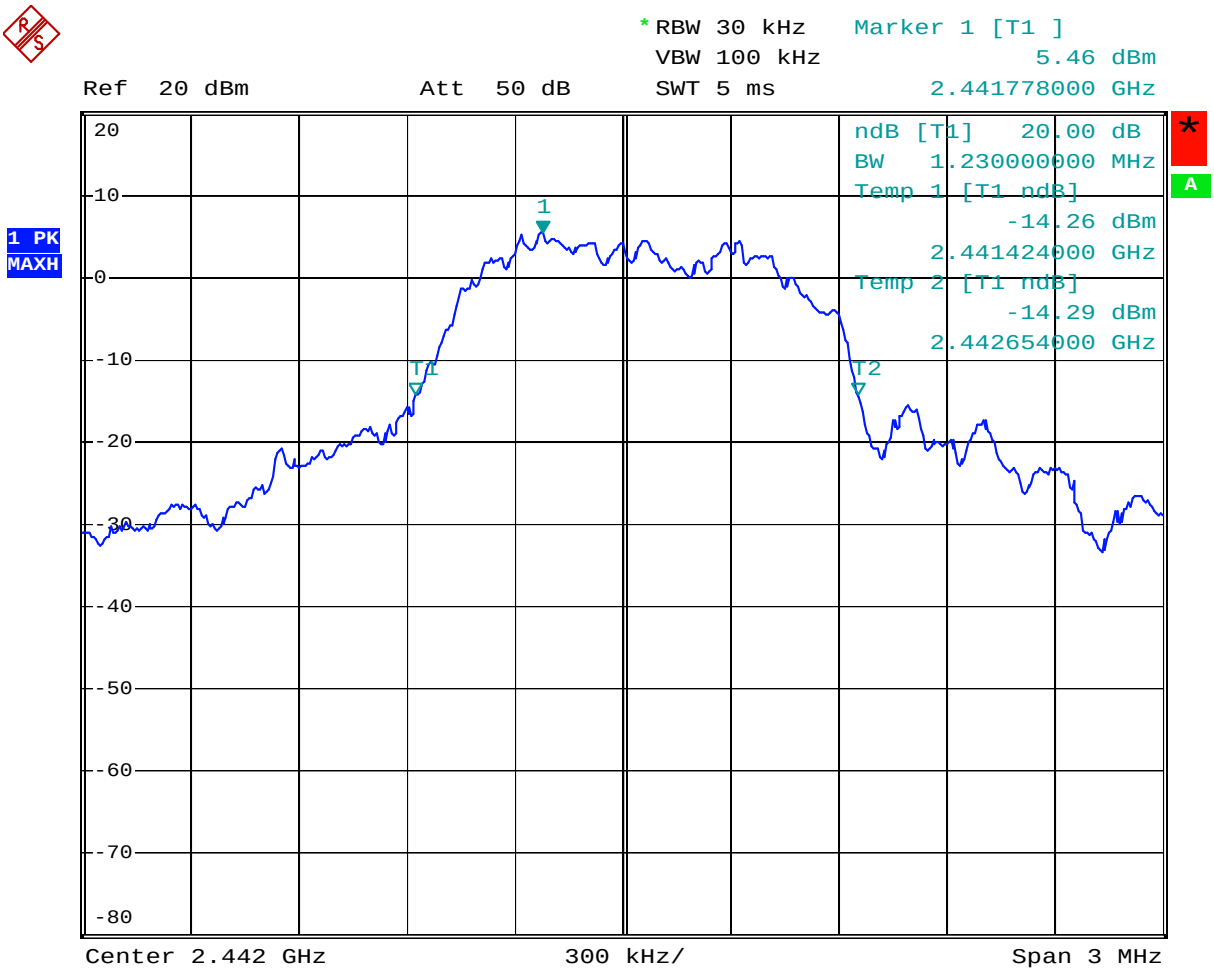
Middle Channel



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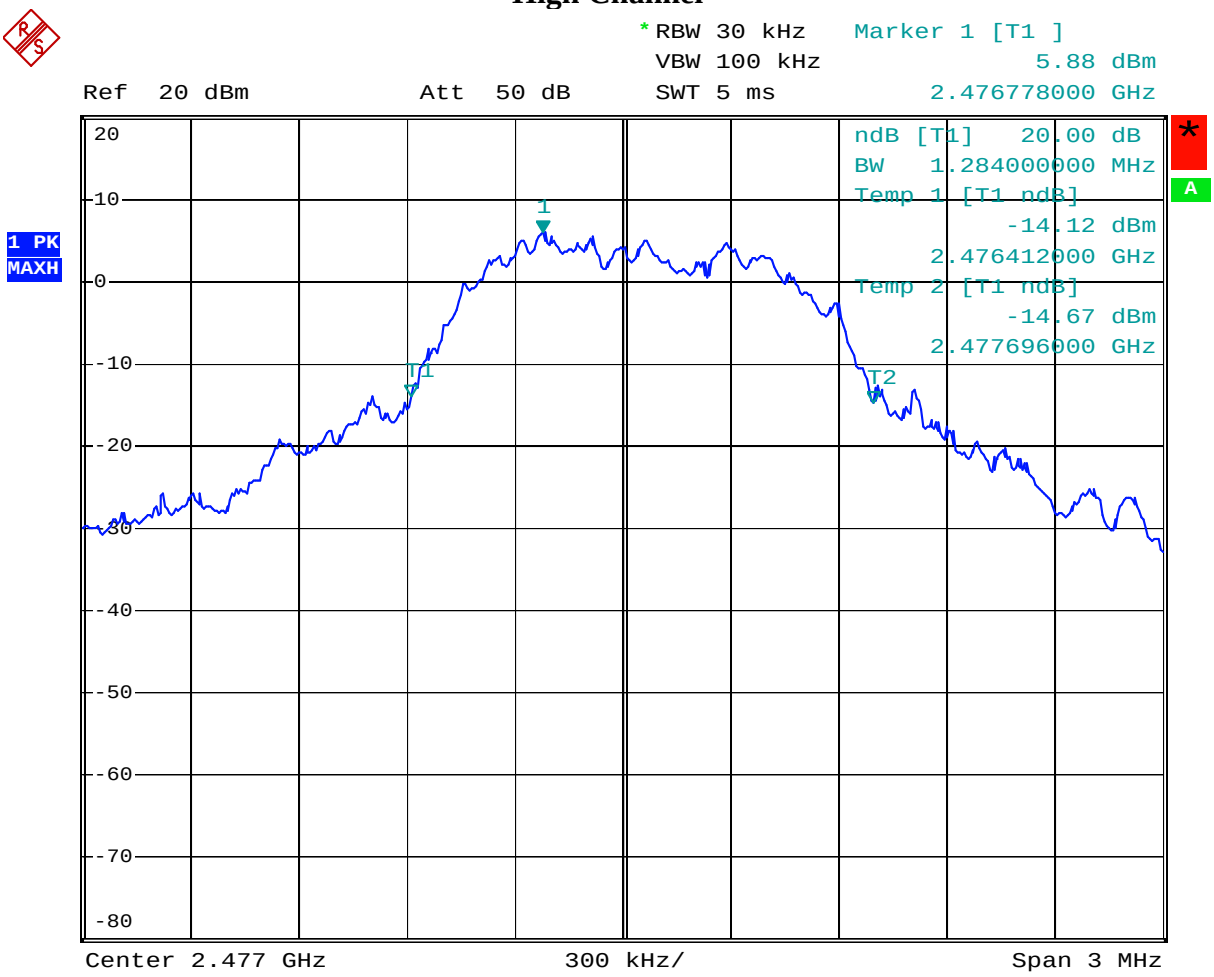
High Channel



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11. SECTION 15.247(A) (1) – CHANNEL SEPARATION TEST

11.1. Test Equipment

Please refer to section 5 this report.

11.2.Test Procedure

1. Set the EUT in transmitting mode, spectrum Bandwidth was set at 100 kHz, maxhold the channel.
2. Set the adjacent channel of the EUT maxhold another truce
3. Measure the channel separation.

11.3.Applicable Standard

Frequency hopping systems shall have hoping channel carrier frequencies separated by a minimum of 25 kHz or the 20dB 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 20dB bandwidth of the hopping channel, whichever is greater provided the systems operate with an output power no greater than 125 mW.

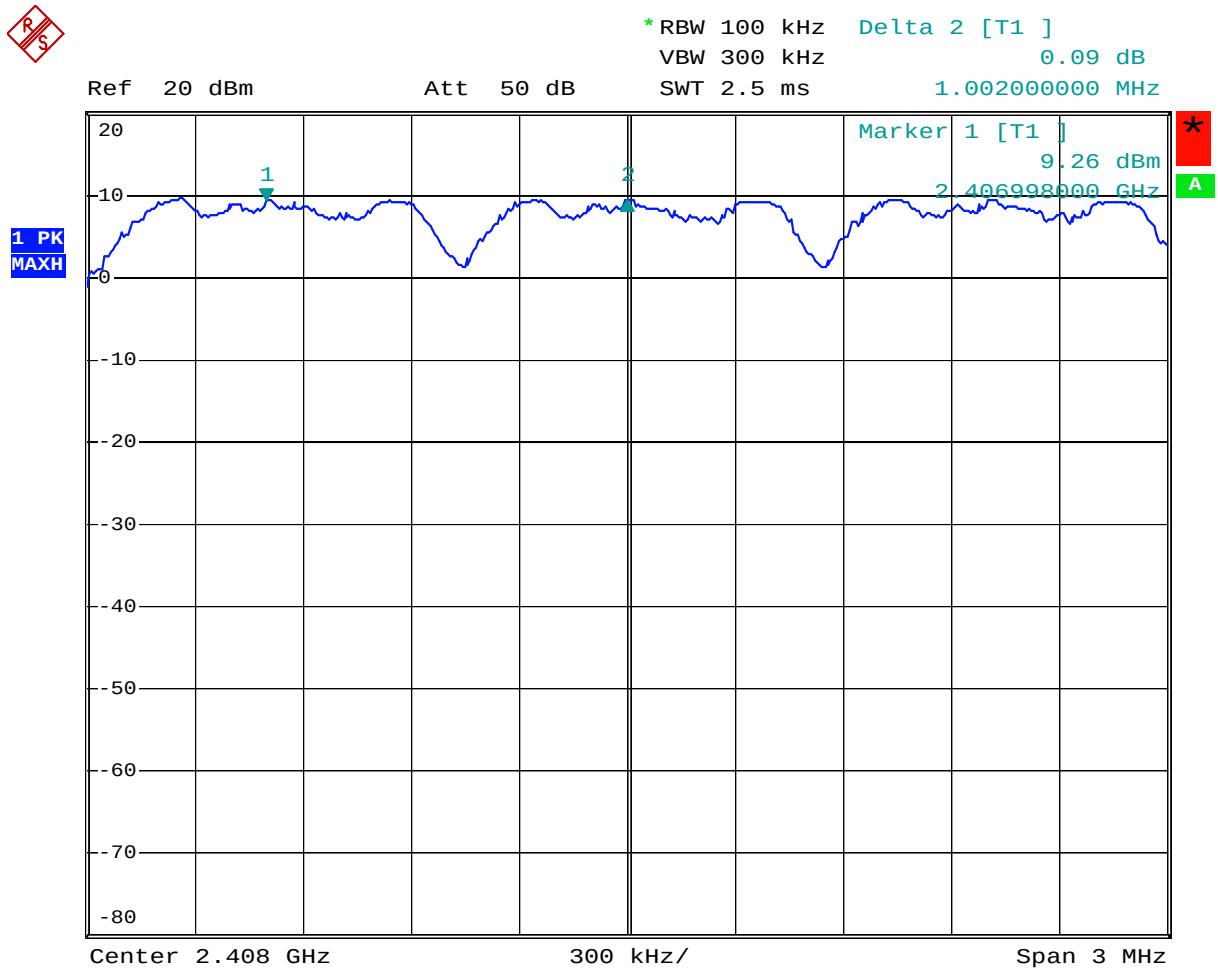
11.4. Test Result:

Pass.

Channel	Channel Frequency (MHz)	Channel separation (MHz)	Limit
Low	2407	1.002	> two-thirds of the 20dB bandwidth = 0.856MHz
Middle	2442	1.002	> two-thirds of the 20dB bandwidth = 0.856MHz
High	2477	1.002	> two-thirds of the 20dB bandwidth = 0.856MHz

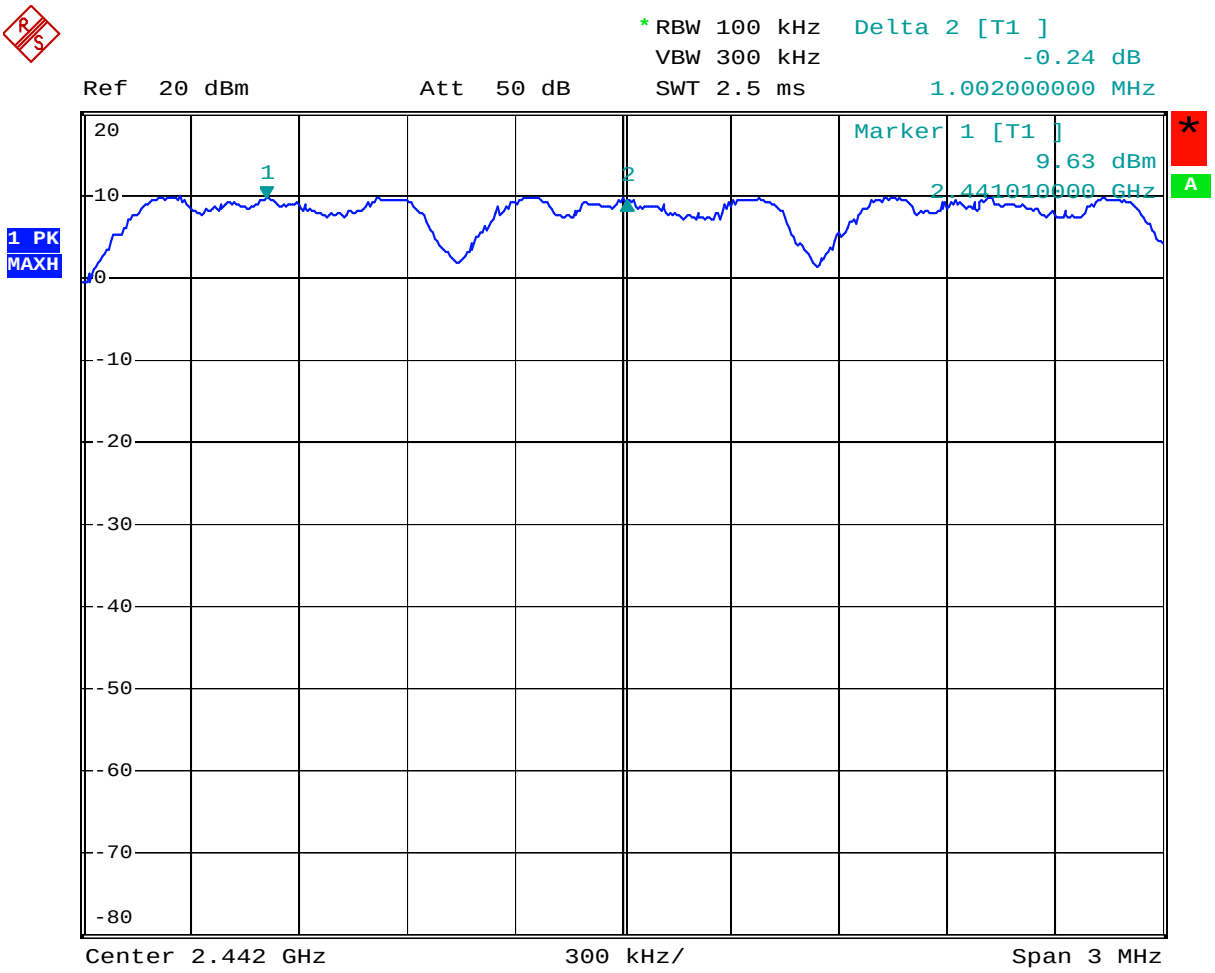
The spectrum analyzer plots are attached as below.

Low Channel



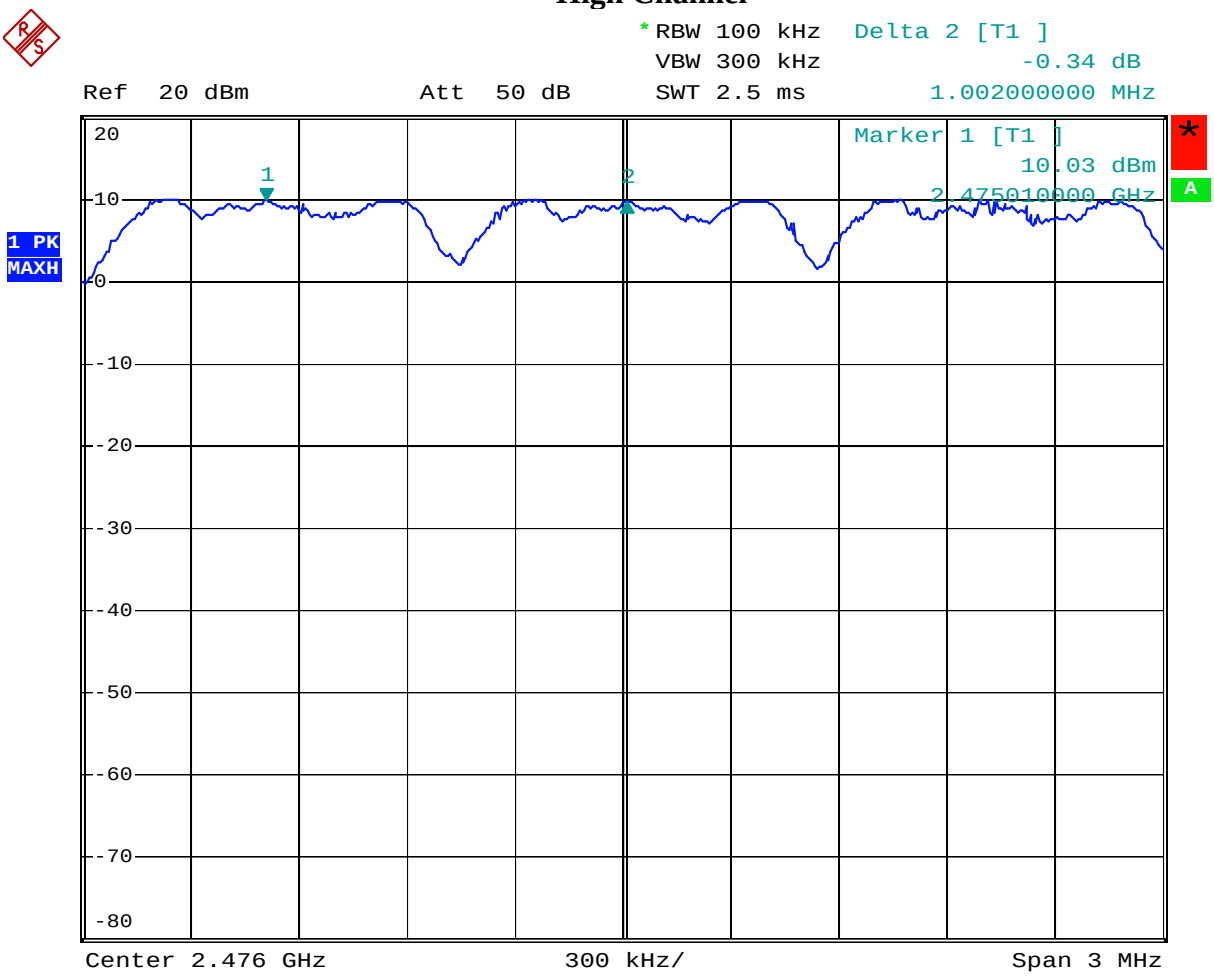
Date: 23.MAR.2012 21:53:10

Middle Channel



Date: 23.MAR.2012 21:55:24

High Channel



Date: 23.MAR.2012 21:57:43

12. SECTION 15.247(A) (1) (III)-QUANTITY OF HOPPING CHANNEL TEST

12.1. Test Equipment

Please refer to Section 2 this report.

12.2. Test Procedure

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Set the EUT in hopping mode from first channel to last.
3. By using the Max-Hold function record the Quantity of the channel.

12.3.Applicable Standard

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.

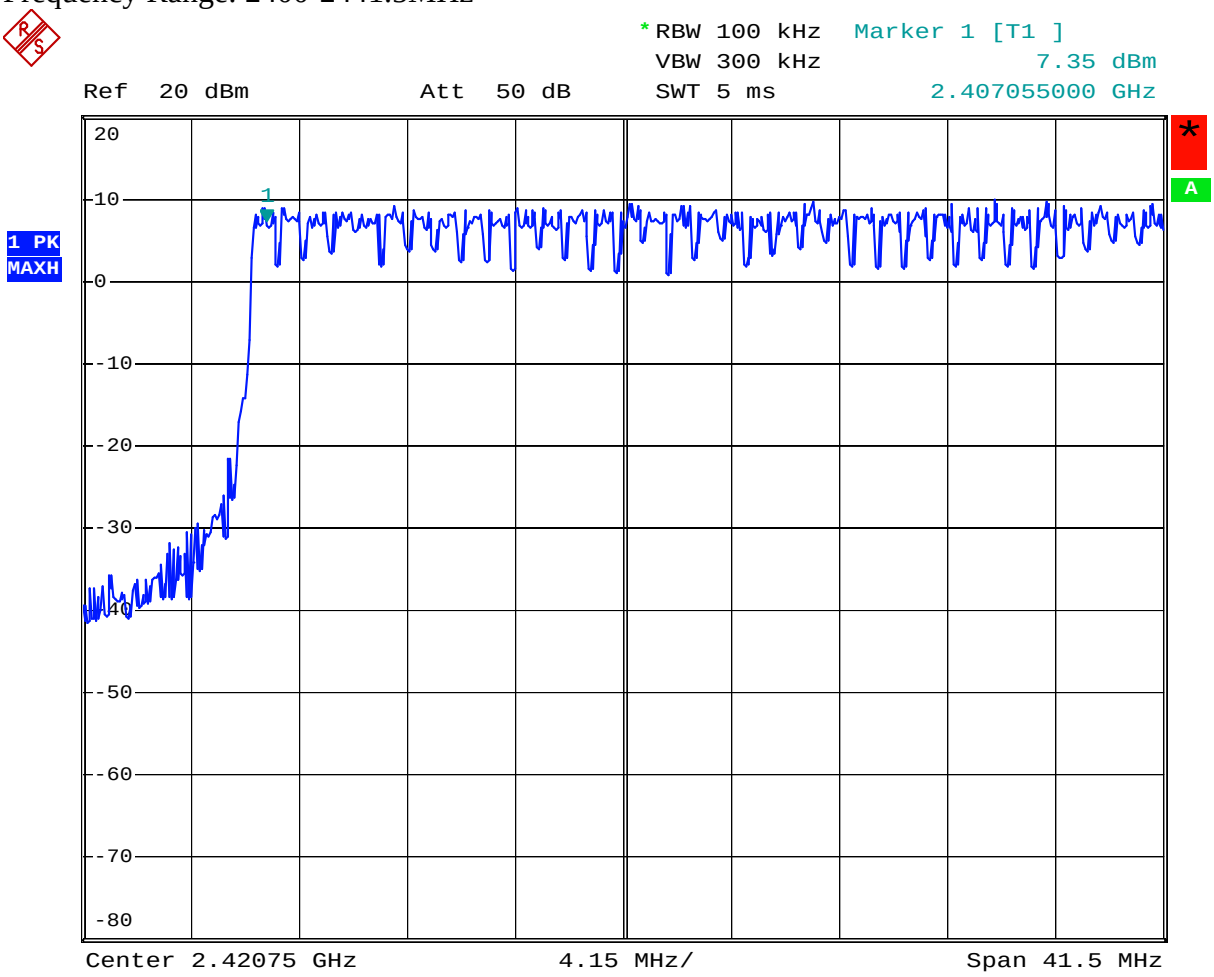
12.4. Test Result:

Pass.

	Measurement result (CH)	Limit (CH)
Total number of hopping channel	71	>15

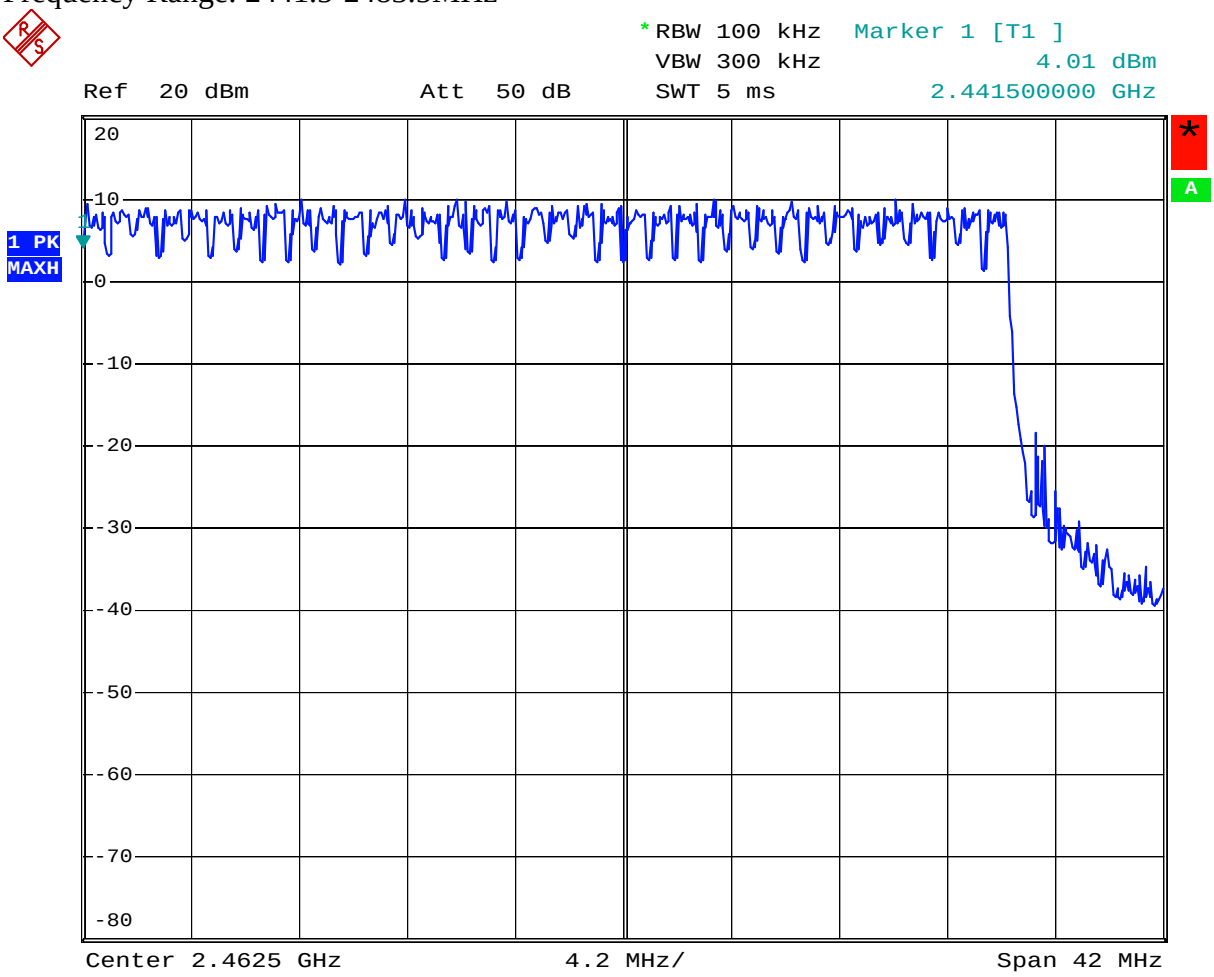
The spectrum analyzer plots are attached as below.

Frequency Range: 2400-2441.5MHz



Date: 23.MAR.2012 21:28:51

Frequency Range: 2441.5-2483.5MHz



Date: 23.MAR.2012 21:35:09

13. SECTION 15.247(A) (1) (III)- TIME OF OCCUPANCY (DWELL TIME)

13.1. Test Equipment

Please refer to Section 2 this report.

13.2. Test Procedure

1. The transmitter output was connected to the spectrum analyzer through a low loss cable.
2. Set center frequency of spectrum analyzer = operating frequency.
3. Set the spectrum analyzer as RBW=100kHz, VBW=300kHz, Span=0Hz, Adjust Sweep=1s. Get the burst (in 1 sec.).
4. Set the spectrum analyzer as RBW=1MHz, VBW=3MHz, Span=0Hz, Adjust Sweep=2ms. Get the pulse time.
5. Repeat above procedures until all frequency measured were complete.

13.3. Applicable Standard

Frequency hopping systems in the 2400-2483.5 MHz 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.

13.4. Test Result:

Pass.

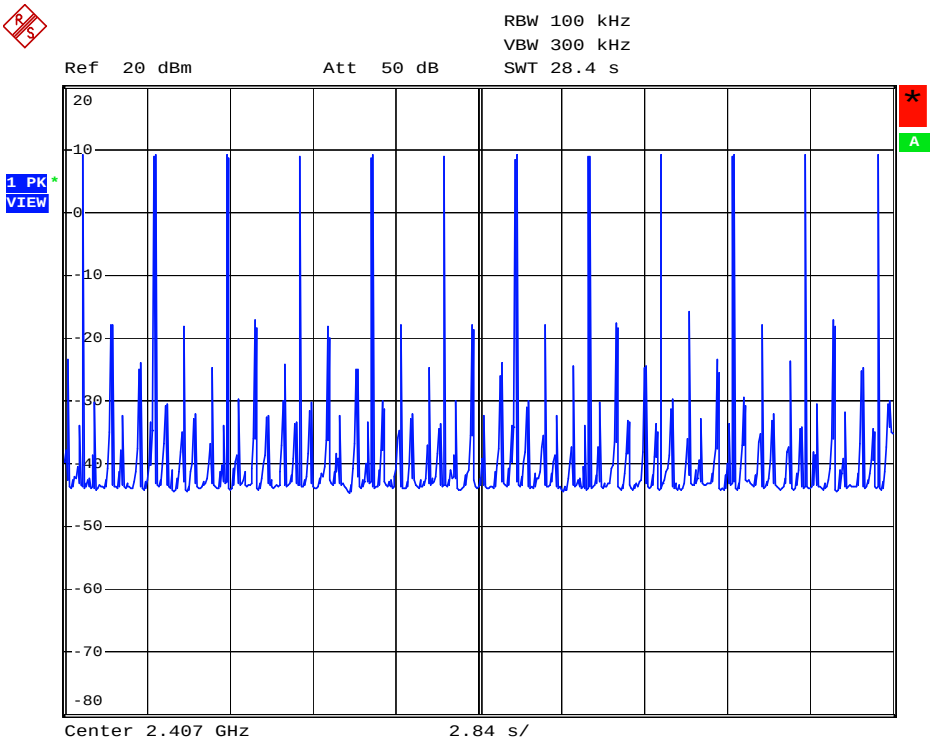
A period transmit time = 0.4 × 71 = 28.4

Dwell time = pulse time × burst (in 28.4 sec.)

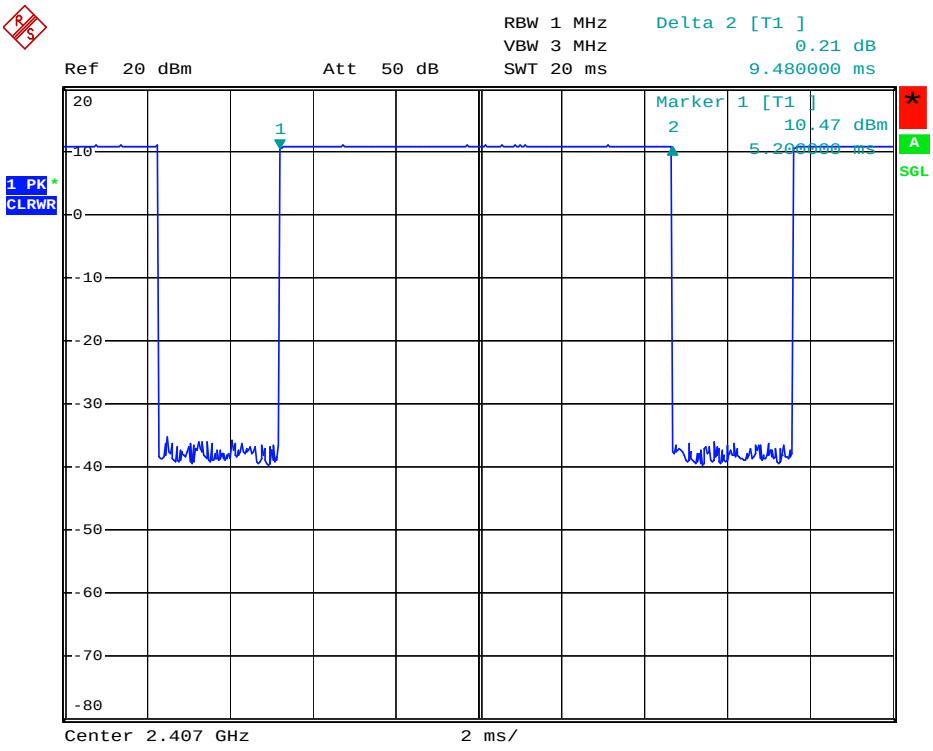
Channel	Channel Frequency (MHz)	Pulse Time (ms)	Burst (in 28.4 sec.)	Dwell Time (ms)	Limit (ms)
Low	2407	9.48	12	113.76	400
Middle	2442	9.80	12	117.60	400
High	2477	10.04	12	120.48	400

The spectrum analyzer plots are attached as below.

Low Channel

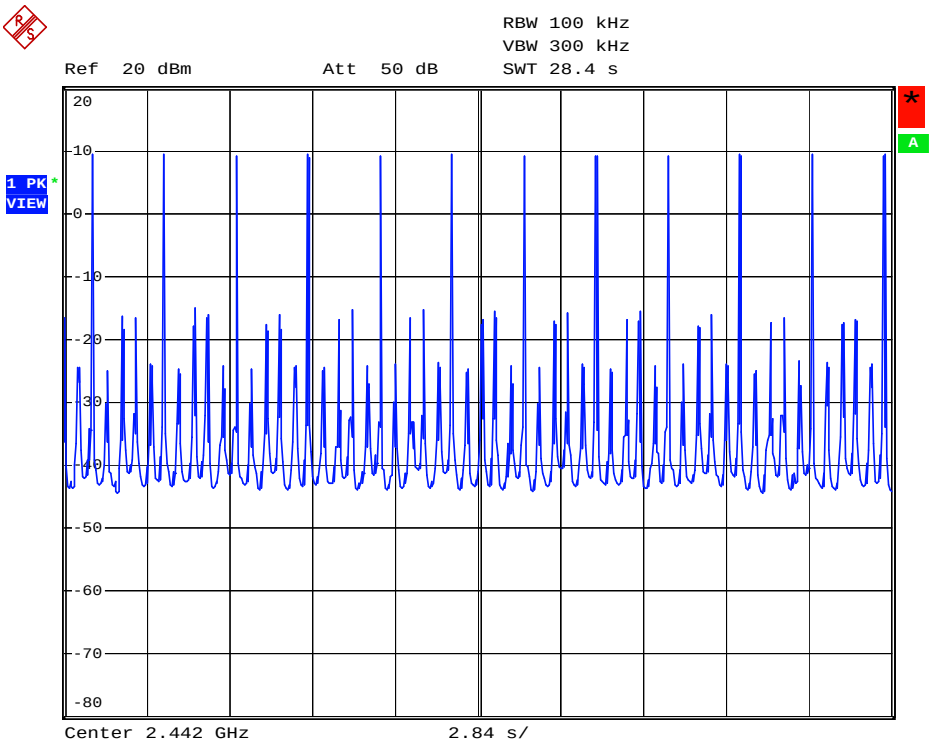


Date: 23.MAR.2012 21:42:45

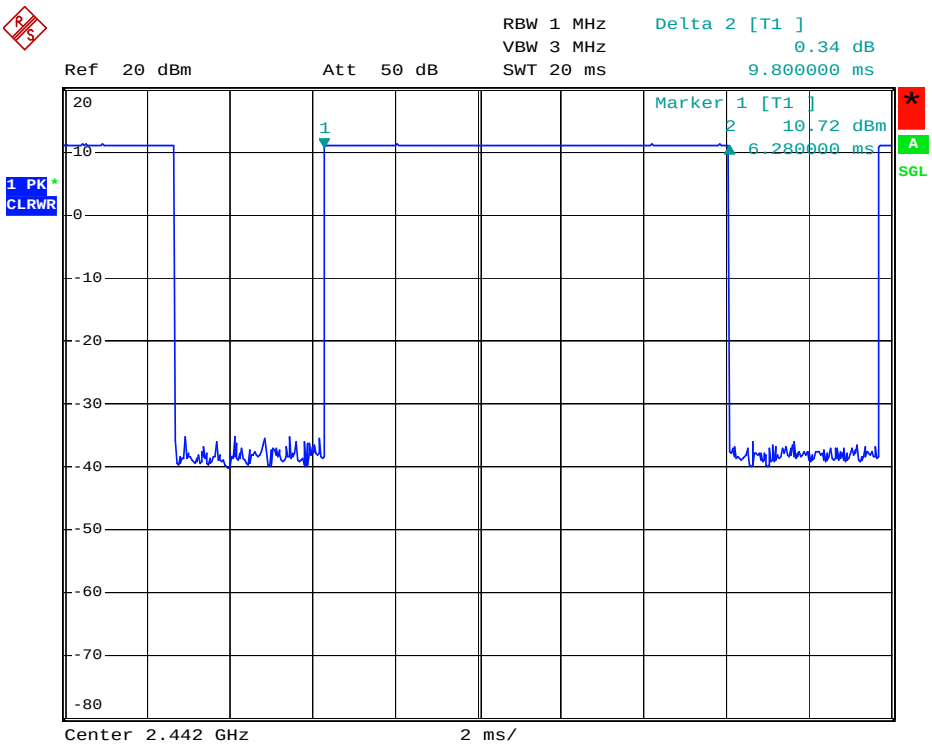


Date: 23.MAR.2012 19:25:55

Middle Channel

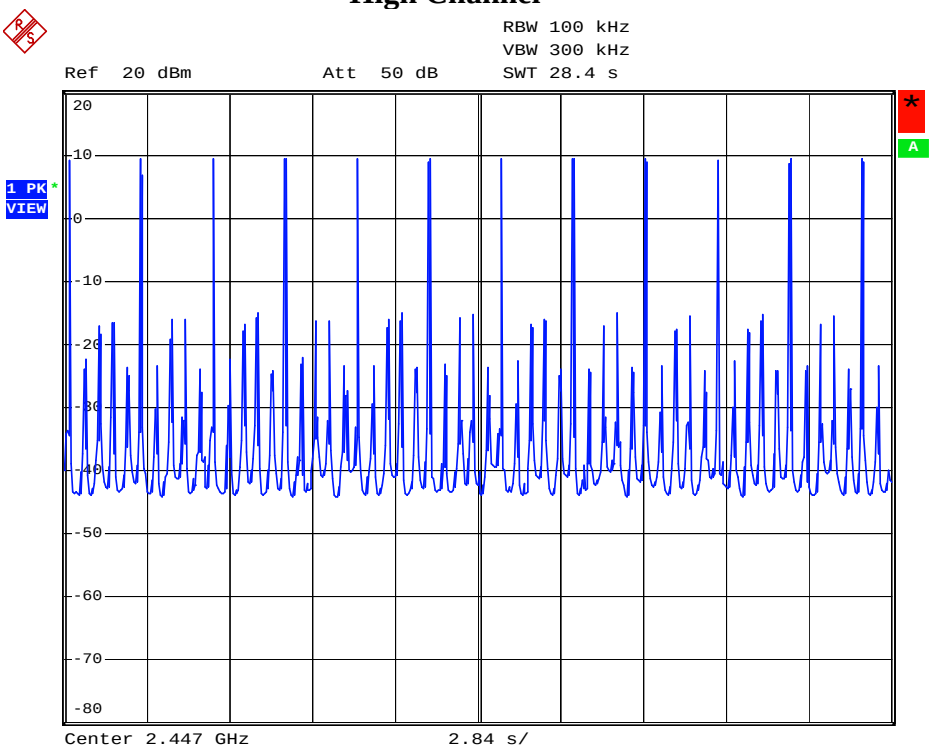


Date: 23.MAR.2012 21:43:29

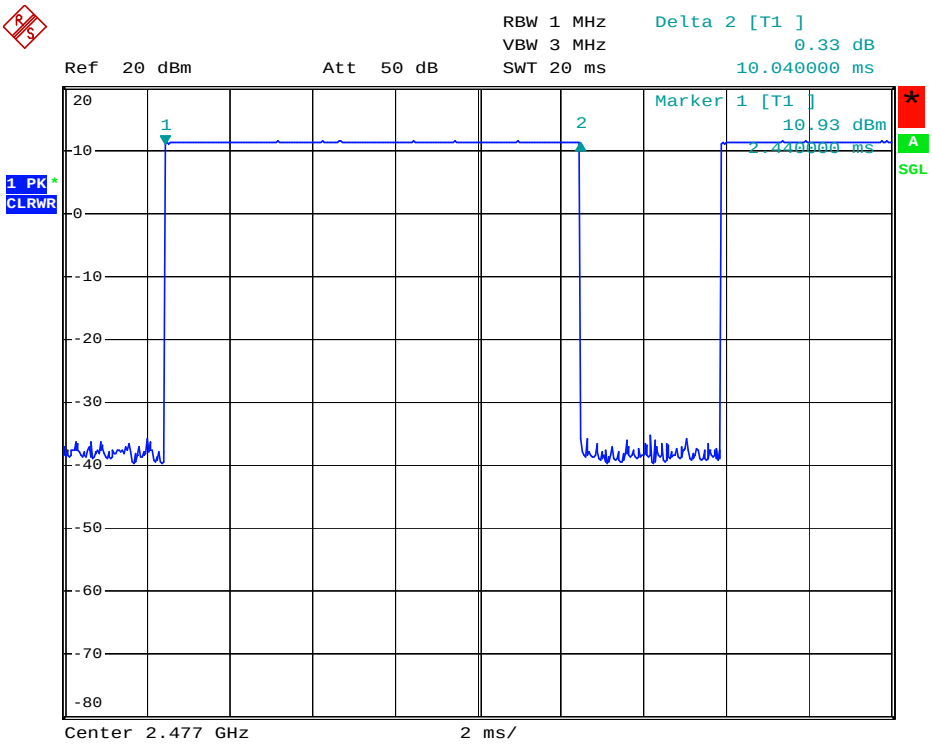


Date: 23.MAR.2012 19:28:34

High Channel



Date: 23.MAR.2012 21:41:55



Date: 23.MAR.2012 19:29:49

14. SECTION 15.247(B) (1) - Maximum Peak Output Power

14.1. Test Equipment

Please refer to Section 2 this report.

14.2.Test Procedure

1. Set span to encompass the entire emission bandwidth (EBW) of the signal.
2. Set RBW = 3 MHz.
3. Set VBW = 10 MHz.
4. Use sample detector mode if bin width (i.e., span/number of points in spectrum display) < 0.5 RBW. Otherwise use peak detector mode.
5. Use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at full control power for entire sweep of every sweep. If the device transmits continuously, with no off intervals or reduced power intervals, the trigger may be set to “free run”.
6. Trace average 100 traces in power averaging mode.
7. Compute power by integrating the spectrum across the 26 dB EBW of the signal. The integration can be performed using the spectrum analyzer’s band power measurement function with band limits set equal to the EBW band edges or by summing power levels in each 1 MHz band in linear power terms. The 1 MHz band power levels to be summed can be obtained by averaging, in linear power terms, power levels in each frequency bin across the 1 MHz.

14.3.Applicable Standard

Section 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.

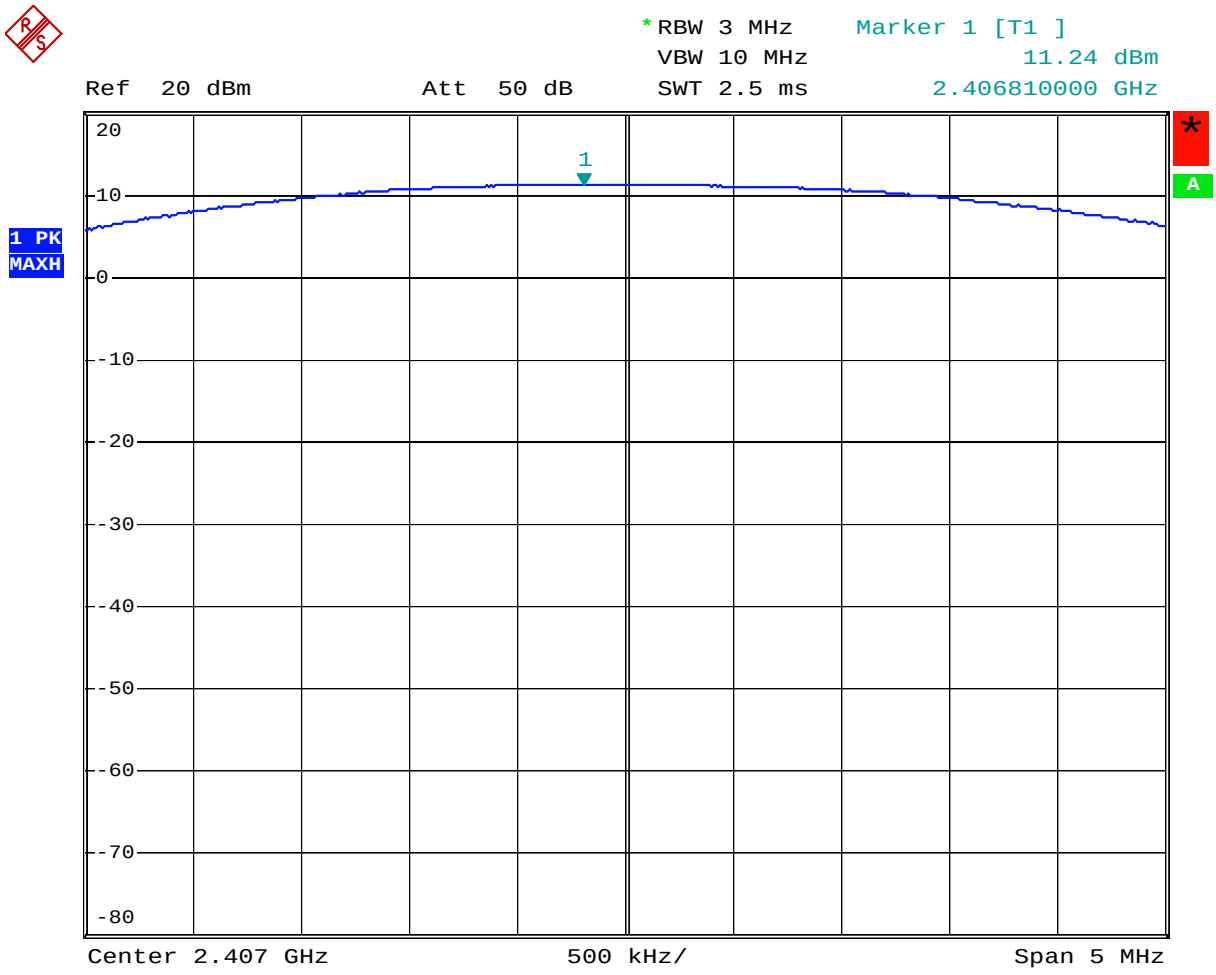
14.4. Test Result

Pass

Channel	Frequency (MHz)	Peak Output Power (dBm)	Peak Output Power (mW)	Limits mW
Low	2407	11.24	0.035	125mW
Middle	2442	11.73	0.048	125mW
High	2477	11.92	0.069	125mW

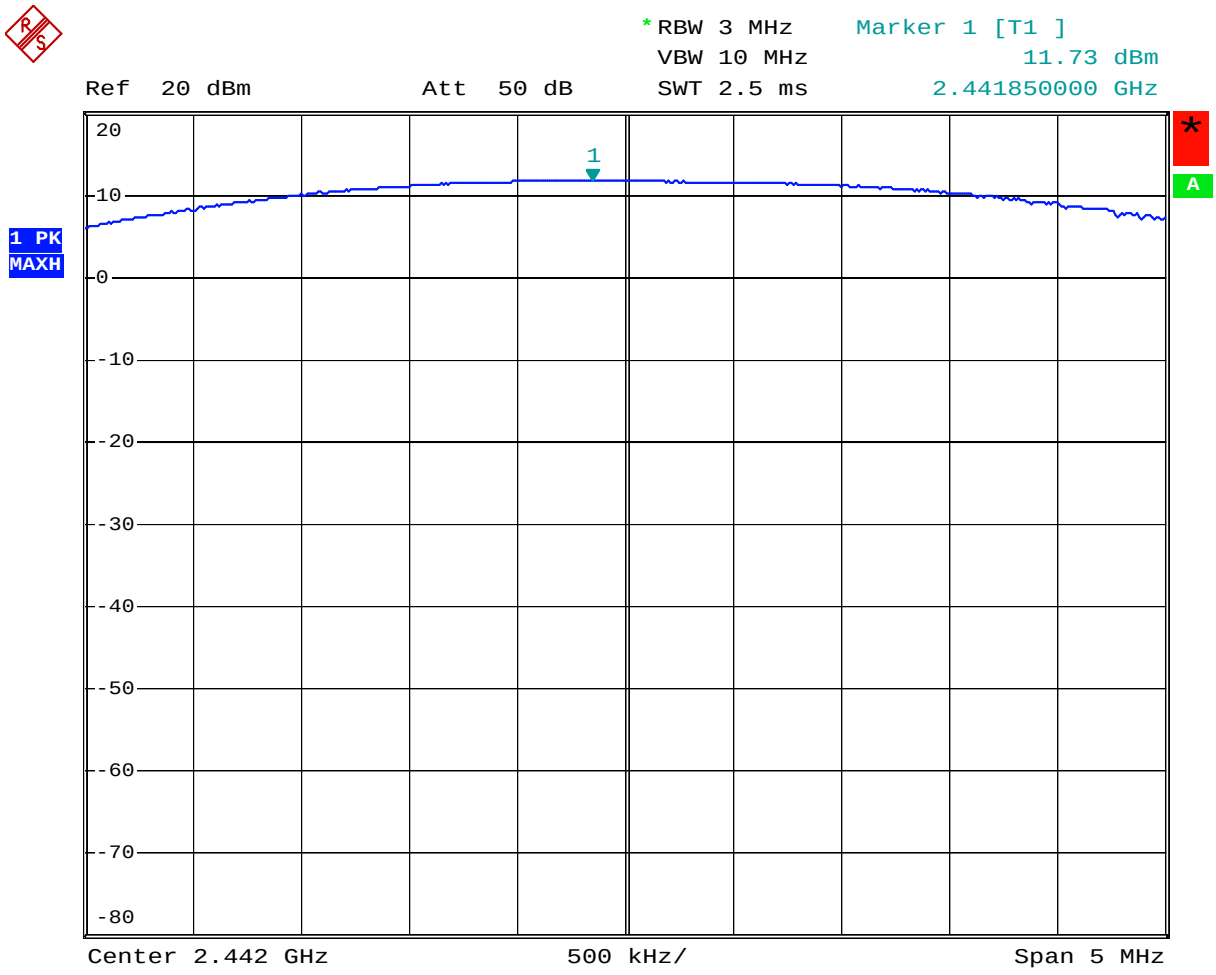
The spectrum analyzer plots are attached as below.

Low Channel



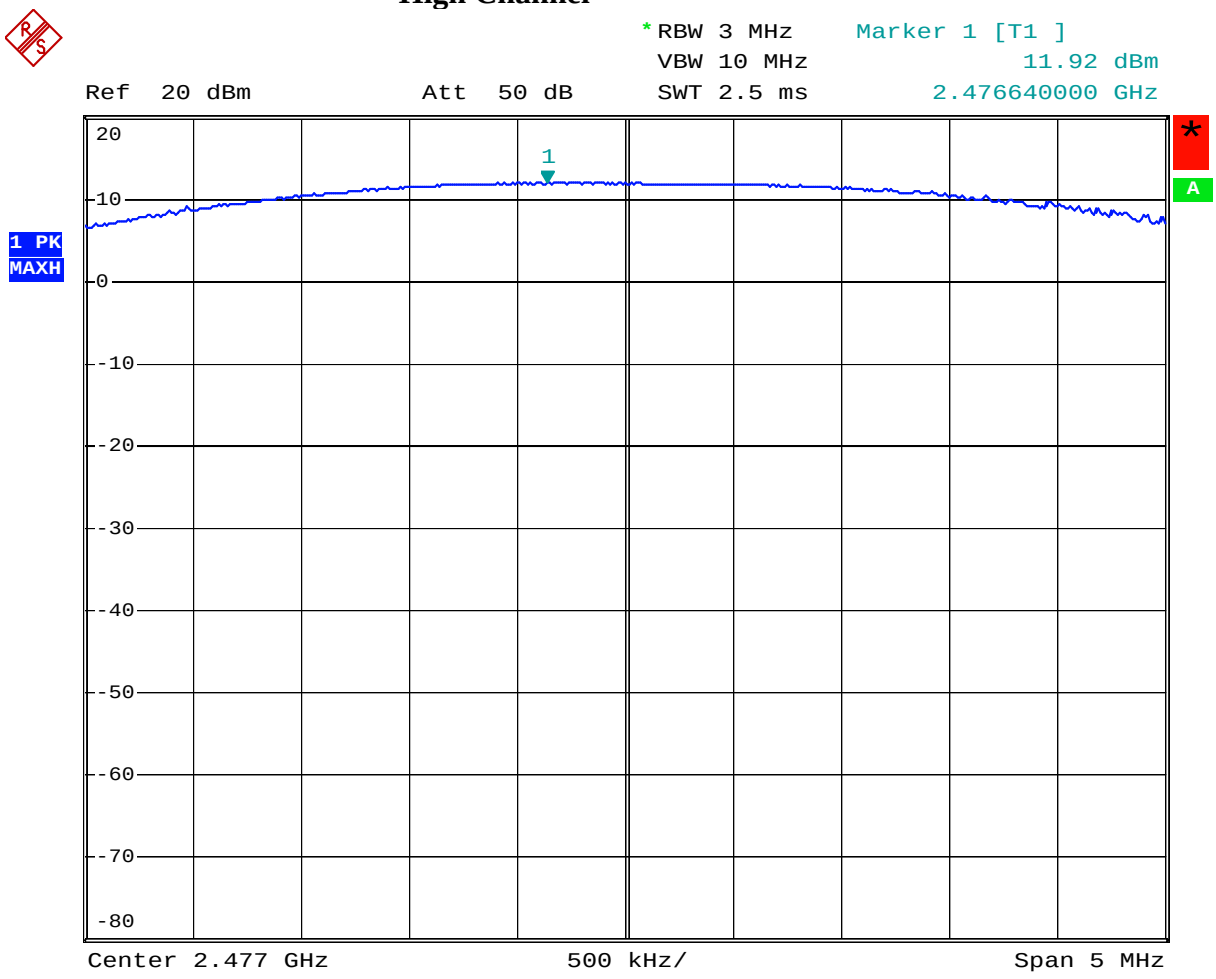
Date: 23.MAR.2012 19:51:12

Middle Channel



Date: 23.MAR.2012 19:42:27

High Channel



Date: 23.MAR.2012 19:43:55

15. SECTION 15.247(D) –Band Edge

15.1.Test Equipment

Please refer to Section 2 this report.

15.2.Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW to 100 kHz and VBW of spectrum analyzer to 300 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
Note: For Rdstricted Band
RBW=1MHz
VBW=1 MHz
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

15.3.Applicable Standard

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)).

15.4.Test Result

Pass

Conducted test

Frequency (MHz)	Result of Band Edge (dBc)	Limit of Band Edge (dBc)
2407	45.50	> 20dBc
2477	44.18	> 20dBc

The lower band edge emission plot as below, shows 45.50dB delta between carrier maximum field strength and local maximum emission in the restricted band(2400MHz)

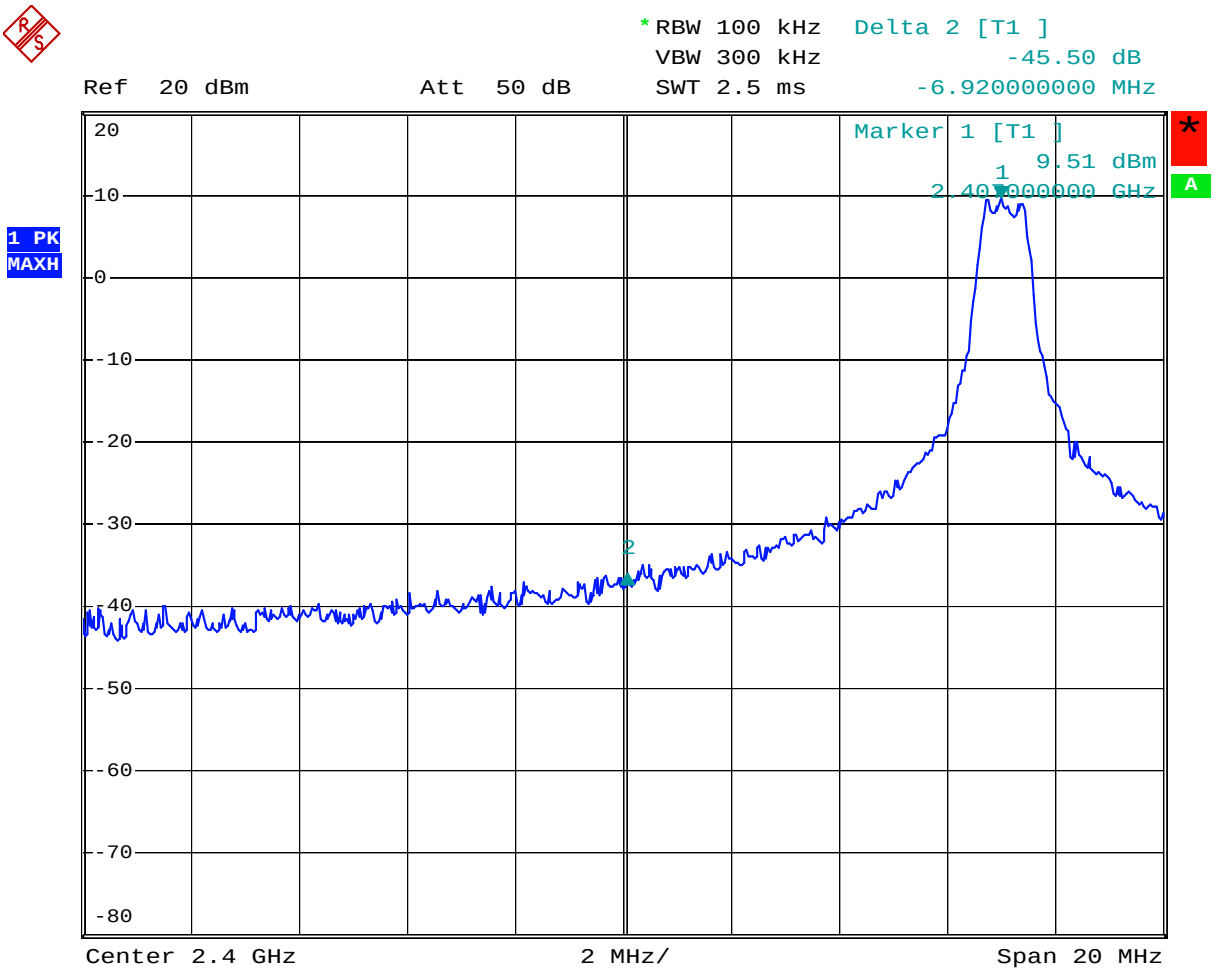
Low Band	The emission of carrier field strength (dBμV/m)	The maximum field strength in restrict band (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
2407	95.63	50.13	74	-23.87	Peak
2407	81.74	36.24	54	-17.76	Average

The higher band edge emission plot as below, shows 44.18dB delta between carrier maximum power and local maximum emission in the restricted band(2483.5MHz)

Low Band	The emission of carrier field strength (dBμV/m)	The maximum field strength in restrict band (dBμV/m)	Limit (dBμV/m)	Margin (dB)	Result
2477	92.48	48.32	74	-25.68	Peak
2477	79.23	35.05	54	-18.95	Average

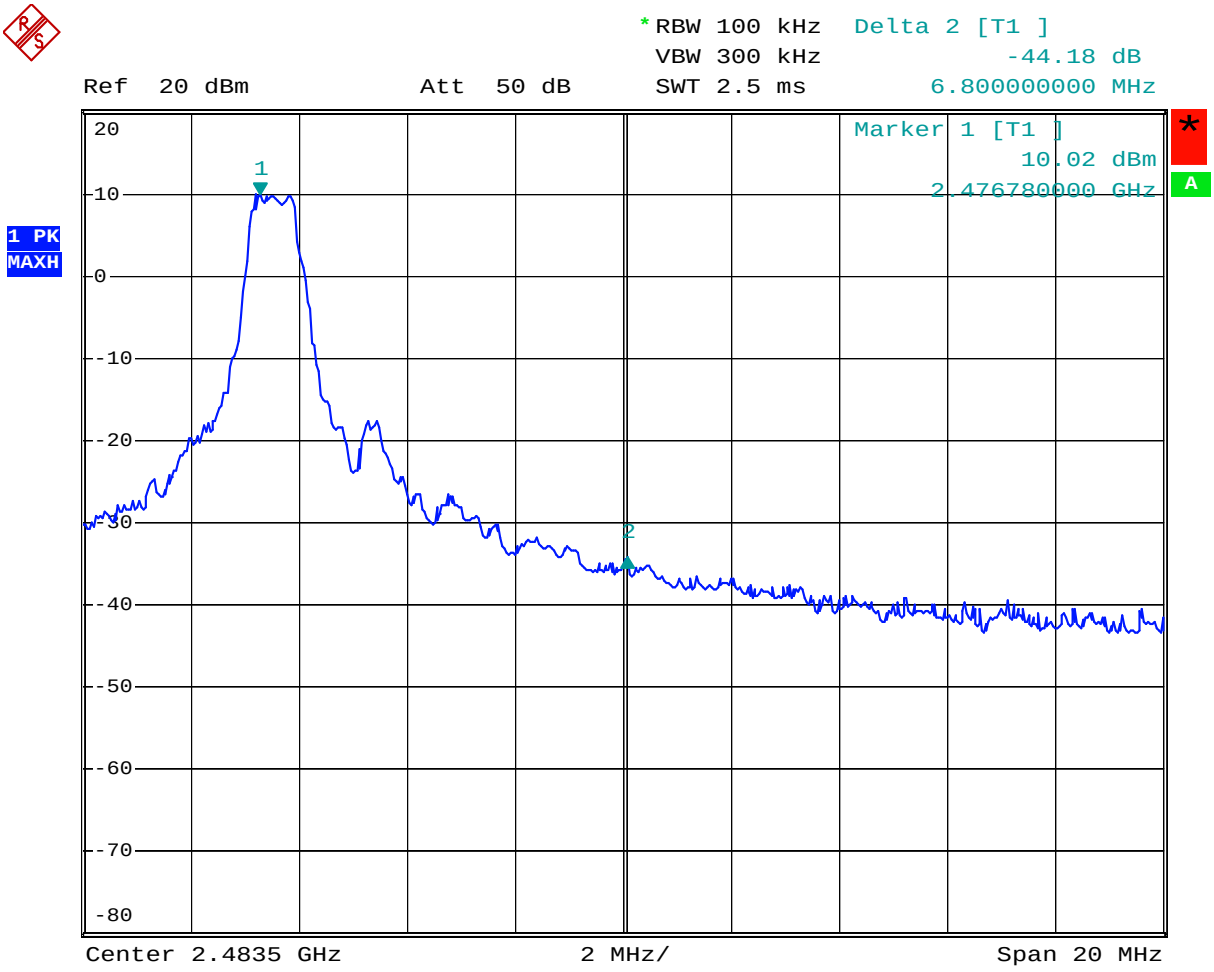
The spectrum analyzer plots are attached as below.

TX 2407MHz



Date: 23.MAR.2012 19:54:20

TX 2477MHz



Date: 23.MAR.2012 19:57:46

Radiated test

The setting of the spectrum analyzer is
Detector=Peak RBW=1MHz RBW=3MHz
Detector=AV RBW=1MHz RBW=10Hz

Corrected Factor = Antenna Factor + Cable Loss – Amplifier Gain

TX 2407MHz

Frequency (MHz)	Reading(dBμV/m)		Factor Corr. (dB)	Result(dBμV/m)		Limit(dBμV/m)		Margin(dBμV/m)		Polarization
	AV	PEAK		AV	PEAK	AV	PEAK	AV	PEAK	
-	-	-	-	-	-	-	-	-	-	Vertical
-	-	-	-	-	-	-	-	-	-	Horizontal

TX 2477MHz

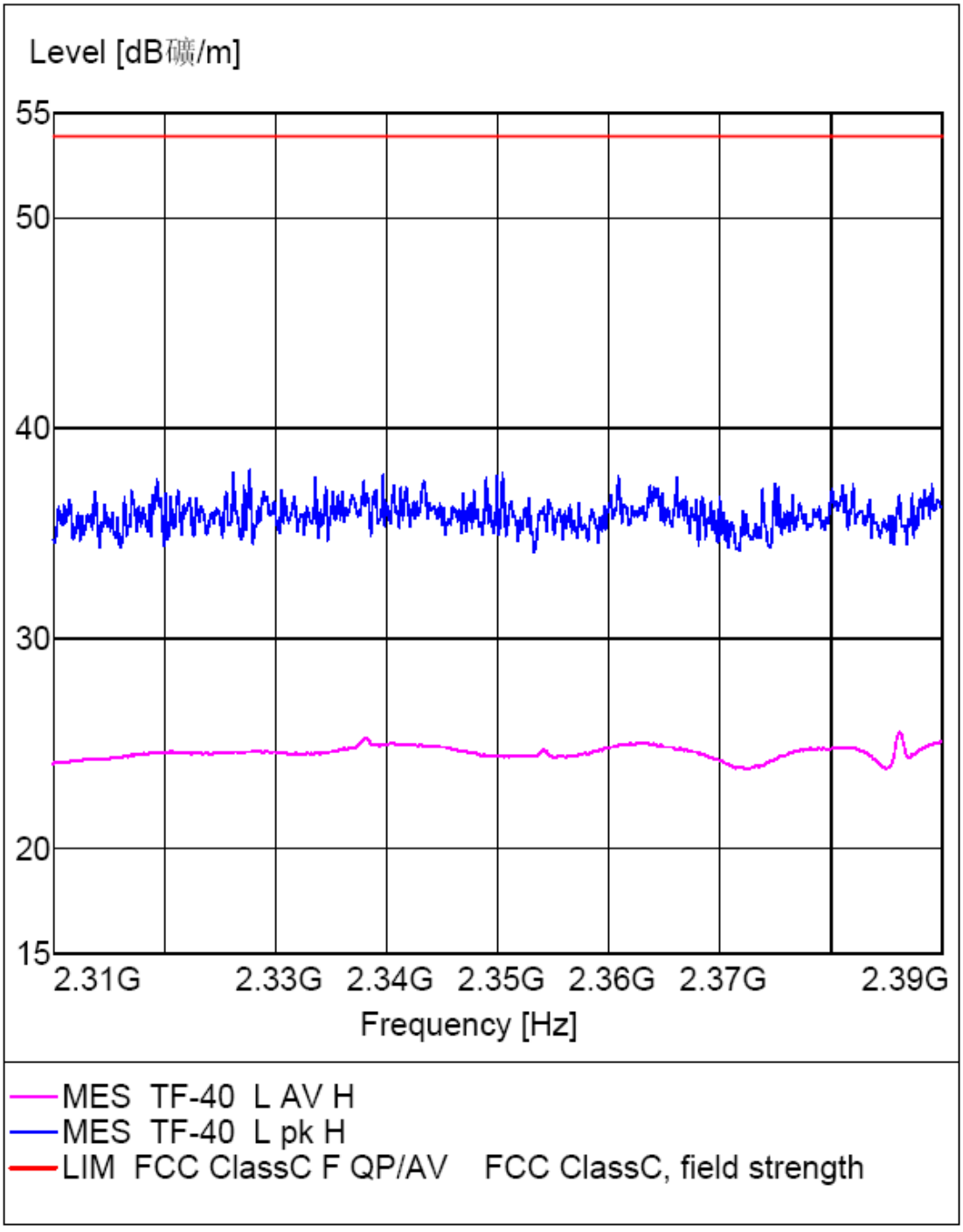
Frequency (MHz)	Reading(dBμV/m)		Factor Corr. (dB)	Result(dBμV/m)		Limit(dBμV/m)		Margin(dBμV/m)		Polarization
	AV	PEAK		AV	PEAK	AV	PEAK	AV	PEAK	
-	-	-	-	-	-	-	-	-	-	Vertical
-	-	-	-	-	-	-	-	-	-	Horizontal

Emissions attenuated more than 20 dB below the permissible value are not reported.

The spectral diagrams are attached as below display the measurement of peak values.

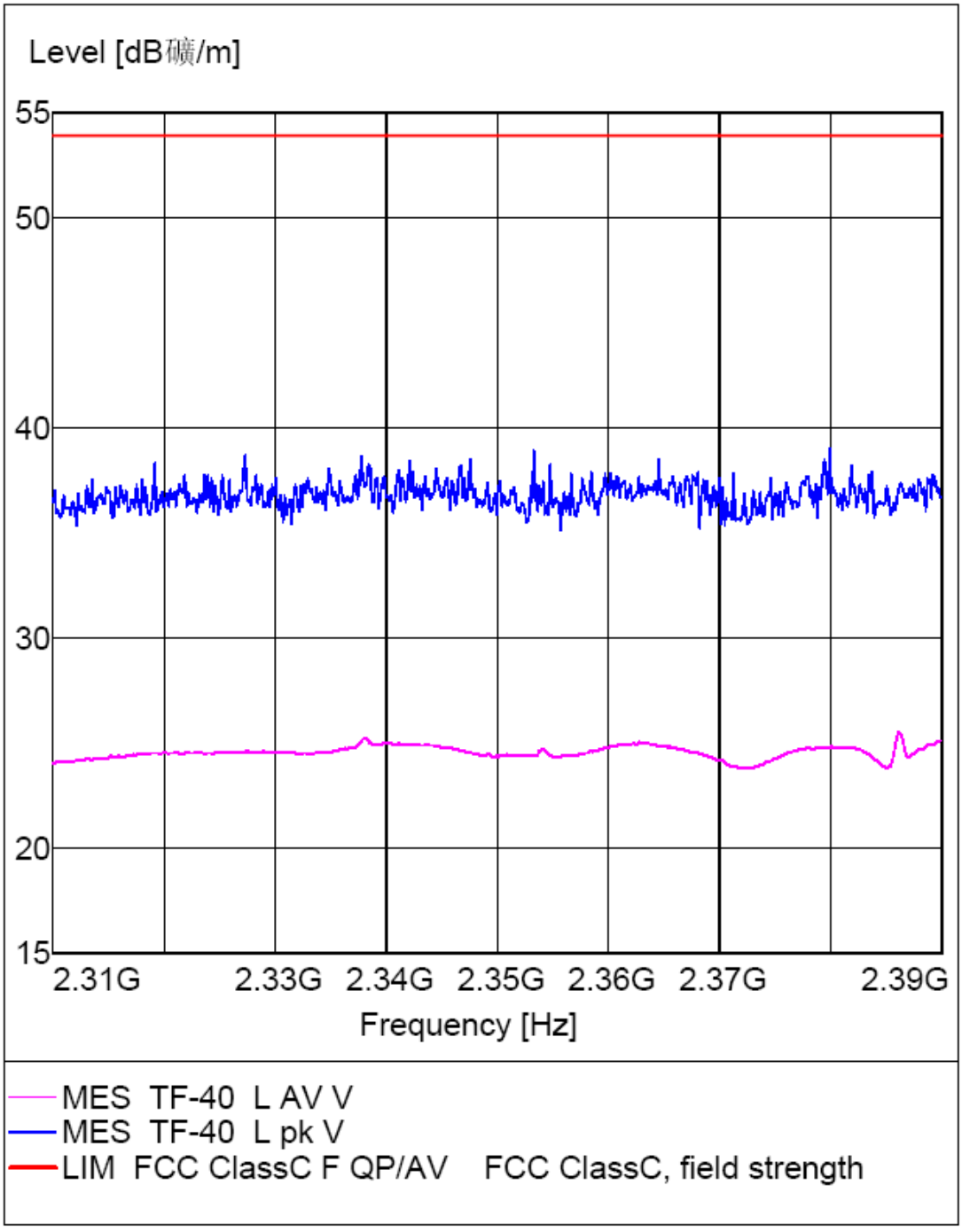
RADIATED EMISSION

EUT: TF-40
Manufacturer:
Operating Condition: TX 2407MHz
Test Specification: Horizontal



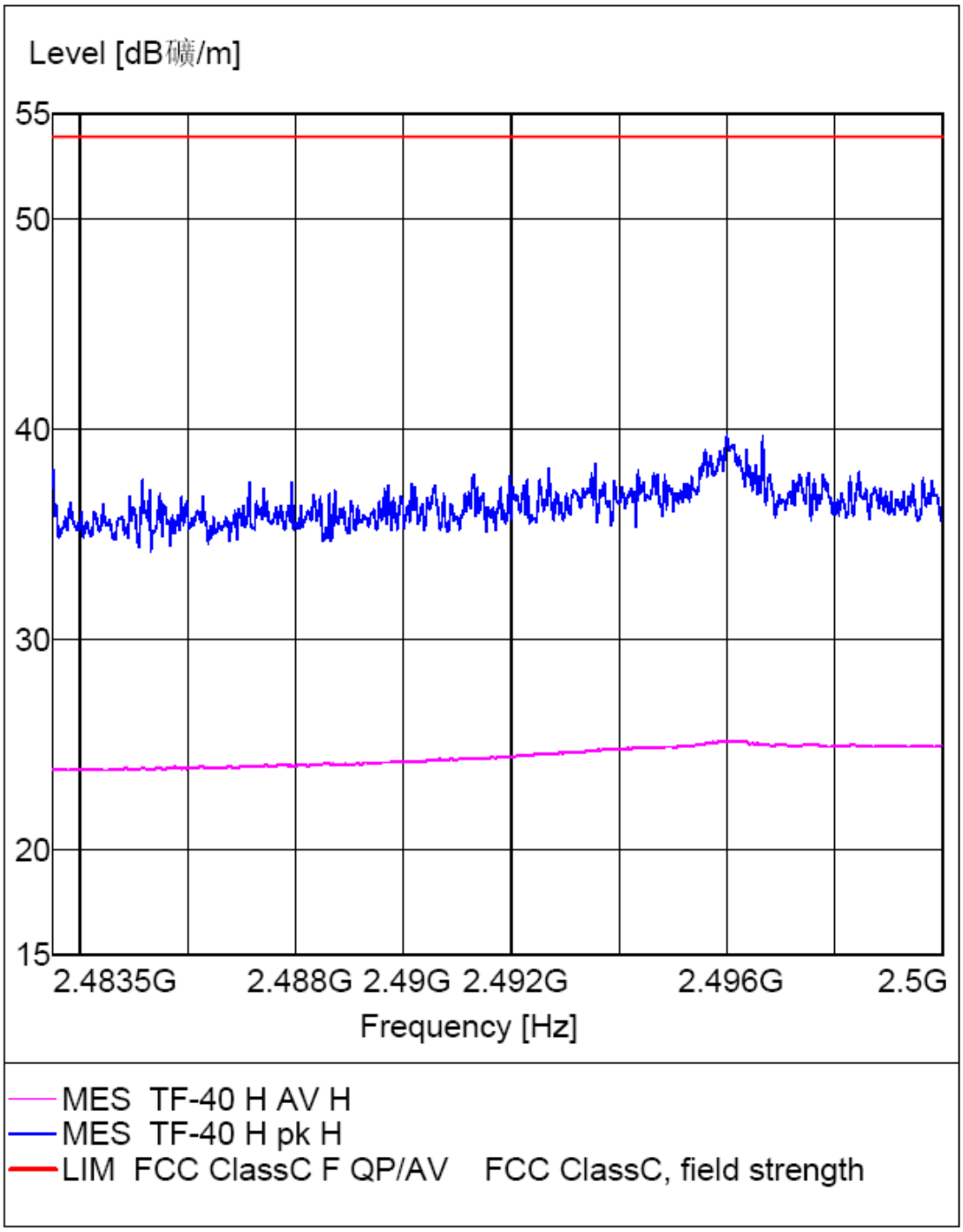
RADIATED EMISSION

EUT: TF-40
Manufacturer:
Operating Condition: TX 2407MHz
Test Specification: Vertical



RADIATED EMISSION

EUT: TF-40
Manufacturer:
Operating Condition: TX 2477MHz
Test Specification: HORIZONTAL



RADIATED EMISSION

EUT: TF-40
Manufacturer:
Operating Condition: TX 2477MHz
Test Specification: Vertical