47 CFR PART 15 C

TEST REPORT

of

e-AR Activity Sensor

Model Name:	e-AR
Brand Name:	e-AR
Trade Name:	Sensixa
Report No.:	SZ09080052E06
FCC ID:	XSH-EARB1

prepared for

Sensixa Limited

53 Cavendish Road, London SW12 0BL, UK

prepared by

Shenzhen Electronic Product Quality Testing Center

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CTIA Authorized Test Lab

LAB CODE 20081223-00

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Change History		
Issue	Date	Reason for change
1.0	October 13, 2009	First edition

1. TEST CERTIFICATION

Equipment under Test:	e-AR Activity Sensor
FCC ID:	XSH-EARB1
Trade Name:	Sensixa
Model Name:	e-AR
Applicant:	Sensixa Limited 53 Cavendish Road, London SW12 0BL, UK
Manufacturer:	Group Sense Mobile-Tech Limited 6/F., Enterprise Place, 5 Science Park West Avenue, Hong Kong Science Park, Shatin, N.T, Hong Kong
Test Standards:	47 CFR Part 15 Subpart C (10-1-05 Edition)
Test Date(s):	Sep 10, 2009 - Sep 30, 2009
Test Result:	PASS

*** We Hereby Certify That:**

The equipment under test was tested by Shenzhen Electronic Product Quality Testing Center Morlab Laboratory. The test data, data evaluation, test procedures and equipment configurations shown in this report were made in accordance with the requirement of related FCC rules.

The test results of this report only apply for the tested sample equipment identified above. The test report shall be invalid without all the signatures of the test engineer, the reviewer and the approver.

Tested by: Cao Shaodong Dated: 2009.10.13
Cao Shaodong

Reviewed by: Liao Jianming Dated: 2009.10.13
Liao Jianming

Approved by: Shu Luan Dated: 2009.10.13
Shu Luan

2. GENERAL INFORMATION

2.1 EUT Description

EUT Type ..... :	e-AR Activity Sensor
Model Name ..... :	e-AR
Serial No. ..... :	(n.a.)
Frequency	2.401GHz - 2.482GHz
Hardware Version ..... :	e-AR Sensor rev3.3a-v8/ e-AR Base Station rev3.3a-v8
Software Version ..... :	e-AR Activity Sensor v1.2
Power Supply ..... :	(see Ancillary Equipments 1)
Ancillary Equipments 1 ..... :	Battery of e-AR Sensor
	Model Name: LP301125-PCB-LD
	Brand Name: EEMB
	Capacitance: 47mAh
	Rated Voltage: 3.7V
	Charge Limit: 4.2V
	Manufacturer: EEMB Co., Ltd

Note 1: The EUT is 2.4GHz e-AR Activity Sensor; it is composed of e-AR Sensor and Base station. They not support frequency hopping. The Base station is powered by USB of PC.

Note 2: Only the Base station will be tested in this report.

Note 3: The Base station operating at 2.4GHz ISM band; the frequencies allocated for the e-AR Sensor is F(MHz)=2400+1*n (1<=n<=82). The lowest, middle, highest channel numbers of the Base station used and tested in this report are separately 1 (2401MHz), 42(2442MHz) and 82 (2482MHz).

Note 4: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

Note 5: EUT Test Model:

The first model:

The EUT is 2.4GHz e-AR Activity Sensor; it is composed of e-AR Sensor and Base station. They not support frequency hopping. The Base station is powered by USB of PC. The Chip Type is CC2500 DP357200 Q726

The second model:

The EUT is 2.4GHz e-AR Activity Sensor; it is composed of e-AR Sensor and Base station. They not support frequency hopping. The Base station is powered by USB of PC. The Chip Type is NRF B 24E1G 0742BT

2.2 Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart C (Wi-Fi, 2.4GHz ISM band radiators) for the EUT FCC ID Certification:

No.	Identity	Document Title
1	47 CFR Part 15 (10-1-05 Edition)	Radio Frequency Devices

Test detailed items/section required by FCC rules and results are as below:

No.	Section	Description	Test Model	Result	Test date
1	15.247(a)	Number of Hopping Frequency	(n.a)	(n.a)	(n.a)
2	15.247(b)	Peak Output Power	The first model	PASS	2009-09-25
			The second model	PASS	2009-09-30
3	15.247(a)	20db Bandwidth	The first model	PASS	2009-09-25
			The second model	PASS	2009-09-30
4	15.247(a)	Carrier Frequency Separation	(n.a)	(n.a)	(n.a)
5	15.247(a)	Time of Occupancy (Dwell time)	(n.a)	(n.a)	(n.a)
6	15.247(c)	Conducted Spurious Emission	The first model	PASS	2009-09-26
			The second model	PASS	2009-09-30
7	15.247(c)	Band Edge	The first model	PASS	2009-09-30
			The second model	PASS	2009-09-30
8	15.207	Conducted Emission	The first model	PASS	2009-09-26
9	15.209 15.247(c)	Radiated Emission	The first model	PASS	2009-09-26
10	15.247(d)	Power spectral density (PSD)	The first model	PASS	2009-09-25
			The second model	PASS	2009-09-30

The tests of Conducted Emission and Radiated Emission were performed according to the method of measurements prescribed in ANSI C63.4 2003.

2.3 Facilities and Accreditations

2.3.1 Facilities

Shenzhen Electronic Product Quality Testing Center Morlab Laboratory is a testing organization accredited by China National Accreditation Service for Conformity Assessment (CNAS) according to ISO/IEC 17025. The accreditation certificate number is L1659.

All measurement facilities used to collect the measurement data are located at Electronic Testing Building, Shahe Road, Xili, Nanshan District, Shenzhen 518055 CHINA. The test site is constructed in conformance with the requirements of ANSI C63.7, ANSI C63.4 and CISPR Publication 22; the FCC registration number is 741109.

2.3.2 Test Environment Conditions

During the measurement, the environmental conditions were within the listed ranges:

Temperature (°C):	20 - 25
Relative Humidity (%):	40 - 60
Atmospheric Pressure (kPa):	96

3. 47 CFR PART 15C REQUIREMENTS

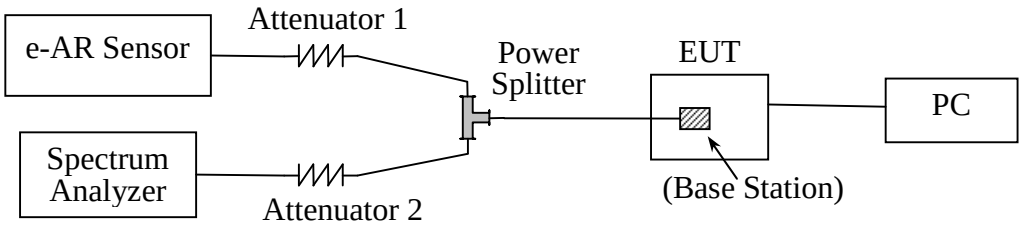
3.1 Peak Output Power

3.1.1 Requirement

According to FCC section 15.247(b)(1), for frequency hopping systems that operates in the 2400MHz to 2483.5MHz band employing at least 75 hopping channels, the maximum peak output power of the intentional radiator shall not exceed 1Watt. For all other frequency hopping systems in the 2400MHz to 2483.5MHz band, it is 0.125Watts.

3.1.2 Test Description

A. Test Setup:



The EUT is a 2.4GHz e-AR Activity Sensor, it is composed of e-AR Sensor and Base station. The Base station is powered by PC. The 2.4GHz e-AR Activity Sensor can not work without the Base station together with the PC. The RF load attached to the Base station antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading. The Base station which controlled by a PC operates at 2.4GHz ISM band and a communication link was established between the e-AR Sensor and Base station. The e-AR Sensor operated at 2.4GHz ISM band. The Data transmission between the e-AR Sensor and Base station is continually working.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Spectrum Analyzer	Agilent	E7405A	US44210471	2009.09	1year
Power Splitter	Weinschel	1506A	NW521	(n.a.)	(n.a.)
Attenuator 1	Resnet	20dB	(n.a.)	(n.a.)	(n.a.)
Attenuator 2	Resnet	3dB	(n.a.)	(n.a.)	(n.a.)

3.1.3 Test Result

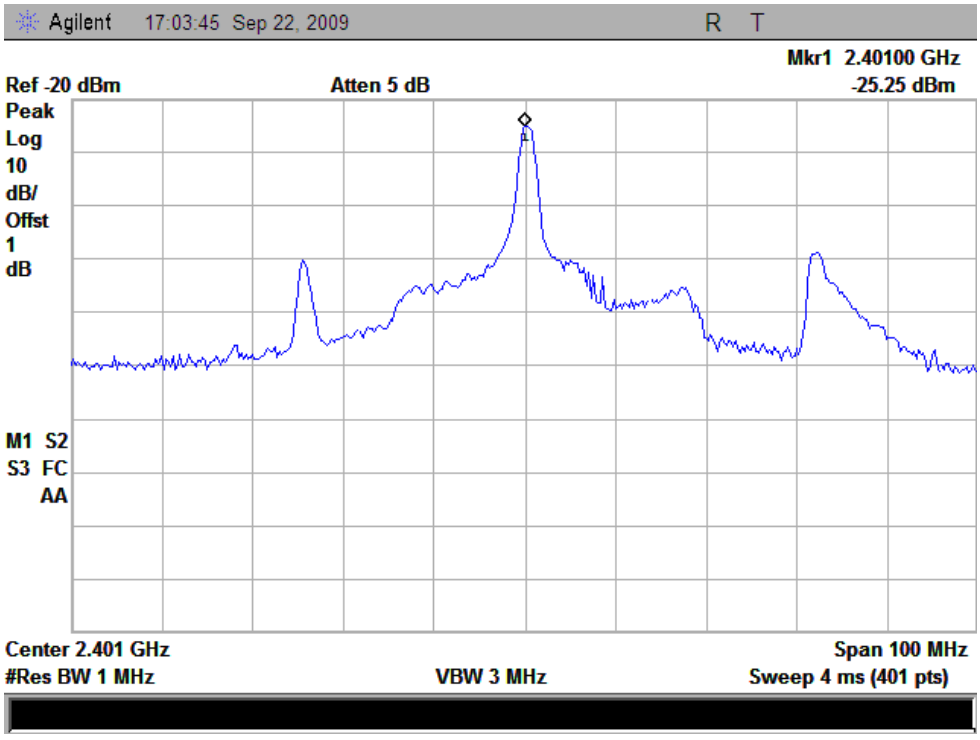
3.1.3.1 The first model

The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the Module.

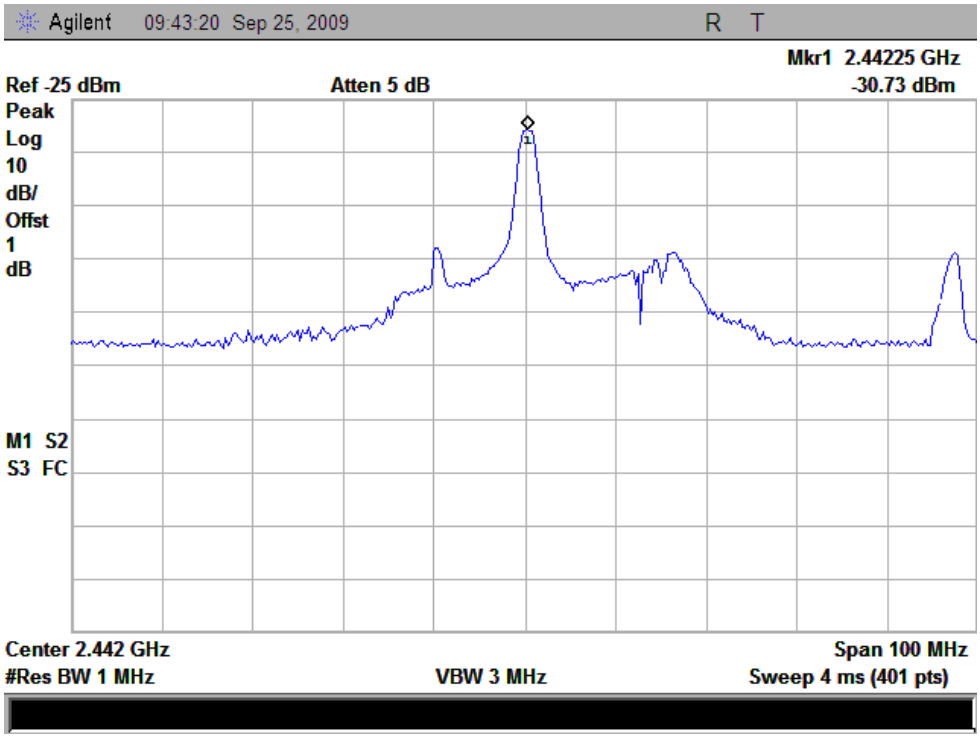
C. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power			Limit		Verdict
		dBm	W	Refer to Plot	dBm	W	
1	2401	-25.25	2.98E-6	Plot A	30	1	PASS
42	2442	-30.73	8.45E-7	Plot B			PASS
82	2482	-37.47	1.79E-7	Plot C			PASS

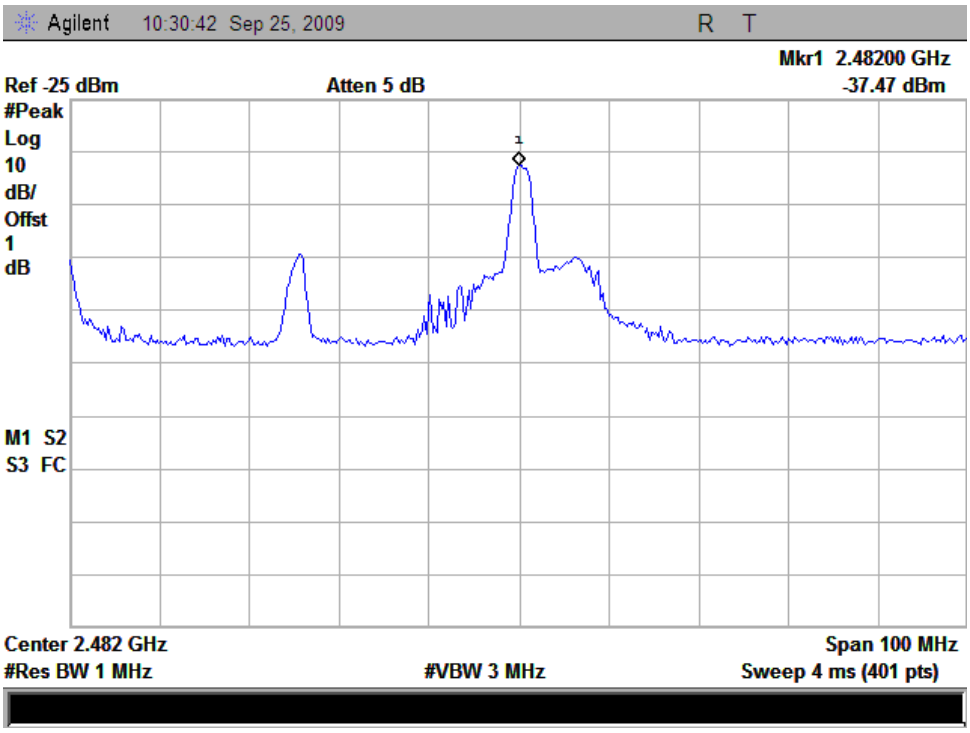
D. Test Plot:



(Plot A: Channel = 2401)



(Plot B: Channel = 2442)



(Plot C: Channel = 2482)

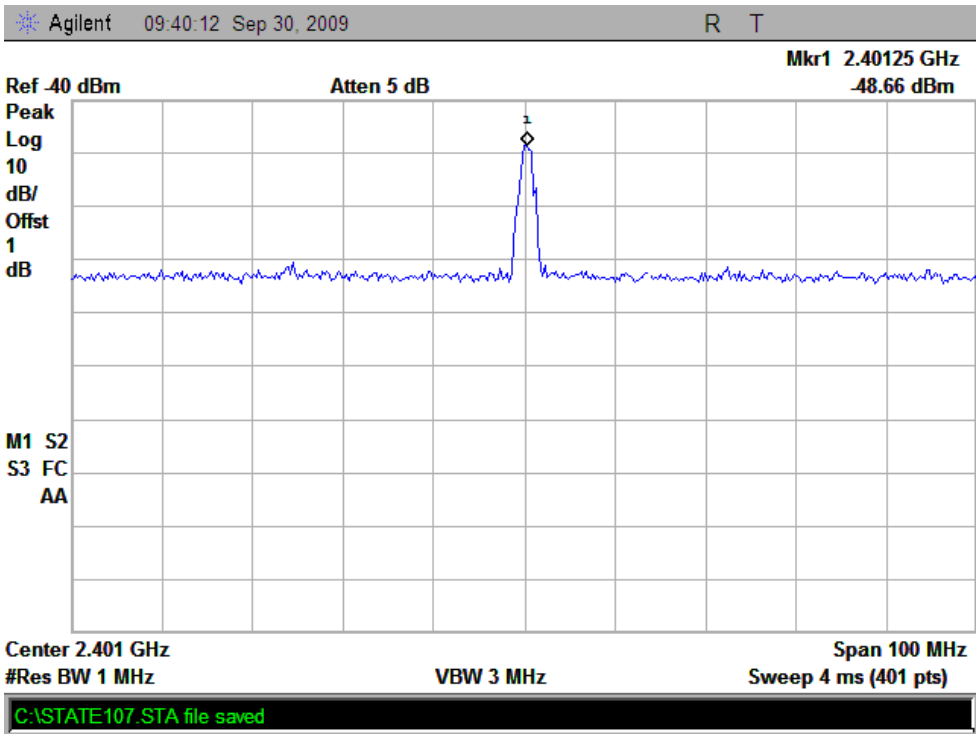
3.1.3.2 The second model

The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the Module.

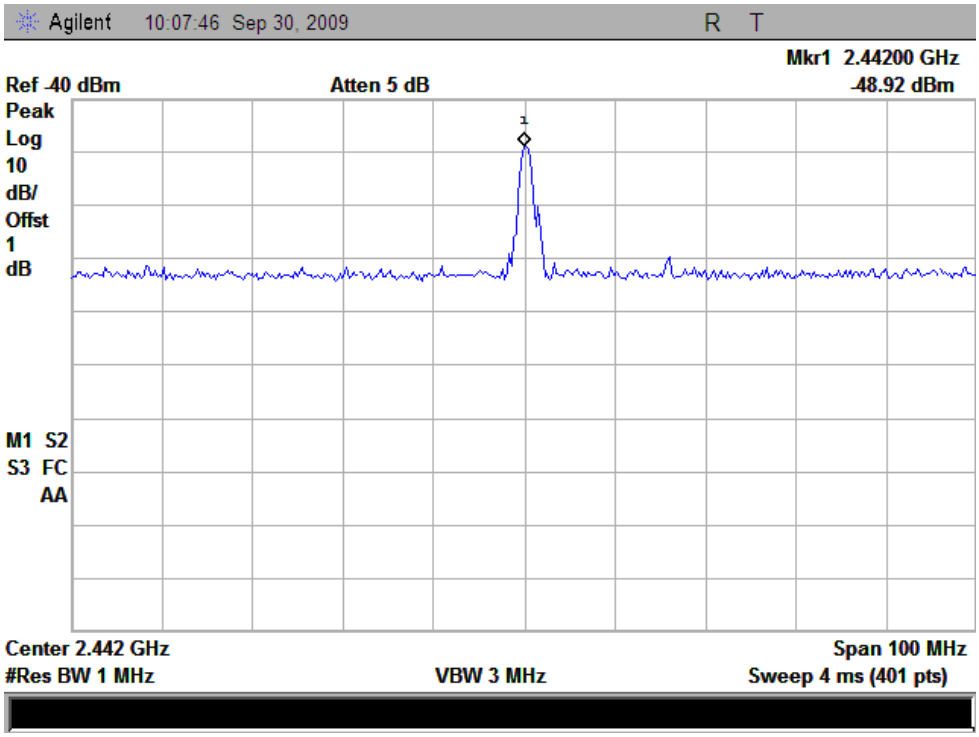
A. Test Verdict:

Channel	Frequency (MHz)	Measured Output Peak Power			Limit		Verdict
		dBm	W	Refer to Plot	dBm	W	
1	2401	-48.66	1.36 E-8	Plot A	30	1	PASS
42	2442	-48.92	1.28E-8	Plot B			PASS
82	2482	-47.8	1.66E-8	Plot C			PASS

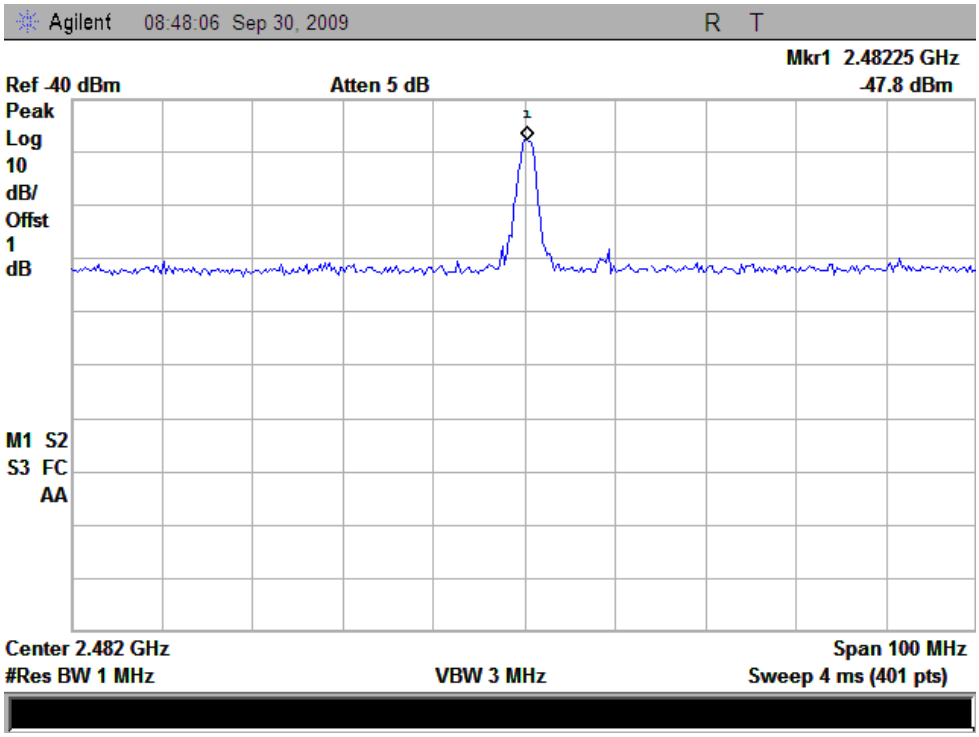
B. Test Plot:



(Plot A: Channel = 2401)



(Plot B: Channel = 2442)



(Plot C: Channel = 2482)

3.2 Bandwidth

3.2.1 Definition

The 20dB bandwidth is known as the 99% emission bandwidth, or 20dB bandwidth (10*log1% = 20dB) taking the total RF output power.

3.2.2 Test Description

See section 3.1.2 of this report.

3.2.3 Test Result

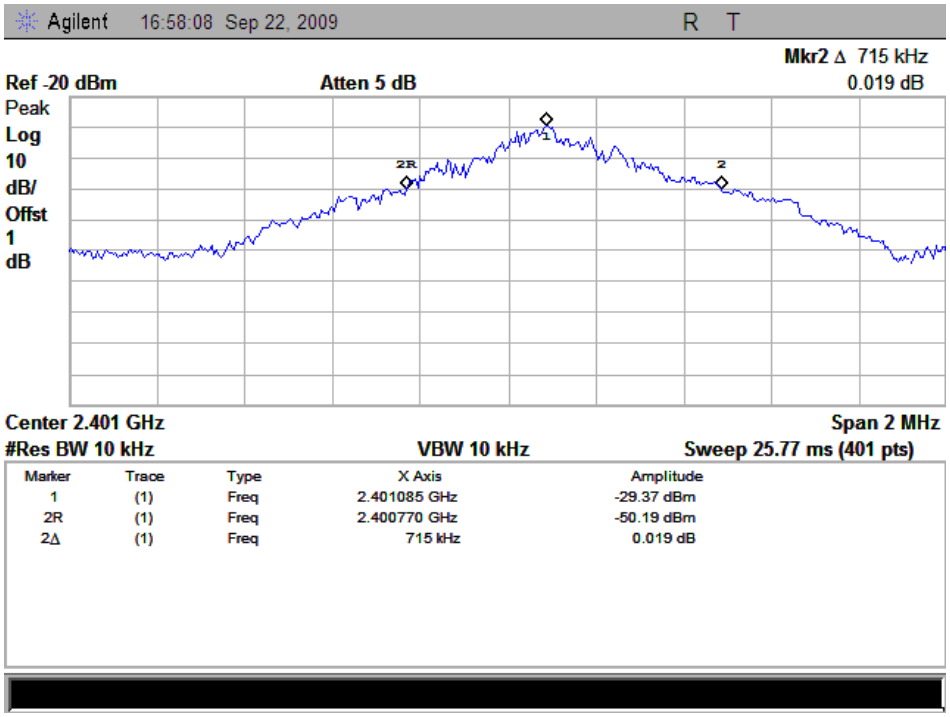
3.2.3.1 The first model

The lowest, middle and highest channels are selected to perform testing to record the 20dB bandwidth of the Module.

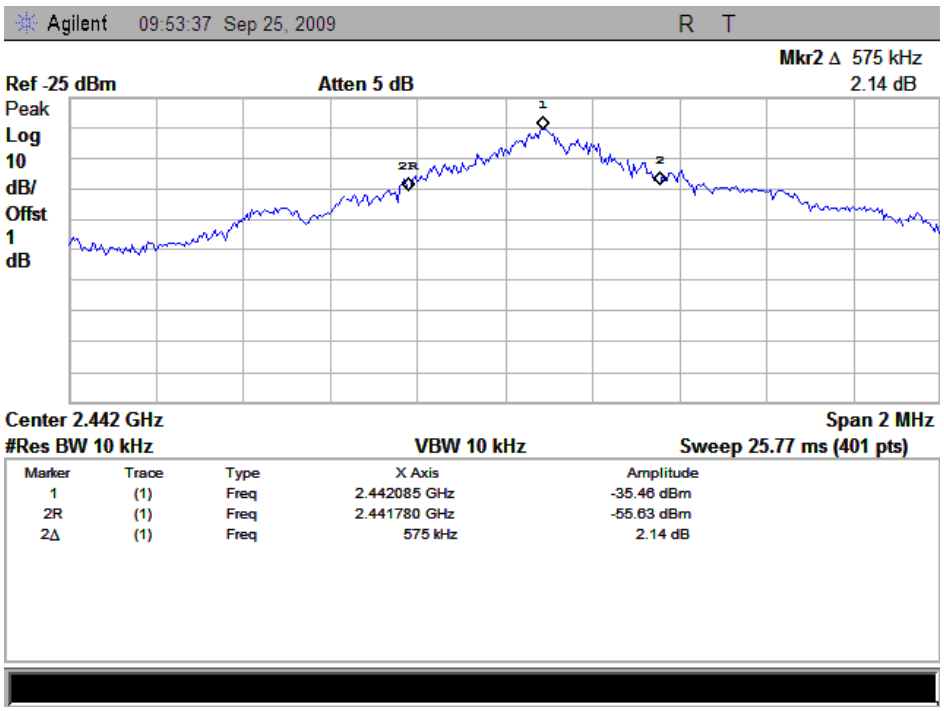
A. Test Verdict:

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
1	2401	0.715	Plot A
42	2442	0.575	Plot B
82	2482	0.670	Plot C

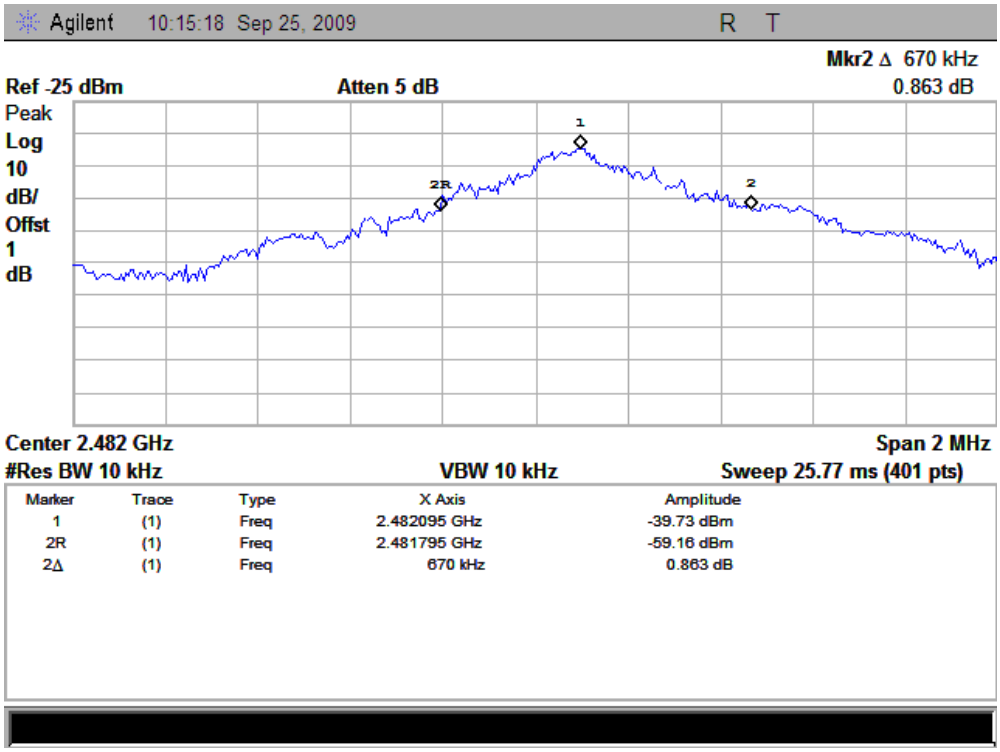
B. Test Plot:



(Plot A: Channel 1: 2401MHz)



(Plot B: Channel 42: 2442 MHz)



(Plot C: Channel 82: 2482MHz)

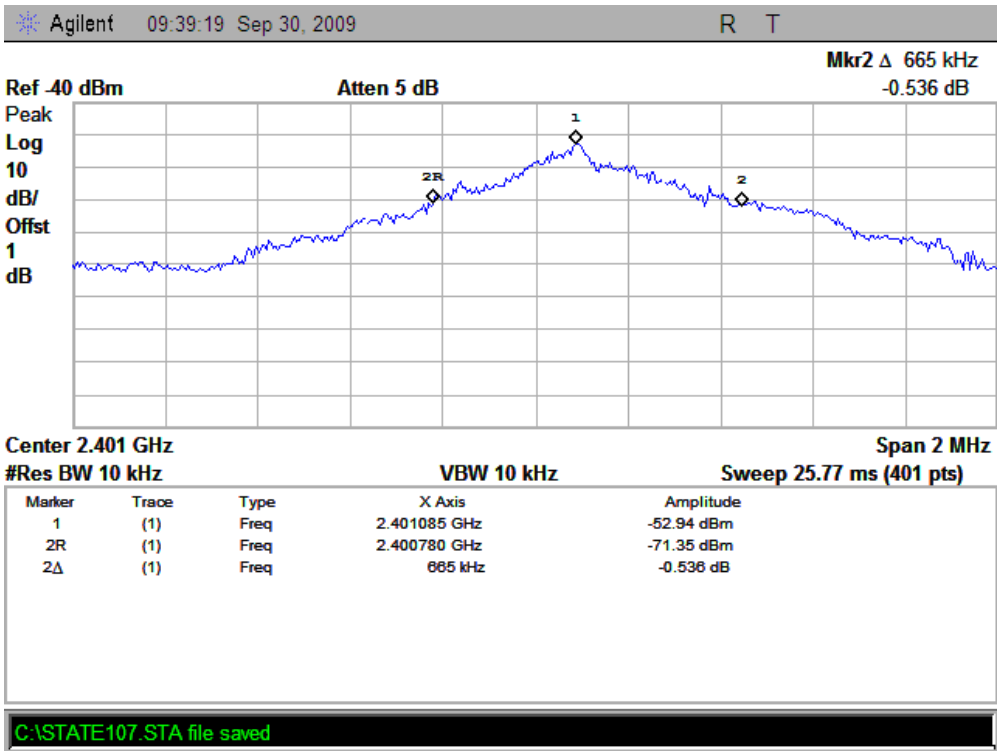
3.2.3.2 The second model

The lowest, middle and highest channels are selected to perform testing to record the 20dB bandwidth of the Module.

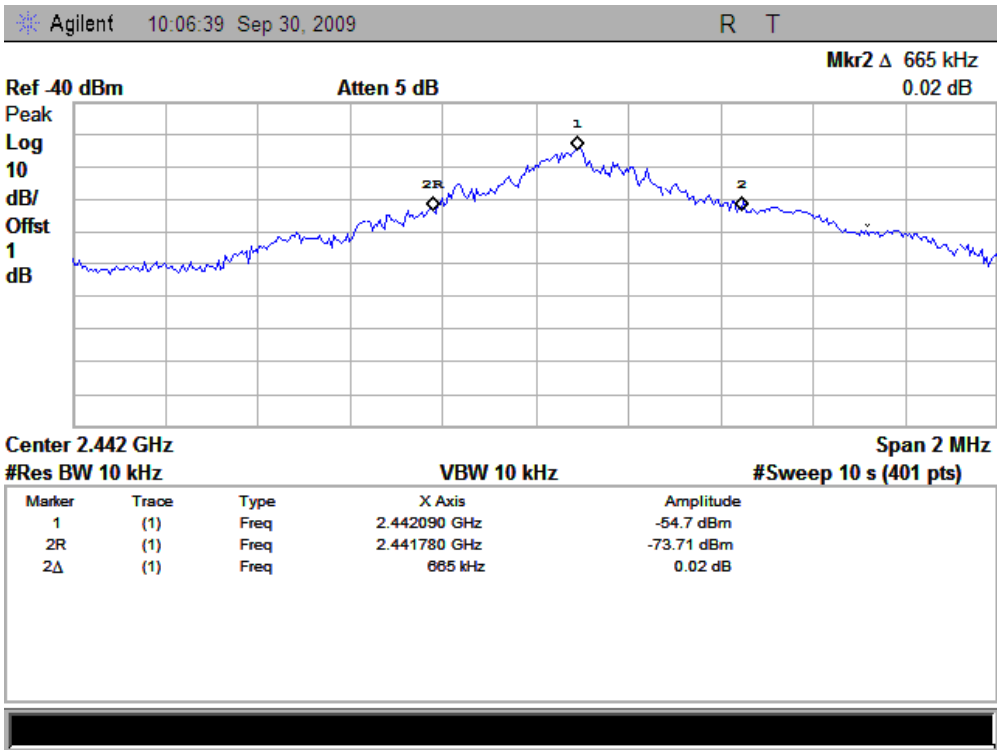
A. Test Verdict:

Channel	Frequency (MHz)	20dB Bandwidth (MHz)	Refer to Plot
1	2401	0.665	Plot A
42	2442	0.665	Plot B
82	2482	0.665	Plot C

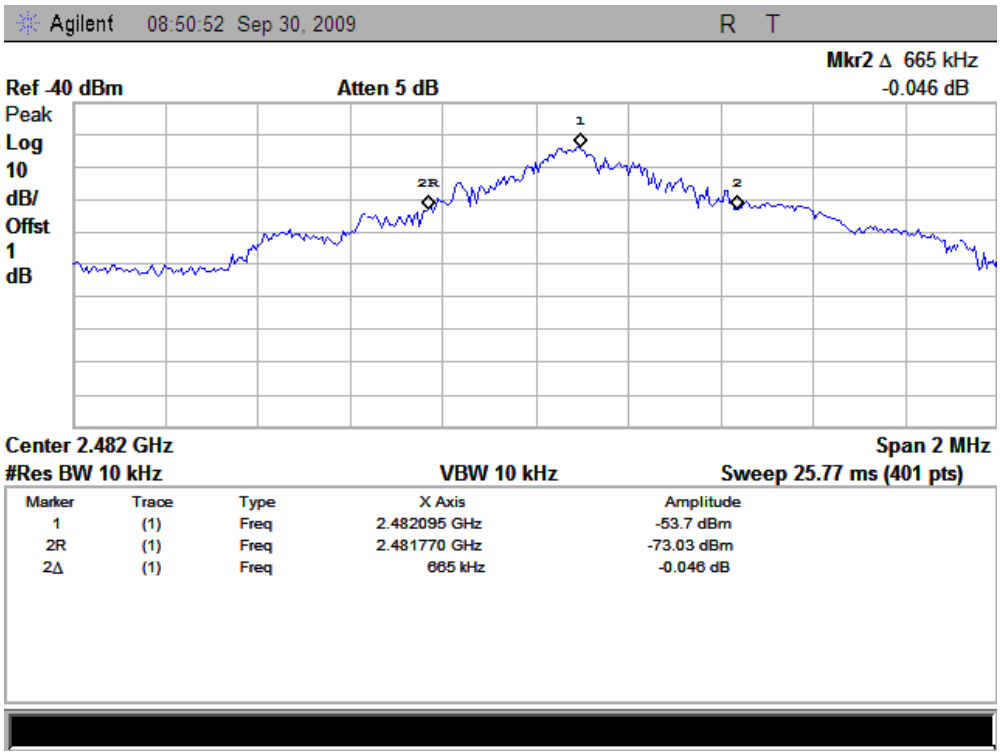
B. Test Plot:



(Plot A: Channel 1: 2401MHz)



(Plot B: Channel 42: 2442 MHz)



(Plot C: Channel 82: 2482MHz)

3.3 Conducted Spurious Emissions

3.3.1 Requirement

According to FCC section 15.247(c), in any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

3.3.2 Test Description

See section 3.1.2 of this report.

3.3.3 Test Result

3.3.3.1 The first model

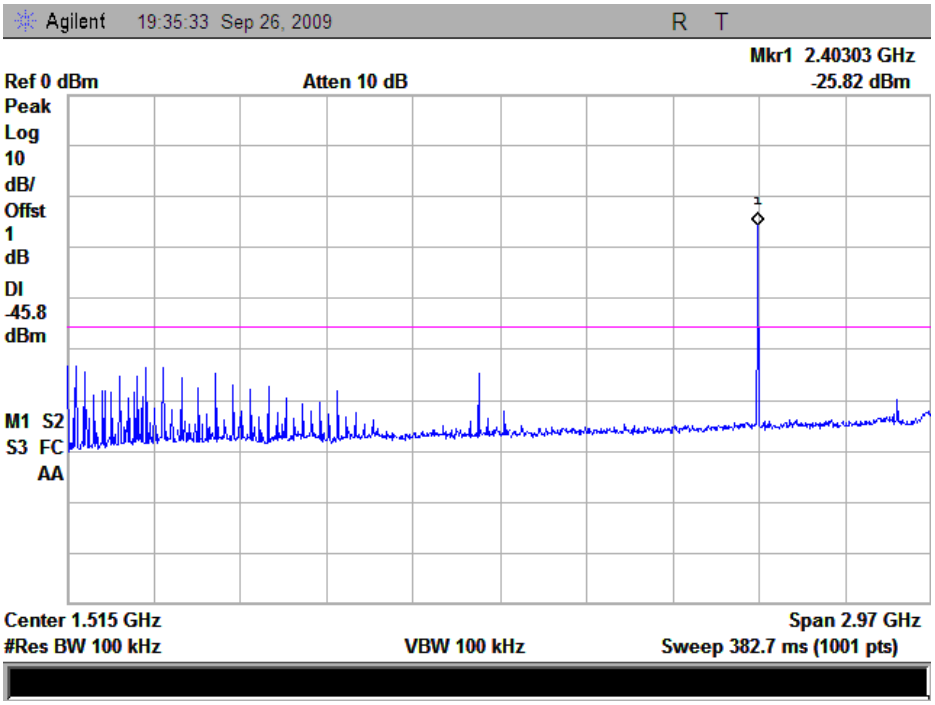
The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions.

A. Test Verdict:

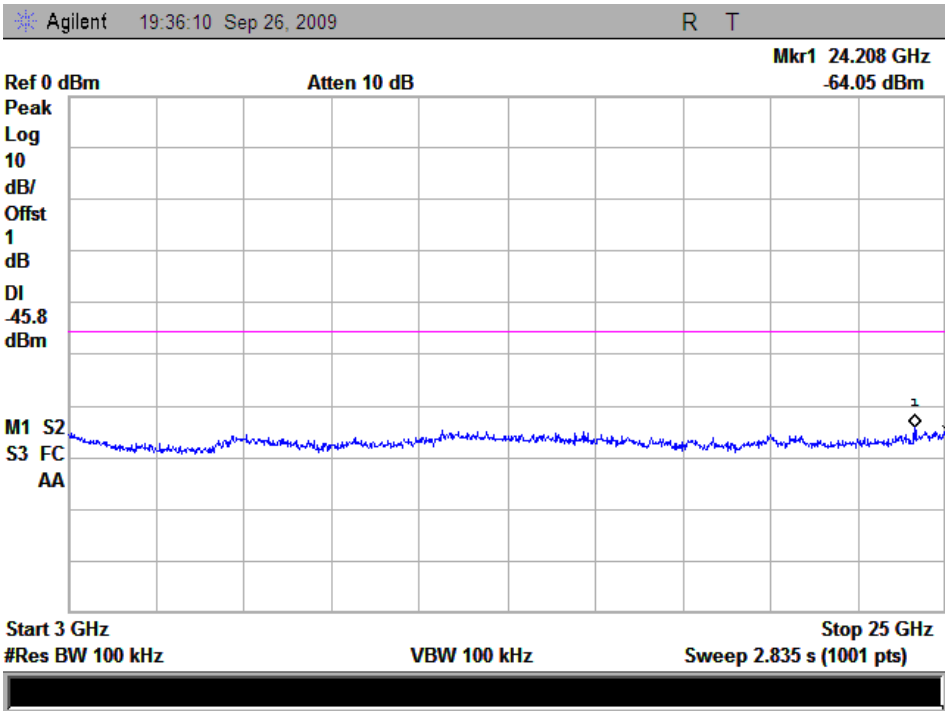
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
1	2402	-64.05	Plot A.1/A.2	-25.82	-45.8	PASS
42	2442	-64.82	Plot B.1/B.2	-25.79	-45.8	PASS
82	2482	-64.72	Plot C.1/C.2	-26.99	-47	PASS

B. Test Plot:

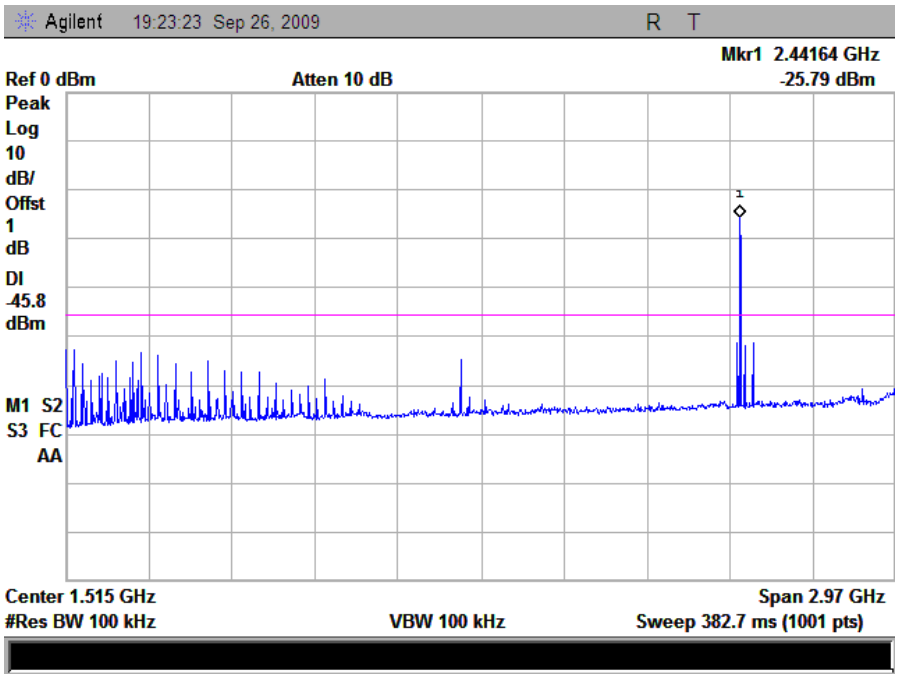
Note: the power of the Module transmitting frequency should be ignored.



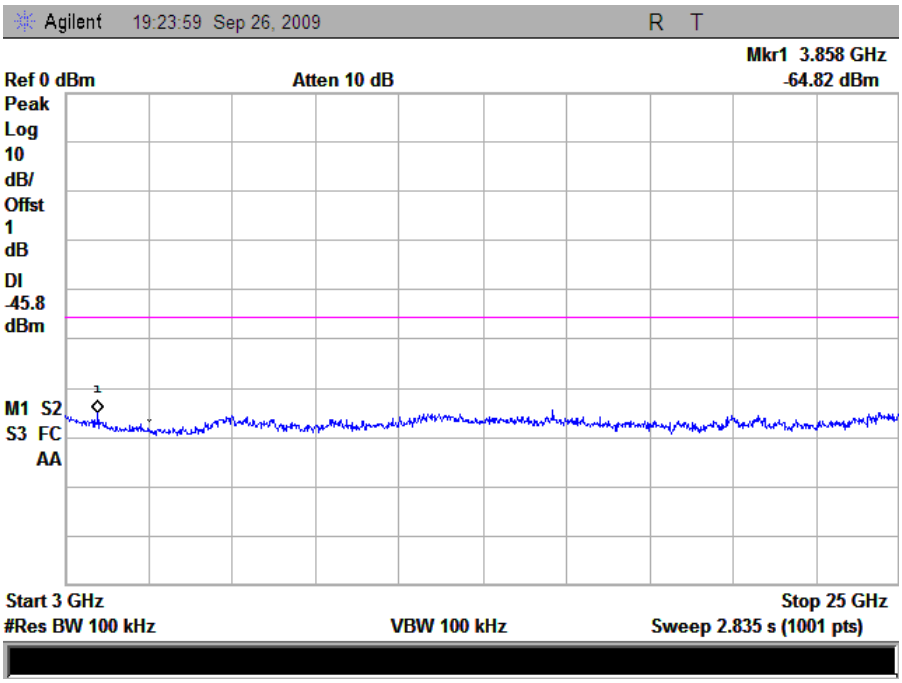
(Plot A.1: Channel = 1, 30MHz to 3GHz)



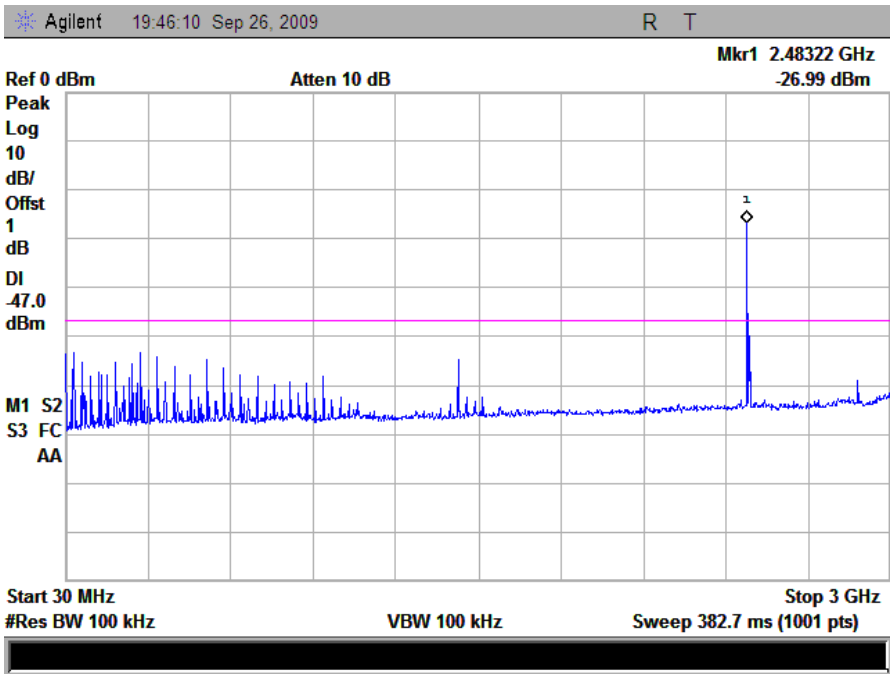
(Plot A.2: Channel = 1, 3GHz to 25GHz)



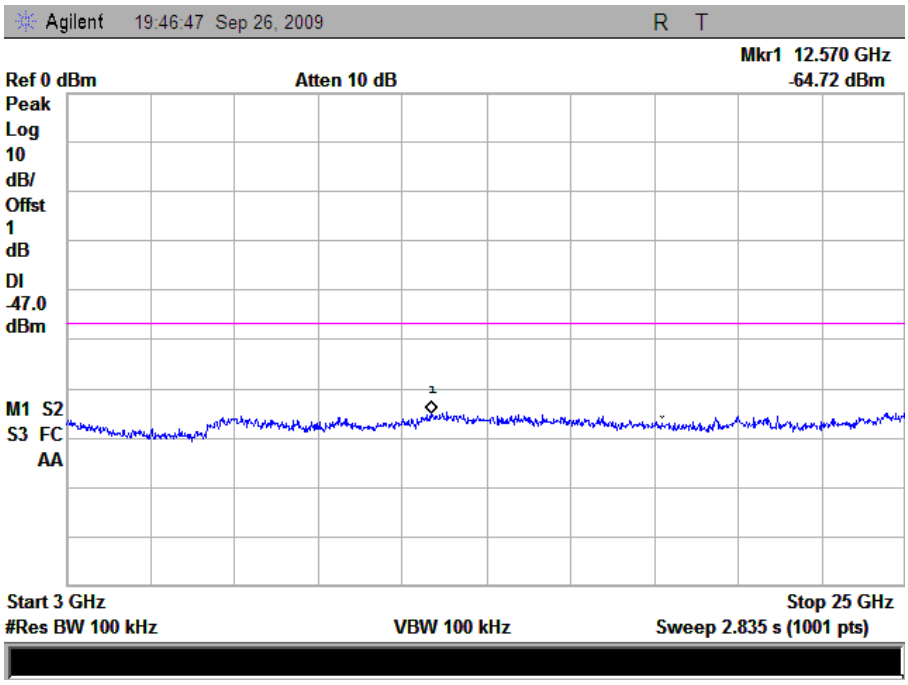
(Plot B.1: Channel = 42, 30MHz to 3GHz)



(Plot B.2: Channel = 42, 3GHz to 25GHz)



(Plot C.1: Channel = 82, 30MHz to 3GHz)



(Plot C.2: Channel =82, 3GHz to 25GHz)

3.3.3.2 The second model

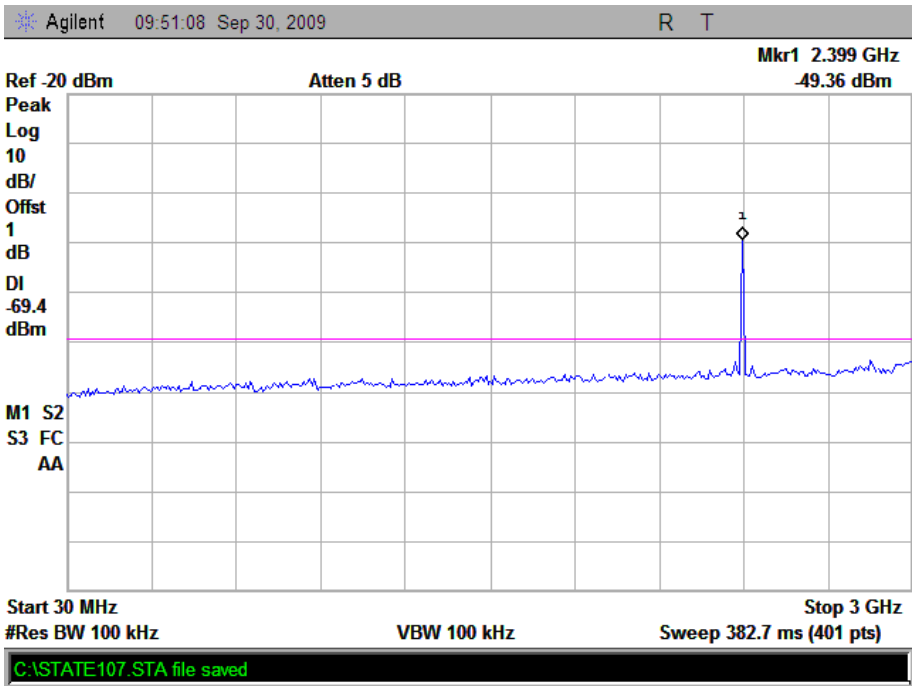
The measurement frequency range is from 30MHz to the 10th harmonic of the fundamental frequency. The lowest, middle and highest channels are tested to verify the spurious emissions.

A. Test Verdict:

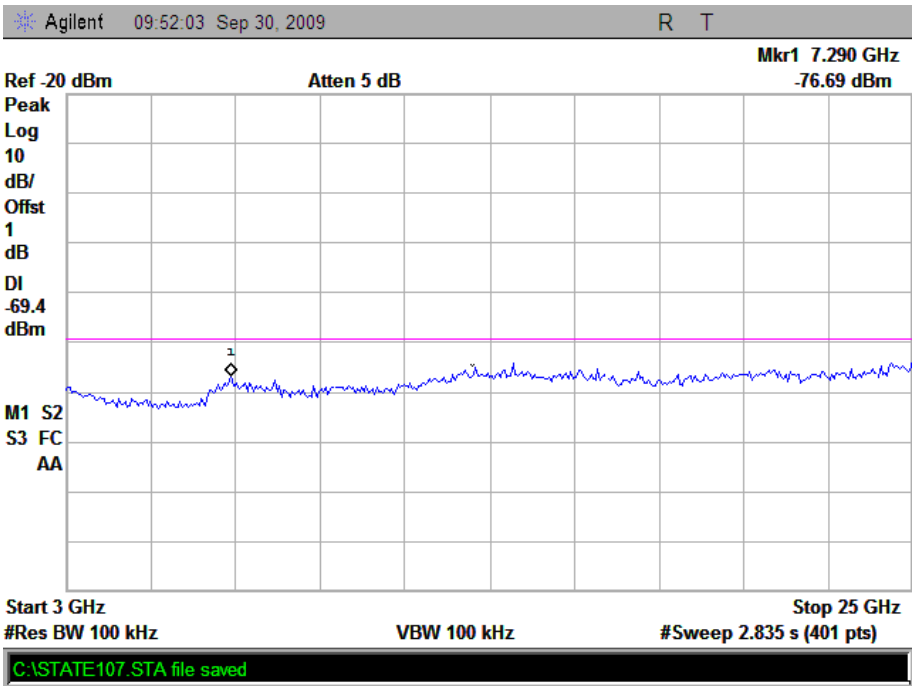
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
1	2402	-76.69	Plot A.1/A.2	-49.36	-69.4	PASS
42	2442	-75.63	Plot B.1/B.2	-49.40	-69.4	PASS
82	2482	-75.95	Plot C.1/C.2	-50.07	-70.1	PASS

B. Test Plot:

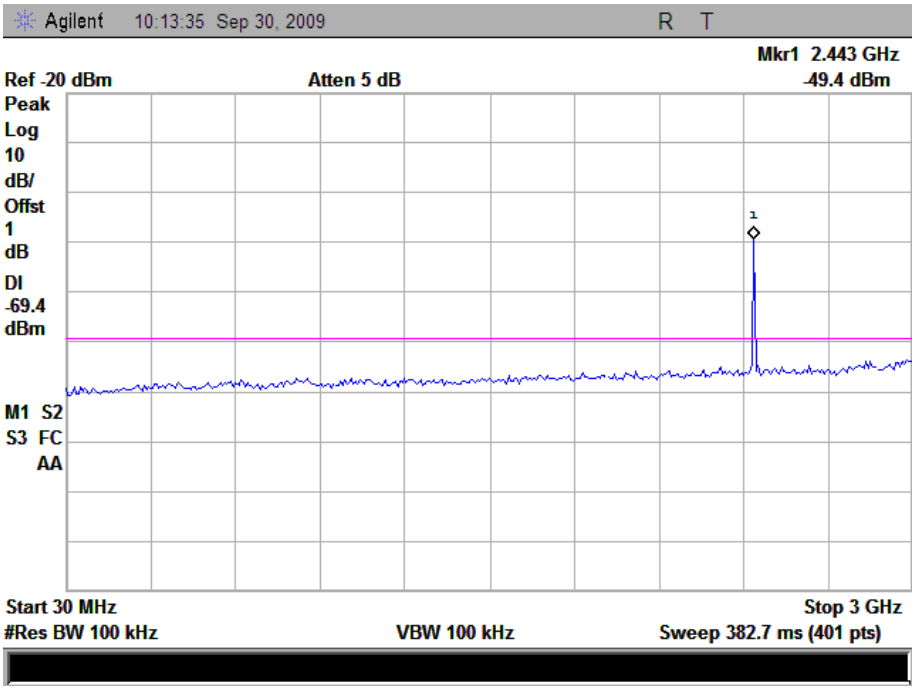
Note: the power of the Module transmitting frequency should be ignored.



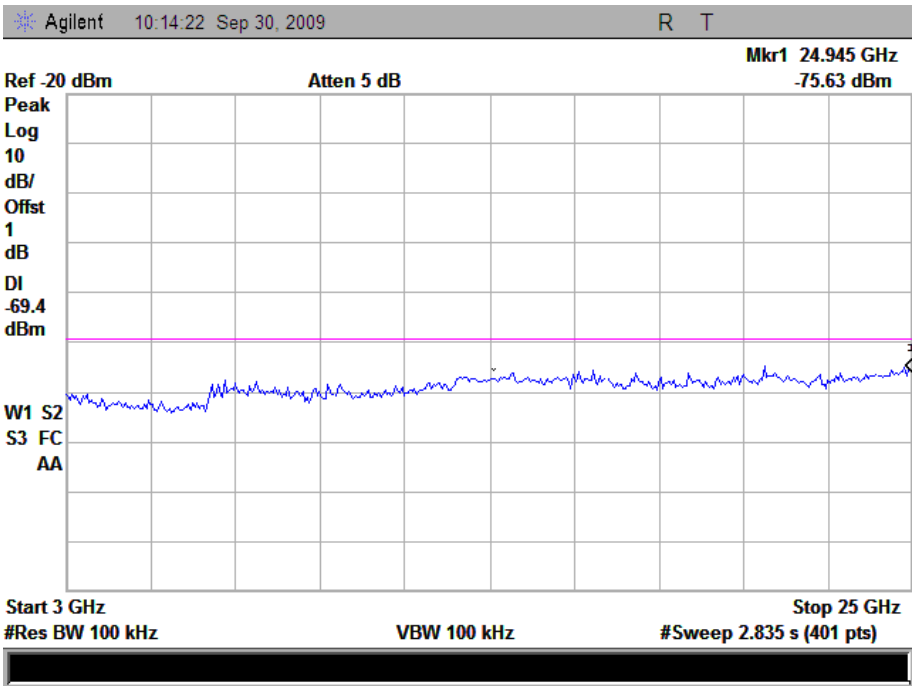
(Plot A.1: Channel = 1, 30MHz to 3GHz)



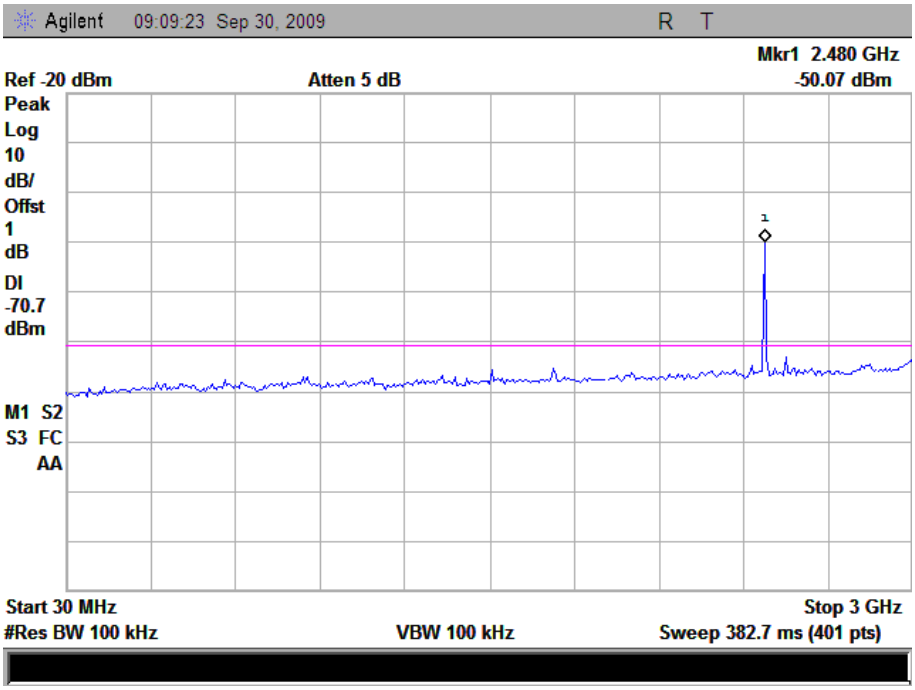
(Plot A.2: Channel = 1, 3GHz to 25GHz)



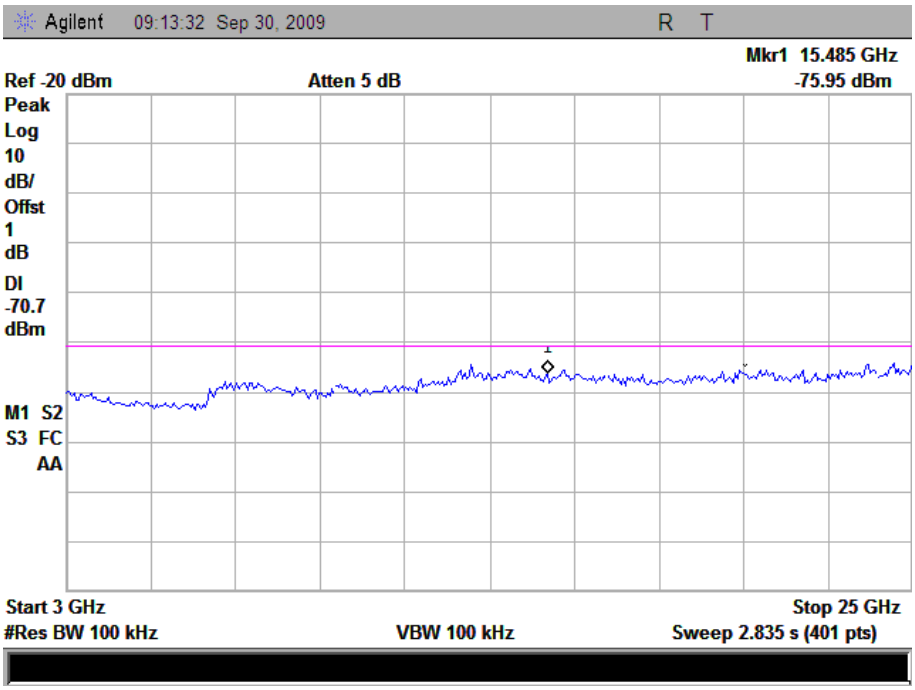
(Plot B.1: Channel = 42, 30MHz to 3GHz)



(Plot B.2: Channel = 42, 3GHz to 25GHz)



(Plot C.1: Channel = 82, 30MHz to 3GHz)



(Plot C.2: Channel =82, 3GHz to 25GHz)

3.4 Power spectral density (PSD)

3.4.1 Requirement

According to FCC section 15.247(d), the same method of determining the conducted output power shall be used to determine the power spectral density. If a peak output power is measured, then a peak power spectral density measurement is required. If an average output power is measured, then an average power spectral density measurement should be used.

3.4.2 Test Description

See section 3.1.2 of this report.

3.4.3 Test Result

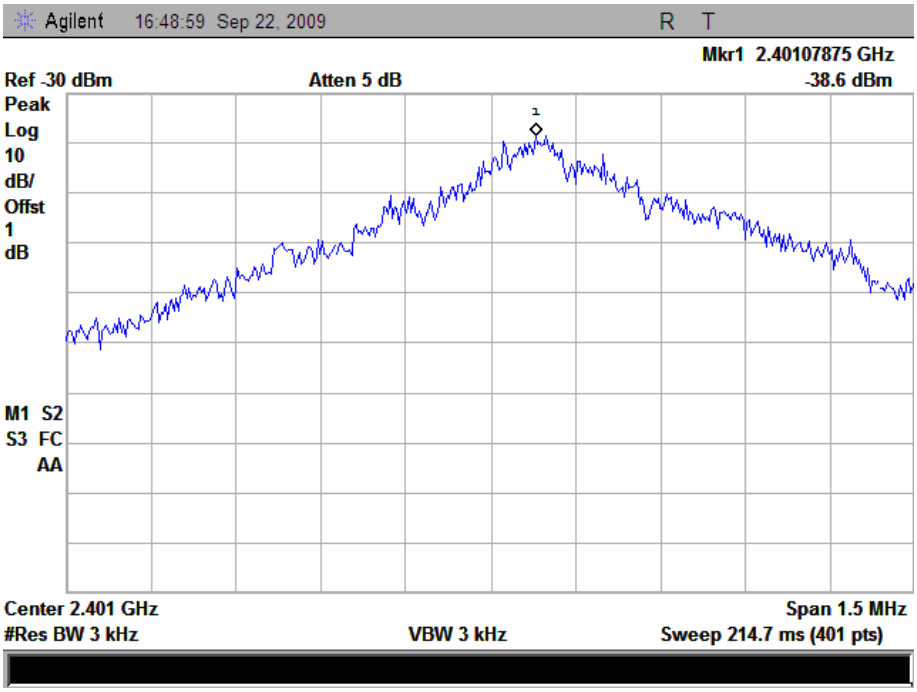
3.4.3.1 The first model

The lowest, middle and highest channels are tested to verify the band edge emissions.

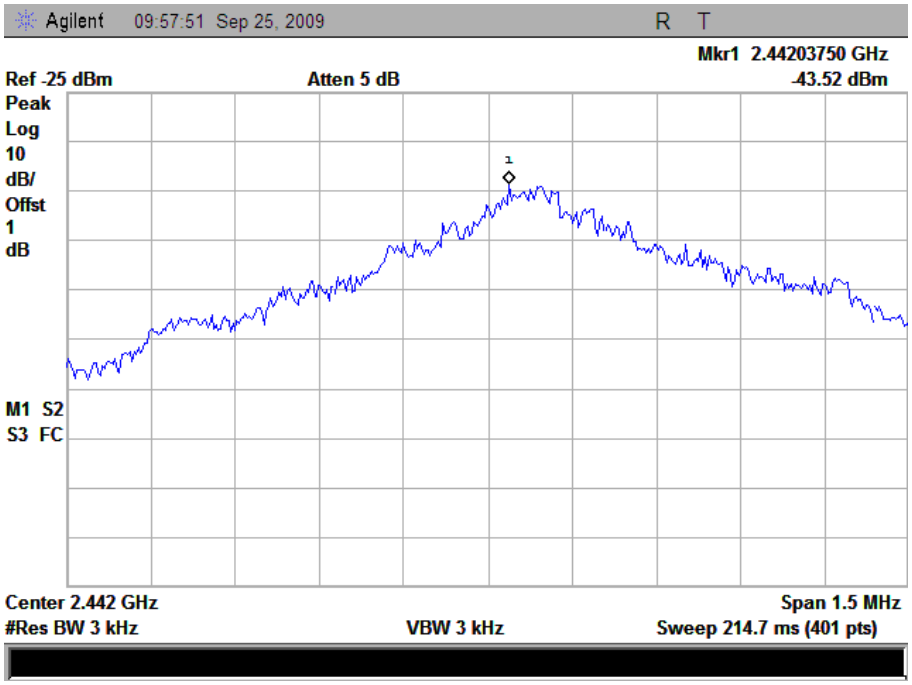
A. Test Verdict:

Spectral power density (dBm/MHz)					
Channel: 1 Frequency, 2401MHz		Channel: 42 Frequency, 2442MHz		Channel: 82 Frequency, 2482MHz	
Test Result	Test plot	Test Result	Test plot	Test Result	Test plot
-38.6	Plot A	-43.52	Plot B	-51.81	Plot C
Measurement uncertainty: ±1.3dB					

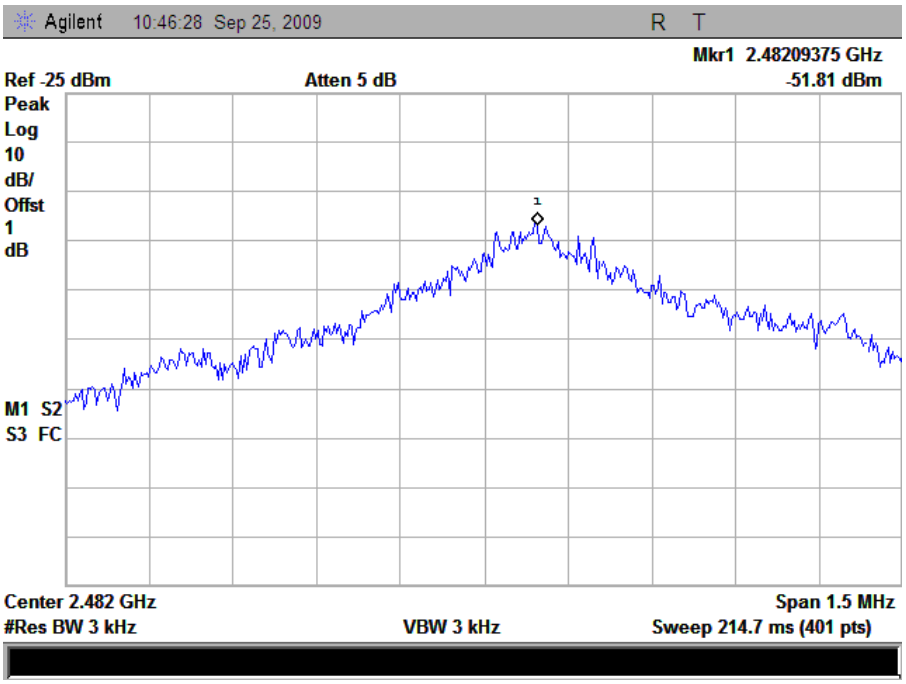
Test Plot:



(Plot A: Channel = 1)



(Plot B: Channel = 42)



(Plot C: Channel = 82)

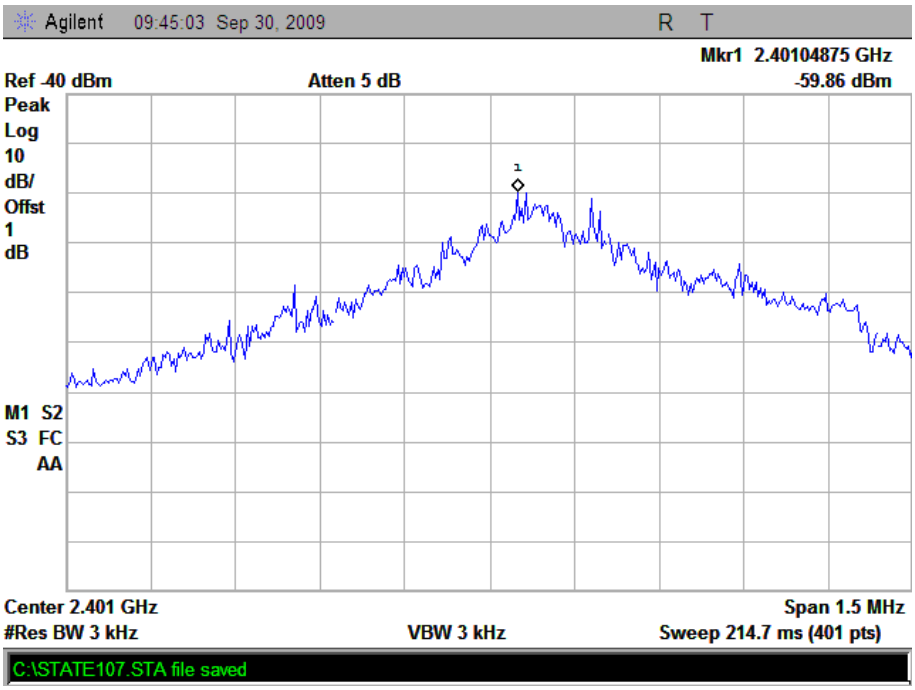
3.4.3.2 The second model

The lowest, middle and highest channels are tested to verify the band edge emissions.

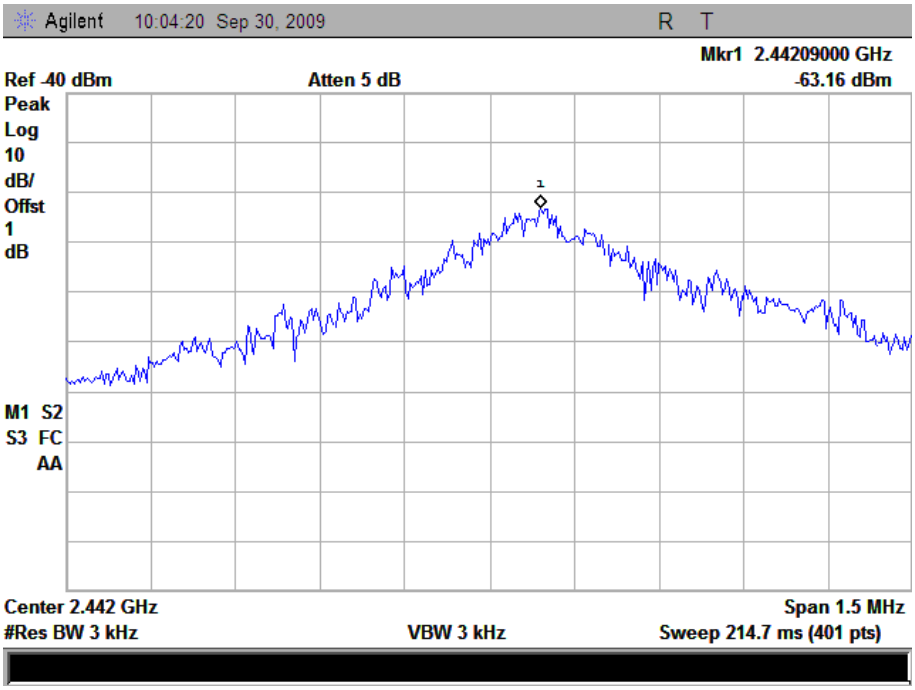
B. Test Verdict:

Spectral power density (dBm/MHz)					
Channel: 1 Frequency, 2401MHz		Channel: 42 Frequency, 2442MHz		Channel: 82 Frequency, 2482MHz	
Test Result	Test plot	Test Result	Test plot	Test Result	Test plot
-59.86	Plot A	-63.16	Plot B	-60.8	Plot C
Measurement uncertainty: ±1.3dB					

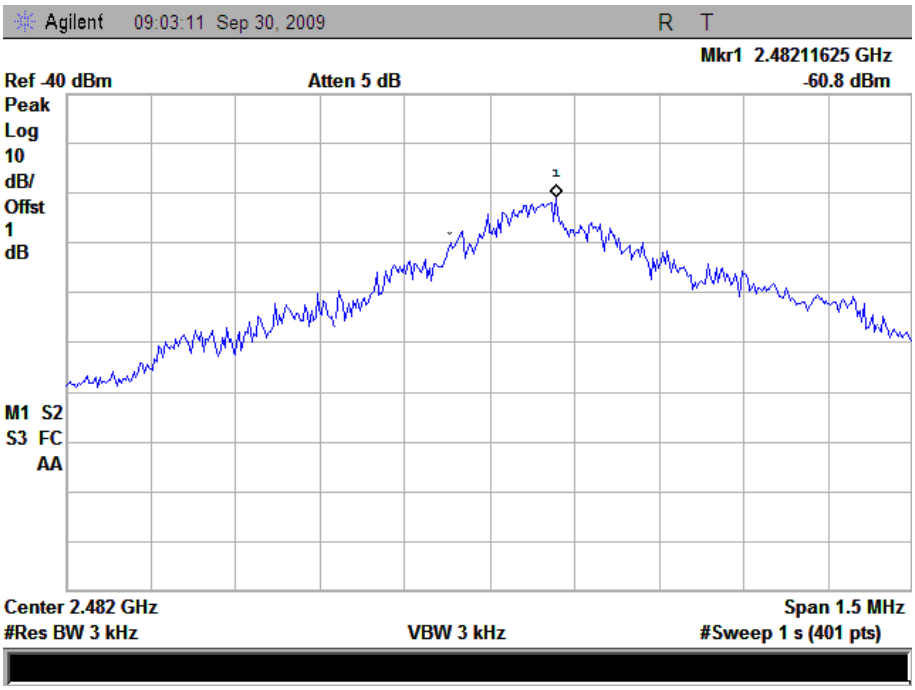
Test Plot:



(Plot A: Channel = 1)



(Plot B: Channel = 42)



(Plot C: Channel = 82)

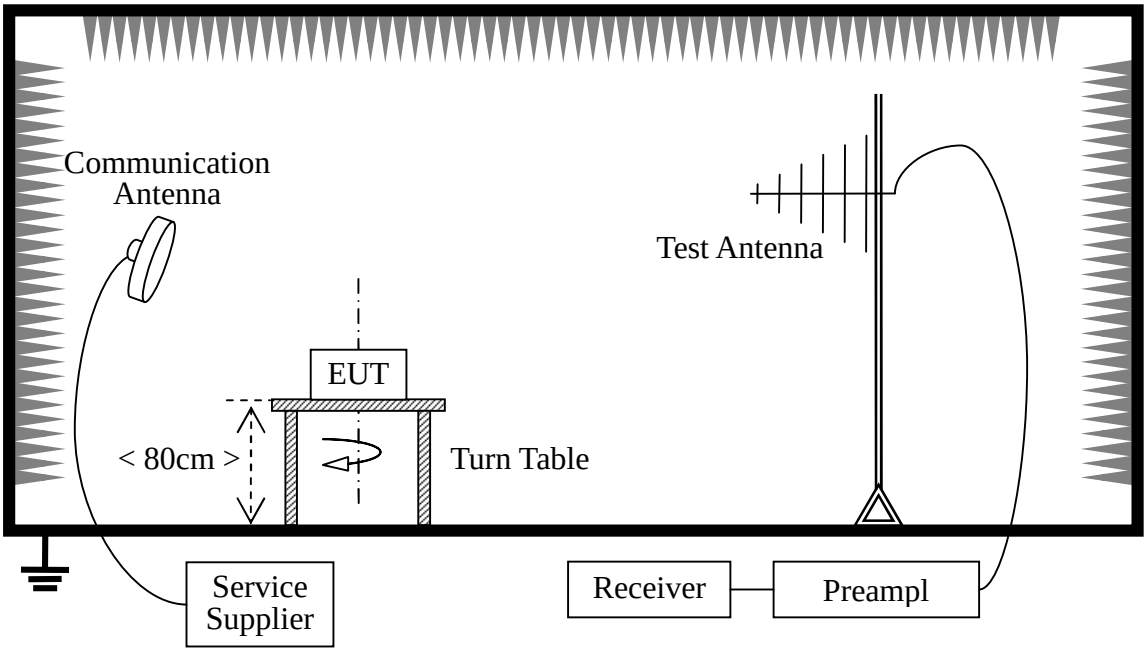
3.5 Band Edge

3.5.1 Requirement

According to FCC section 15.247(c), in any 100kHz 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 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

3.5.2 Test Description

A. Test Setup



The Module is located in a 3m Semi-Anechoic Chamber; the antenna factors, cable loss and so on of the site as factors are calculated to correct the reading.

For the Test Antenna:

Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength..

C. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Receiver	Agilent	E7405A	US44210471	2009.9	1year

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Full-Anechoic Chamber	Albatross	9m*6m*6m	(n.a.)	2009.9	2year
Test Antenna	Schwarzbeck	BBHA 9120C	9120C-384	2009.9	1year

3.5.3 Test Result

The lowest and highest channels are tested to verify the band edge emissions.

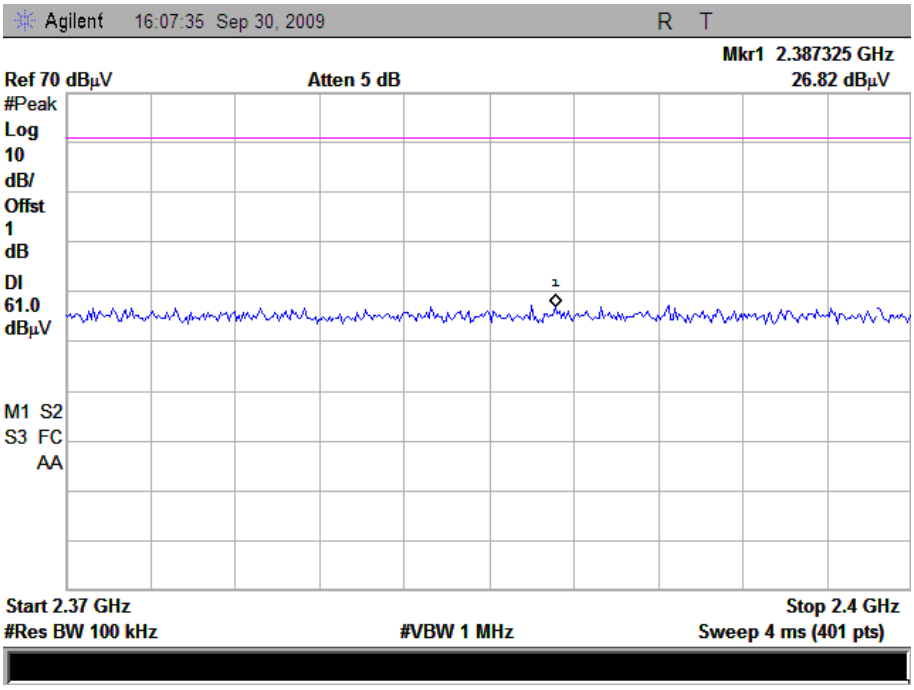
3.5.3.1 The first model

The lowest and highest channels are tested to verify the band edge emissions.

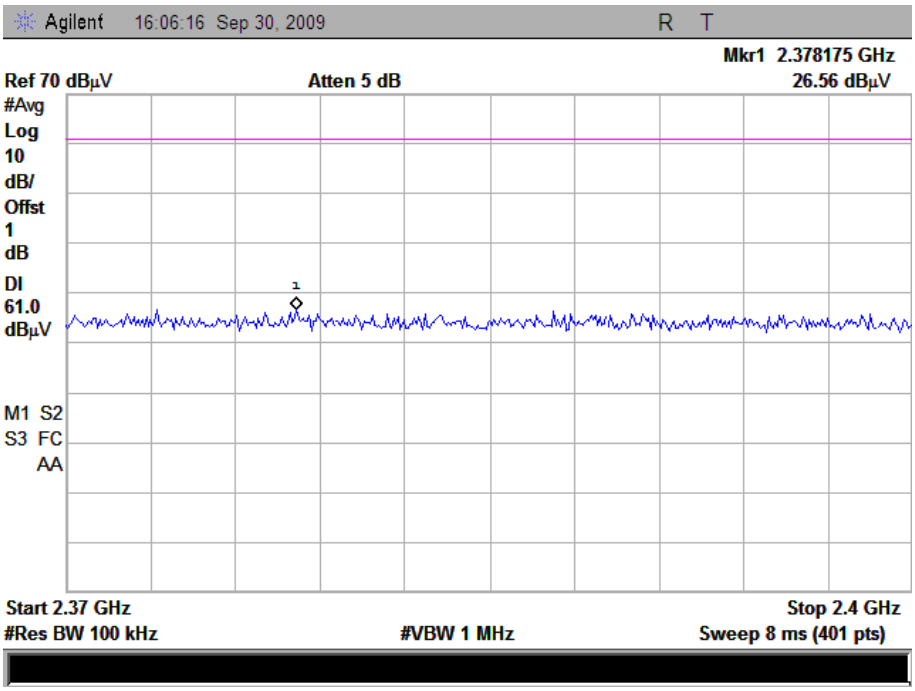
D. Test Verdict:.

Channel	Frequency (MHz)	Max. Emission in the Restricted Bands (dBμV/m)		Limit (dBμV/m)		Verdict
		PK	AV	PK	AV	
1	2401	26.82	26.56	74	54	PASS
82	2482	26.38	22.86	74	54	PASS

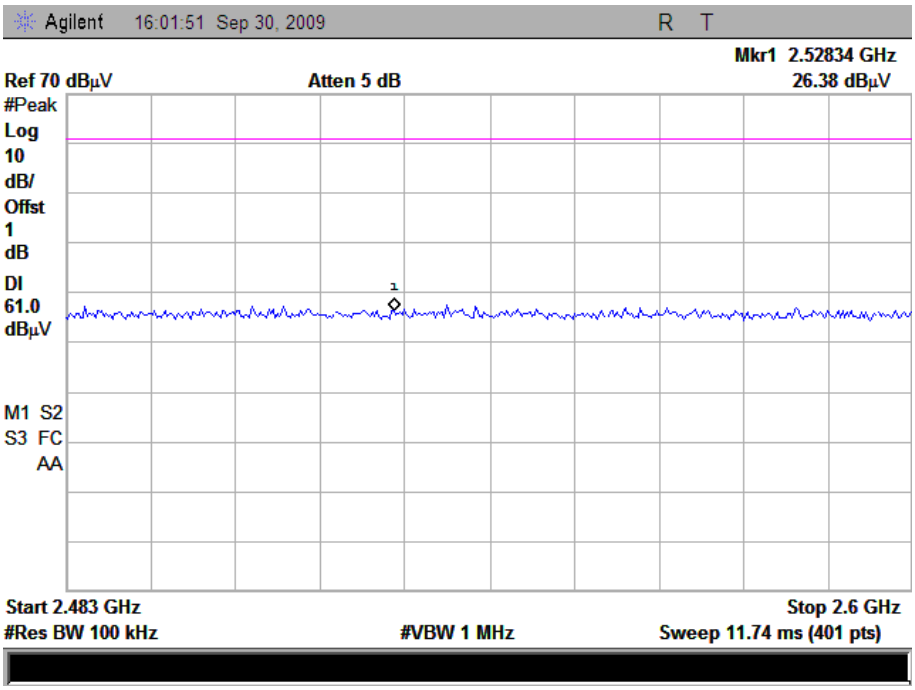
E. Test Plot:



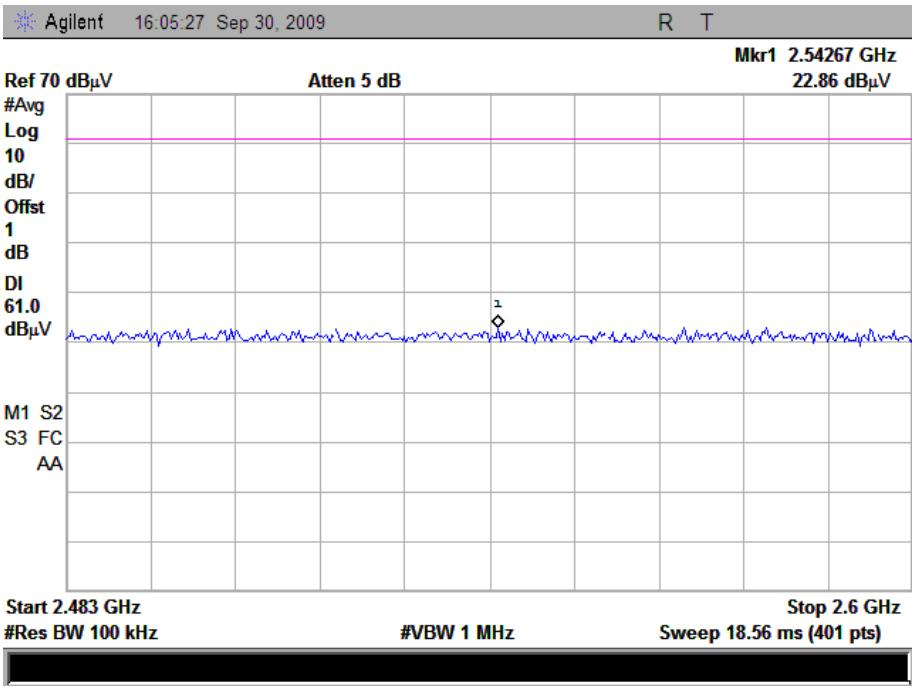
(Plot A1: Channel = 1 PEAK)



(Plot A2: Channel = 1 AVERAGE)



(Plot B1: Channel = 82 PEAK)



(Plot B2: Channel = 82 AVERAGE)

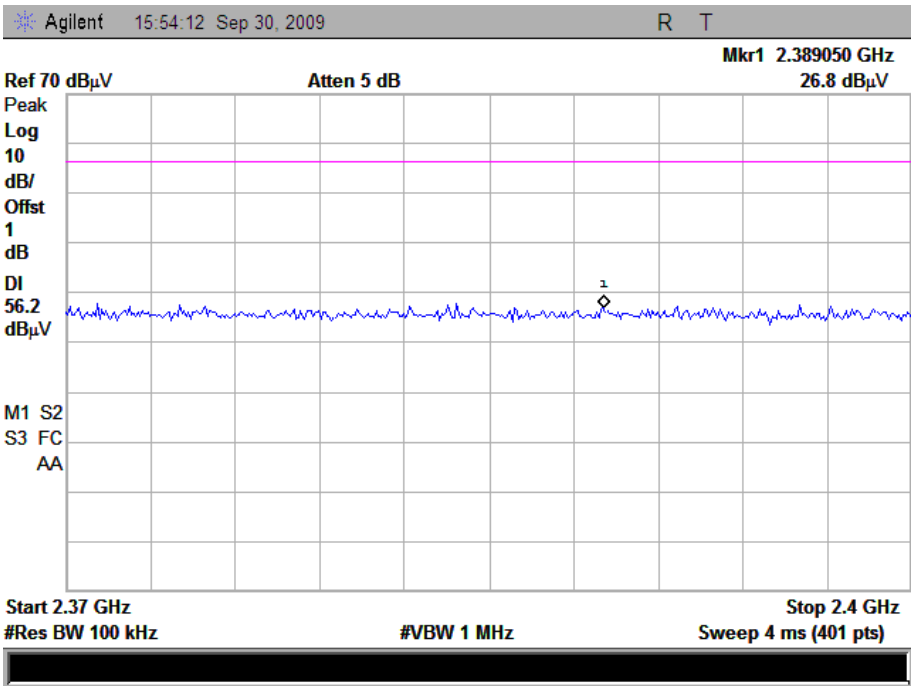
3.5.3.2 The second model

The lowest and highest channels are tested to verify the band edge emissions.

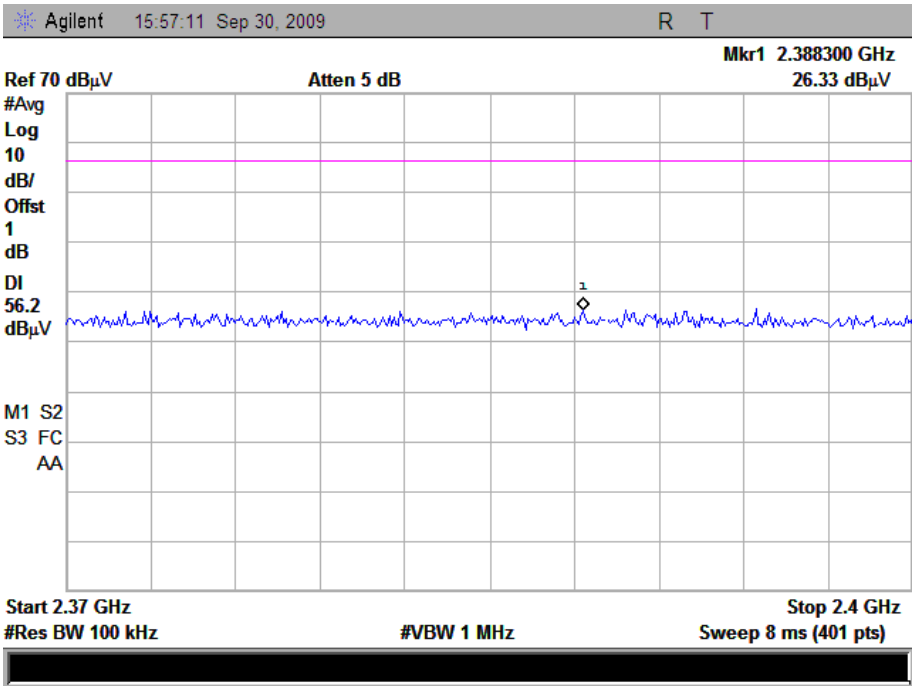
A. Test Verdict:.

Channel	Frequency (MHz)	Max. Emission in the Restricted Bands (dBµV/m)		Limit (dBµV/m)		Verdict
		PK	AV	PK	AV	
1	2401	26.8	26.33	74	54	PASS
82	2482	27.35	23.63	74	54	PASS

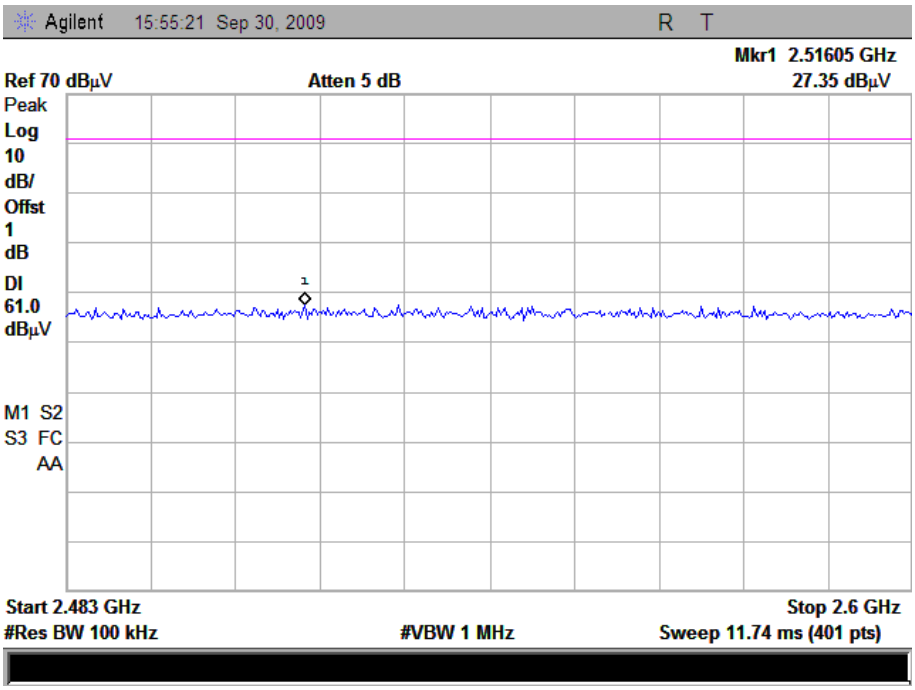
B. Test Plot:



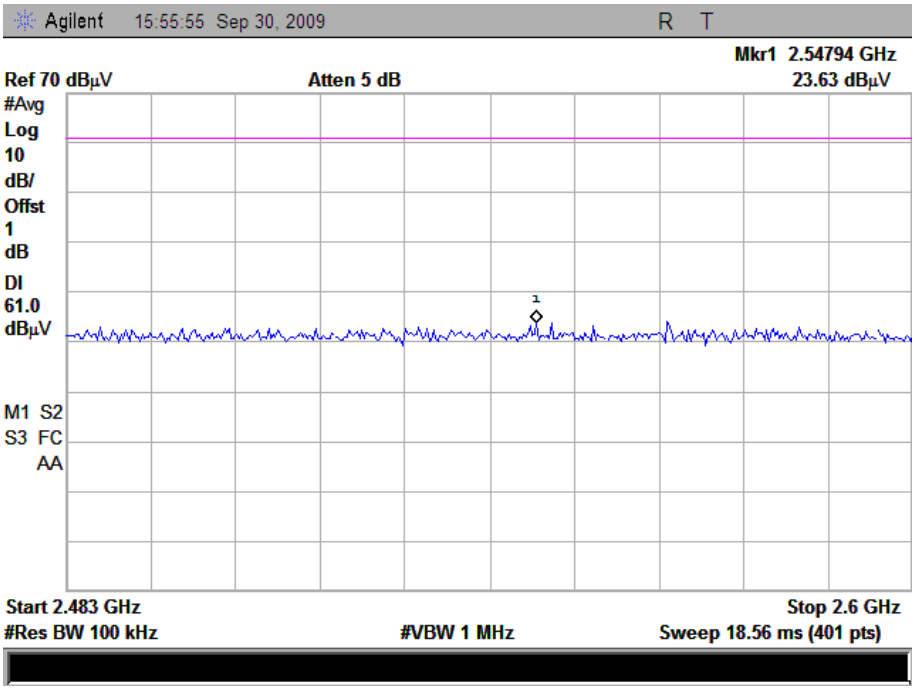
(Plot A1: Channel = 1 PEAK)



(Plot A2: Channel = 1 AVERAGE)



(Plot B1: Channel = 82 PEAK)



(Plot B2: Channel = 82 AVERAGE)

3.6 Conducted Emission

3.6.1 Requirement

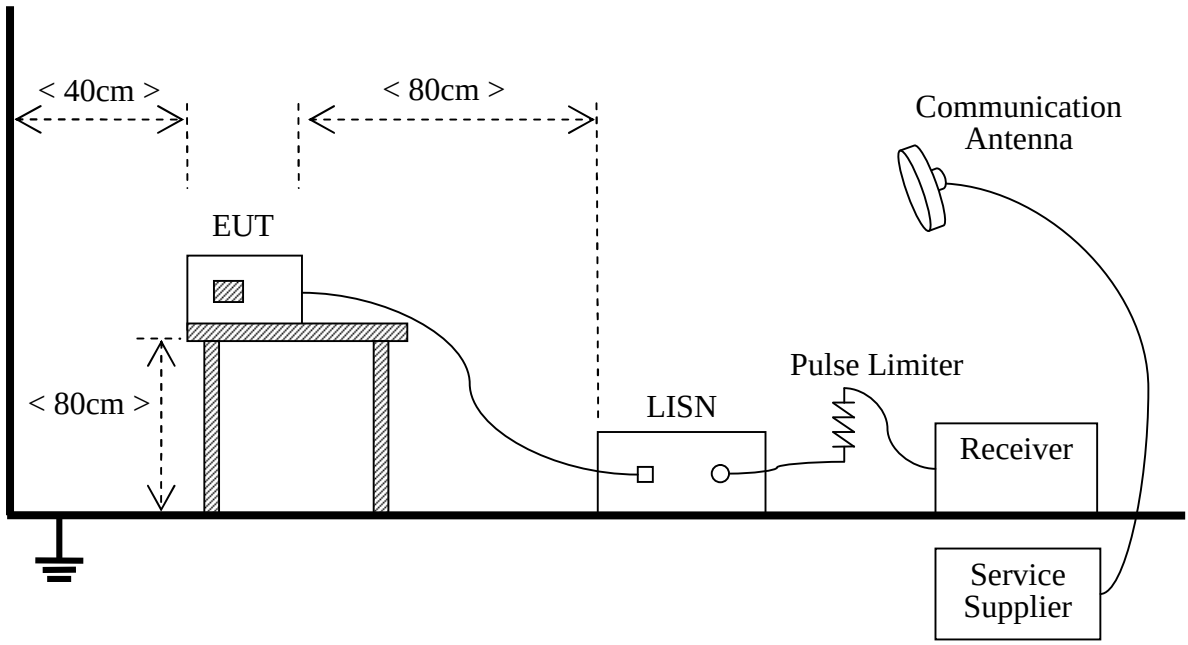
According to FCC section 15.207, for an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150kHz to 30MHz shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dBμV)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

NOTE:
(a) The lower limit shall apply at the band edges.
(b) The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

3.6.2 Test Description

A. Test Setup:



The Table-top EUT was placed upon a non-metallic table 0.8m above the horizontal metal reference ground plane. EUT was connected to LISN and LISN was connected to reference Ground Plane. EUT was 80cm from LISN. The set-up and test methods were according to ANSI C63.4:2003

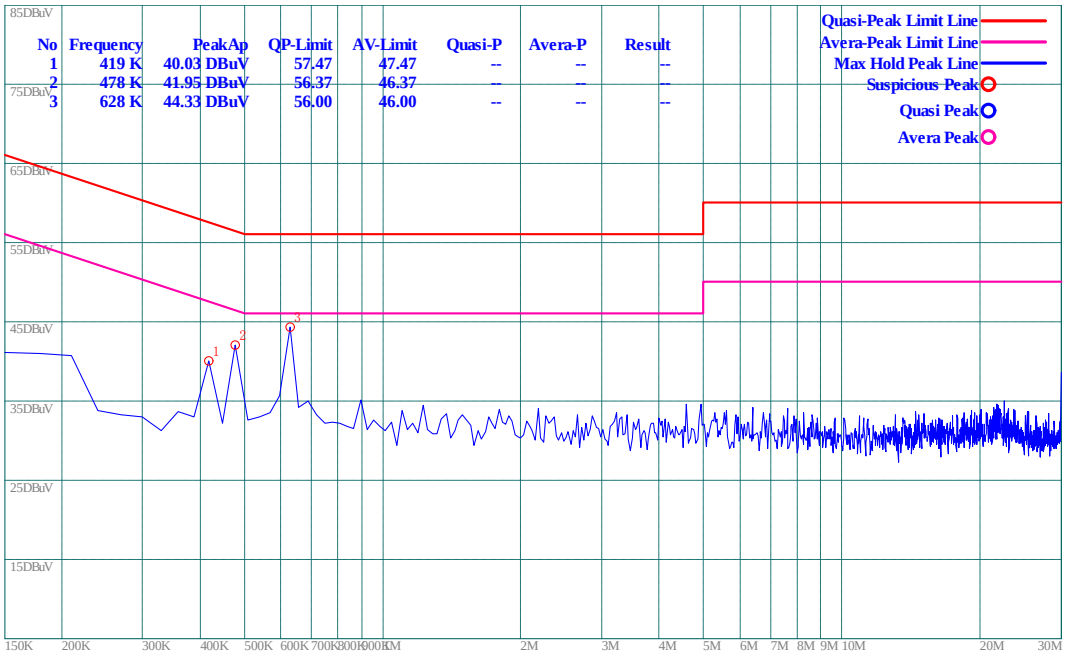
The factors of the site are calibrated to correct the reading. During the measurement, a special program, supplied by applicant, installed in a Personal Computer (PC) is employed to control the Test Sample to work appropriately through their serial ports.

B. Equipments List:

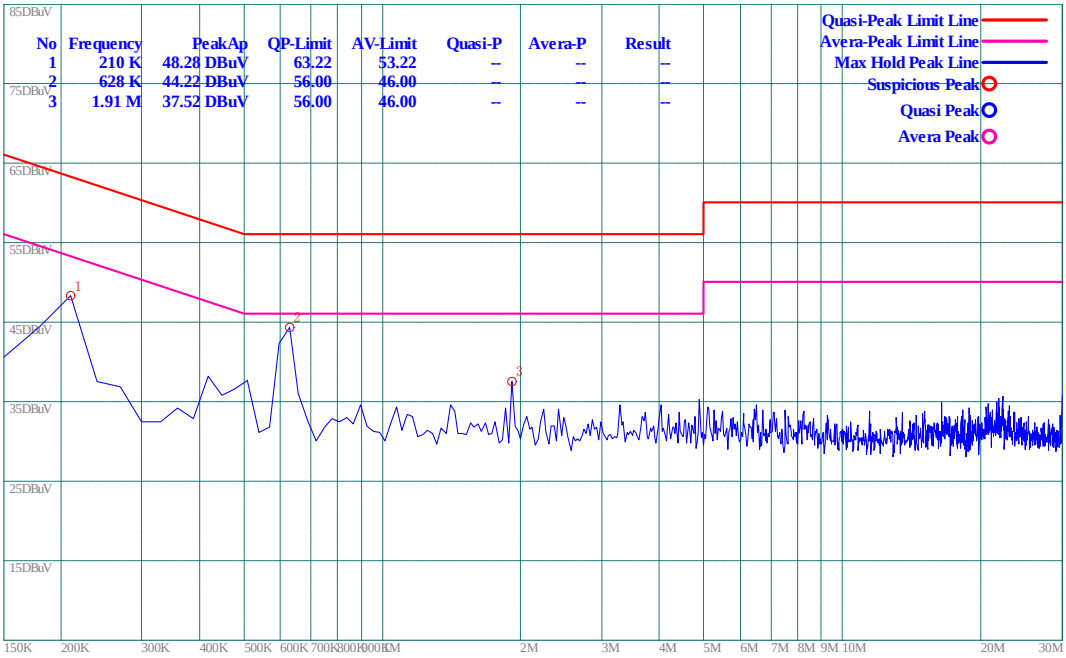
Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Receiver	Agilent	E7405A	US44210471	2009.09	1year
LISN	Schwarzbeck	NSLK 8127	812744	2009.09	1year
Service Supplier	R&S	CMU200	100448	2009.09	1year
Pulse Limiter (20dB)	Schwarzbeck	VTSD 9561-D	9391	(n.a.)	(n.a.)

3.6.3 Test Result

The maximum conducted interference is searched using Peak (PK), Quasi-peak (QP) and Average (AV) detectors; the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Refer to recorded points and plots below.



(Plot A: L Phase)



No	Frequency	PeakAp	QP-Limit	AV-Limit	Quasi-P	Avera-P	Result
1	210 K	48.28 DBuV	63.22	53.22	--	--	--
2	628 K	44.22 DBuV	56.00	46.00	--	--	--
3	1.91 M	37.52 DBuV	56.00	46.00	--	--	--

(Plot B: N Phase)

3.7 Radiated Emission

3.7.1 Requirement

According to FCC section 15.247(c), radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

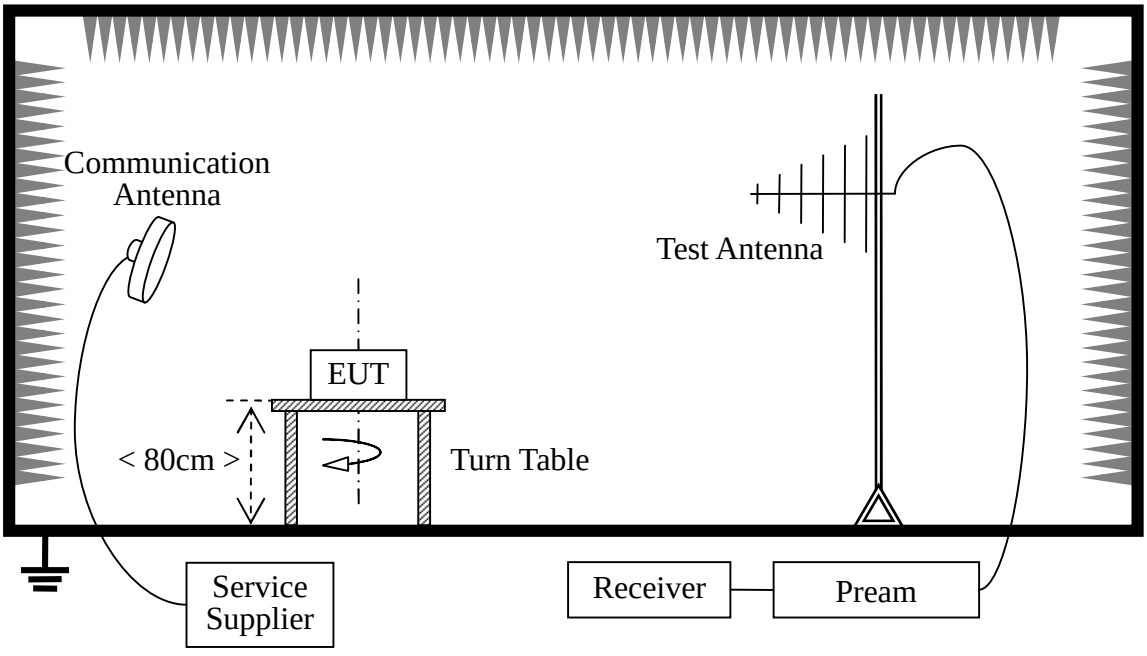
According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

Frequency (MHz)	Field Strength (μV/m)	Measurement Distance (m)	Detector
30 - 88	100	3	QP
88 - 216	150	3	QP
216 - 960	200	3	QP
960 - 1000	500	3	QP
Above 1000	500	3	AV

In addition, radiated emissions which fall in the restricted bands, as defined in Section 15.205(a), also should comply with the radiated emission limits specified in Section 15.209(a)(above table)

3.7.2 Test Description

A. Test Setup:



The test site semi-anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSI C63.4 (2003). The EUT was set-up on insulator 80cm above the Ground Plane. The set-up and test methods were according to ANSI C63.4.

The factors of the site are calibrated to correct the reading. During the measurement, a special program, supplied by applicant, installed in a Personal Computer (PC) is employed to control the Test Sample to work appropriately through their serial ports

For the Test Antenna: In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 1GHz) and Horn Test Antenna (above 1GHz) are used. Test Antenna is 3m away from the EUT. Test Antenna height is varied from 1m to 4m above the ground to determine the maximum value of the field strength, the azimuth range of turntable was 0^o to 360^o, the receive antenna has two polarizations horizontal and vertical. When doing measurements above 1GHz, the EUT has been within the 3dB cone width of the horn antenna during vertical antenna.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
System Simulator	R&S	CMU200	100448	2009.9	1year
Receiver	Agilent	E7405A	US44210471	2009.9	1year
Full-Anechoic Chamber	Albatross	9m*6m*6m	(n.a.)	2009.9	2year
Test Antenna - Bi-Log	Schwarzbeck	VULB 9163	9163-274	2009.9	1year
Test Antenna - Horn	Schwarzbeck	BBHA 9120C	9120C-384	2009.9	1year
Test Antenna - circular	R&S	AC004R1	0749.3000.03	2009.9	1year

3.7.3 Test Result

A. Test Verdict for Harmonics:

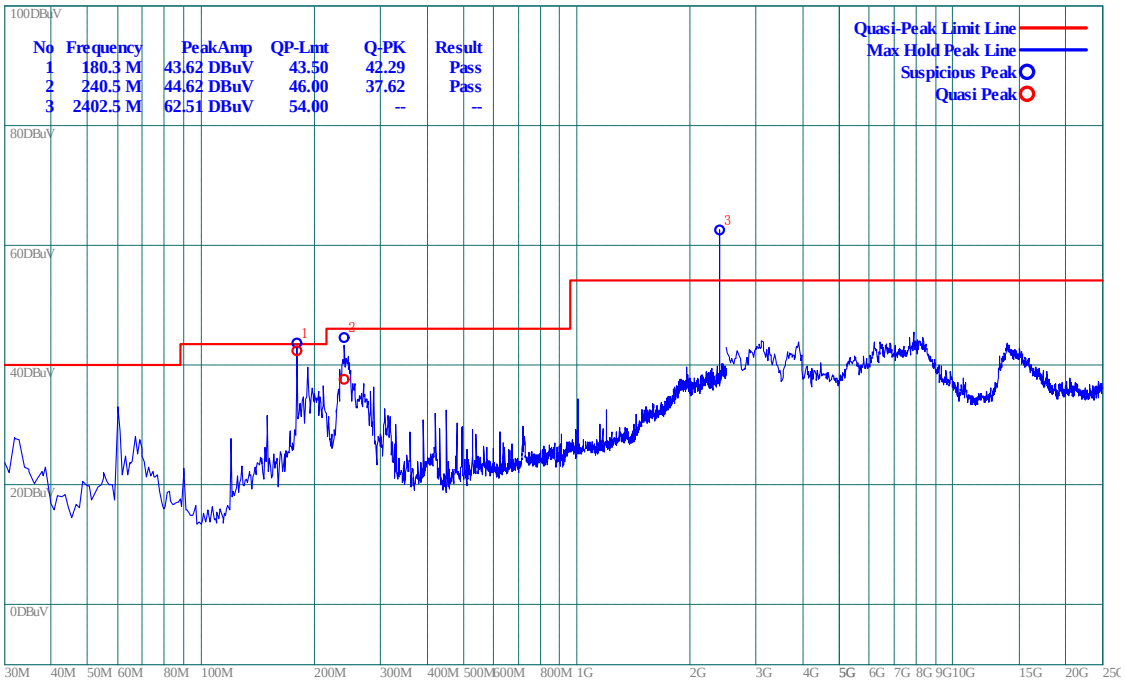
The Fundamental Emissions

The field strength of {Fundamental Emission} listed below is recorded, and used in the next table.

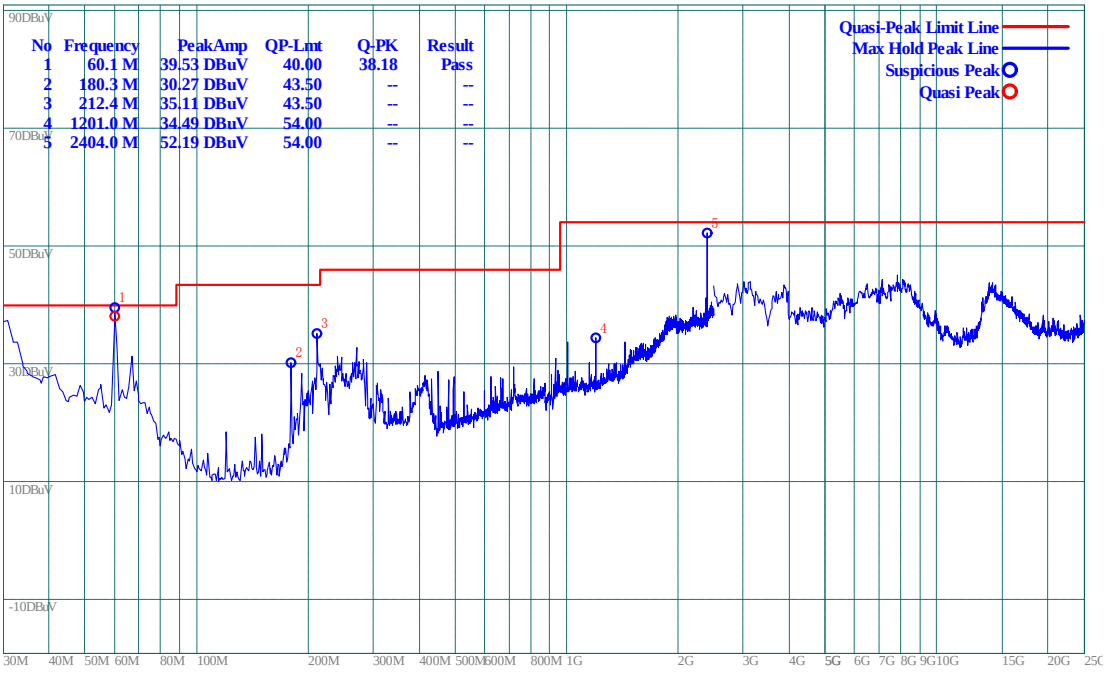
Channel	Frequency (MHz)	Fundamental Emission (dBμV/m)		Antenna Polarization	Refer to Plot
		PK	AV		
1	2401	62.51	N/A	Horizontal	Plot A.1
		52.19	N/A	Vertical	Plot A.2
42	2442	66.09	N/A	Horizontal	Plot B.1
		75.41	N/A	Vertical	Plot B.2
82	2482	56.71	N/A	Horizontal	Plot C.1
		61.42	N/A	Vertical	Plot C.2

B. Test Plots for the Whole Measurement Frequency Range:

Plots for Channel = 1

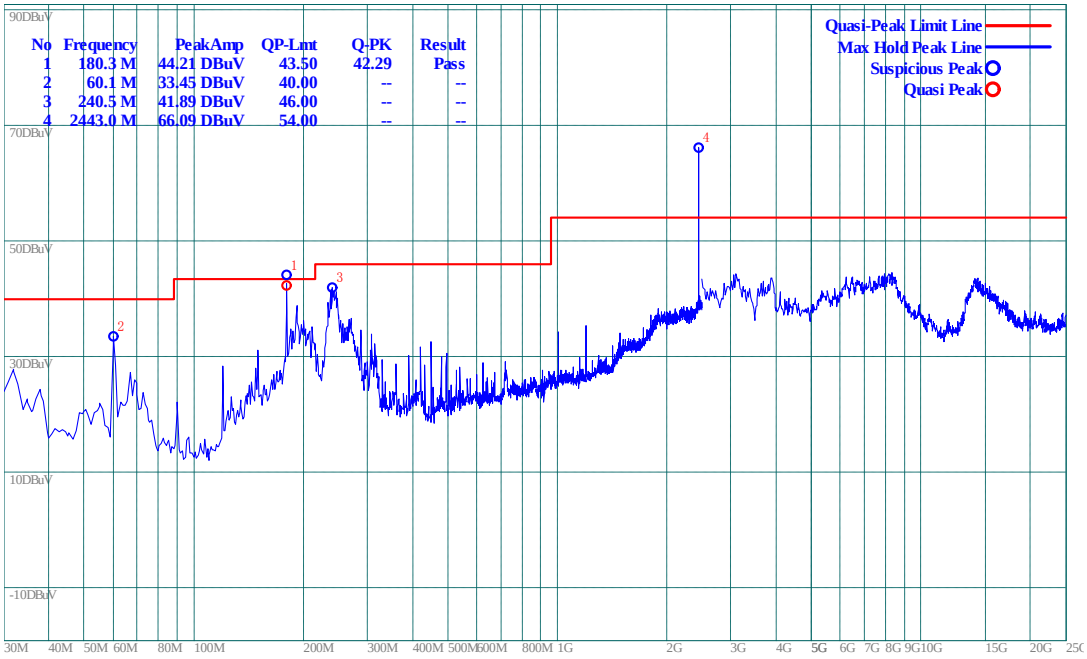


(Plot A.1: Antenna Horizontal)

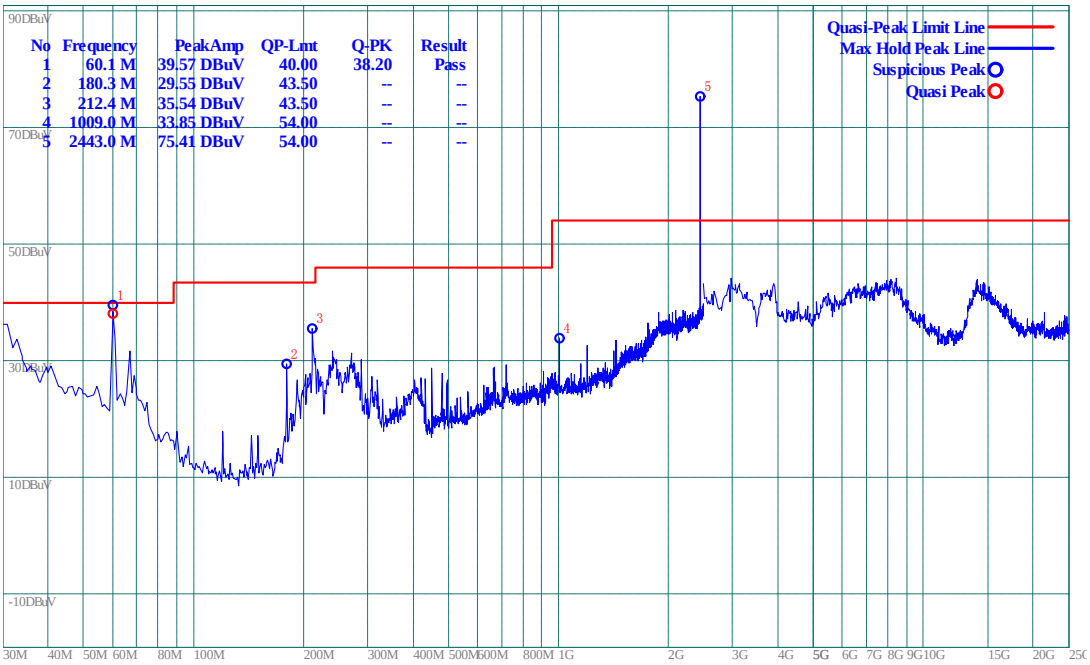


(Plot A.2: Antenna Vertical)

Plot for Channel = 42

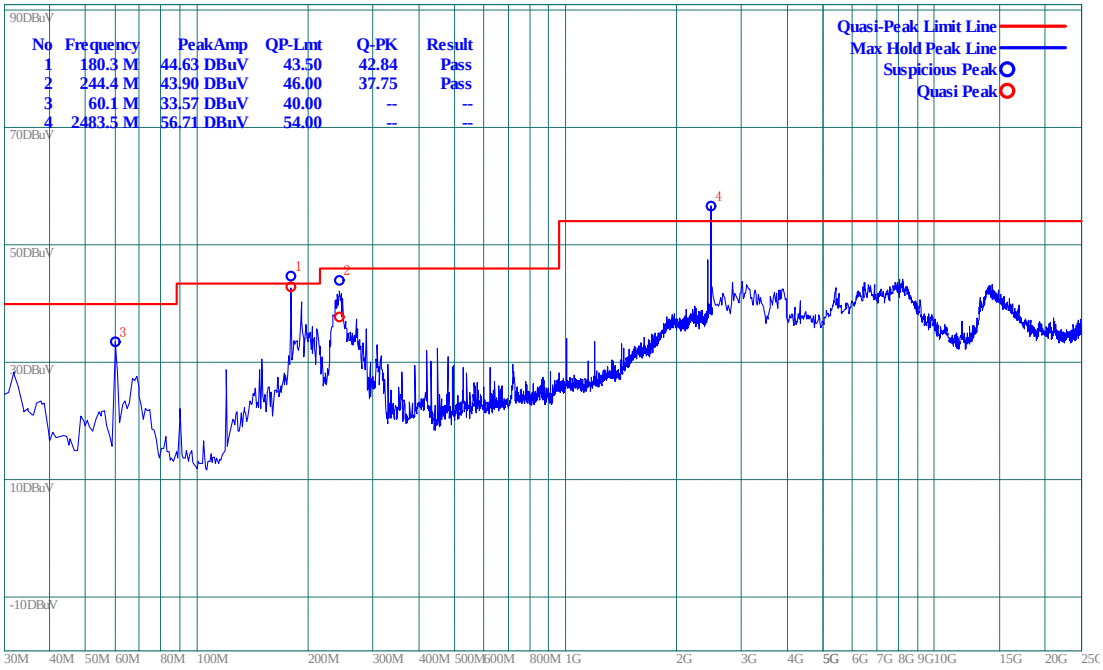


(Plot B.1: Antenna Horizontal)

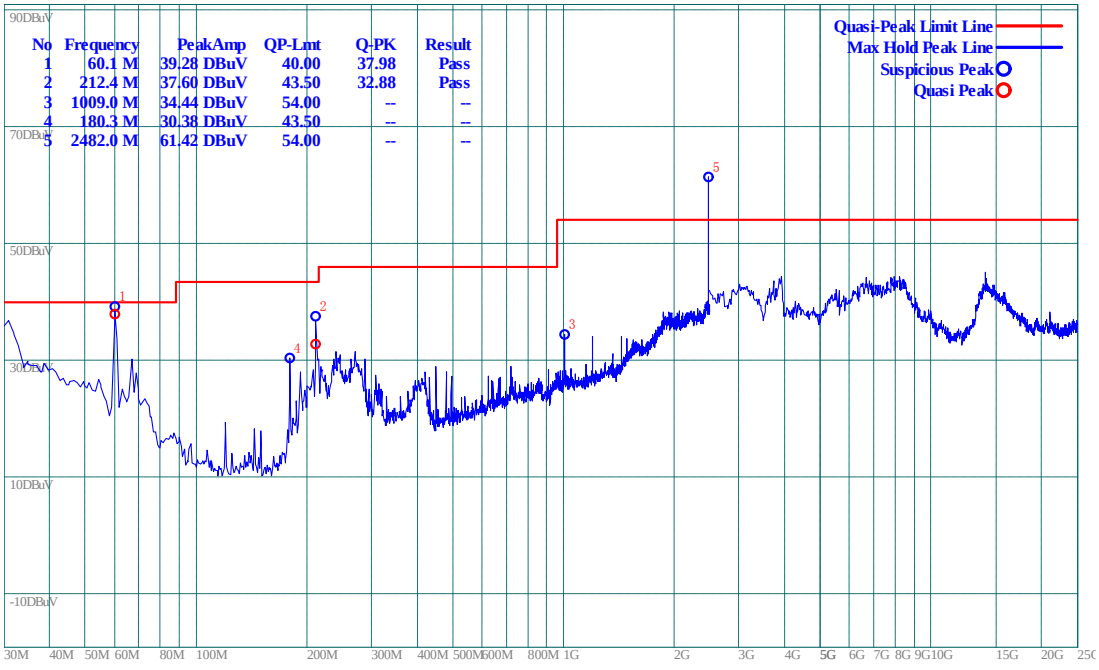


(Plot B.2: Antenna Vertical)

Plot for Channel = 82



(Plot C.1: Antenna Horizontal)



(Plot C.2: Antenna Vertical)

** END OF REPORT **