

FCC Test Report

Product Name	RF 2.4G TX PCBA Module
Model No.	ARFMT
FCC ID	2AAIL-ARFMT

Applicant	Mae Tay Precision Co.,Ltd.
Address	6F.,No.62, Ln.188, Ruiguang RD., Neihu Dist., Taipei City 114, Taiwan, R.O.C

Date of Receipt	June 26, 2013
Issued Date	July 30, 2013
Report No.	137001R-RFUSP44V01
Report Version	V1.0



The test results relate only to the samples tested.

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Test Report Certification

Issued Date: July 30, 2013

Report No.: 137001R-RFUSP44V01



Product Name	RF 2.4G TX PCBA Module
Applicant	Mae Tay Precision Co.,Ltd.
Address	6F.,No.62, Ln.188, Ruiguang RD., Neihu Dist., Taipei City 114, Taiwan, R.O.C
Manufacturer	Mae Tay Precision Co.,Ltd.
Model No.	ARFMT
EUT Rated Voltage	DC 3.3V
EUT Test Voltage	AC 120V/60Hz
Trade Name	Maetay
Applicable Standard	FCC CFR Title 47 Part 15 Subpart C: 2012 ANSI C63.4: 2003, ANSI C63.10: 2009
Test Result	Complied

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Documented By :

A handwritten signature in blue ink that appears to read "Genie Chang".

(Senior Adm. Specialist / Genie Chang)

Tested By :

A handwritten signature in blue ink that appears to read "Alan Chen".

(Assistant Engineer / Alan Chen)

Approved By :

A handwritten signature in blue ink that appears to read "Vincent Lin".

(Manager / Vincent Lin)

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Attachment 1: EUT Test Photographs

Attachment 2: EUT Detailed Photographs

1. GENERAL INFORMATION

1.1. EUT Description

Product Name	RF 2.4G TX PCBA Module
Trade Name	Maetay
Model No.	ARFMT
FCC ID	2AAIL-ARFMT
Frequency Range	2402~2478MHz
Channel Control	Auto
Channel Separation	1MHz
Antenna Type	Printed on PCB
Channel Number	77
Type of Modulation	GFSK

Antenna List

No.	Manufacturer	Model name.	Peak Gain
1	Mae Tay	ARFMT	2.49dBi for 2.4 GHz

Note: The antenna of EUT is conform to FCC 15.203

Center Frequency of Each Channel:

Channel 01: 2402 MHz Channel 21: 2422 MHz Channel 41: 2442 MHz Channel 61: 2462 MHz
Channel 02: 2403 MHz Channel 22: 2423 MHz Channel 42: 2443 MHz Channel 62: 2463 MHz
Channel 03: 2404 MHz Channel 23: 2424 MHz Channel 43: 2444 MHz Channel 63: 2464 MHz
Channel 04: 2405 MHz Channel 24: 2425 MHz Channel 44: 2445 MHz Channel 64: 2465 MHz
Channel 05: 2406 MHz Channel 25: 2426 MHz Channel 45: 2446 MHz Channel 65: 2466 MHz
Channel 06: 2407 MHz Channel 26: 2427 MHz Channel 46: 2447 MHz Channel 66: 2467 MHz
Channel 07: 2408 MHz Channel 27: 2428 MHz Channel 47: 2448 MHz Channel 67: 2468 MHz
Channel 08: 2409 MHz Channel 28: 2429 MHz Channel 48: 2449 MHz Channel 68: 2469 MHz
Channel 09: 2410 MHz Channel 29: 2430 MHz Channel 49: 2450 MHz Channel 69: 2470 MHz
Channel 10: 2411 MHz Channel 30: 2431 MHz Channel 50: 2451 MHz Channel 70: 2471 MHz
Channel 11: 2412 MHz Channel 31: 2432 MHz Channel 51: 2452 MHz Channel 71: 2472 MHz
Channel 12: 2413 MHz Channel 32: 2433 MHz Channel 52: 2453 MHz Channel 72: 2473 MHz
Channel 13: 2414 MHz Channel 33: 2434 MHz Channel 53: 2454 MHz Channel 73: 2474 MHz
Channel 14: 2415 MHz Channel 34: 2435 MHz Channel 54: 2455 MHz Channel 74: 2475 MHz
Channel 15: 2416 MHz Channel 35: 2436 MHz Channel 55: 2456 MHz Channel 75: 2476 MHz
Channel 16: 2417 MHz Channel 36: 2437 MHz Channel 56: 2457 MHz Channel 76: 2477 MHz
Channel 17: 2418 MHz Channel 37: 2438 MHz Channel 57: 2458 MHz Channel 77: 2478 MHz
Channel 18: 2419 MHz Channel 38: 2439 MHz Channel 58: 2459 MHz
Channel 19: 2420 MHz Channel 39: 2440 MHz Channel 59: 2460 MHz
Channel 20: 2421 MHz Channel 40: 2441 MHz Channel 60: 2461 MHz

Note:

1. The EUT is a RF 2.4G TX PCBA Module with a built-in 2.4GHz transceiver.
2. This module is “Limited Modular Approval” (LMA).
3. Regarding to the operation frequency, the lowest, middle and highest frequency are selected to perform the test.
4. The radiation measurements are performed in X, Y, Z axis positioning. Only the worst case is shown in the report.
5. These tests are conducted on a sample of the equipment for the purpose of demonstrating compliance with Part 15 Subpart C Paragraph 15.249 for spread spectrum devices.

Test Mode	Mode 1: Transmit
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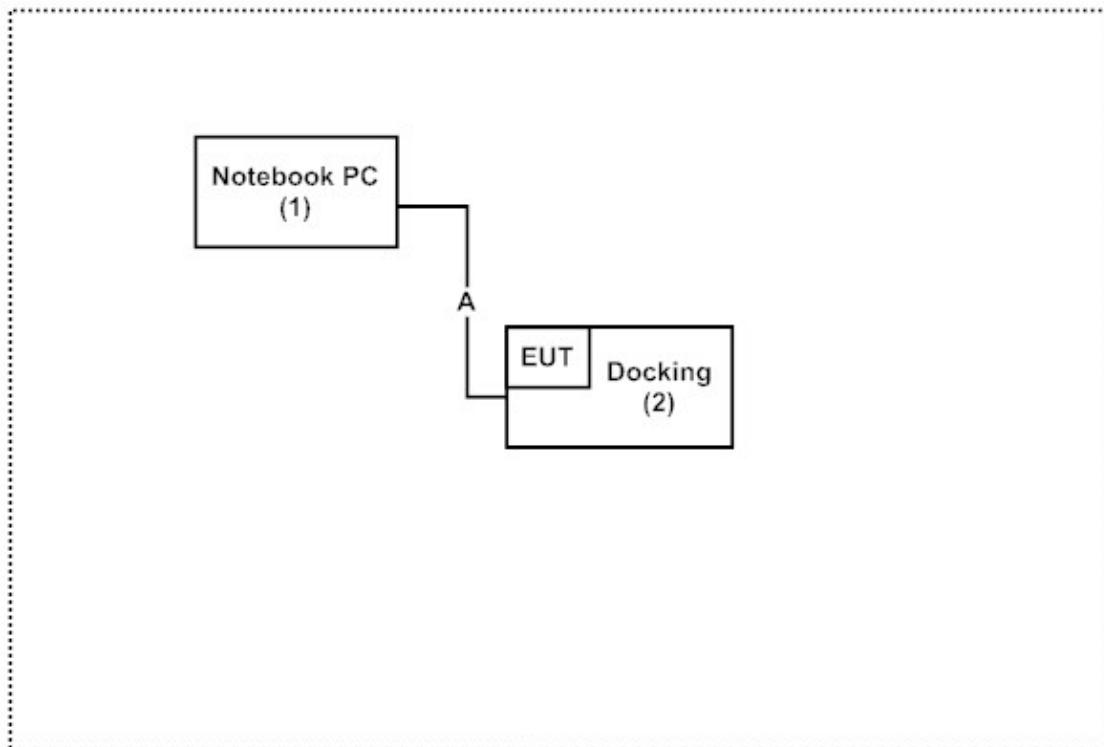
1.3. Tested System Details

The types for all equipment, plus descriptions of all cables used in the tested system (including inserted cards) are:

Product	Manufacturer	Model No.	Serial No.	Power Cord
1. Notebook PC	DELL	PPT	N/A	Non-Shielded, 1.8m
2 Docking	ASUS	T300L PC DOCK	N/A	N/A

Signal Cable Type	Signal cable Description
A USB Cable	Shielded, 0.5m

1.4. Configuration of Test System



1.5. EUT Exercise Software

- (1) Setup the EUT as shown in section 1.4.
- (2) Press and hold the Docking button.
- (3) Start transmits continually.
- (4) Verify that the EUT works properly.

1.6. Test Facility

Ambient conditions in the laboratory:

Items	Required (IEC 68-1)	Actual
Temperature (°C)	15-35	20-35
Humidity (%RH)	25-75	50-65
Barometric pressure (mbar)	860-1060	950-1000

The related certificate for our laboratories about the test site and management system can be downloaded from QuieTek Corporation's Web Site : <http://tw.quietek.com/modules/myalbum/>

The address and introduction of QuieTek Corporation's laboratories can be founded in our Web site : <http://www.quietek.com/>

Site Description: File on
Federal Communications Commission
FCC Engineering Laboratory
7435 Oakland Mills Road
Columbia, MD 21046
Registration Number: 92195

Site Name: Quietek Corporation
Site Address: No.5-22, Ruishukeng Linkou Dist., New Taipei City
24451, Taiwan, R.O.C.

TEL: 886-2-8601-3788 / FAX : 886-2-8601-3789
E-Mail : service@quietek.com

FCC Accreditation Number: TW1014

2. Conducted Emission

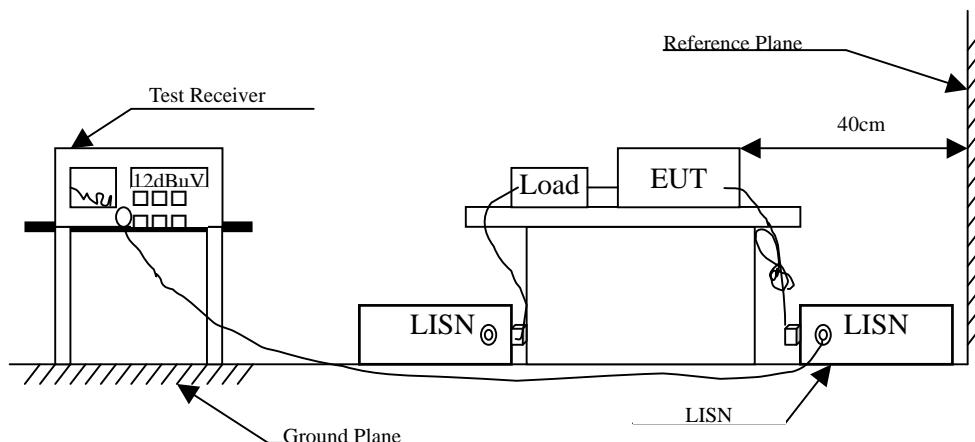
2.1. Test Equipment

	Equipment	Manufacturer	Model No. / Serial No.	Last Cal.	Remark
X	Test Receiver	R & S	ESCS 30 / 825442/018	Sep., 2012	
X	Artificial Mains Network	R & S	ENV4200 / 848411/10	Feb., 2013	Peripherals
X	LISN	R & S	ESH3-Z5 / 825562/002	Feb., 2013	EUT
	DC LISN	Schwarzbeck	8226 / 176	Mar, 2013	EUT
X	Pulse Limiter	R & S	ESH3-Z2 / 357.8810.52	Feb., 2013	
	No.1 Shielded Room				

Note:

1. All equipments are calibrated every one year.
2. The test instruments marked by “X” are used to measure the final test results.

2.2. Test Setup



2.3. Limits

FCC Part 15 Subpart C Paragraph 15.207 (dBuV) Limit		
Frequency MHz	Limits	
	QP	AV
0.15 - 0.50	66-56	56-46
0.50-5.0	56	46
5.0 - 30	60	50

Remarks: In the above table, the tighter limit applies at the band edges.

2.4. Test Procedure

The EUT and simulators are connected to the main power through a line impedance stabilization network (L.I.S.N.). This provides a 50 ohm /50uH coupling impedance for the measuring equipment. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm /50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs.)

Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2009 on conducted measurement.

Conducted emissions were invested over the frequency range from 0.15MHz to 30MHz using a receiver bandwidth of 9kHz.

2.5. Uncertainty

± 2.26 dB

2.6. Test Result of Conducted Emission

Product : RF 2.4G TX PCBA Module
 Test Item : Conducted Emission Test
 Power Line : Line 1
 Test Mode : Mode 1: Transmit (2440MHz)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV	dB	dBuV
LINE 1					
Quasi-Peak					
0.150	9.830	40.440	50.270	-15.730	66.000
0.193	9.830	39.180	49.010	-15.761	64.771
0.291	9.830	35.550	45.380	-16.591	61.971
0.521	9.830	31.530	41.360	-14.640	56.000
2.045	9.840	32.030	41.870	-14.130	56.000
7.982	9.941	26.920	36.861	-23.139	60.000
Average					
0.150	9.830	19.850	29.680	-26.320	56.000
0.193	9.830	21.040	30.870	-23.901	54.771
0.291	9.830	22.010	31.840	-20.131	51.971
0.521	9.830	20.620	30.450	-15.550	46.000
2.045	9.840	20.490	30.330	-15.670	46.000
7.982	9.941	16.320	26.261	-23.739	50.000

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. " █ " means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

Product : RF 2.4G TX PCBA Module
 Test Item : Conducted Emission Test
 Power Line : Line 2
 Test Mode : Mode 1: Transmit (2440MHz)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV	dB	dBuV
LINE 2					
Quasi-Peak					
0.189	9.830	36.030	45.860	-19.026	64.886
0.263	9.830	28.040	37.870	-24.901	62.771
0.447	9.840	31.220	41.060	-16.454	57.514
0.814	9.850	28.750	38.600	-17.400	56.000
1.220	9.850	28.770	38.620	-17.380	56.000
2.056	9.860	30.760	40.620	-15.380	56.000
Average					
0.189	9.830	18.120	27.950	-26.936	54.886
0.263	9.830	8.460	18.290	-34.481	52.771
0.447	9.840	14.250	24.090	-23.424	47.514
0.814	9.850	10.770	20.620	-25.380	46.000
1.220	9.850	10.260	20.110	-25.890	46.000
2.056	9.860	17.660	27.520	-18.480	46.000

Note:

1. All Reading Levels are Quasi-Peak and average value.
2. "  " means the worst emission level.
3. Measurement Level = Reading Level + Correct Factor

3. Radiated Emission

3.1. Test Equipment

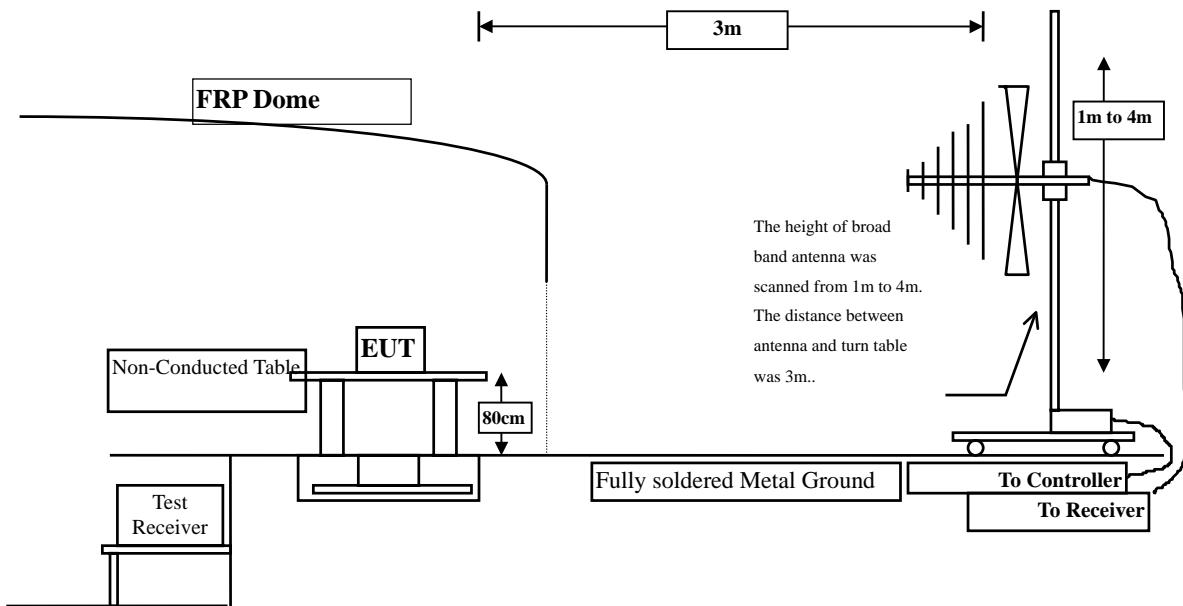
The following test equipment are used during the radiated emission test:

Test Site	Equipment		Manufacturer	Model No./Serial No.	Last Cal.
☒Site # 3	X	Loop Antenna	Teseq	HLA6120 / 26739	Jul., 2012
	X	Bilog Antenna	Schaffner Chase	CBL6112B/2673	Sep., 2012
	X	Horn Antenna	Schwarzbeck	BBHA9120D/D305	Sep., 2012
	X	Horn Antenna	Schwarzbeck	BBHA9170/208	Jul., 2013
	X	Pre-Amplifier	QTK	QTK-AMP-03 / 0003	May, 2013
	X	Pre-Amplifier	QTK	AP-180C / CHM_0906076	Sep., 2012
	X	Pre-Amplifier	MITEQ	AMF-4D-180400-45-6P/925975	Mar, 2013
	X	Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2013
	X	Test Receiver	R & S	ESCS 30/ 825442/018	Sep., 2012
	X	Coaxial Cable	Quietek	QTK-CABLE/ CAB5	Feb., 2013
	X	Controller	Quietek	QTK-CONTROLLER/ CTRL3	N/A
	X	Coaxial Switch	Anritsu	MP59B/6200265729	N/A

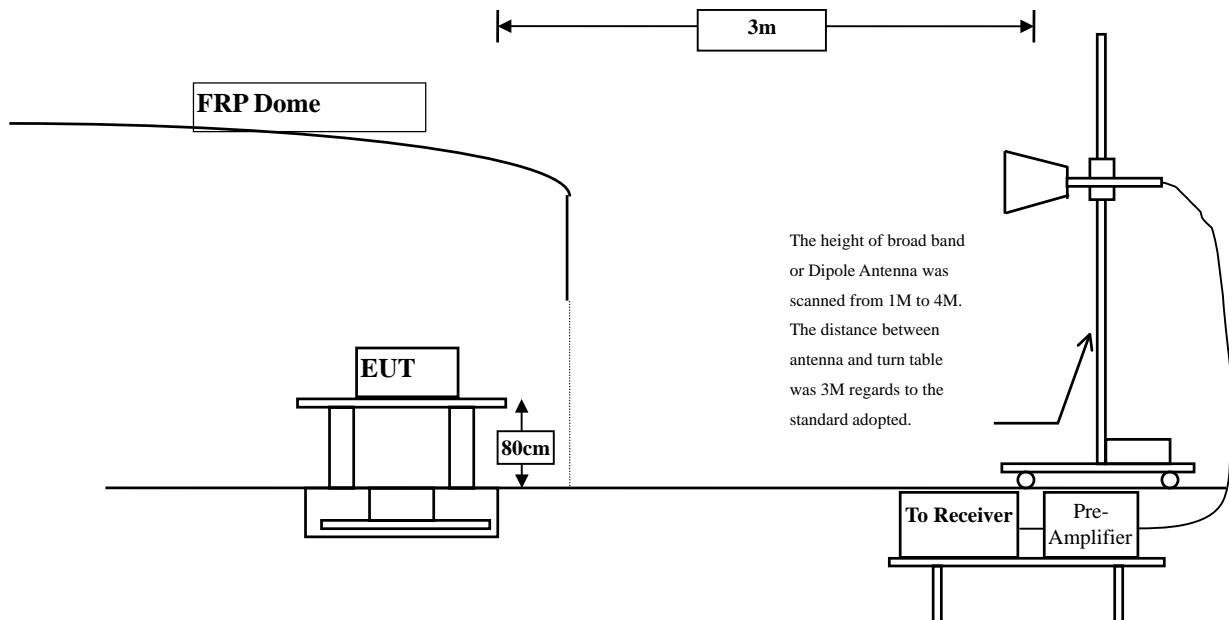
Note: 1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
2. The test instruments marked with "X" are used to measure the final test results.

3.2. Test Setup

Radiated Emission Below 1GHz



Radiated Emission Above 1GHz



3.3. Limits

➤ Fundamental and Harmonics Emission Limits

FCC Part 15 Subpart C Paragraph 15.249 Limits				
Frequency MHz	Field Strength of Fundamental		Field Strength of Harmonics	
	(mV/m @3m)	(dBuV/m @3m)	(uV/m @3m)	(dBuV/m @3m)
902-928	50	94	500	54
2400-2483.5	50	94	500	54
5725-5875	50	94	500	54

Remarks : 1. RF Voltage (dBuV/m) = 20 log RF Voltage (uV/m)

2. Distance refers to the distance in meters between the measuring instrument antenna and the closed point of any part of the device or system.

➤ General Radiated Emission Limits

Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50dB below the level of the fundamental or to the general radiated emission limits in paragraph 15.209, whichever is the lesser attenuation.

FCC Part 15 Subpart C Paragraph 15.209(a) Limits		
Frequency MHz	Field strength (microvolts/meter)	Measurement distance (meter)
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Remarks: E field strength (dBuV/m) = 20 log E field strength (uV/m)

3.4. Test Procedure

The EUT was setup according to ANSI C63.10, 2009 and tested compliance to FCC 47CFR 15.249 requirements.

The EUT is placed on a turn table which is 0.8 meter above ground. The turn table is rotated 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna is scanned between 1 meter and 4 meters to find out the maximum emission level. This is repeated for both horizontal and vertical polarization of the antenna. In order to find the maximum emission, all of the interface cables were manipulated according to ANSI C63.10: 2009 on radiated measurement.

The resolution bandwidth below 30MHz setting on the field strength meter is 9kHz and 30MHz~1GHz is 120kHz and above 1GHz is 1MHz.

Radiated emission measurements below 30MHz are made using Loop Antenna and 30MHz~1GHz are made using broadband Bilog antenna and above 1GHz are made using Horn Antennas.

The measurement is divided into the Preliminary Measurement and the Final Measurement.

The suspected frequencies are searched for in Preliminary Measurement with the measurement antenna kept pointed at the source of the emission both in azimuth and elevation, with the polarization of the antenna oriented for maximum response. The antenna is pointed at an angle towards the source of the emission, and the EUT is rotated in both height and polarization to maximize the measured emission. The emission is kept within the illumination area of the 3 dB bandwidth of the antenna.

The worst radiated emission is measured in the Open Area Test Site on the Final Measurement.

The measurement frequency range from 9kHz - 10th Harmonic of fundamental was investigated.

3.5. Uncertainty

± 3.9 dB above 1GHz

± 3.8 dB below 1GHz

3.6. Test Result of Radiated Emission

Product : RF 2.4G TX PCBA Module
Test Item : Fundamental Radiated Emission
Test Site : No.3OATS
Test Mode : Mode 1: Transmit

X-Axis

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
Peak Detector:					
2402.000	31.573	51.410	82.984	-31.016	114.000
2440.000	31.852	48.960	80.812	-33.188	114.000
2478.000	32.140	47.940	80.080	-33.920	114.000
Average					
Detector:					
2402.000	31.573	37.400	68.974	-25.026	94.000
2440.000	31.852	35.680	67.532	-26.468	94.000
2478.000	32.140	34.910	67.050	-26.950	94.000

Note:

1. Measurement Level = Reading Level + Correct Factor.
2. Correct Factor = Antenna Factor + Cable Loss – PreAMP.
3. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.

Product : RF 2.4G TX PCBA Module
 Test Item : Fundamental Radiated Emission
 Test Site : No.3OATS
 Test Mode : Mode 1: Transmit

X-Axis

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Vertical					
Peak Detector:					
2402.000	30.917	52.570	83.487	-30.513	114.000
2440.000	31.139	49.340	80.479	-33.521	114.000
2478.000	31.397	47.970	79.368	-34.632	114.000
Average					
Detector:					
2402.000	30.917	38.160	69.077	-24.923	94.000
2440.000	31.139	35.920	67.059	-26.941	94.000
2478.000	31.397	35.010	66.408	-27.592	94.000

Note:

1. Measurement Level = Reading Level + Correct Factor.
2. Correct Factor = Antenna Factor + Cable Loss – PreAMP.
3. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.

Product : RF 2.4G TX PCBA Module
 Test Item : Fundamental Radiated Emission
 Test Site : No.3OATS
 Test Mode : Mode 1: Transmit

Y-Axis

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
Peak Detector:					
2402.000	31.573	47.820	79.394	-34.606	114.000
2440.000	31.852	46.850	78.702	-35.298	114.000
2478.000	32.140	43.290	75.430	-38.570	114.000
Average					
Detector:					
2402.000	31.573	34.900	66.474	-27.526	94.000
2440.000	31.852	34.130	65.982	-28.018	94.000
2478.000	32.140	31.700	63.840	-30.160	94.000

Note:

1. Measurement Level = Reading Level + Correct Factor.
2. Correct Factor = Antenna Factor + Cable Loss – PreAMP.
3. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.

Product : RF 2.4G TX PCBA Module
 Test Item : Fundamental Radiated Emission
 Test Site : No.3OATS
 Test Mode : Mode 1: Transmit

Y-Axis

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Vertical					
Peak Detector:					
2402.000	30.917	45.000	75.917	-38.083	114.000
2440.000	31.139	42.150	73.289	-40.711	114.000
2478.000	31.397	40.200	71.598	-42.402	114.000
Average					
Detector:					
2402.000	30.917	32.850	63.767	-30.233	94.000
2440.000	31.139	30.770	61.909	-32.091	94.000
2478.000	31.397	29.280	60.678	-33.322	94.000

Note:

1. Measurement Level = Reading Level + Correct Factor.
2. Correct Factor = Antenna Factor + Cable Loss – PreAMP.
3. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.

Product : RF 2.4G TX PCBA Module
 Test Item : Fundamental Radiated Emission
 Test Site : No.3OATS
 Test Mode : Mode 1: Transmit

Z-Axis

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Horizontal					
Peak Detector:					
2402.000	31.573	52.440	84.014	-29.986	114.000
2440.000	31.852	51.220	83.072	-30.928	114.000
2478.000	32.140	48.880	81.020	-32.980	114.000
Average					
Detector:					
2402.000	31.573	38.150	69.724	-24.276	94.000
2440.000	31.852	37.280	69.132	-24.868	94.000
2478.000	32.140	35.510	67.650	-26.350	94.000

Note:

1. Measurement Level = Reading Level + Correct Factor.
2. Correct Factor = Antenna Factor + Cable Loss – PreAMP.
3. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.

Product : RF 2.4G TX PCBA Module
 Test Item : Fundamental Radiated Emission
 Test Site : No.3OATS
 Test Mode : Mode 1: Transmit

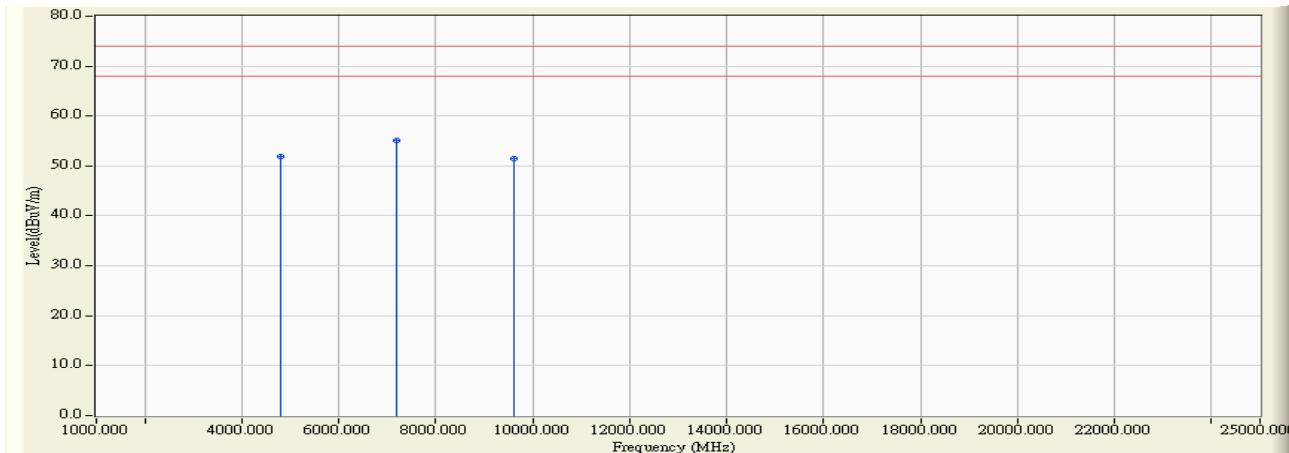
Z-Axis

Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
Vertical					
Peak Detector:					
2402.000	30.917	48.410	79.327	-34.673	114.000
2440.000	31.139	47.070	78.209	-35.791	114.000
2478.000	31.397	43.420	74.818	-39.182	114.000
Average					
Detector:					
2402.000	30.917	35.370	66.287	-27.713	94.000
2440.000	31.139	34.310	65.449	-28.551	94.000
2478.000	31.397	31.810	63.208	-30.792	94.000

Note:

1. Measurement Level = Reading Level + Correct Factor.
2. Correct Factor = Antenna Factor + Cable Loss – PreAMP.
3. The average measurement was not performed when the peak measured data under the limit of average detection. If the readings given are average, peak measurement should also be supplied.

Product : RF 2.4G TX PCBA Module
 Test Item : Harmonic Radiated Emission Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmit (2402MHz)



Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level	dB	dBuV/m
		dB	dBuV		

Horizontal

Peak Detector:

4804.000	3.327	48.480	51.807	-22.193	74.000
7206.000	10.136	44.880	55.016	-18.984	74.000
9608.000	13.706	37.830	51.536	-22.464	74.000

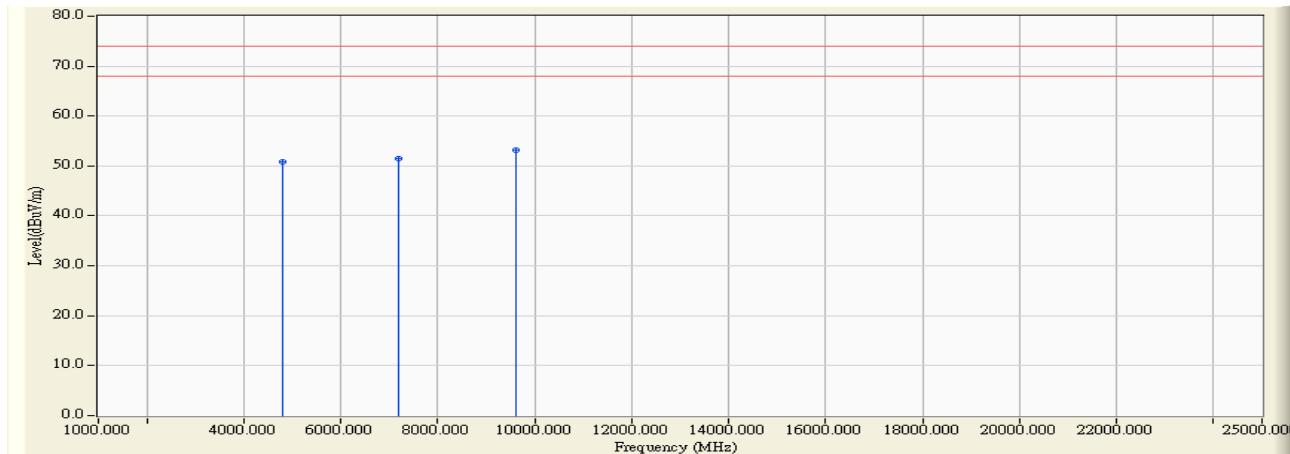
Average Detector:

7206.000	10.136	32.280	42.416	-11.584	54.000
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Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss -Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : RF 2.4G TX PCBA Module
 Test Item : Harmonic Radiated Emission Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmit (2402MHz)



Frequency	Correct	Reading	Measurement	Margin	Limit
	Factor	Level	Level		
MHz	dB	dBuV	dBuV/m	dB	dBuV/m

Vertical

Peak Detector:

4804.000	6.638	44.250	50.887	-23.113	74.000
7206.000	11.005	40.550	51.555	-22.445	74.000
9608.000	14.103	39.050	53.153	-20.847	74.000

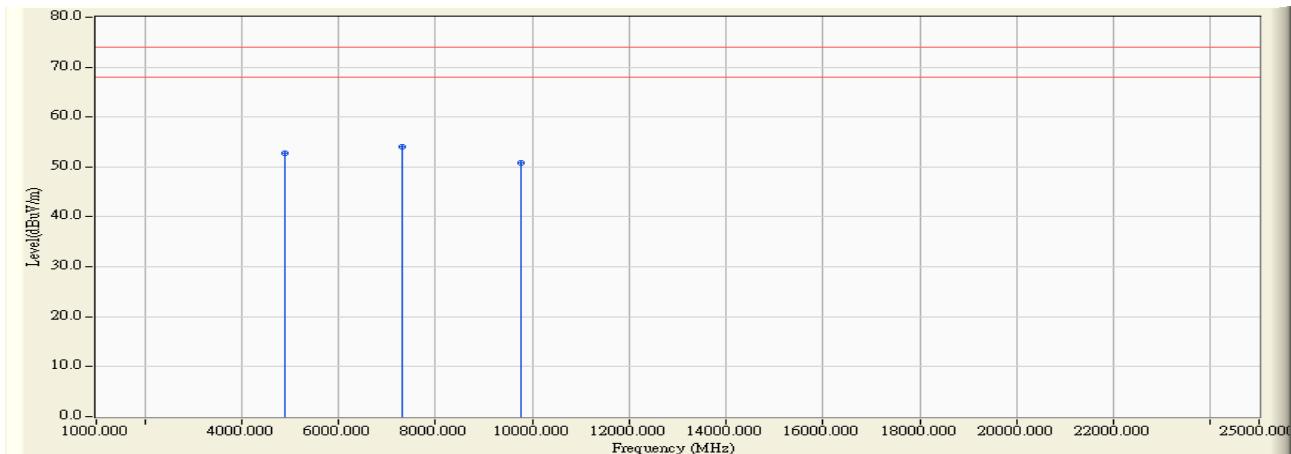
Average Detector:

--

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss -Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : RF 2.4G TX PCBA Module
 Test Item : Harmonic Radiated Emission Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmit (2440 MHz)



Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
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Horizontal

Peak Detector:

4880.000	3.010	49.780	52.790	-21.210	74.000
7320.000	11.833	42.140	53.974	-20.026	74.000
9760.000	12.580	38.170	50.751	-23.249	74.000

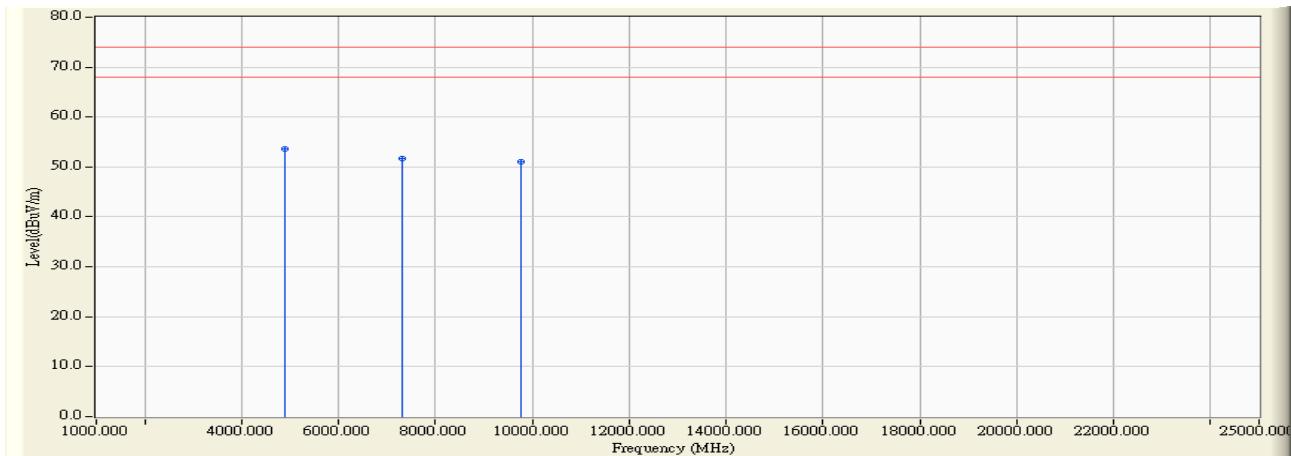
Average Detector:

--

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss -Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : RF 2.4G TX PCBA Module
 Test Item : Harmonic Radiated Emission Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmit (2440 MHz)



Frequency MHz	Correct Factor dB	Reading Level dBuV	Measurement Level dBuV/m	Margin dB	Limit dBuV/m
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Vertical

Peak Detector:

4880.000	5.738	47.780	53.518	-20.482	74.000
7320.000	12.703	38.890	51.593	-22.407	74.000
9760.000	13.052	38.070	51.122	-22.878	74.000

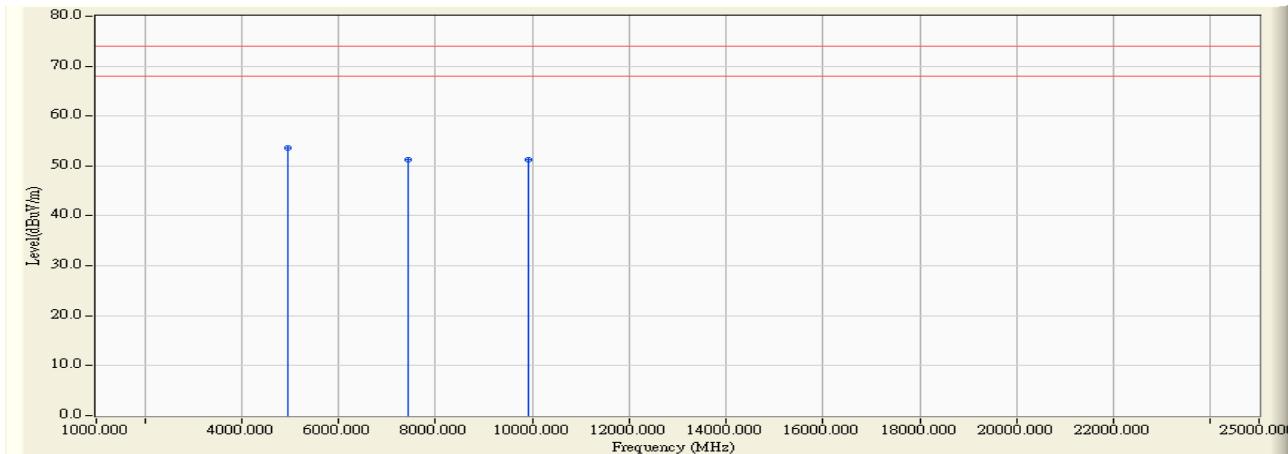
Average Detector:

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Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss -Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : RF 2.4G TX PCBA Module
 Test Item : Harmonic Radiated Emission Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmit (2478 MHz)



Frequency	Correct	Reading	Measurement	Margin	Limit
MHz	Factor	Level	Level	dB	dBuV/m

Horizontal

Peak Detector:

4956.000	2.771	50.770	53.541	-20.459	74.000
7434.000	12.509	38.740	51.250	-22.750	74.000
9912.000	13.411	37.890	51.301	-22.699	74.000

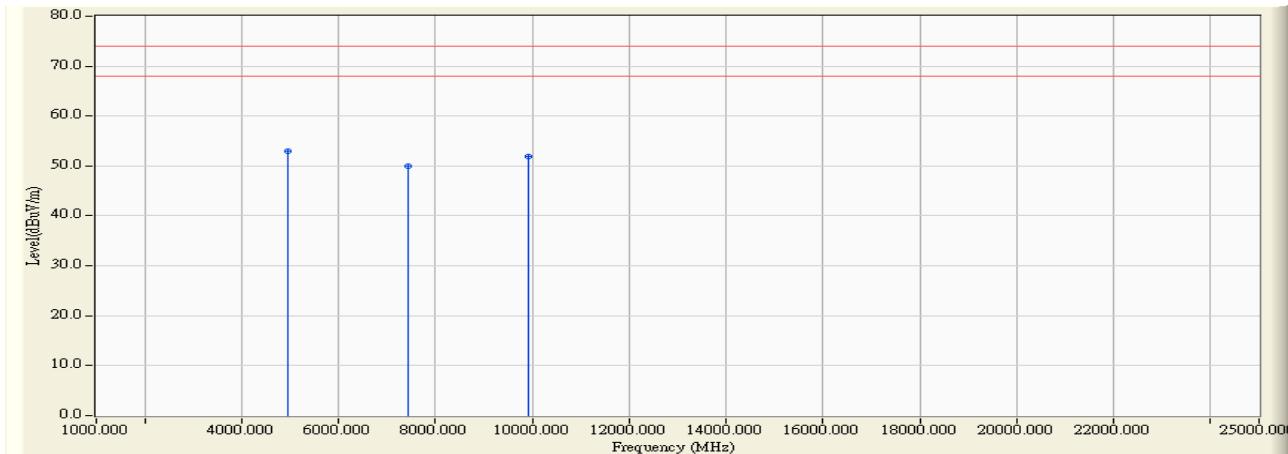
Average Detector:

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Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss -Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.

Product : RF 2.4G TX PCBA Module
 Test Item : Harmonic Radiated Emission Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmit (2478 MHz)



Frequency	Correct	Reading	Measurement	Margin	Limit
	Factor	Level	Level		
MHz	dB	dBuV	dBuV/m	dB	dBuV/m

Vertical

Peak Detector:

4956.000	5.553	47.380	52.934	-21.066	74.000
7434.000	13.416	36.480	49.897	-24.103	74.000
9912.000	13.964	37.980	51.945	-22.055	74.000

Average Detector:

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Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss -Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.
8. No emission found between lowest internal used/generated frequency to 30MHz.

Product : RF 2.4G TX PCBA Module
 Test Item : General Radiated Emission Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmit (2440 MHz)

Frequency	Correct Factor	Reading Level	Measurement Level	Margin	Limit
MHz	dB	dBuV	dBuV/m	dB	dBuV/m
Horizontal					
383.080	-1.164	25.016	23.852	-22.148	46.000
460.680	1.589	23.548	25.137	-20.863	46.000
544.100	3.512	25.511	29.023	-16.977	46.000
615.880	3.215	27.566	30.781	-15.219	46.000
759.440	4.372	25.627	29.999	-16.001	46.000
916.580	6.144	24.049	30.193	-15.807	46.000
Vertical					
212.360	-7.981	34.355	26.374	-17.126	43.500
344.280	-3.171	27.343	24.173	-21.827	46.000
501.420	-0.795	24.442	23.647	-22.353	46.000
689.600	2.538	22.969	25.507	-20.493	46.000
753.620	3.187	24.646	27.833	-18.167	46.000
881.660	2.557	24.667	27.224	-18.776	46.000

Note:

1. All Readings below 1GHz are Quasi-Peak, above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. Measurement Level = Reading Level + Correct Factor.
5. Correct Factor = Antenna factor + Cable loss -Amplifier gain.
6. The average measurement was not performed when the peak measured data under the limit of average detection.
7. The emission levels of other frequencies are very lower than the limit and not show in test report.
8. No emission found between lowest internal used/generated frequency to 30MHz.

4. Band Edge

4.1. Test Equipment

RF Conducted Measurement

The following test equipments are used during the band edge tests:

Equipment	Manufacturer	Model No./Serial No.	Last Cal.
Spectrum Analyzer	R&S	FSP40 / 100170	Jun, 2013
Spectrum Analyzer	Agilent	E4407B / US39440758	Jun, 2013
X Spectrum Analyzer	Agilent	N9010A / MY48030495	Apr., 2013

Note:

1. All equipments are calibrated with traceable calibrations. Each calibration is traceable to the national or international standards.
2. The test instruments marked with “X” are used to measure the final test results.

The following test equipments are used during the band edge tests:

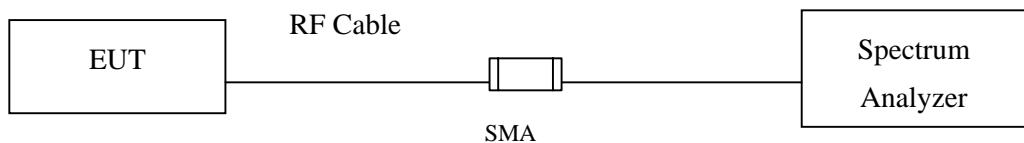
Test Site	Equipment	Manufacturer	Model No./Serial No.	Last Cal.
☒Site # 3	Bilog Antenna	Schaffner Chase	CBL6112B/2673	Sep., 2012
	X Horn Antenna	Schwarzbeck	BBHA9120D/D305	Sep., 2012
	Horn Antenna	Schwarzbeck	BBHA9170/208	Jul., 2013
	Pre-Amplifier	QTK	QTK-AMP-03 / 0003	May, 2013
	X Pre-Amplifier	QTK	AP-180C / CHM_0906076	Sep., 2012
	Pre-Amplifier	MITEQ	AMF-4D-180400-45-6P/925975	Mar, 2013
	X Spectrum Analyzer	Agilent	E4407B / US39440758	May, 2013
	Test Receiver	R & S	ESCS 30/ 825442/018	Sep., 2012
	X Coaxial Cable	QuieTek	QTK-CABLE/ CAB5	Feb., 2013
	X Controller	QuieTek	QTK-CONTROLLER/ CTRL3	N/A
	X Coaxial Switch	Anritsu	MP59B/6200265729	N/A

Note: 1. All equipments are calibrated every one year.

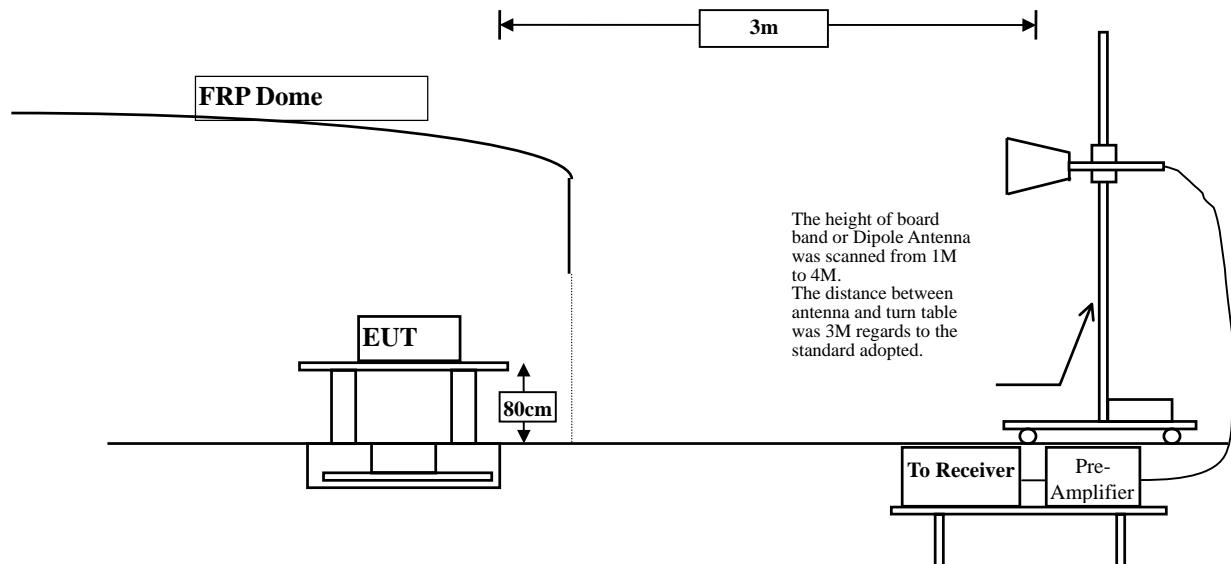
2. The test equipments marked by “X” are used to measure the final test results.

4.2. Test Setup

RF Conducted Measurement



RF Radiated Measurement:



4.3. Limits

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 50 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. Attenuation below the general limits specified in Section 15.209(a) is not required. 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)).

4.4. Test Procedure

The EUT and its simulators are placed on a turn table which is 0.8 meter above ground. The turn table can rotate 360 degrees to determine the position of the maximum emission level. The EUT was positioned such that the distance from antenna to the EUT was 3 meters.

The antenna can move up and down between 1 meter and 4 meters to find out the maximum emission level.

Both horizontal and vertical polarization of the antenna are set on measurement. In order to find the maximum emission, all of the interface cables must be manipulated according to ANSI C63.10: 2009 on radiated measurement.

The bandwidth setting below 1GHz and above 1GHz on the field strength meter is 120 kHz and 1MHz, respectively.

4.5. Uncertainty

Conducted is \pm 1.27 dB

Radiated is \pm 3.9 dB

4.6. Test Result of Band Edge

Product : RF 2.4G TX PCBA Module
 Test Item : Band Edge Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmit

RF Radiated Measurement (Horizontal):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
01 (Peak)	2390.000	-1.131	50.965	49.834	74.00	54.00	Pass
01 (Peak)	2400.000	-1.084	73.297	72.214	74.00	54.00	Pass
01 (Peak)	2402.000	-1.073	86.008	84.936	--	--	--
01 (Average)	2386.200	-1.146	25.469	24.323	74.00	54.00	Pass
01 (Average)	2390.000	-1.131	24.238	23.107	74.00	54.00	Pass
01 (Average)	2400.000	-1.084	47.865	46.782	74.00	54.00	Pass
01 (Average)	2402.000	-1.073	65.607	64.535	--	--	--

Figure Channel 01:

Horizontal (Peak)

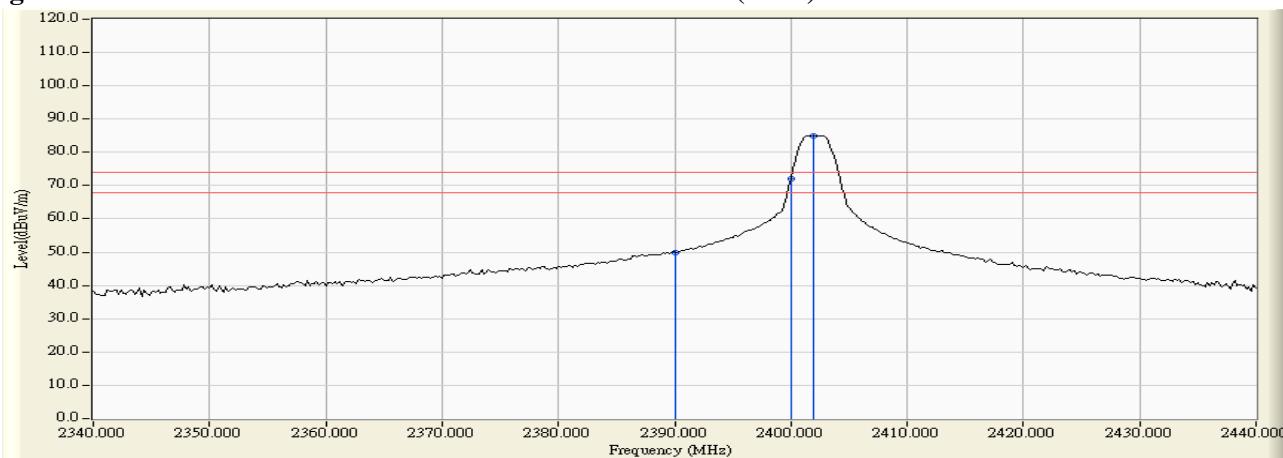
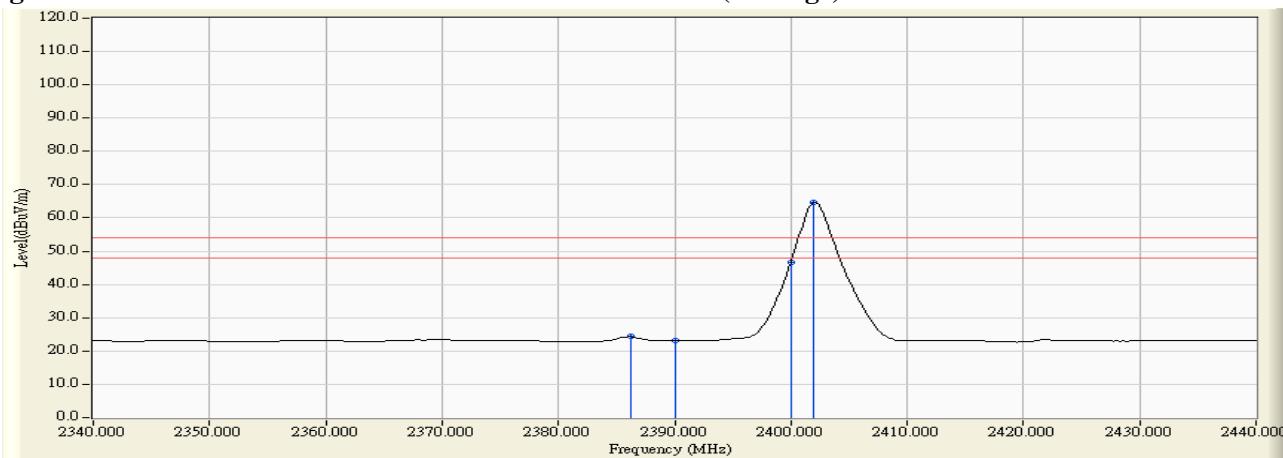


Figure Channel 01:

Horizontal (Average)



Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. “ * ”, means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : RF 2.4G TX PCBA Module
 Test Item : Band Edge Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmit

RF Radiated Measurement (Vertical):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
01 (Peak)	2390.000	-1.725	48.374	46.649	74.00	54.00	Pass
01 (Peak)	2400.000	-1.733	69.700	67.968	74.00	54.00	Pass
01 (Peak)	2402.000	-1.729	82.033	80.304	--	--	--
01 (Average)	2385.800	-1.705	24.884	23.179	74.00	54.00	Pass
01 (Average)	2390.000	-1.725	23.990	22.265	74.00	54.00	Pass
01 (Average)	2400.000	-1.733	45.486	43.754	74.00	54.00	Pass
01 (Average)	2402.200	-1.729	62.573	60.845	--	--	--

Figure Channel 01:

Vertical (Peak)

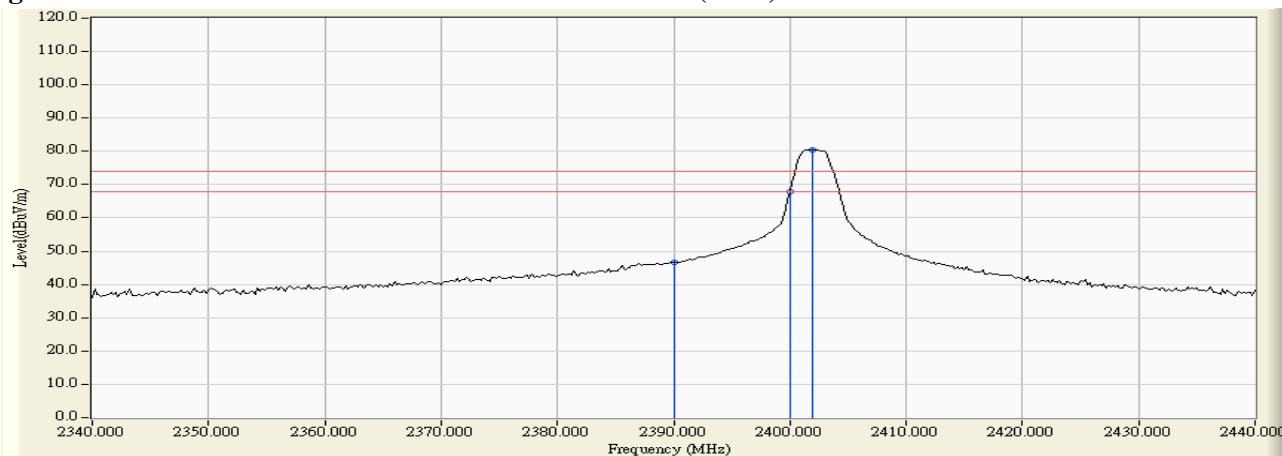
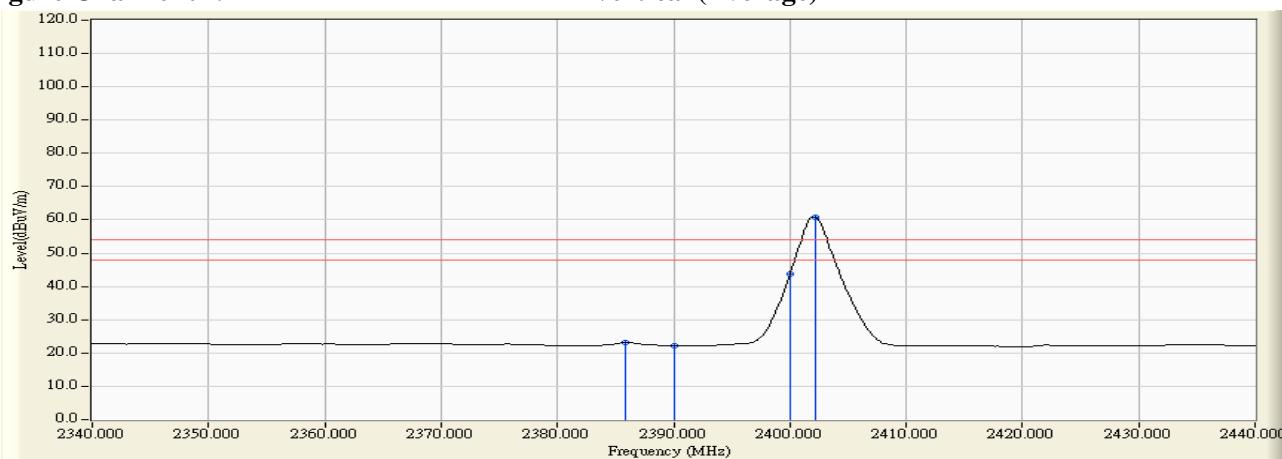


Figure Channel 01:

Vertical (Average)



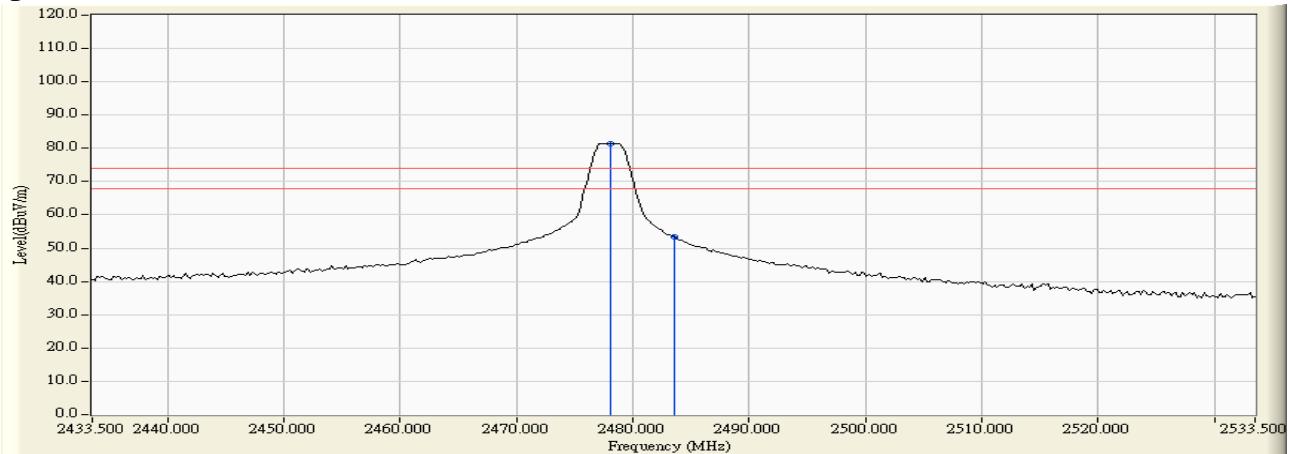
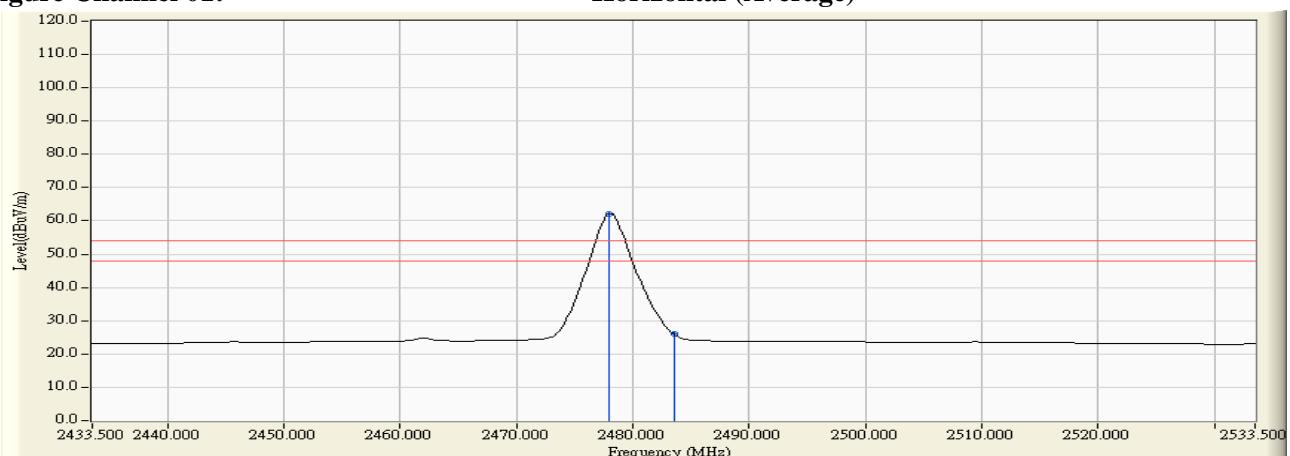
Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. “ * ”, means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : RF 2.4G TX PCBA Module
 Test Item : Band Edge Data
 Test Site : No.3 OATS
 Test Mode : Mode 1: Transmit

RF Radiated Measurement (Horizontal):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
77 (Peak)	2478.100	-0.592	82.146	81.553	--	--	--
77 (Peak)	2483.500	-0.558	54.068	53.510	74.00	54.00	Pass
77 (Average)	2477.900	-0.594	62.781	62.187	--	--	--
77 (Average)	2483.500	-0.558	26.555	25.997	74.00	54.00	Pass

Figure Channel 01:
Horizontal (Peak)

Figure Channel 01:
Horizontal (Average)


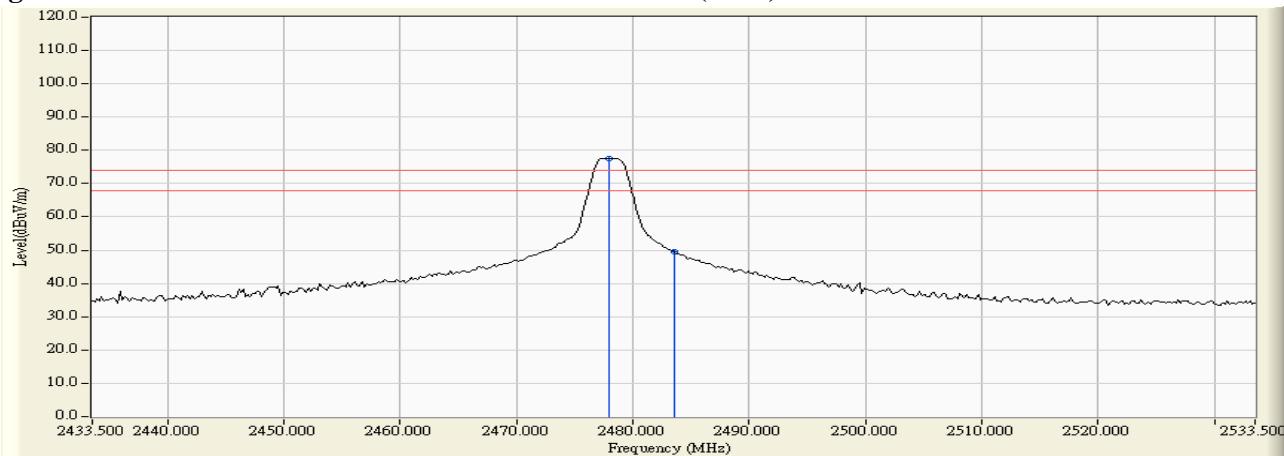
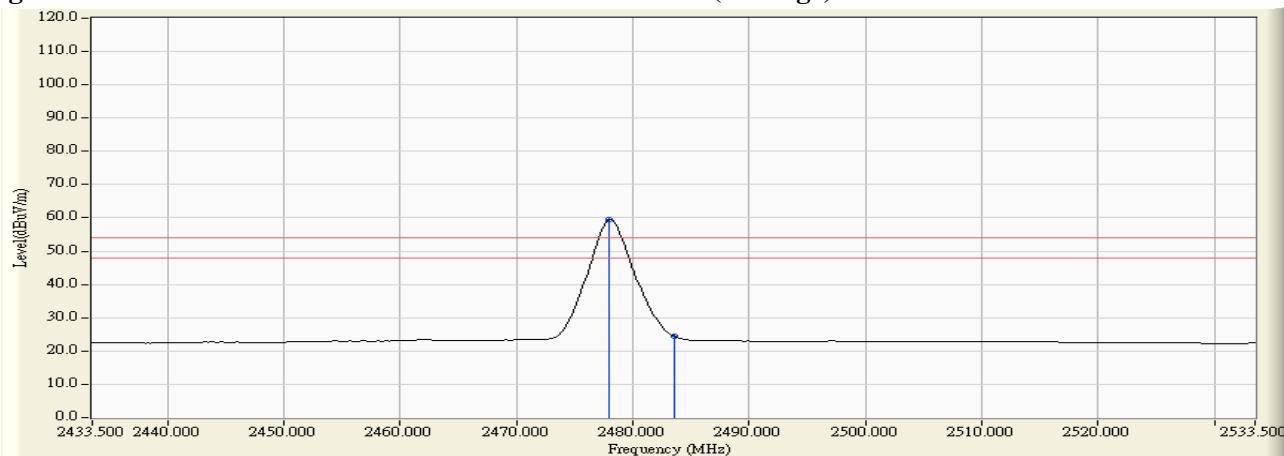
Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. “ * ”, means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

Product : RF 2.4G TX PCBA Module
Test Item : Band Edge Data
Test Site : No.3 OATS
Test Mode : Mode 1: Transmit

RF Radiated Measurement (Vertical):

Channel No.	Frequency (MHz)	Correct Factor (dB)	Reading Level (dBuV)	Emission Level (dBuV/m)	Peak Limit (dBuV/m)	Average Limit (dBuV/m)	Result
77 (Peak)	2477.900	-1.336	78.865	77.529	--	--	--
77 (Peak)	2483.500	-1.305	50.707	49.402	74.00	54.00	Pass
77 (Average)	2477.900	-1.336	60.934	59.598	--	--	--
77 (Average)	2483.500	-1.305	25.765	24.460	74.00	54.00	Pass

Figure Channel 77:**Vertical (Peak)****Figure Channel 77:****Vertical (Average)**

Note:

1. All readings above 1GHz are performed with peak and/or average measurements as necessary.
2. Peak measurements: RBW = 1MHz, VBW = 3 MHz, Sweep: Auto.
3. Average measurements: RBW = 1MHz, VBW = 10 Hz, Sweep: Auto.
4. “ * ”, means this data is the worst emission level.
5. Measurement Level = Reading Level + Correct Factor.
6. The average measurement was not performed when the peak measured data under the limit of average detection.

5. EMI Reduction Method During Compliance Testing

No modification was made during testing.