FCC /IC RADIO TEST REPORT

TESTING
CNAS L3572

Issued to

testo Instruments (Shenzhen) Co., Ltd

For

testo Saveris 2

Model Name:	T3
Trade Name:	Testo
Brand Name:	Testo
FCC ID:	2ACVD-05722003
IC Number	12231A-05722003
Standard:	47 CFR Part 15 Subpart C
	RSS-GEN
	RSS-210
Test date:	2014-07-21 to 2014-08-08
Issue date:	2014-09-10

by

Shenzhen Morlab Communications Technology Co., Ltd.

FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province,P. R. China 518101

Tested by	Nie Quan	***Approved by***	Hao Yanjun	***Reviewed by***	Qiu Xiaojun
	Nie Quan		Hao Yanjun		Qiu Xiaojun
	(Test Engineer)		(Chief Engineer)		(Dept. Manager)
Date	2014.09.10	***Date***	2014.09.10	***Date***	2014.09.10

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Change History		
Issue	Date	Reason for change
1.0	September 10, 2014	First Edition

1. General Information

1.1. EUT Description

EUT Type..... :	testo Saveris 2
Serial No. ..... :	(n.a, marked #1 by test site)
Hardware Version..... :	T3_0
Software Version..... :	1.2
Applicant..... :	testo Instruments (Shenzhen) Co., Ltd Block A, B4 Building, China Merchants Guangming Sci&Tech Park, No.3009 Guan Guang Road, Guangming New District, Shenzhen City
Manufacturer ..... :	testo Instruments (Shenzhen) Co., Ltd Block A, B4 Building, China Merchants Guangming Sci&Tech Park, No.3009 Guan Guang Road, Guangming New District, Shenzhen City
Frequency Range..... :	802.11b/g/n-20MHz: 2.412GHz - 2.462GHz
Channel Number ..... :	802.11b/g/n-20MHz: 11
Modulation Type..... :	DSSS (802.11b), OFDM (802.11g/n)
Antenna Type ..... :	PCB Antenna
Antenna Gain..... :	-2.5dBi

Note :

1. The EUT is testo Saveris 2, it contains WIFI Module operating at 2.4GHz ISM band; it supports 802.11b, 802.11g, 802.11n and they are all tested in this report.
2. For 802.11b/g/n-20MHz, the frequencies allocated is F (MHz) =2412+5*(n-1) (1<=n<=11). The lowest, middle, highest channel numbers of the EUT used and tested in this report are separately 1 (2412MHz), 6 (2437MHz) and 11 (2462MHz).
3. For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.
4. The antenna connector of EUT is designed with permanent attachment and no consideration of replacement.

1.2. Test Standards and Results

The objective of the report is to perform testing according to 47 CFR Part 15 Subpart C for the EUT FCC Certification:

No.	Identity	Document Title
1	47 CFR Part 15 (10-1-13 Edition)	Radio Frequency Devices

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

No.	Section in CFR 47	Section in RSS-GEN, RSS-210	Description	Result
1	15.203	7.1.2	Antenna Requirement	**PASS**
2	15.247(b)	A8.4 (4)	Peak Output Power	**PASS**
3	15.247(a)	A8.2 (a)	Bandwidth	**PASS**
4	15.247(d)	A8.5	Conducted Spurious Emission and Band Edge	**PASS**
5	15.247(d)	A8.5	Restricted Frequency Bands	**PASS**
6	15.207	7.2.4	Conducted Emission	**PASS**
7	15.209 ,15.247(d)	A8.5	Radiated Emission	**PASS**
8	15.247(e)	A8.2(b)	Power spectral density (PSD)	**PASS**
9	15.247(i), 1.1307&2.1091	RSS-102	RF exposure evaluation	**PASS**

The tests of Conducted Emission and Radiated Emission were performed according to the method of measurements prescribed in ANSI C63.4 2009.

These RF tests were performed according to the method of measurements prescribed in KDB558074 D01 v03r02 (05/06/2014).

1.3. Facilities and Accreditations

1.3.1. Facilities

Shenzhen Morlab Communications Technology Co., Ltd. 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 L3572.

All measurement facilities used to collect the measurement data are located at FL.1, Building A, FeiYang Science Park, Block 67, BaoAn District, Shenzhen, 518101 P. R. China. The test site is constructed in conformance with the requirements of ANSI C63.10 2009, ANSI C63.4 2009 and CISPR Publication 22; the FCC registration number is 695796.

The IC registration number is 7183A-2.

1.3.2. Test Environment Conditions

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

Temperature (°C):	15 - 35
Relative Humidity (%):	30 -60
Atmospheric Pressure (kPa):	86-106

2. 47 CFR Part 15C Requirements

2.1. Antenna requirement

2.1.1. Applicable Standard

According to FCC 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.

2.1.2. Result: Compliant

The EUT has a permanently and irreplaceable attached antenna. Please refer to the EUT internal photos.

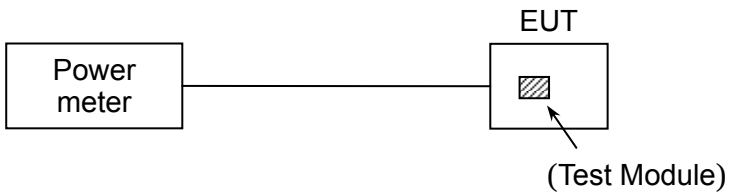
2.2. Peak Output Power

2.2.1. Requirement

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: The maximum peak conducted output power of the intentional radiator shall not exceed1 Watt.

2.2.2. Test Description

A. Test Setup:



The EUT (Equipment under the test) which is powered by the Battery is coupled to the Power Meter; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading, all test result in power meter.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
EPM Series Power Meter	Agilent	E4418B	GB43318055	2014.02.26	2015.02.25
Power Sensor	Agilent	8482A	MY41091706	2014.02.26	2015.02.25

2.2.3. Test Result

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

2.2.3.1. 802.11b Test mode

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
1	2412	14.12	0.025823	30	1	PASS
6	2437	13.13	0.020559			PASS
11	2462	13.39	0.021827			PASS

2.2.3.2. 802.11g Test mode

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
1	2412	16.44	0.044055	30	1	PASS
6	2437	15.64	0.036644			PASS
11	2462	15.61	0.036392			PASS

2.2.3.3. 802.11n-20MHz Test mode

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
1	2412	16.82	0.048084	30	1	PASS
6	2437	15.59	0.036224			PASS
11	2462	15.38	0.034514			PASS

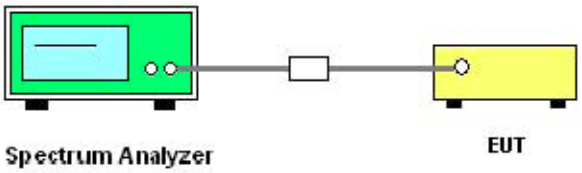
2.3. Bandwidth

2.3.1. Requirement

Systems using digital modulation techniques may operate in the 902 - 928 MHz, 2400 - 2483.5 MHz, and 5725 - 5850 MHz bands. The minimum 6 dB bandwidth shall be at least 500 kHz.

2.3.2. Test Description

A. Test Set:



The EUT which is powered by the Battery, is coupled to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Receiver	Agilent	E7405A	US44210471	2014.02.26	2015.02.25

2.3.3. Test Result

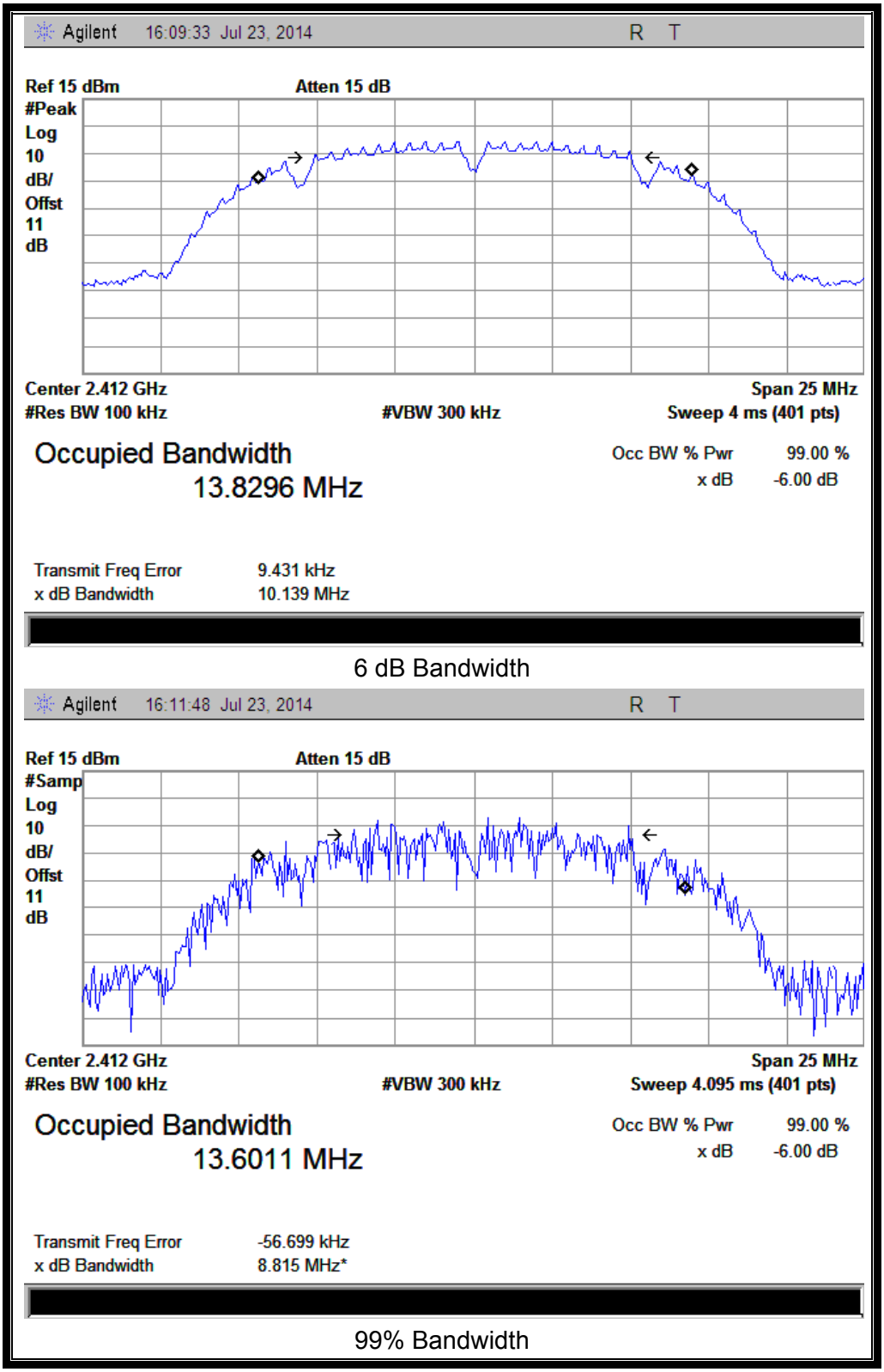
The lowest, middle and highest channels are selected to perform testing to record the 6 dB bandwidth of the Module.

2.3.3.1. 802.11b Test mode

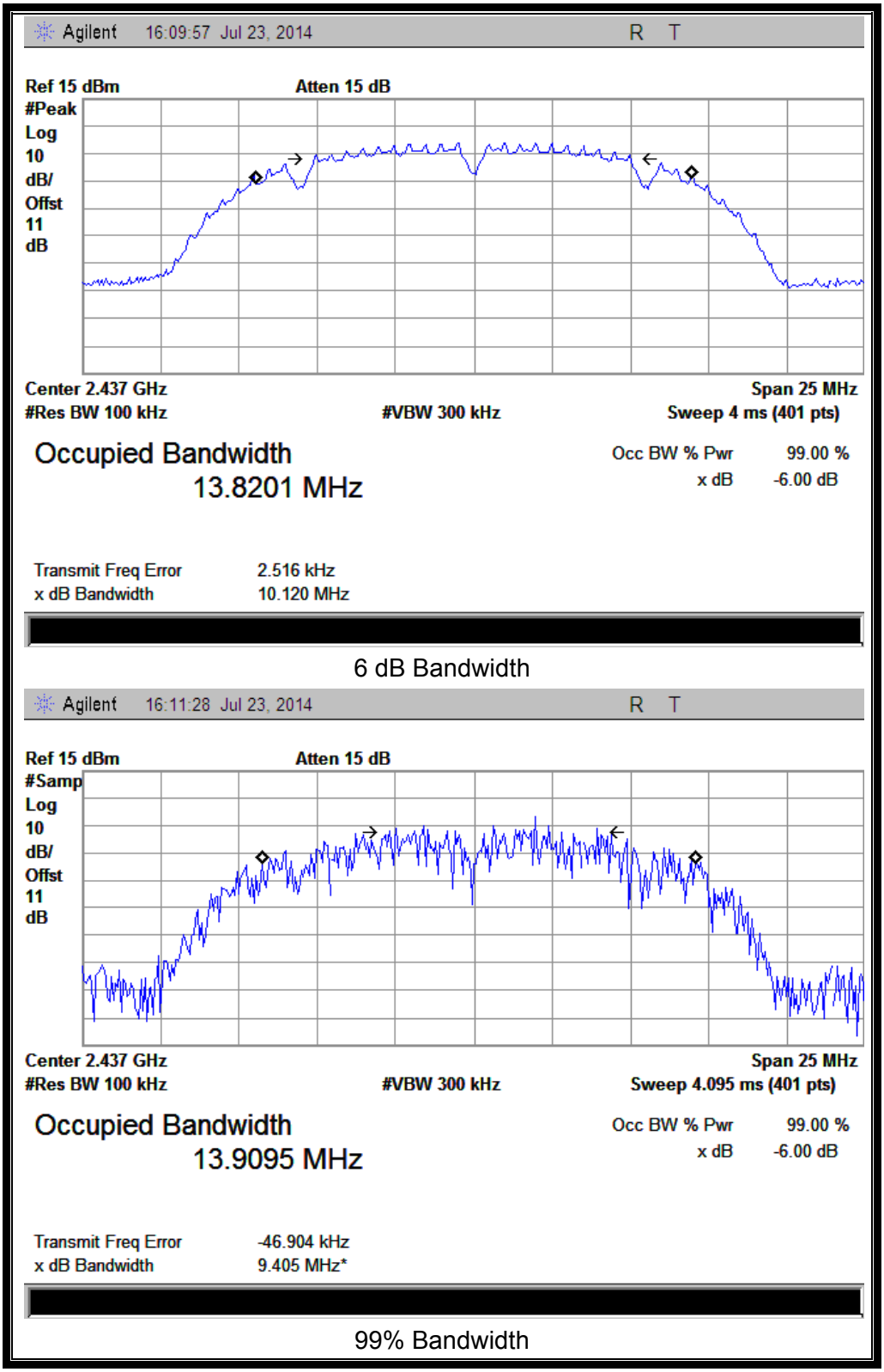
A. Test Verdict:

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	99% Bandwidth (MHz)	Refer to Plot	Limits(kHz)	Result
1	2412	10.139	13.6011	Plot A	≥500	PASS
6	2437	10.120	13.9095	Plot B	≥500	PASS
11	2462	9.666	13.7070	Plot C	≥500	PASS

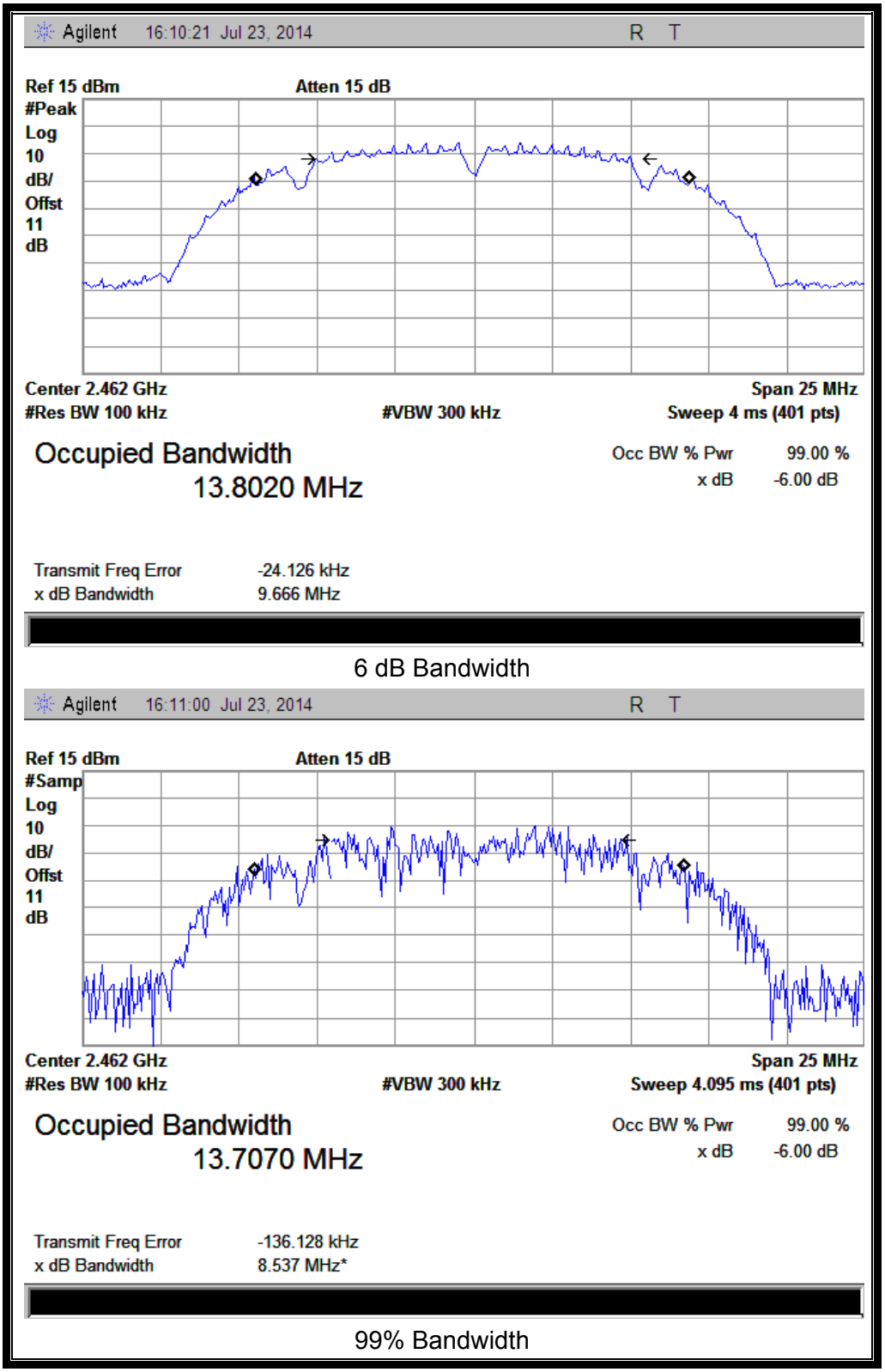
B. Test Plots



(Plot A: Channel 1: 2412MHz @ 802.11b)



(Plot B: Channel 6: 2437 MHz @ 802.11b)



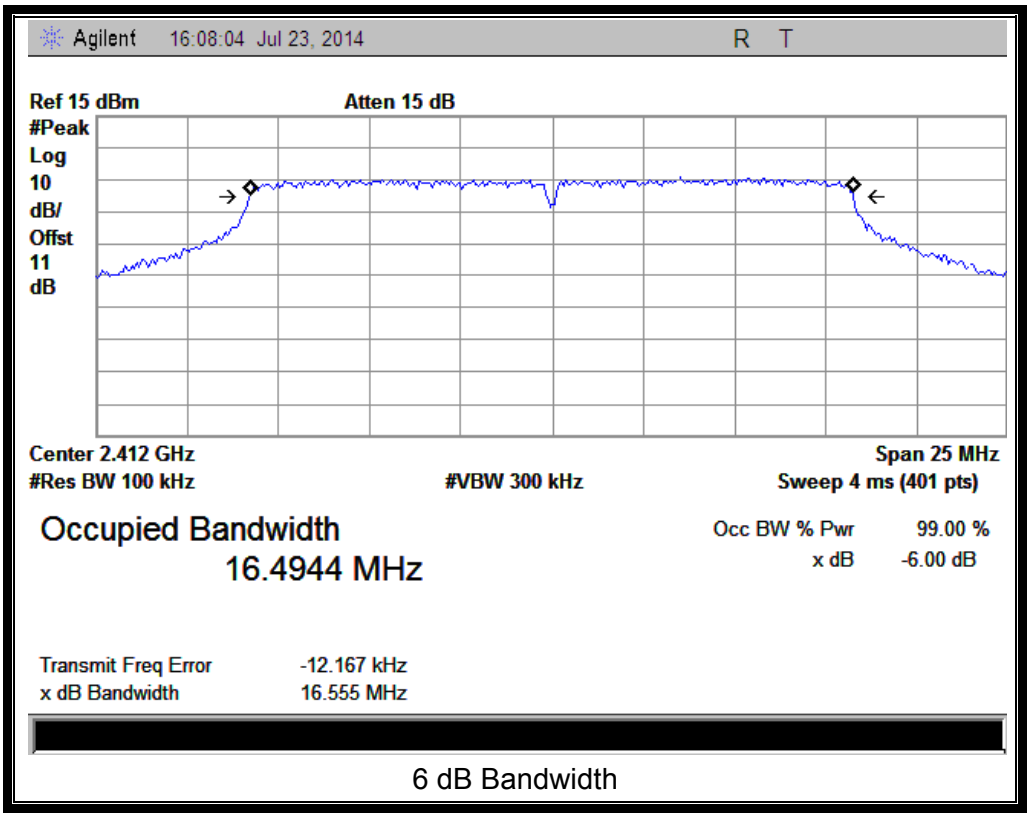
(Plot C: Channel 11: 2462MHz @ 802.11b)

2.3.3.2. 802.11g Test mode

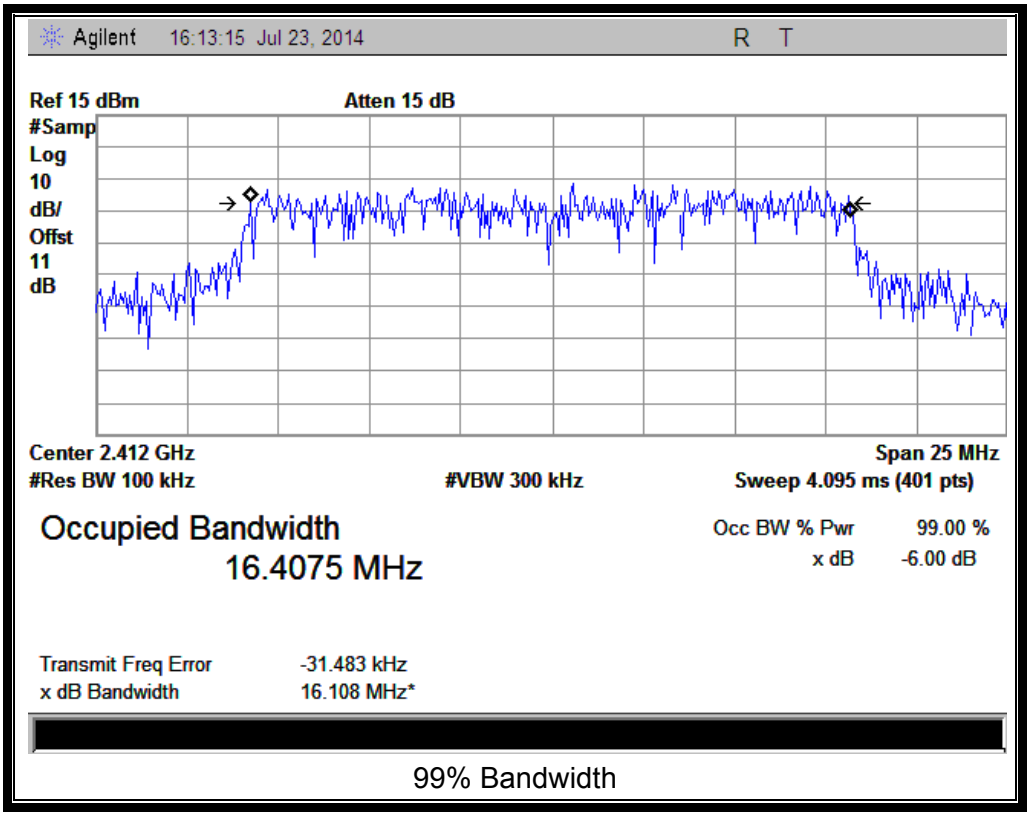
A. Test Verdict:

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	99% Bandwidth (MHz)	Refer to Plot	Limits(kHz)	Result
1	2412	16.555	16.4075	Plot D	≥500	PASS
6	2437	16.580	16.3751	Plot E	≥500	PASS
11	2462	16.575	16.4202	Plot F	≥500	PASS

B. Test Plots:

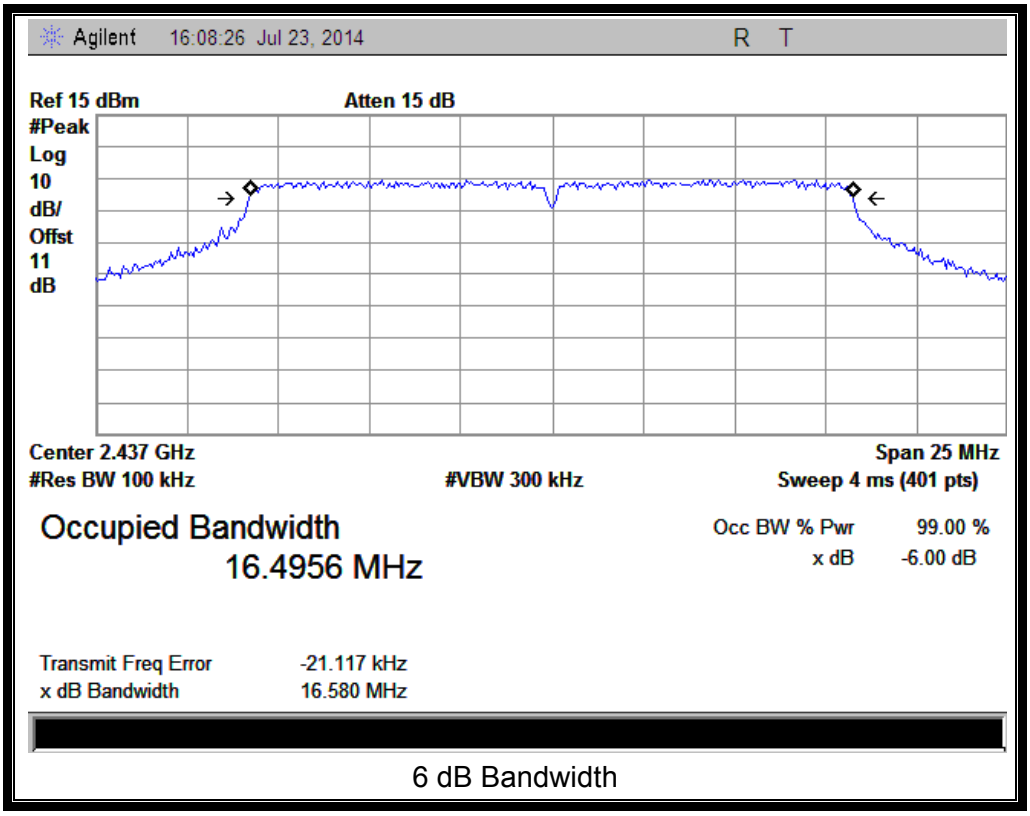


6 dB Bandwidth

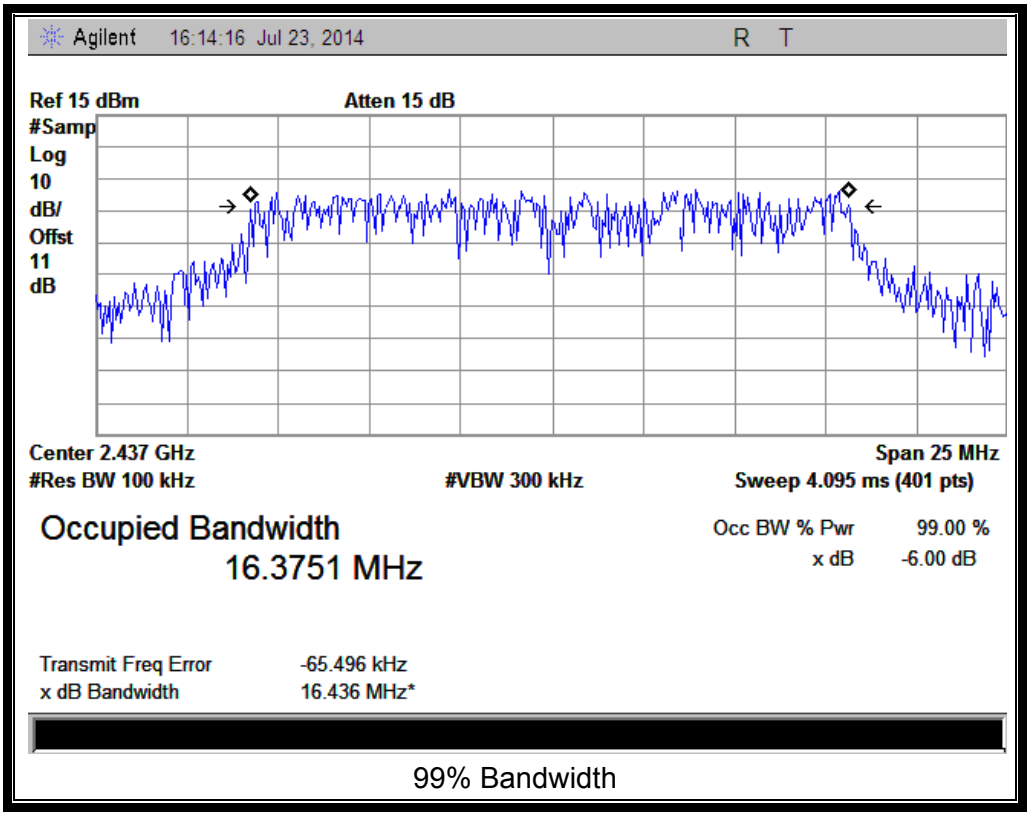


99% Bandwidth

(Plot D: Channel 1: 2412MHz @ 802.11g)

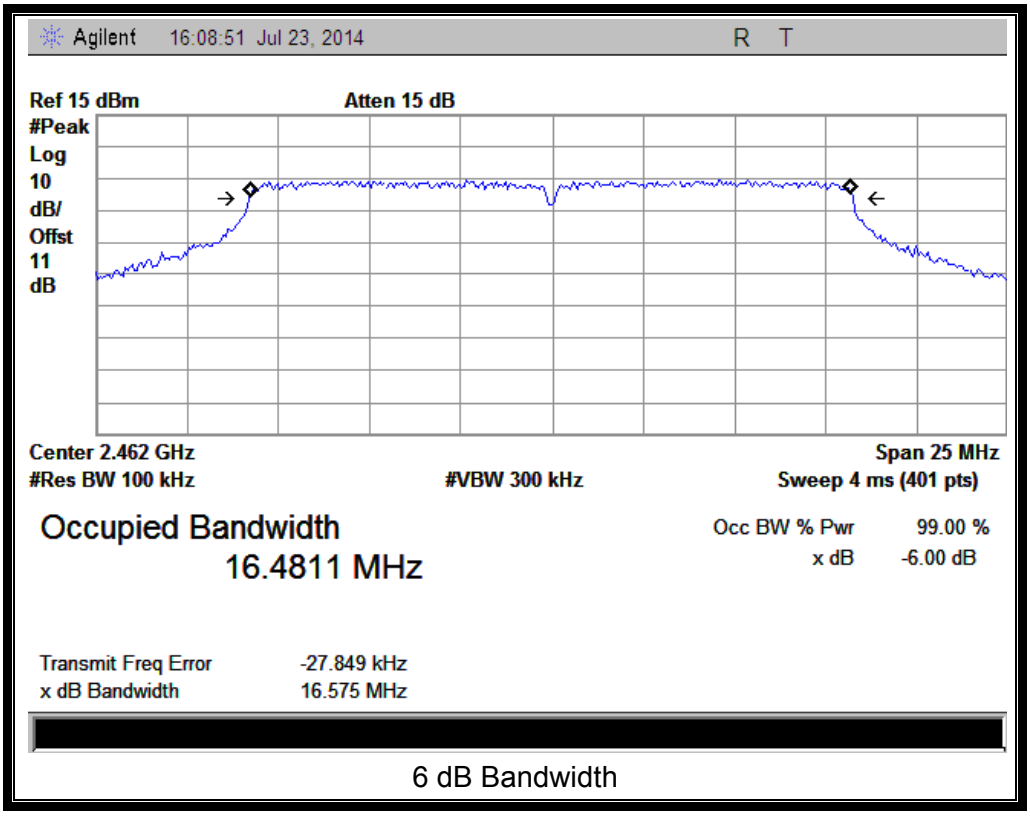


6 dB Bandwidth

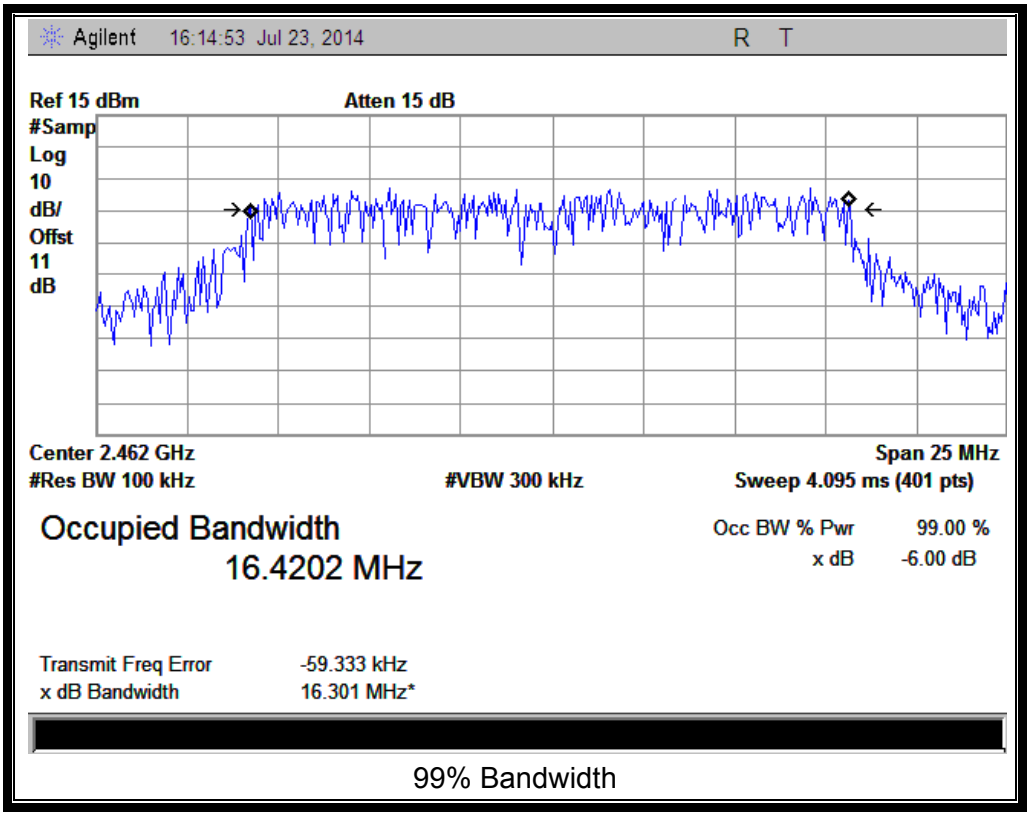


99% Bandwidth

(Plot E: Channel 6: 2437MHz @ 802.11g)



6 dB Bandwidth



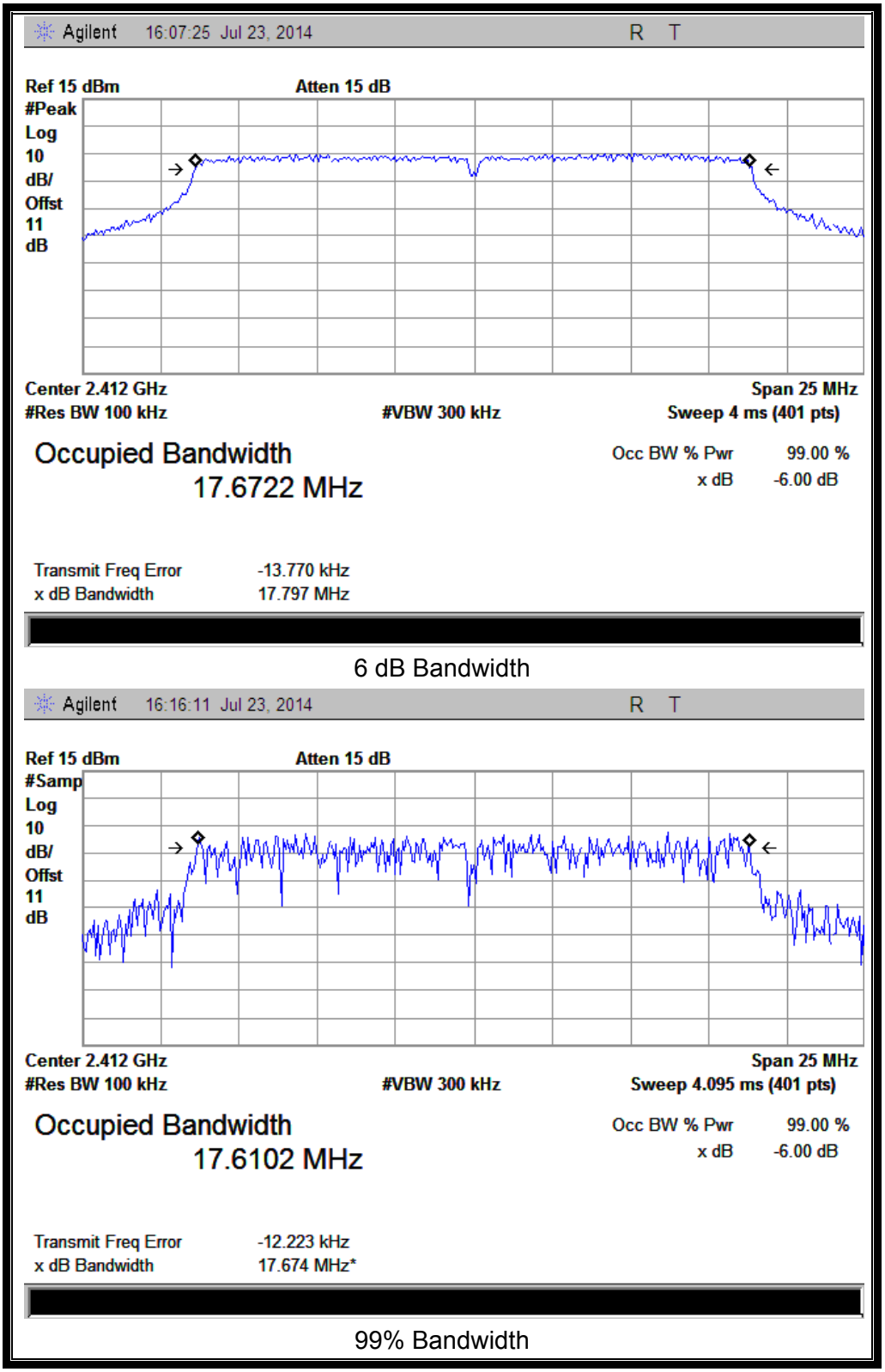
(Plot F: Channel 11: 2462MHz @ 802.11g)

2.3.3.3. 802.11n-20 Test mode

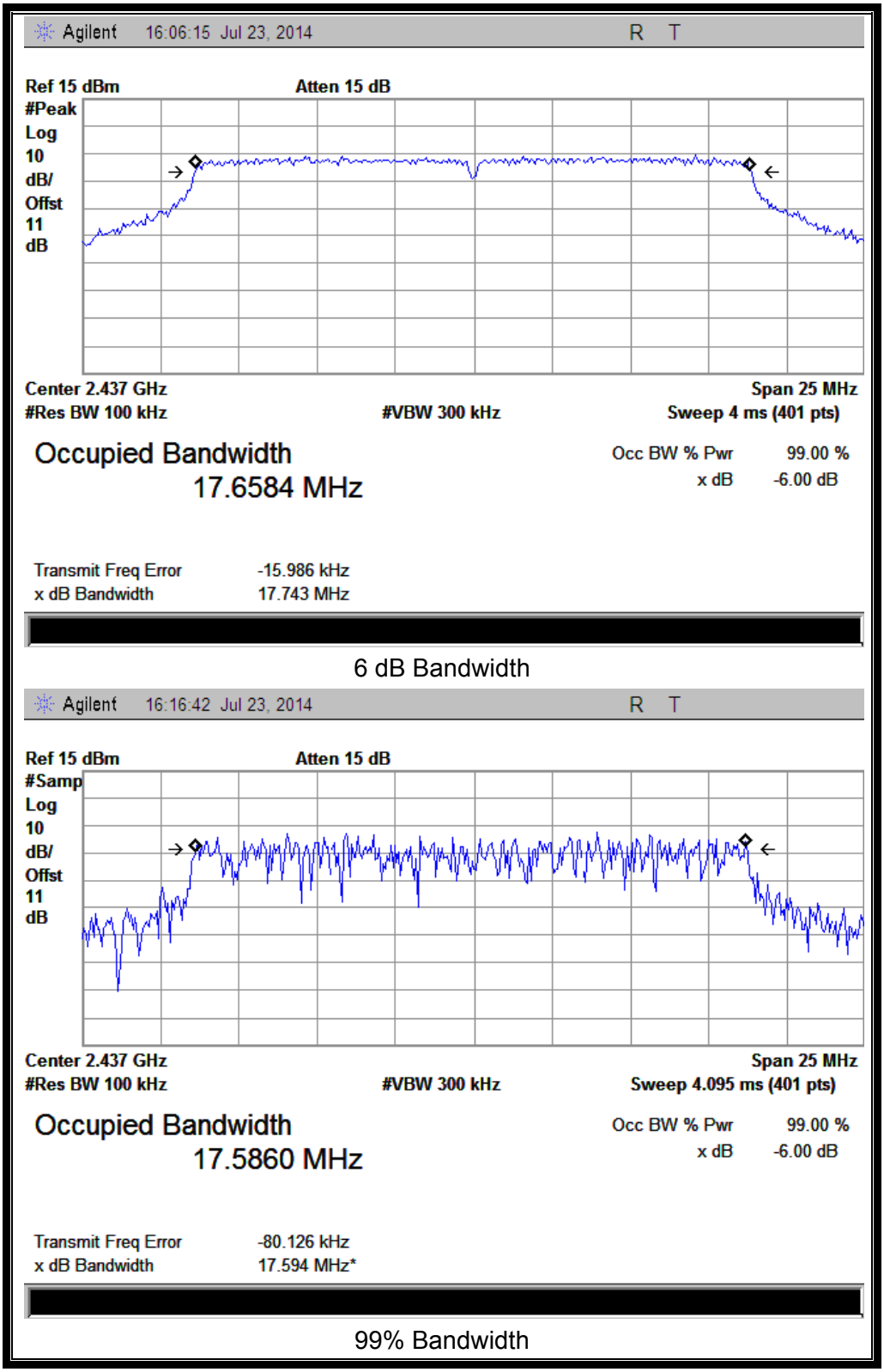
A. Test Verdict:

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	99% Bandwidth (MHz)	Refer to Plot	Limits(kHz)	Result
1	2412	17.797	17.6102	Plot G	≥500	PASS
6	2437	17.743	17.5860	Plot H	≥500	PASS
11	2462	17.802	17.5717	Plot I	≥500	PASS

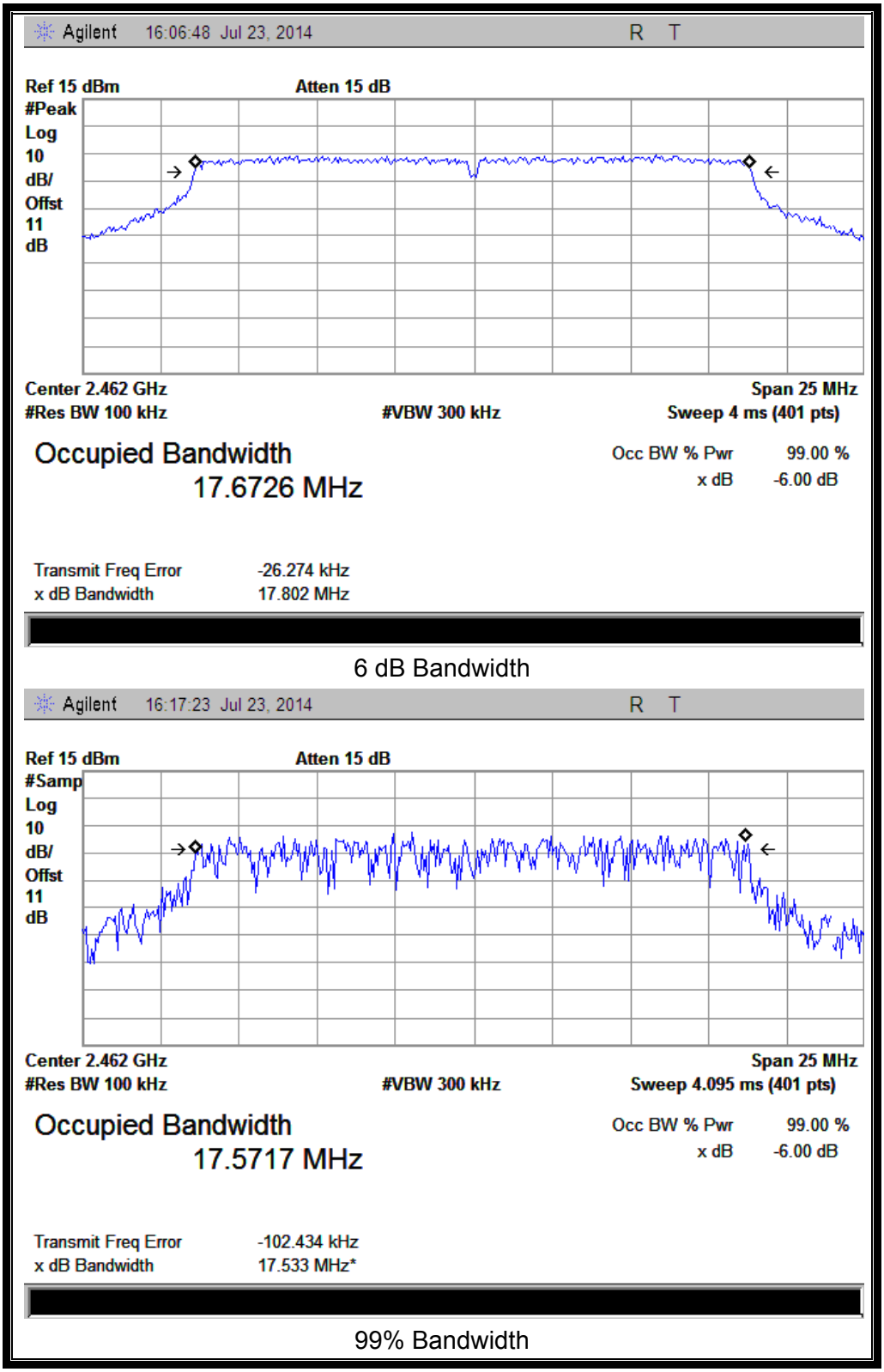
B. Test Plots:



(Plot G: Channel 1: 2412MHz @ 802.11n-20)



(Plot H: Channel 6: 2437MHz @ 802.11n-20)



(Plot I: Channel 11: 2462MHz @ 802.11n-20)

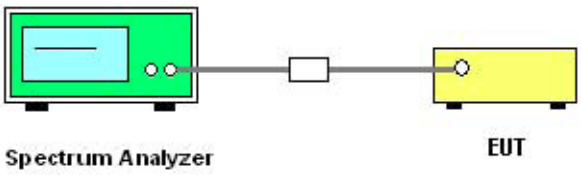
2.4. Conducted Spurious Emissions and Band Edge

2.4.1. Requirement

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.

2.4.2. Test Description

A. Test Set:



The EUT which is powered by the Battery, is coupled to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Receiver	Agilent	E7405A	US44210471	2014.02.26	2015.02.25

2.4.3. Test Result

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.

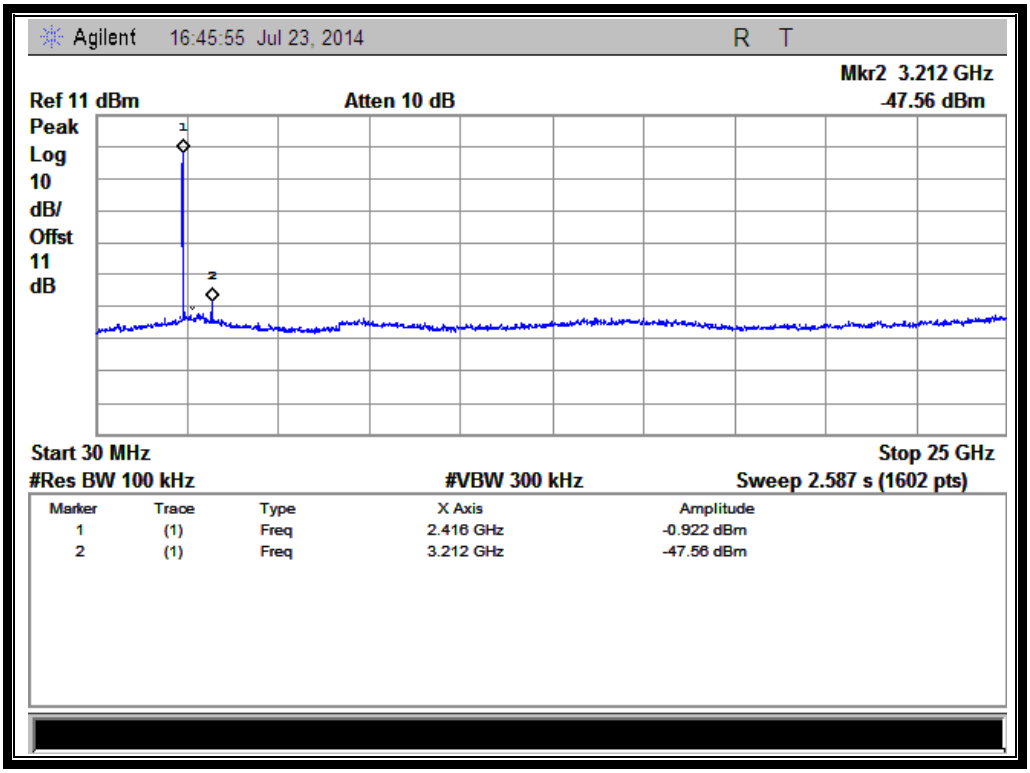
2.4.3.1. 802.11b Test mode

A. Test Verdict:

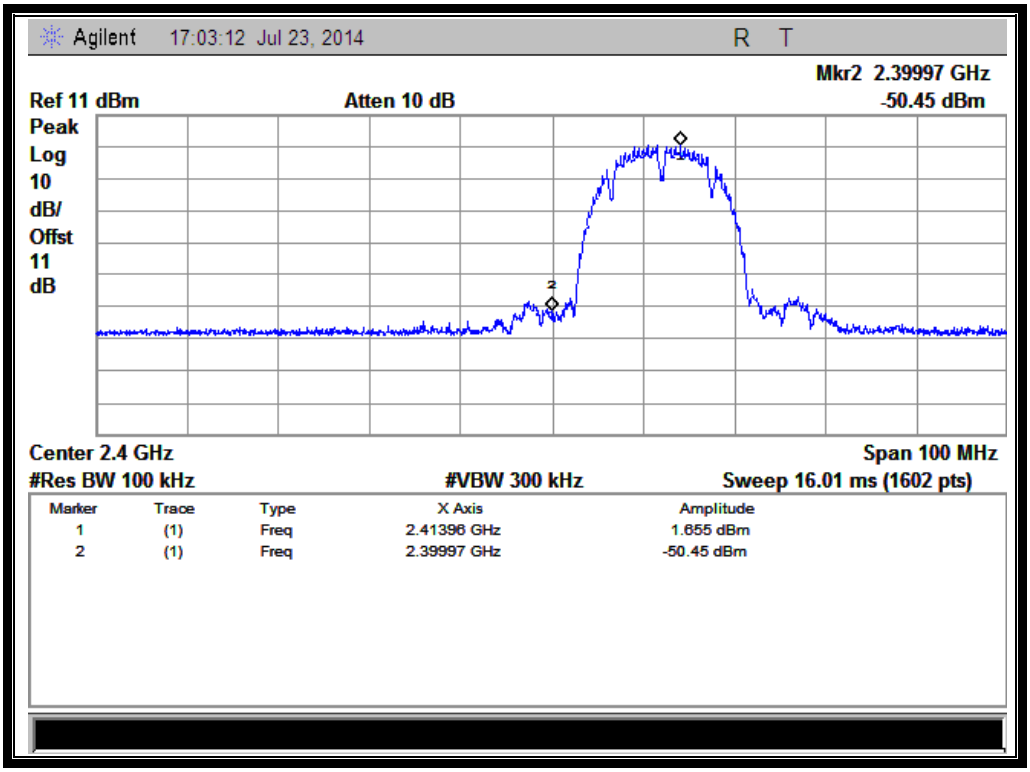
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
1	2412	-47.56	Plot A.1	-0.922	-20.9	PASS
6	2437	-47.64	Plot B.1	-3.498	-23.5	PASS
11	2462	-46.42	Plot C.1	-1.827	-21.8	PASS

B. Test Plots:

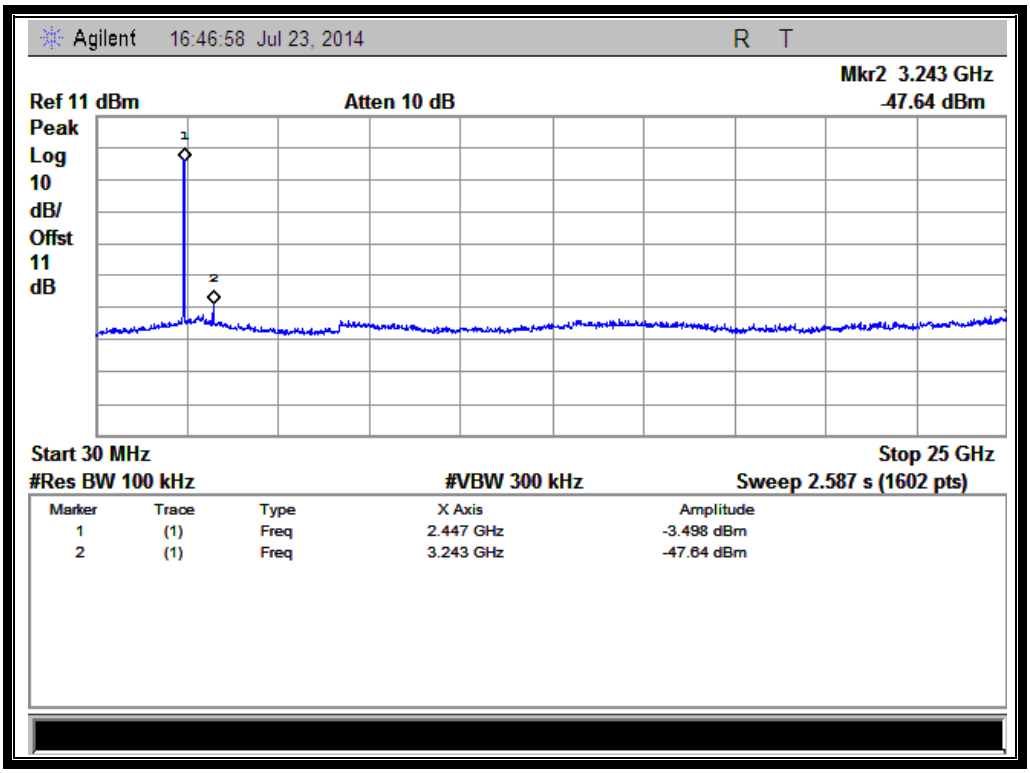
Note: the power of the Module transmitting frequency should be ignored.



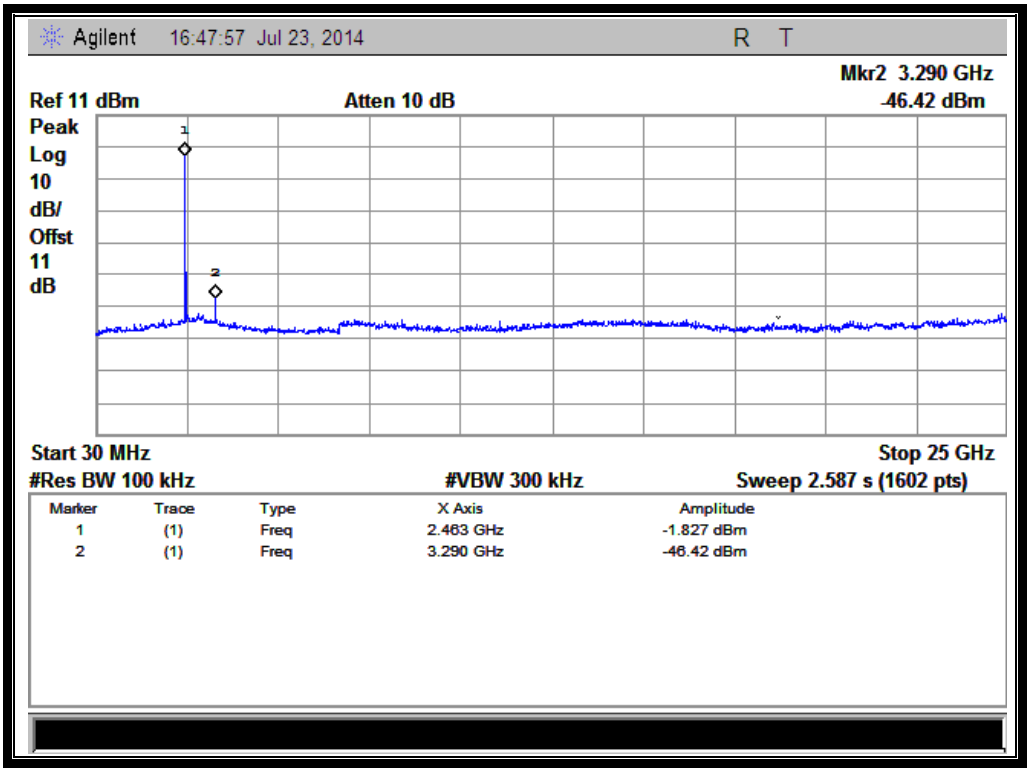
(Plot A.1: Channel = 1, 30MHz to 25GHz)



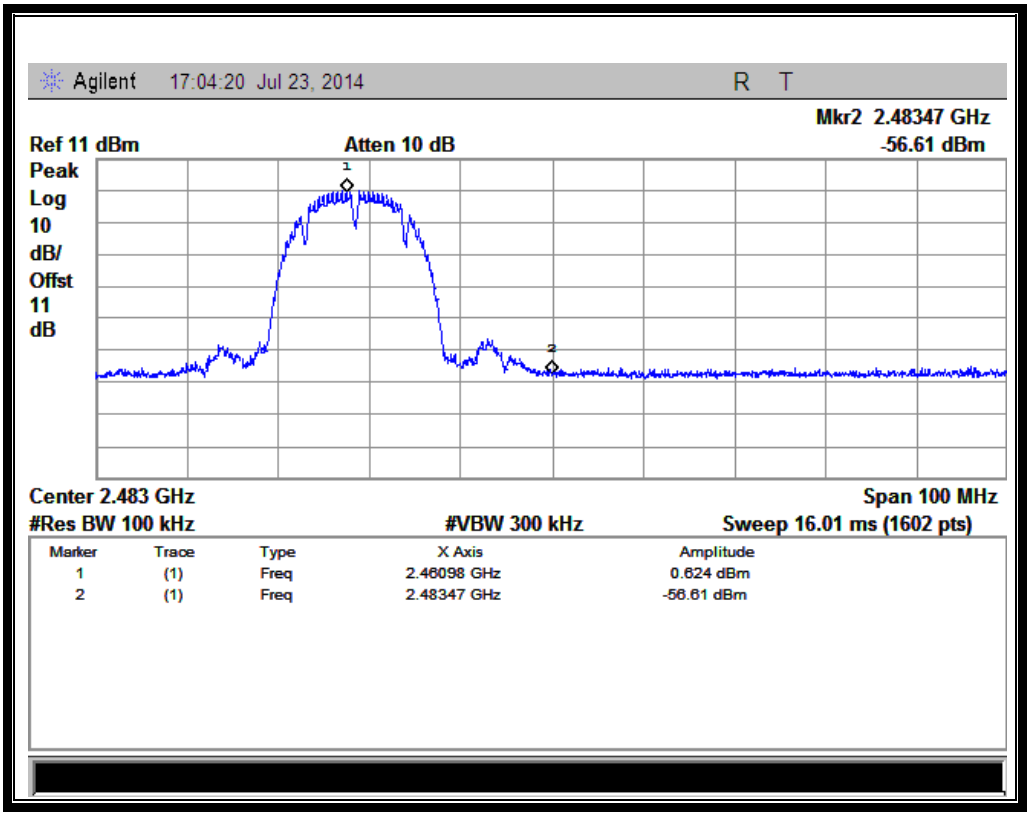
(Band Edge @ Channel = 1)



(Plot B.1: Channel = 6, 30MHz to 25GHz)



(Plot C.1: Channel = 11, 30MHz to 25GHz)



(Band Edge @ Channel = 11)

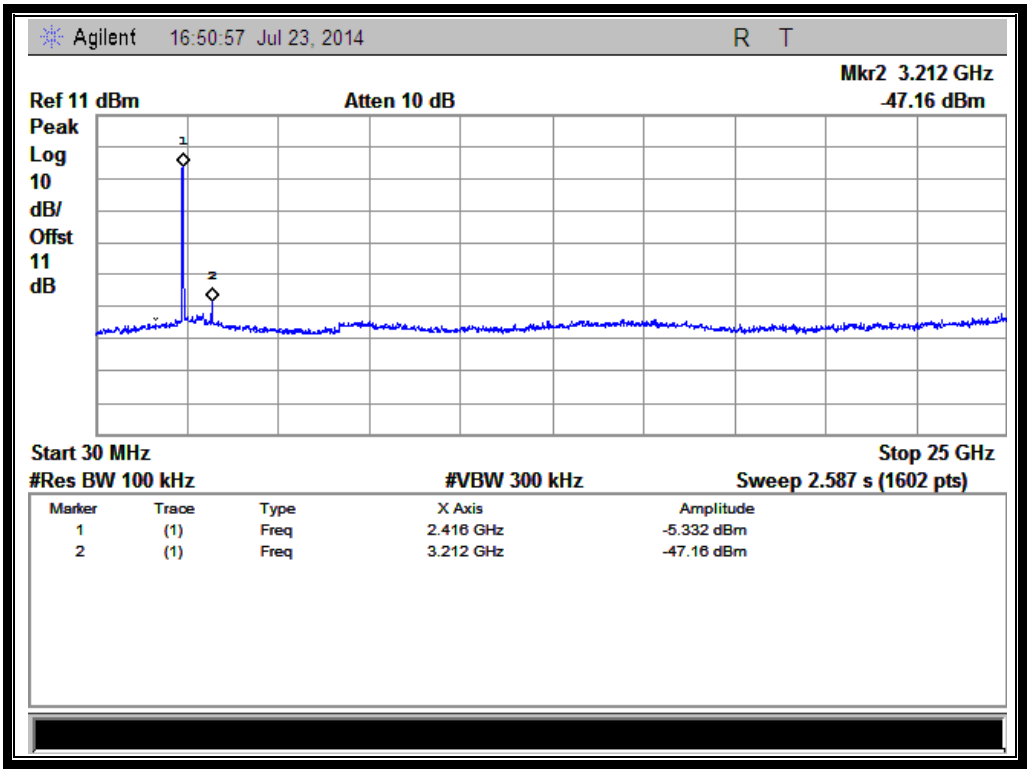
2.4.3.2. 802.11g Test mode

A. Test Verdict:

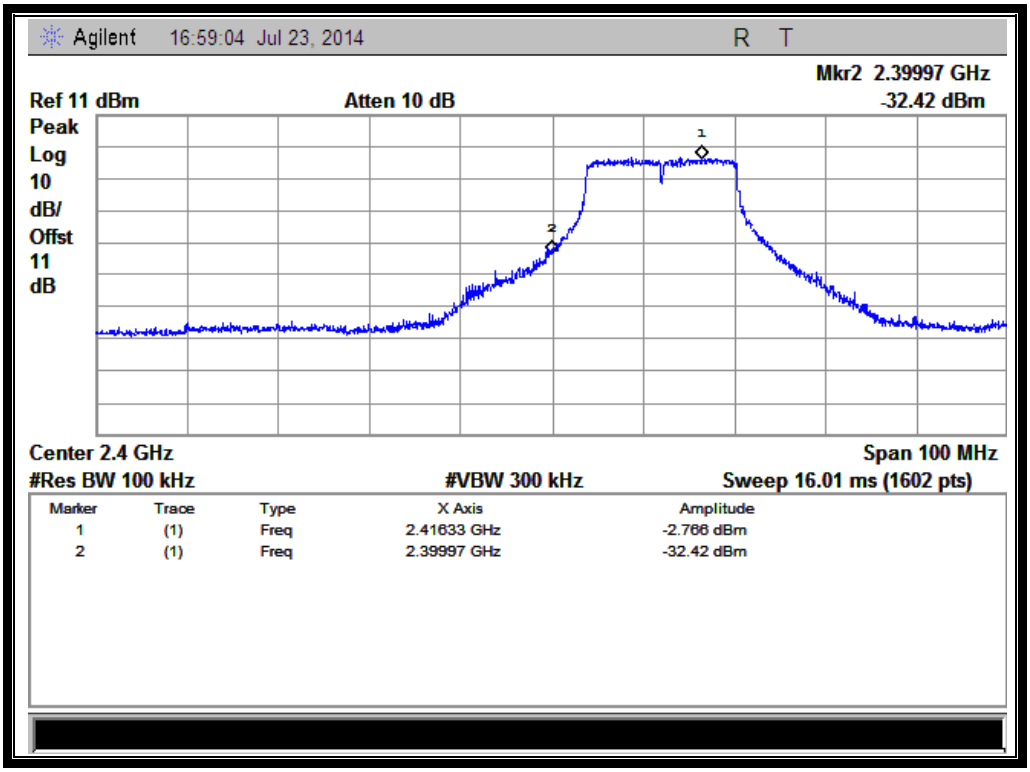
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
1	2412	-47.16	Plot D.1	-5.332	-25.3	PASS
6	2437	-46.64	Plot E.1	-6.324	-26.3	PASS
11	2462	-46.28	Plot F.1	-1.827	-21.8	PASS

B. Test Plots:

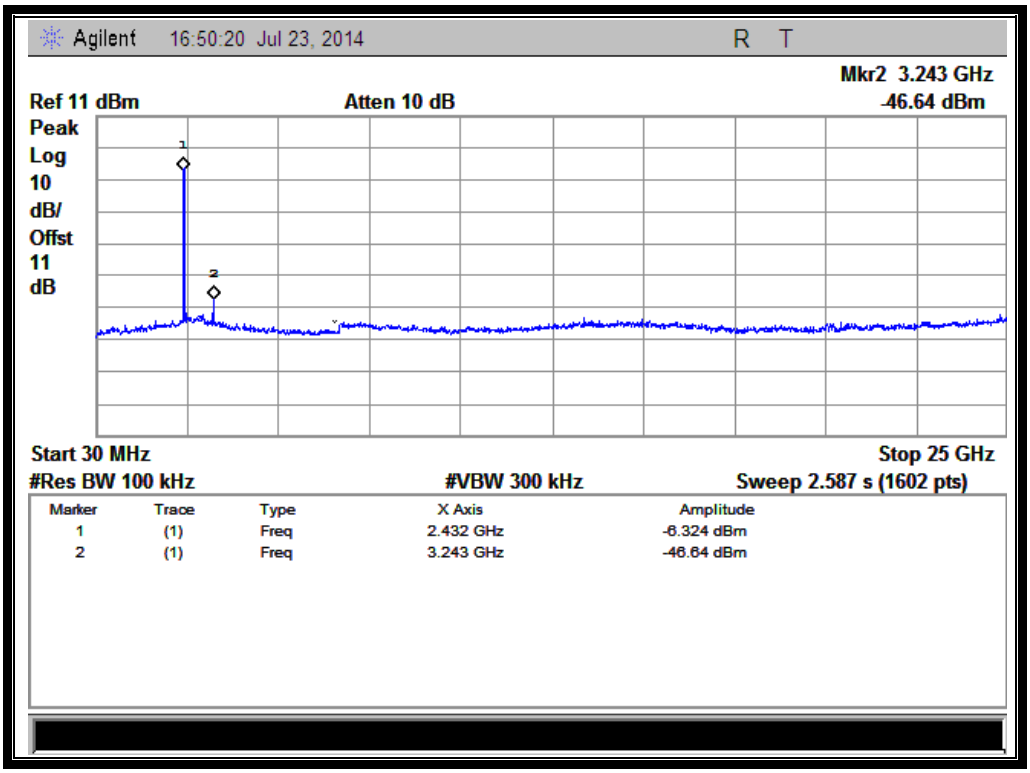
Note: the power of the Module transmitting frequency should be ignored.



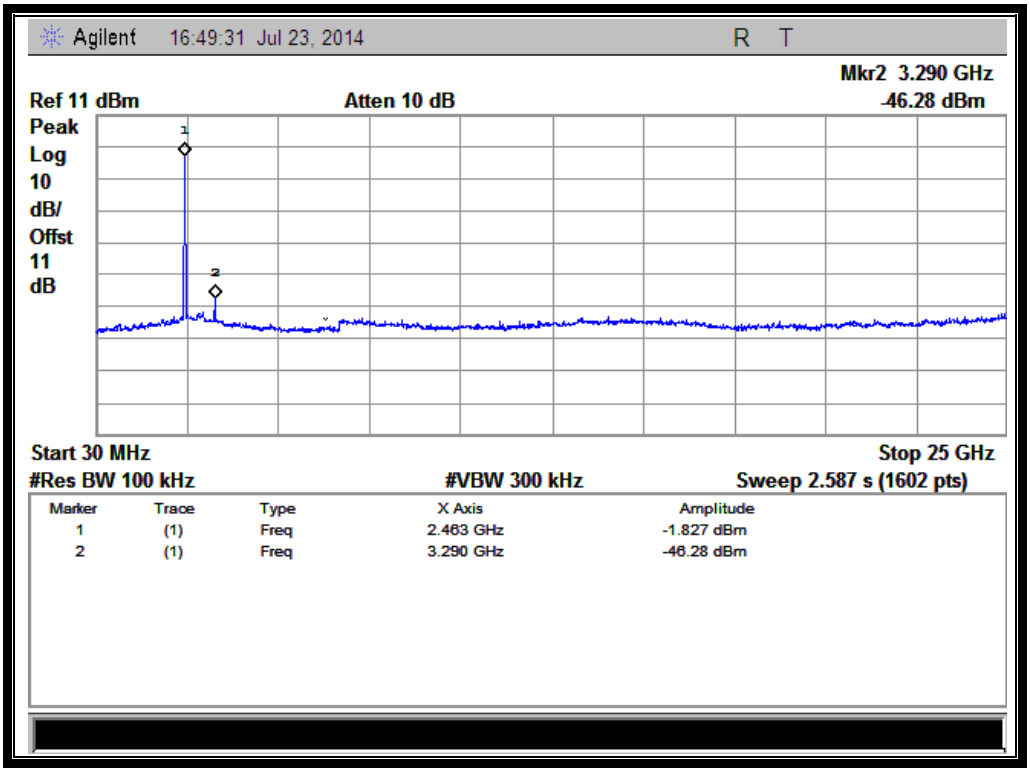
(Plot D.1: Channel = 1, 30MHz to 25GHz)



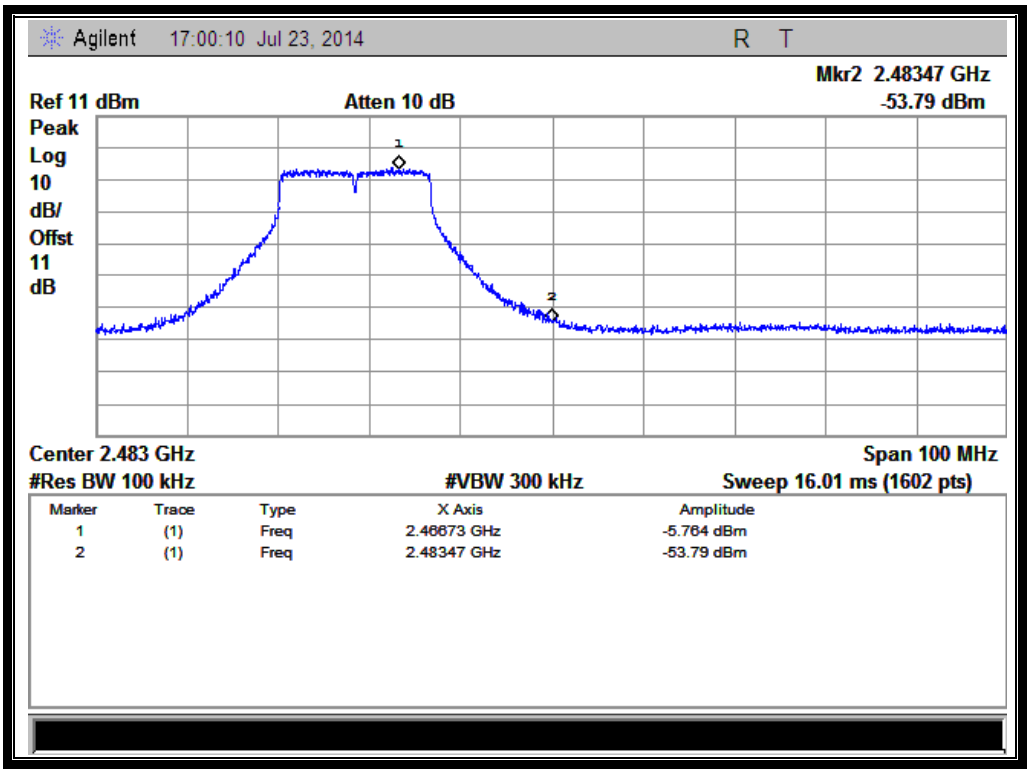
(Band Edge @ Channel = 1)



(Plot E.1: Channel = 6, 30MHz to 25GHz)



(Plot F.1: Channel = 11, 30MHz to 25GHz)



(Band Edge @ Channel = 11)

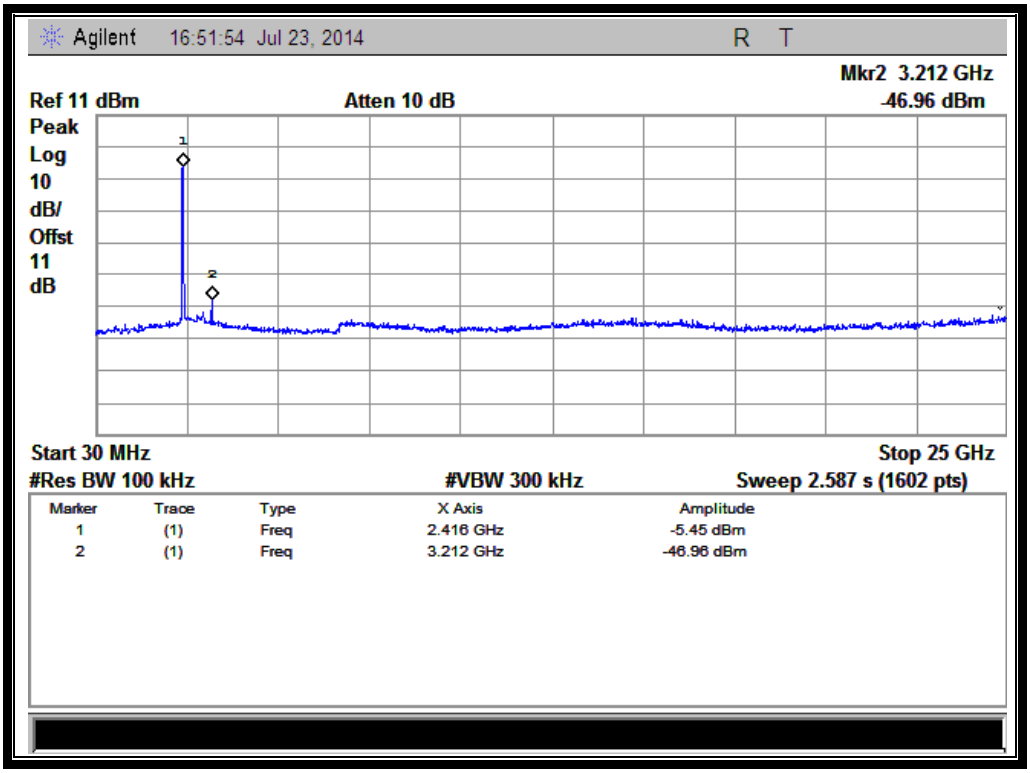
2.4.3.3. 802.11n -20MHz Test mode

A. Test Verdict:

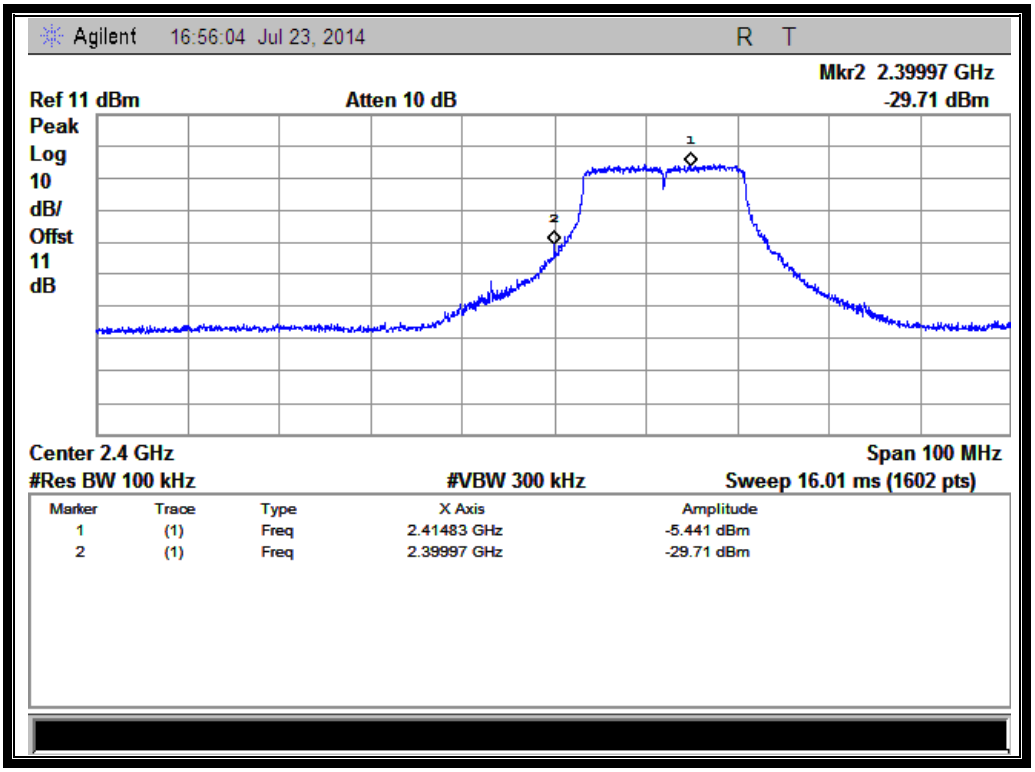
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Refer to Plot	Limit (dBm)		Verdict
				Carrier Level	Calculated -20dBc Limit	
1	2412	-46.96	Plot G.1	-5.45	-25.5	PASS
6	2437	-46.82	Plot H.1	-6.155	-26.2	PASS
11	2462	-46.91	Plot I.1	-6.172	-26.2	PASS

B. Test Plots:

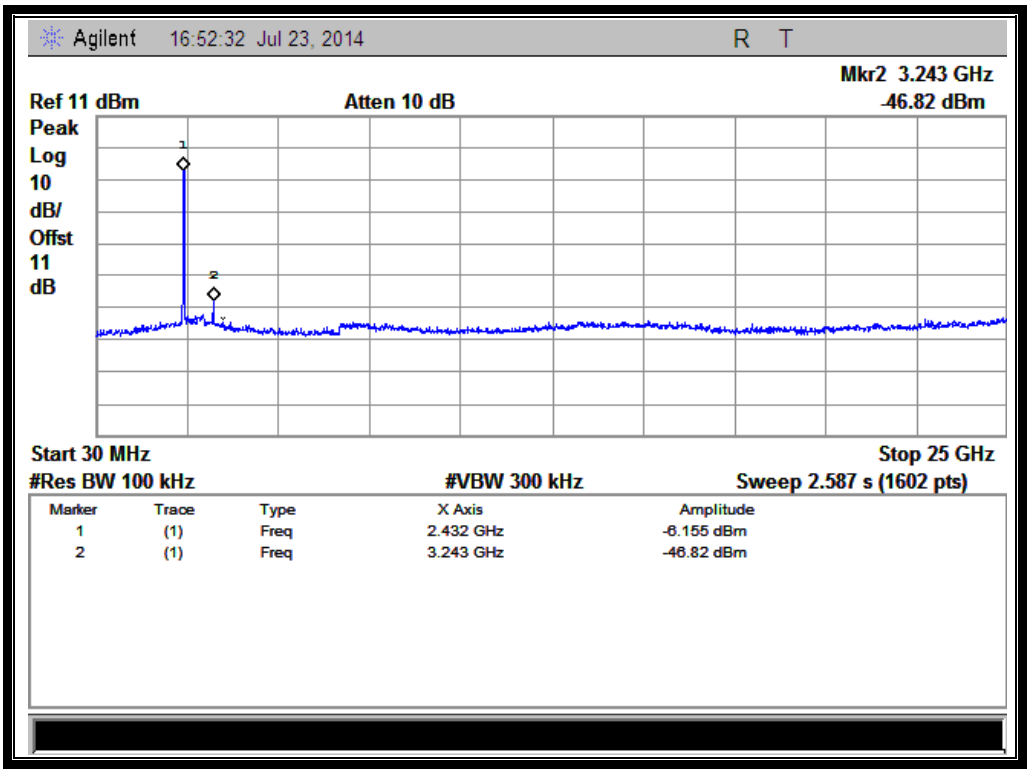
Note: the power of the Module transmitting frequency should be ignored.



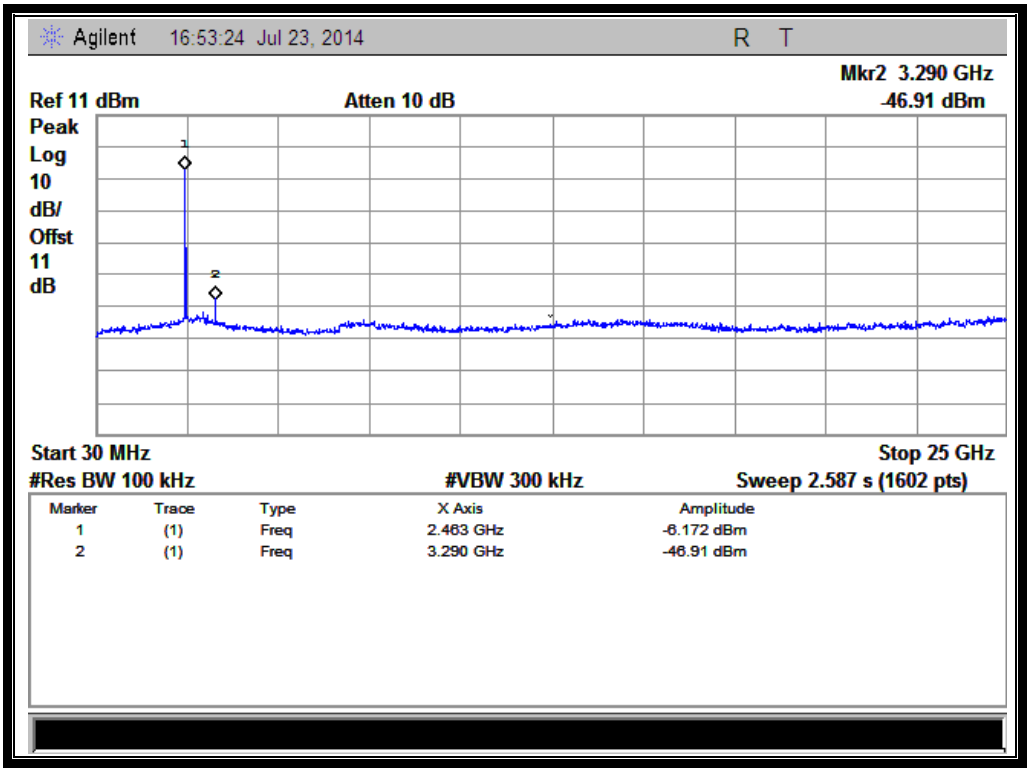
(Plot G.1: Channel = 1, 30MHz to 25GHz)



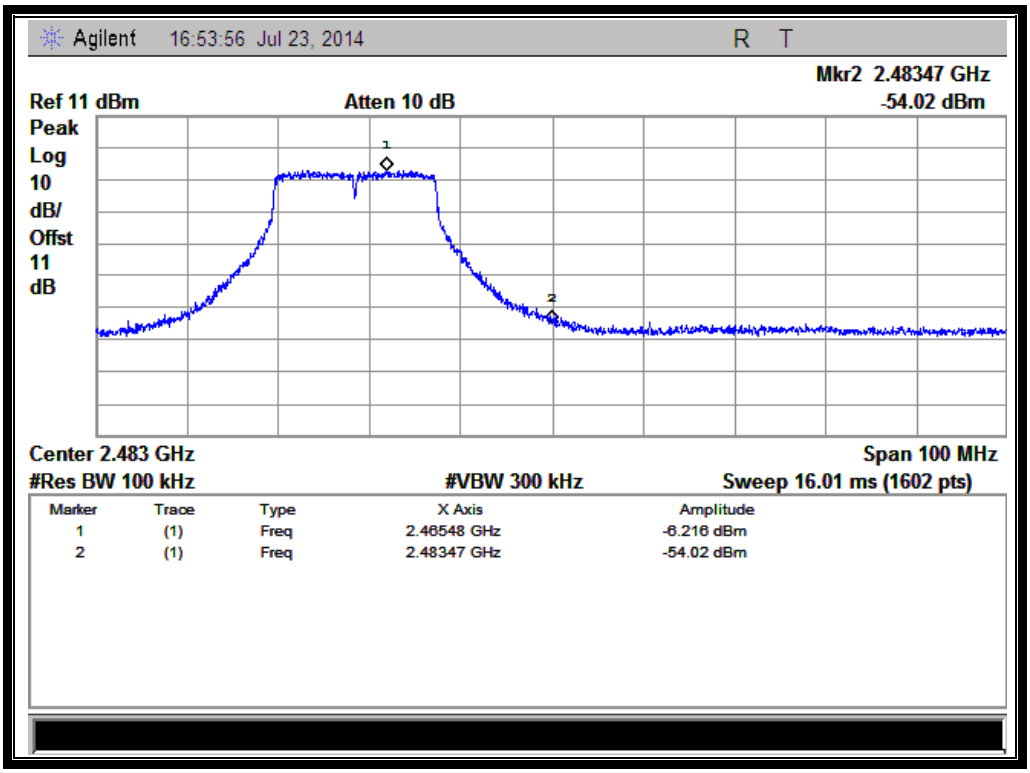
(Band Edge @ Channel = 1)



(Plot H.1: Channel = 6, 30MHz to 25GHz)



(Plot I.1: Channel = 11, 30MHz to 25GHz)



(Band Edge @ Channel = 11)

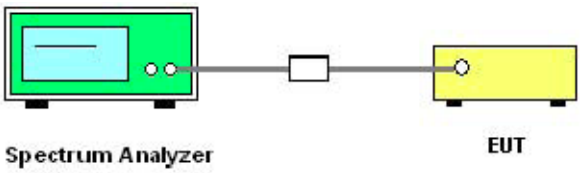
2.5. Power spectral density (PSD)

2.5.1. Requirement

For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of paragraph (b) of this section. The same method of determining the conducted output power shall be used to determine the power spectral density

2.5.2. Test Description

A. Test Set:



The EUT which is powered by the Battery, is coupled to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50Ohm; the path loss as the factor is calibrated to correct the reading.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Receiver	Agilent	E7405A	US44210471	2014.02.26	2015.02.25

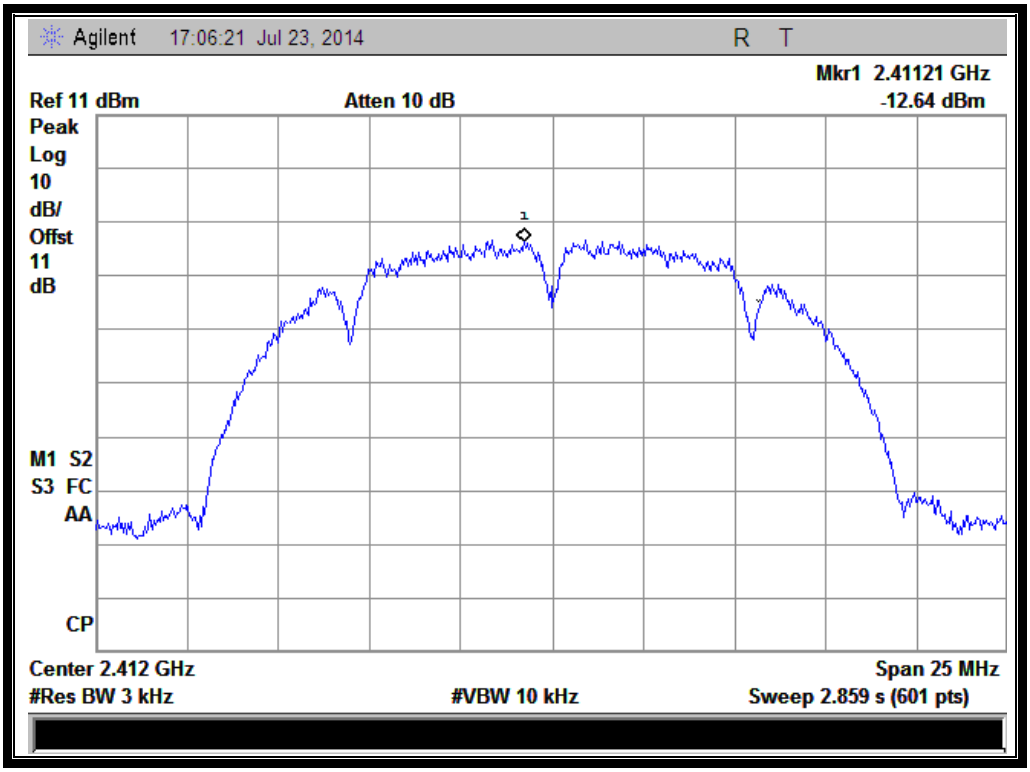
2.5.3. Test Result

2.5.3.1. 802.11b Test mode

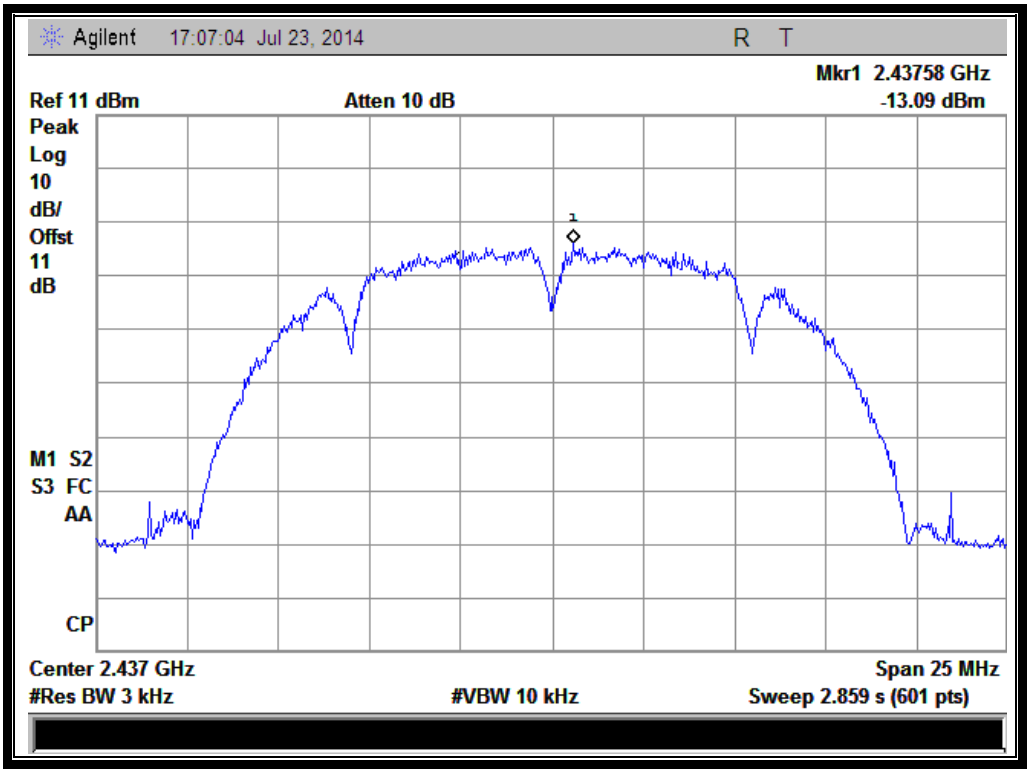
A. Test Verdict:

Spectral power density (dBm/3kHz)					
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Refer to Plot	Limit (dBm/3kHz)	Verdict
1	2412	-12.64	Plot A	8	PASS
6	2437	-13.09	Plot B	8	PASS
11	2462	-13.78	Plot C	8	PASS
Measurement uncertainty: ±1.3dB					

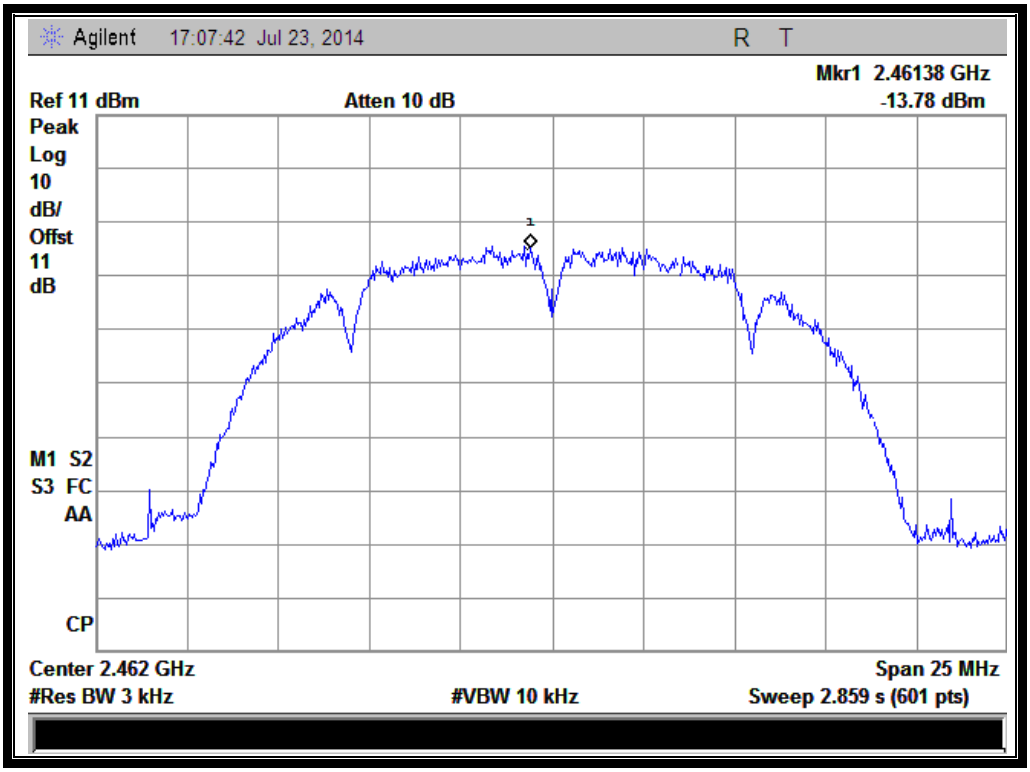
B. Test Plots:



(Plot A: Channel = 1 @ 802.11b)



(Plot B: Channel = 6 @ 802.11b)



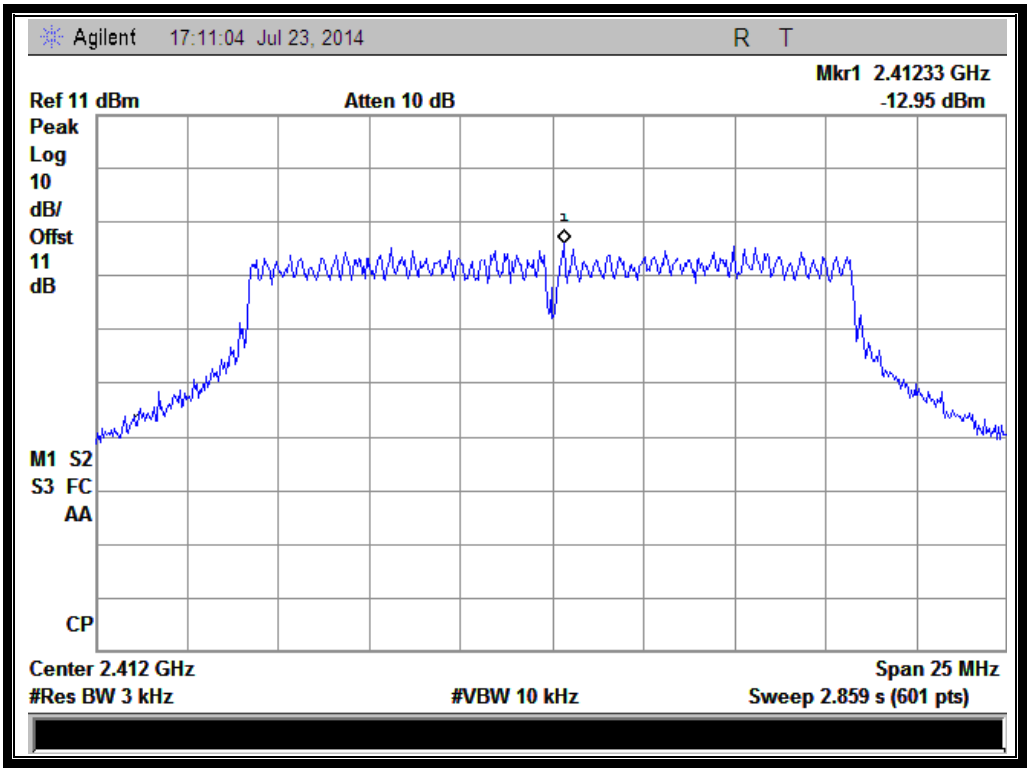
(Plot C: Channel = 11 @ 802.11b)

2.5.3.2. 802.11g Test mode

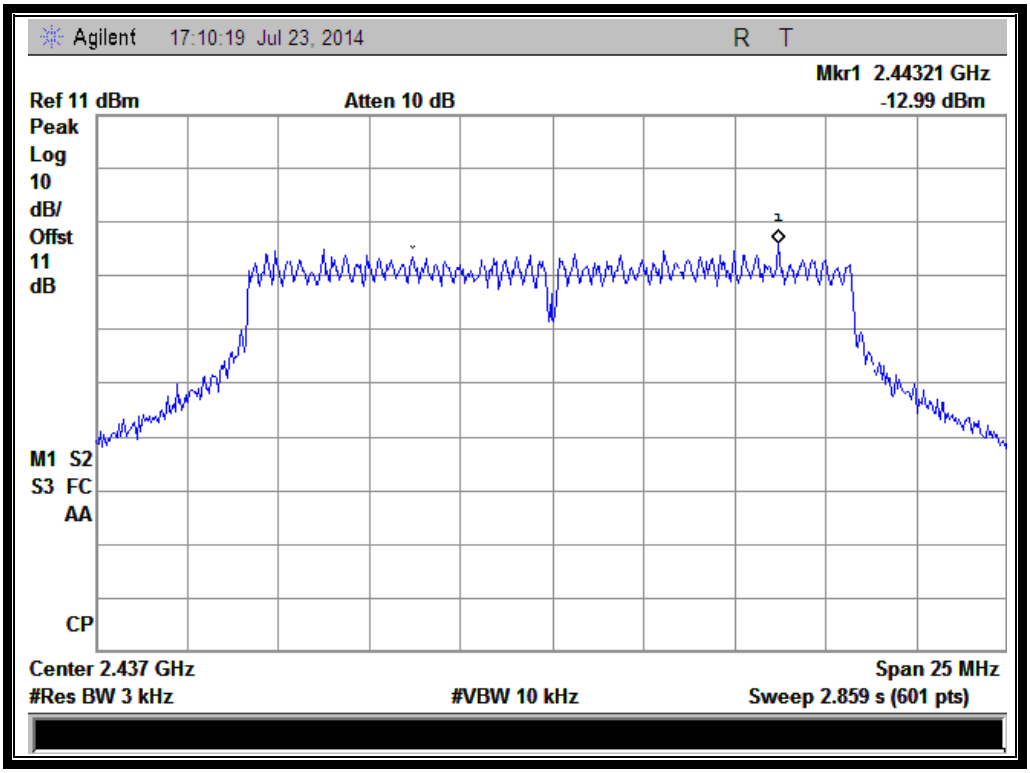
A. Test Verdict:

Spectral power density (dBm/3kHz)					
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Refer to Plot	Limit (dBm/3kHz)	Verdict
1	2412	-12.95	Plot A	8	PASS
6	2437	-12.99	Plot B	8	PASS
11	2462	-13.45	Plot C	8	PASS
Measurement uncertainty: ±1.3dB					

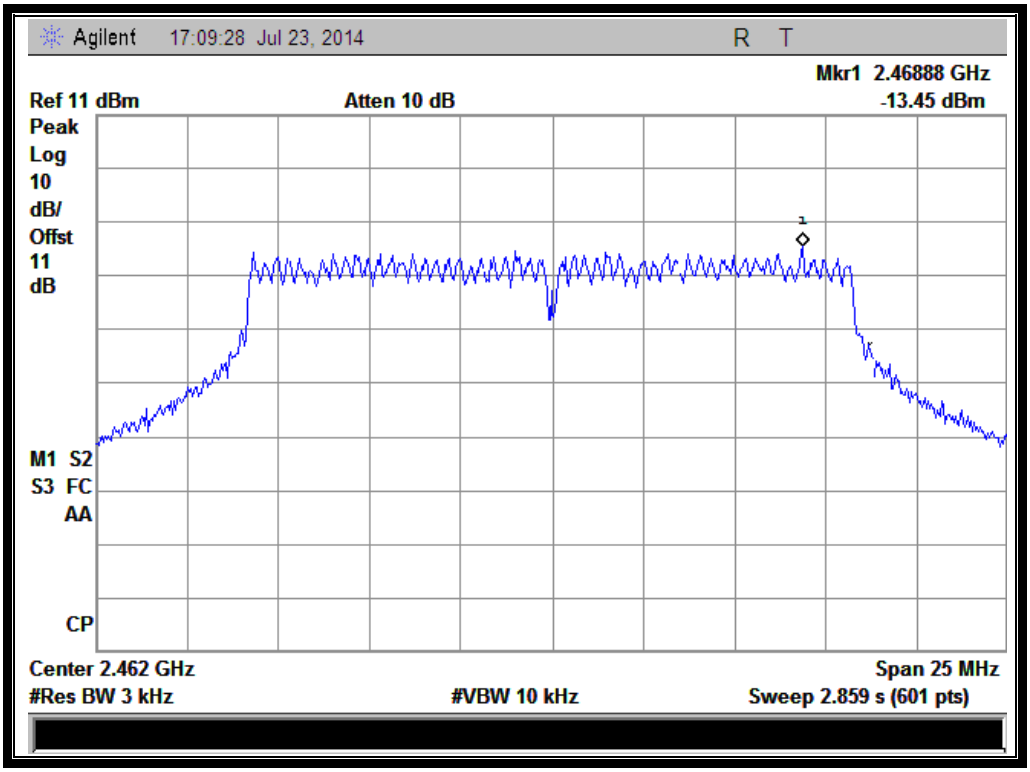
B. Test Plots:



(Plot A: Channel = 1 @ 802.11g)



(Plot B: Channel = 6 @ 802.11g)



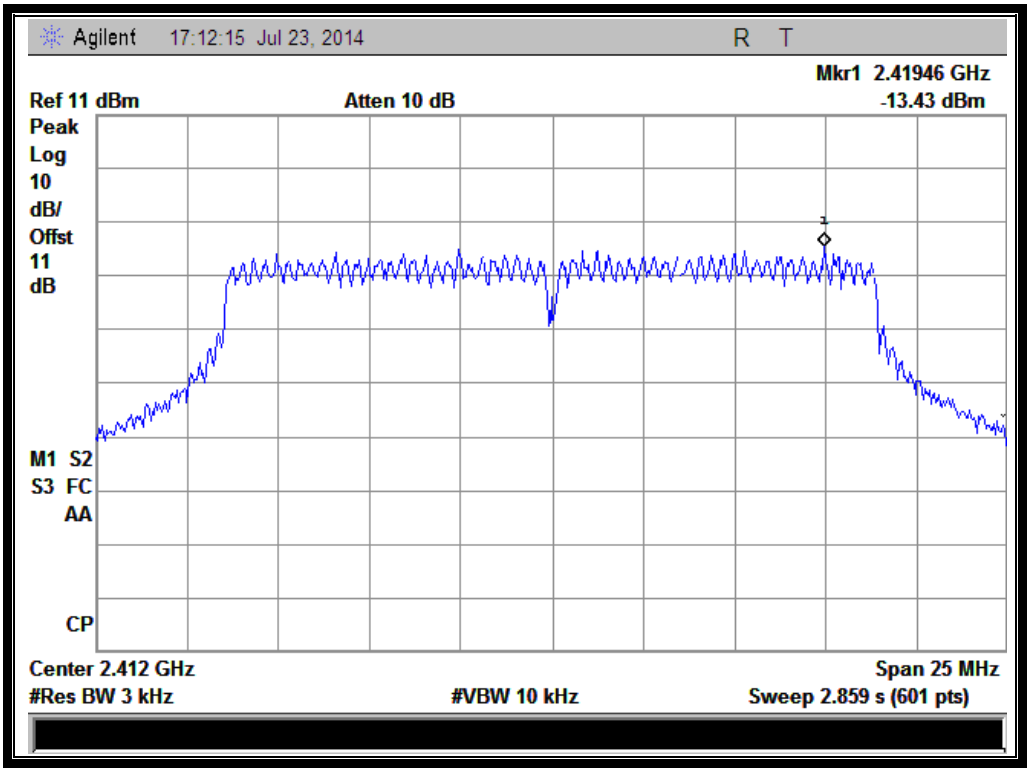
(Plot C: Channel = 11 @ 802.11g)

2.5.3.3. 802.11n-20MHz Test mode

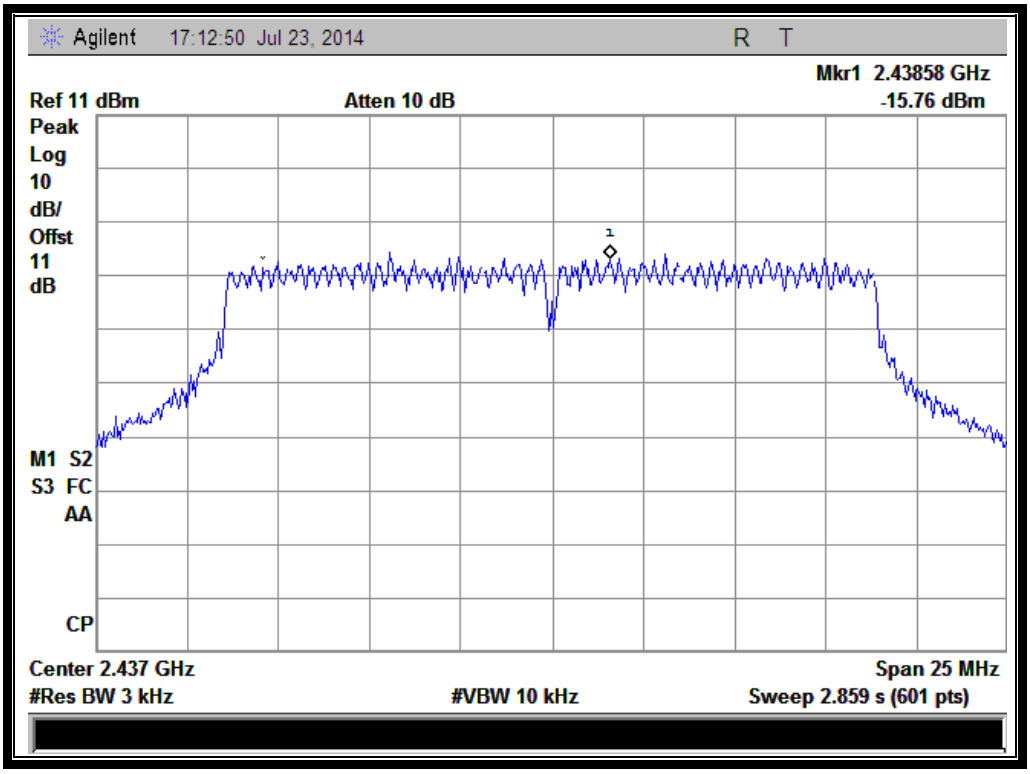
A. Test Verdict:

Spectral power density (dBm/3kHz)					
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Refer to Plot	Limit (dBm/3kHz)	Verdict
1	2412	-13.43	Plot A	8	PASS
6	2437	-15.76	Plot B	8	PASS
11	2462	-14.09	Plot C	8	PASS
Measurement uncertainty: ±1.3dB					

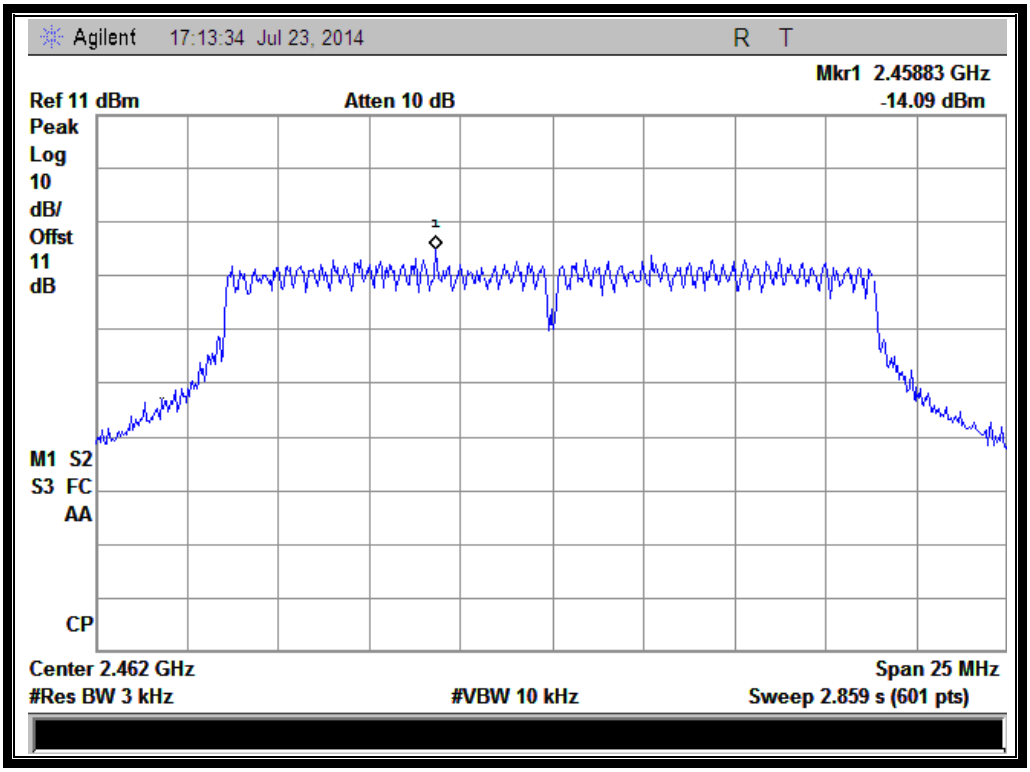
B. Test Plots:



(Plot A: Channel = 1 @ 802.11n-20MHz)



(Plot B: Channel = 6 @ 802.11n-20MHz)



(Plot C: Channel = 11 @ 802.11n-20MHz)

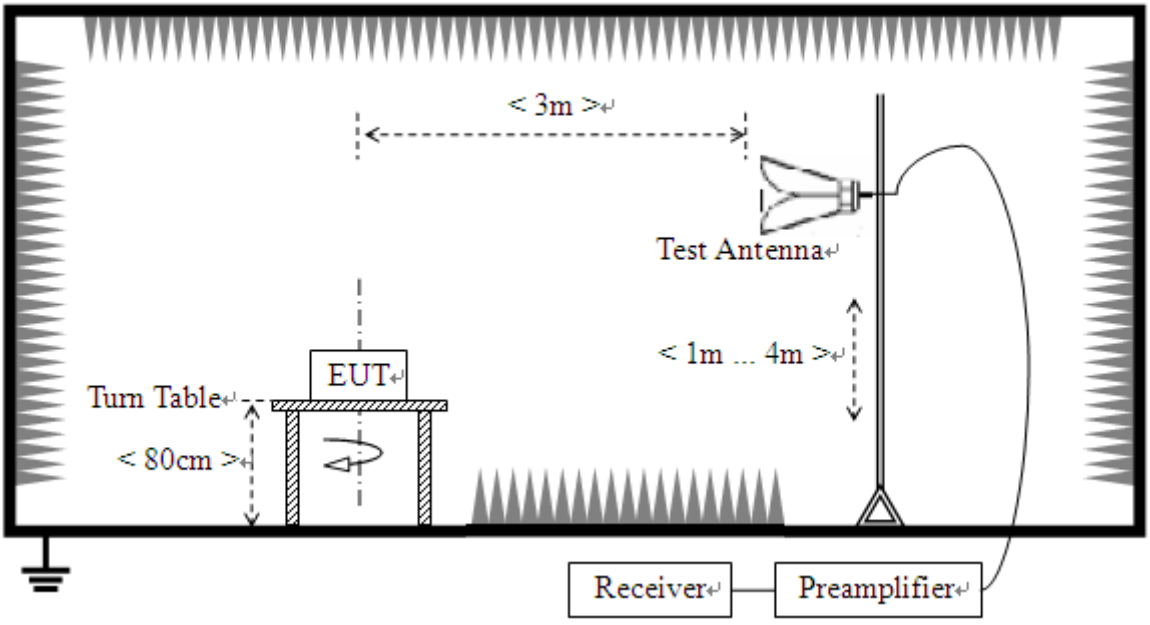
2.6. Restricted Frequency Bands

2.6.1. Requirement

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, 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).

2.6.2. 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.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Receiver	Agilent	E7405A	US44210471	2014.02.26	2015.02.25
Full-Anechoic Chamber	Albatross	9m*6m*6m	(n.a.)	2014.02.26	2015.02.25
Test Antenna - Horn	Schwarzbeck	BBHA 9120D	9120D-963	2014.02.26	2015.02.25

2.6.3. Test Result

The lowest and highest channels are tested to verify Restricted Frequency Bands.

The measurement results are obtained as below:
$E\ [dB\mu V/m] = U_R + A_T + A_{Factor}\ [dB]$; $A_T = L_{Cable\ loss}\ [dB] - G_{preamp}\ [dB]$
A_T: Total correction Factor except Antenna
U_R: Receiver Reading
G_{preamp}: Preamplifier Gain
A_{Factor}: Antenna Factor at 3m

Note: Restricted Frequency Bands were performed when antenna was at vertical and horizontal polarity, and only the worse test condition (vertical) was recorded in this test report.

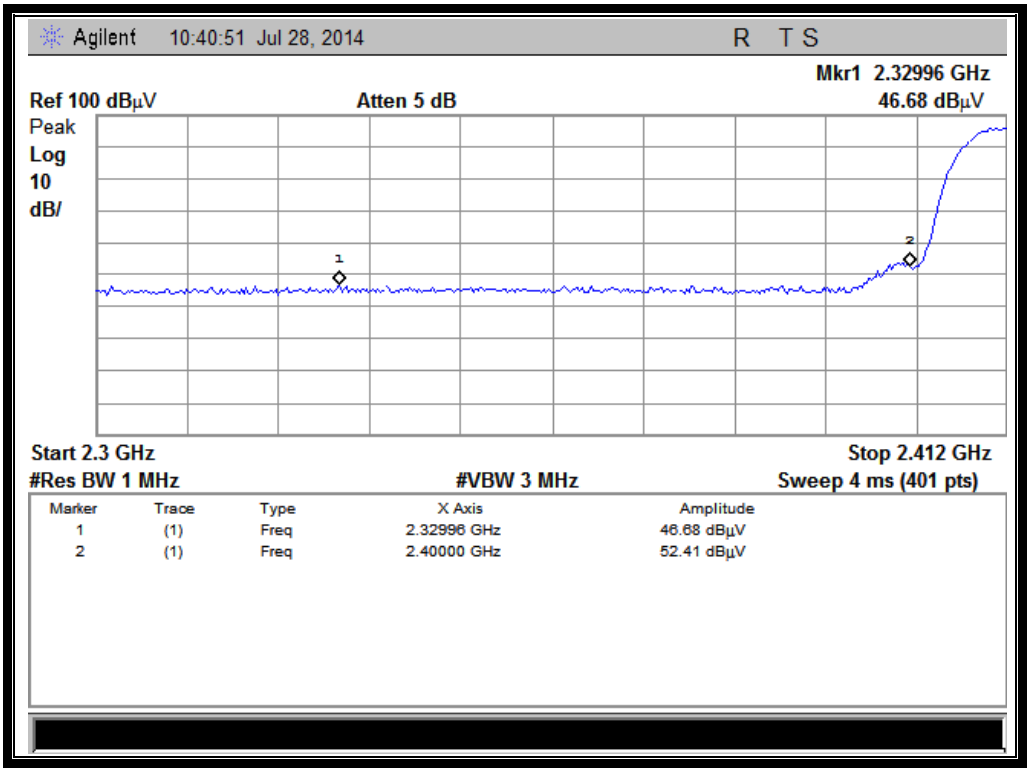
2.6.3.1. 802.11b Test mode

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

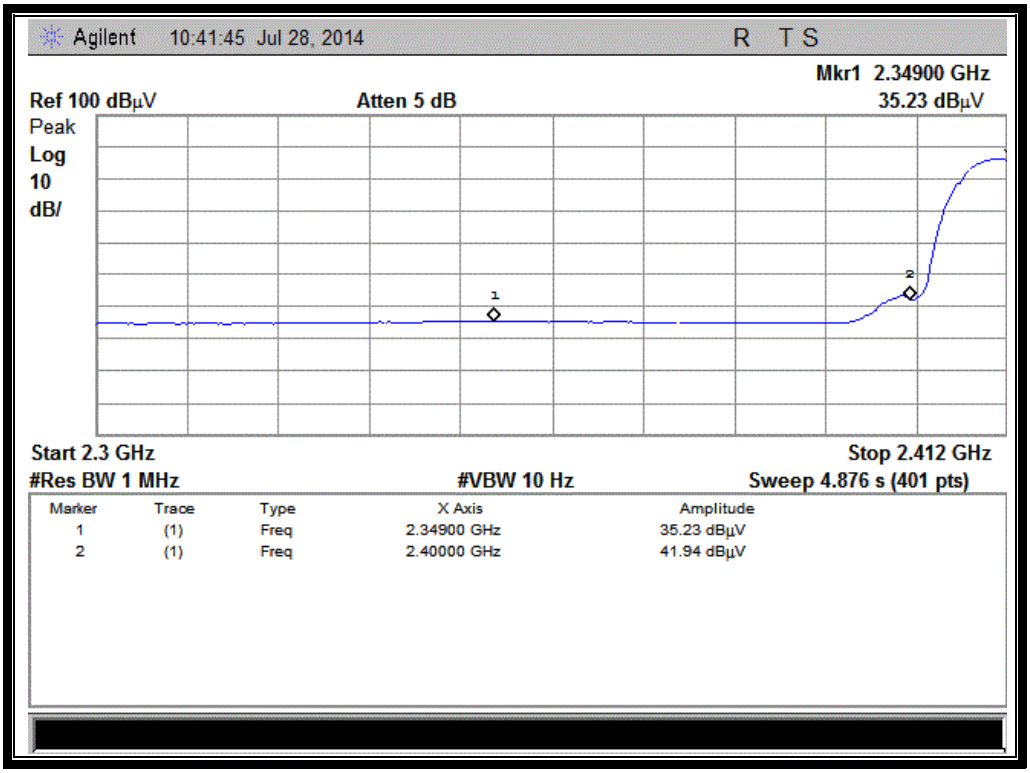
A. Test Verdict:

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading UR (dBuV)	AT (dB)	AFactor (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
1	2329.96	PK	46.68	-30.93	32.56	48.31	74	Pass
1	2349.00	AV	35.23	-30.93	32.56	36.86	54	Pass
11	2495.54	PK	46.46	-29.05	32.50	49.91	74	Pass
11	2496.96	AV	34.76	-29.05	32.50	38.21	54	Pass

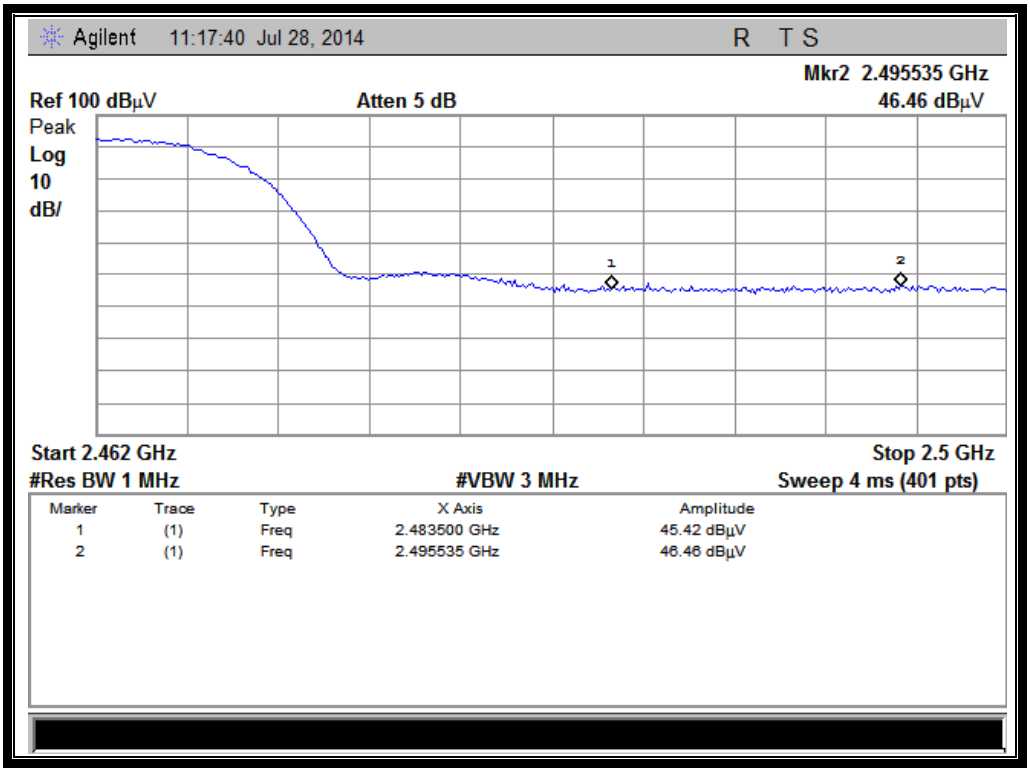
B. Test Plots:



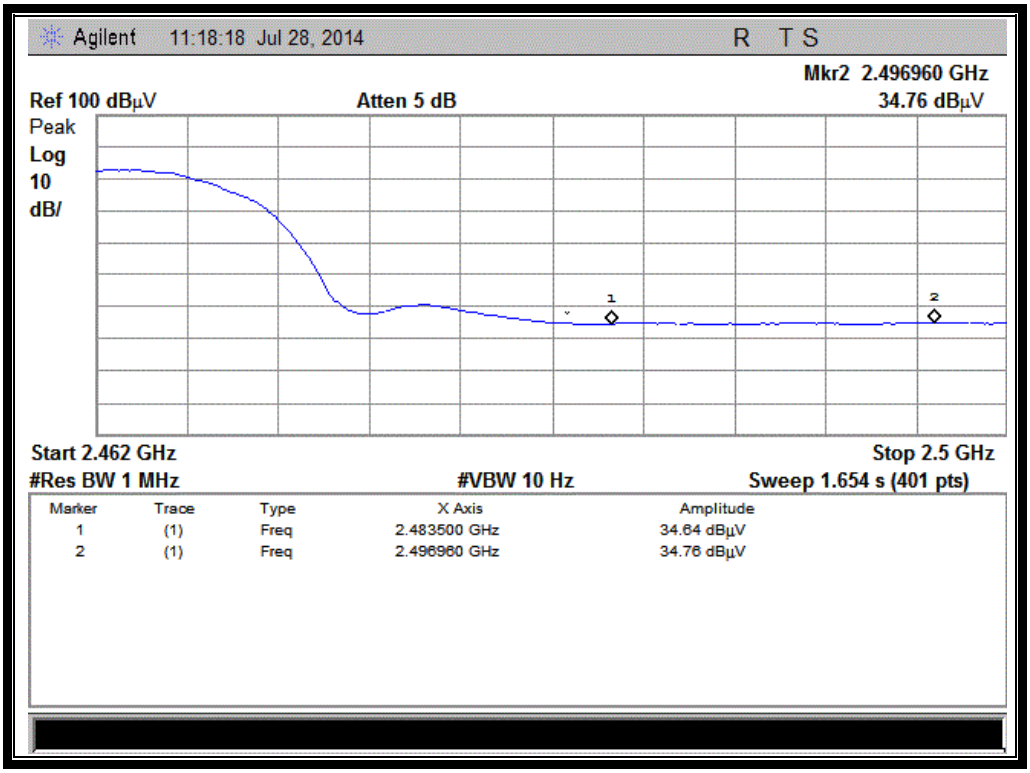
(Plot A1: Channel = 1 PEAK @ 802.11b)



(Plot A2: Channel = 1 AVG @ 802.11b)



(Plot B1: Channel = 11 PEAK @ 802.11b)



(Plot B2: Channel = 11 AVG @ 802.11b)

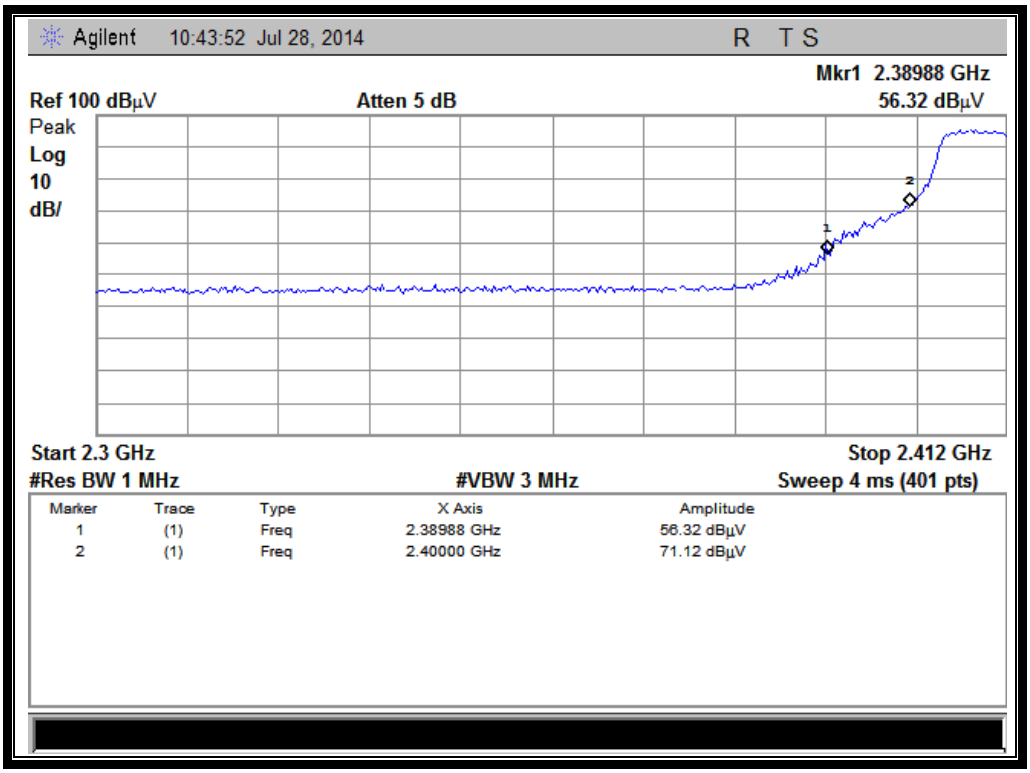
2.6.3.2. 802.11g Test mode

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

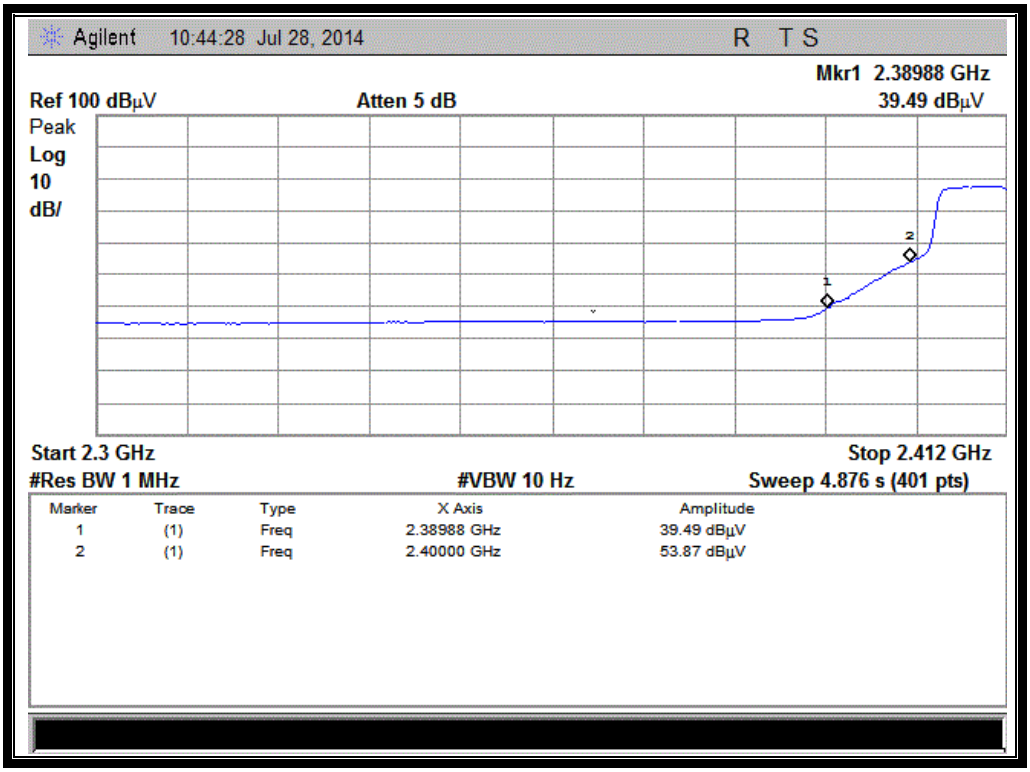
A. Test Verdict:

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading UR (dBuV)	AT (dB)	AFactor (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
1	2389.88	PK	56.32	-30.93	32.56	57.95	74	Pass
1	2389.88	AV	39.49	-30.93	32.56	41.12	54	Pass
11	2483.57	PK	55.70	-29.05	32.50	59.15	74	Pass
11	2483.50	AV	37.78	-29.05	32.50	41.23	54	Pass

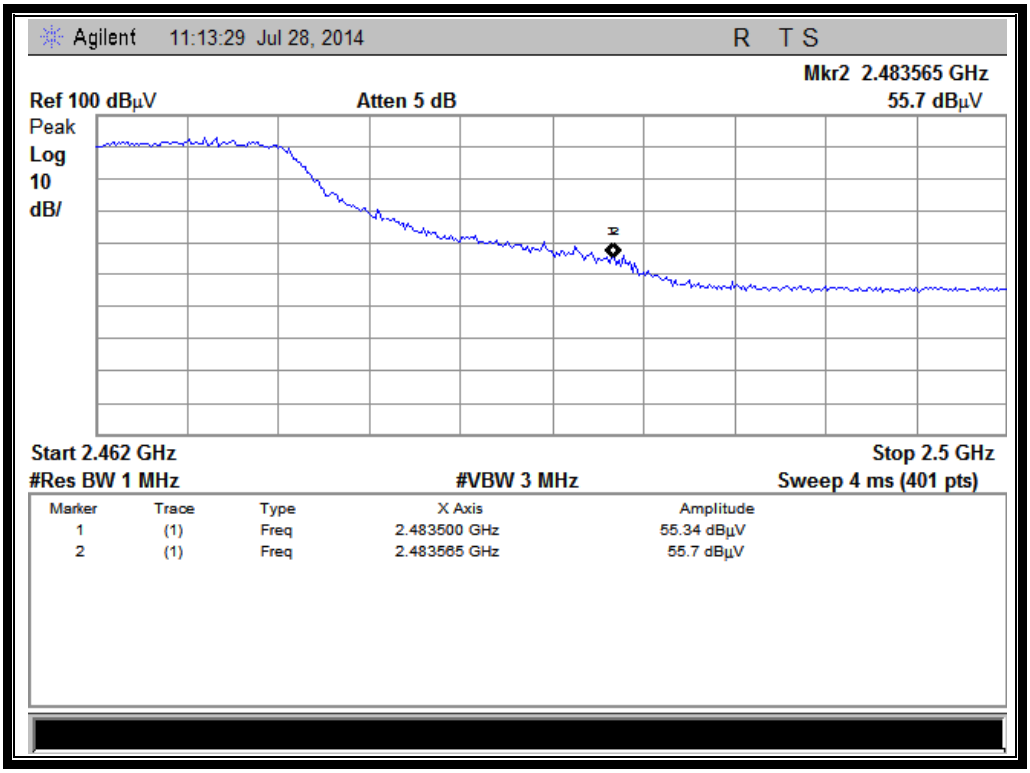
B. Test Plots:



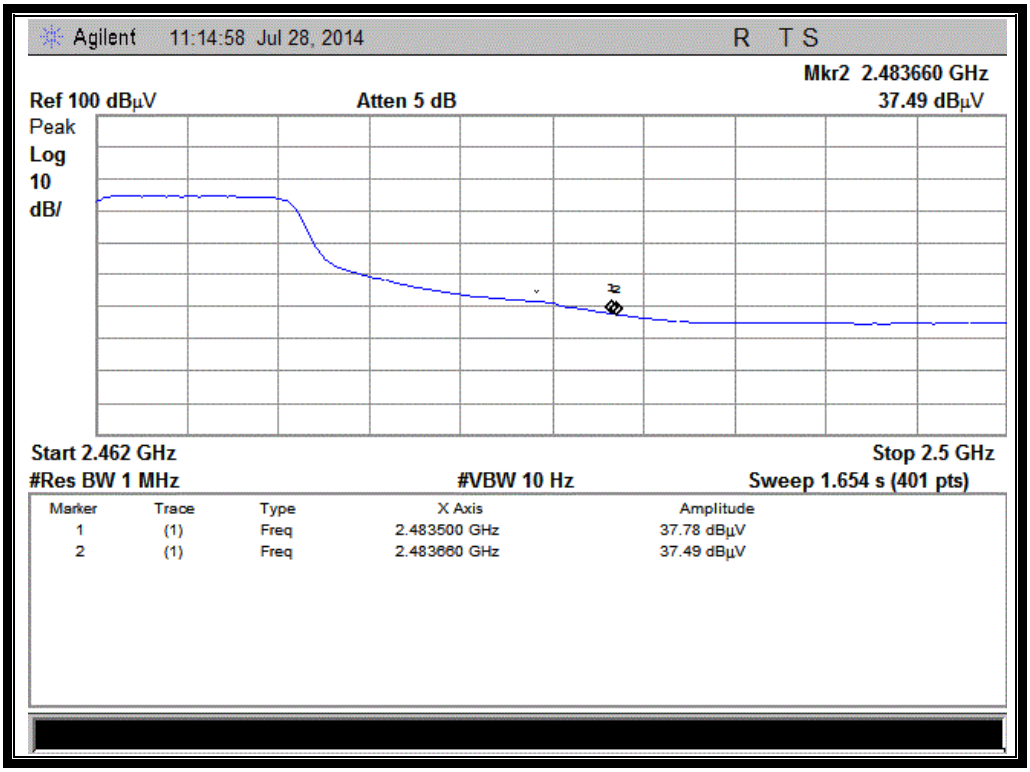
(Plot C1: Channel = 1 PEAK @ 802.11g)



(Plot C2: Channel = 1 AVG @ 802.11g)



(Plot D1: Channel = 11 PEAK @ 802.11g)



(Plot D2: Channel = 11 AVG @ 802.11g)

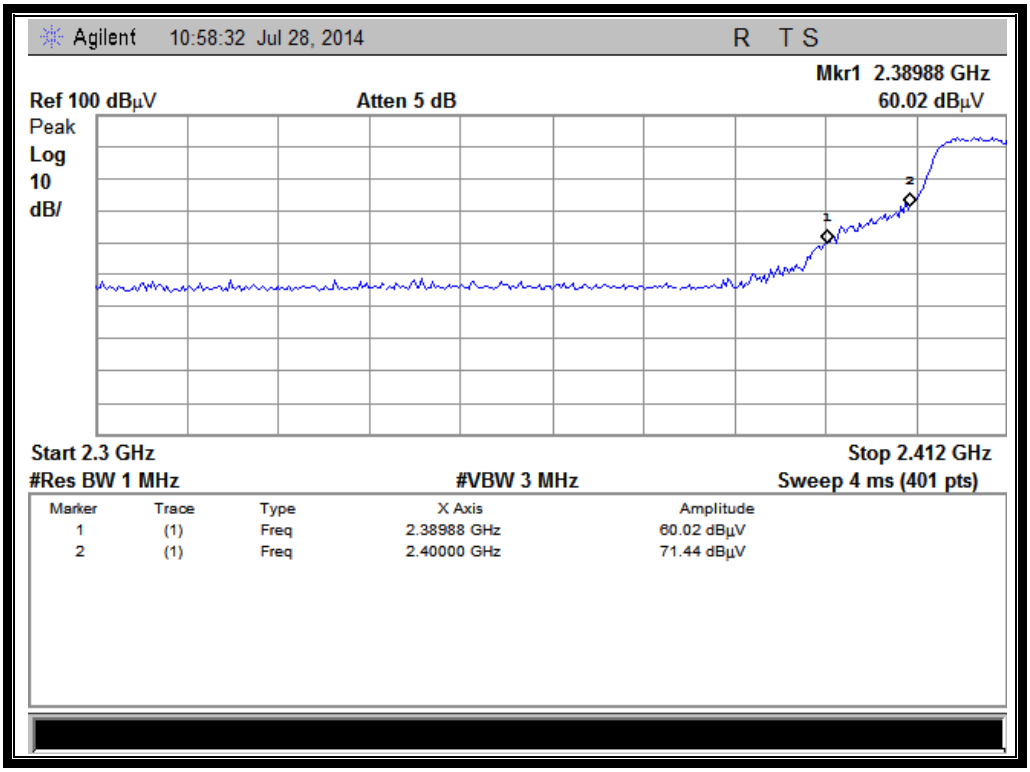
2.6.3.3. 802.11n-20MHz Test mode

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

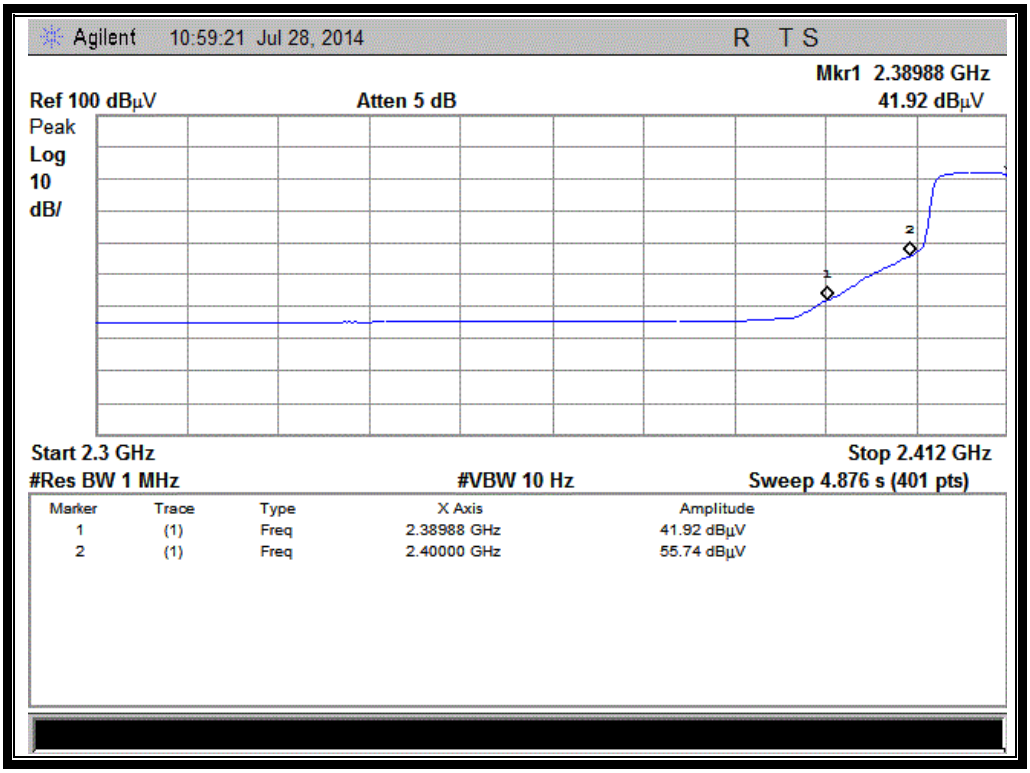
A. Test Verdict:

Channel	Frequency (MHz)	Detector	Receiver Reading UR (dBuV)	AT (dB)	AFactor (dB@3m)	Max. Emission E (dBµV/m)	Limit (dBµV/m)	Verdict
		PK/ AV						
1	2389.88	PK	60.02	-30.93	32.56	61.65	74	Pass
1	2389.88	AV	41.92	-30.93	32.56	43.55	54	Pass
11	2484.14	PK	60.45	-29.05	32.50	63.9	74	Pass
11	2483.50	AV	39.62	-29.05	32.50	43.07	54	Pass

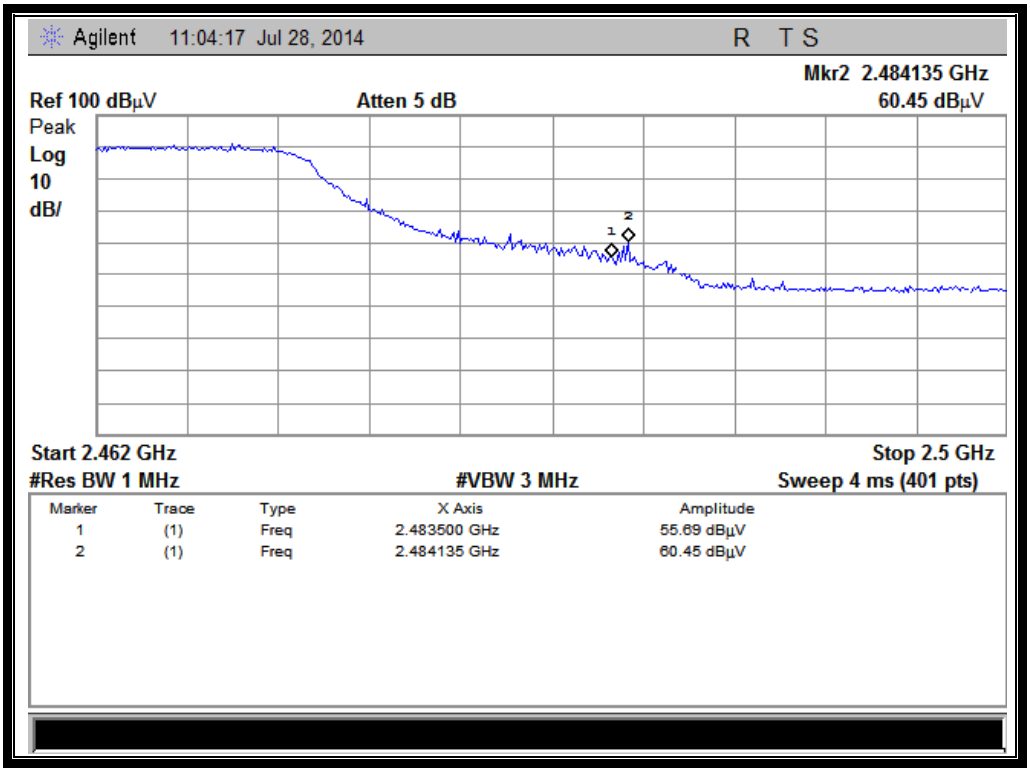
B. Test Plots:



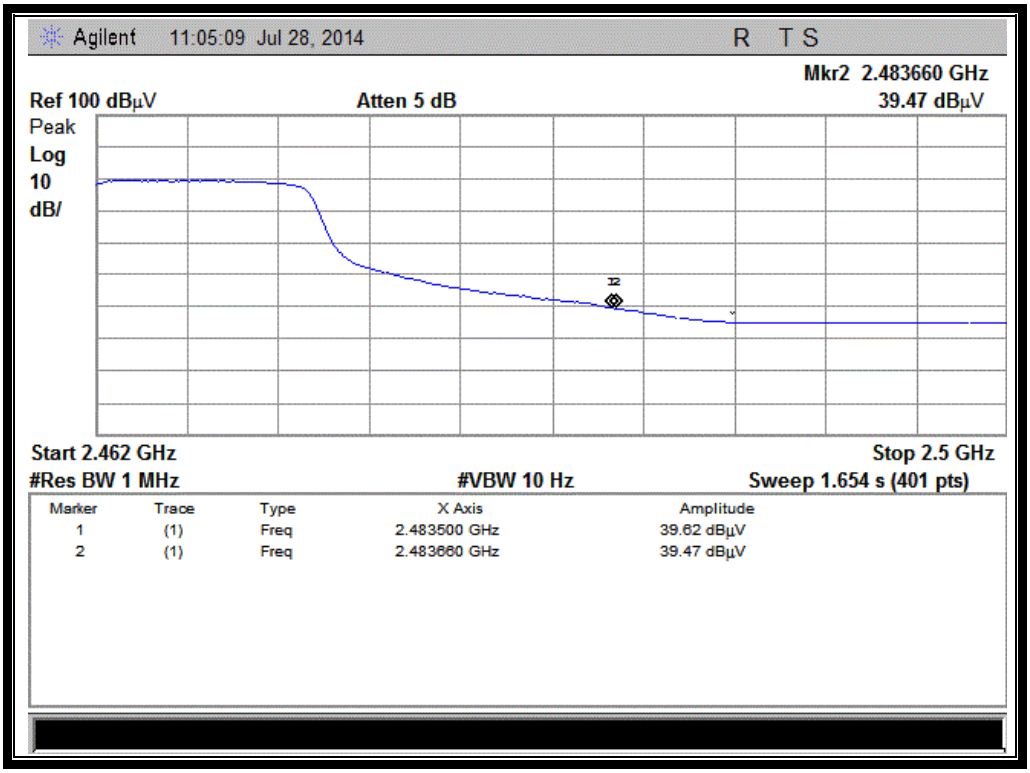
(Plot E1: Channel = 1 PEAK @ 802.11n-20)



(Plot E2: Channel = 1 AVG @ 802.11n-20)



(Plot F1: Channel = 11 PEAK @ 802.11n-20)



(Plot F2: Channel = 11 AVG @ 802.11n-20)

2.7. Conducted Emission

2.7.1. Requirement

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

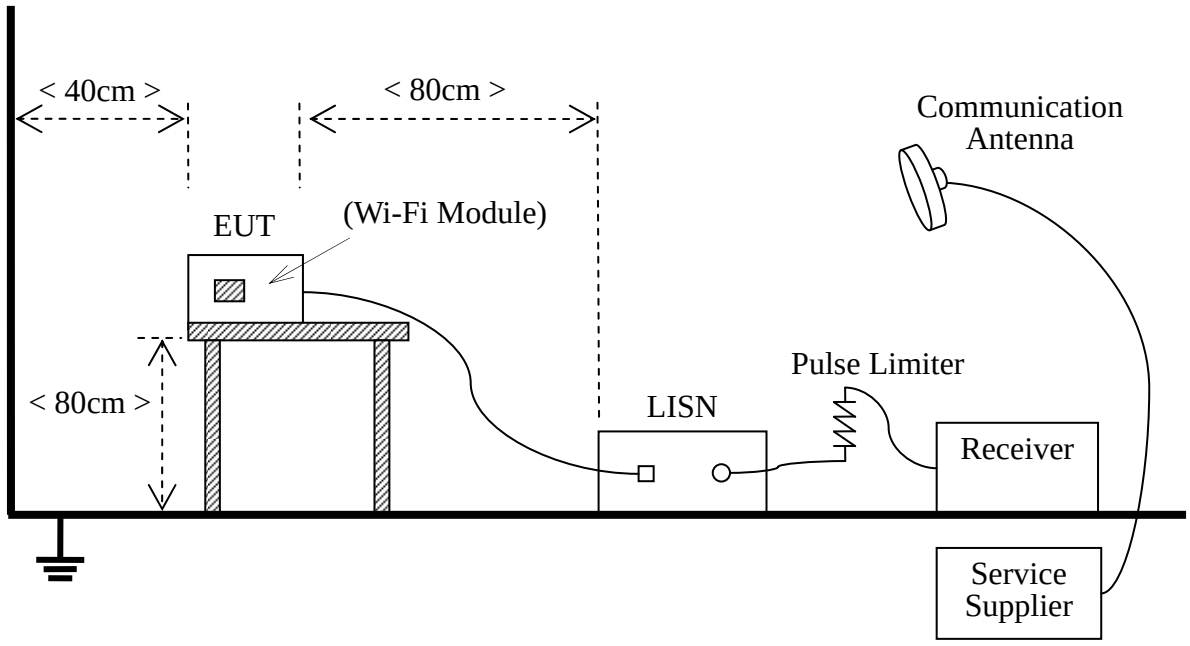
NOTE:

(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.

2.7.2. 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 C63.4:2009

The EUT is powered by the Battery charged with the AC Adapter which is powered by 120V, 60Hz AC mains supply. The factors of the site are calibrated to correct the reading. During the measurement, the EUT is activated and controlled by the Wi-Fi Service Supplier (SS) via a Common Antenna.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
Receiver	Agilent	E7405A	US44210471	2014.02.26	2015.02.25
LISN	Schwarzbeck	NSLK 8127	812744	2014.02.26	2015.02.25
Service Supplier	R&S	CMU200	100448	2014.02.26	2015.02.25
Pulse Limiter (20dB)	Schwarzbeck	VTSD 9561-D	9391	(n.a.)	(n.a.)

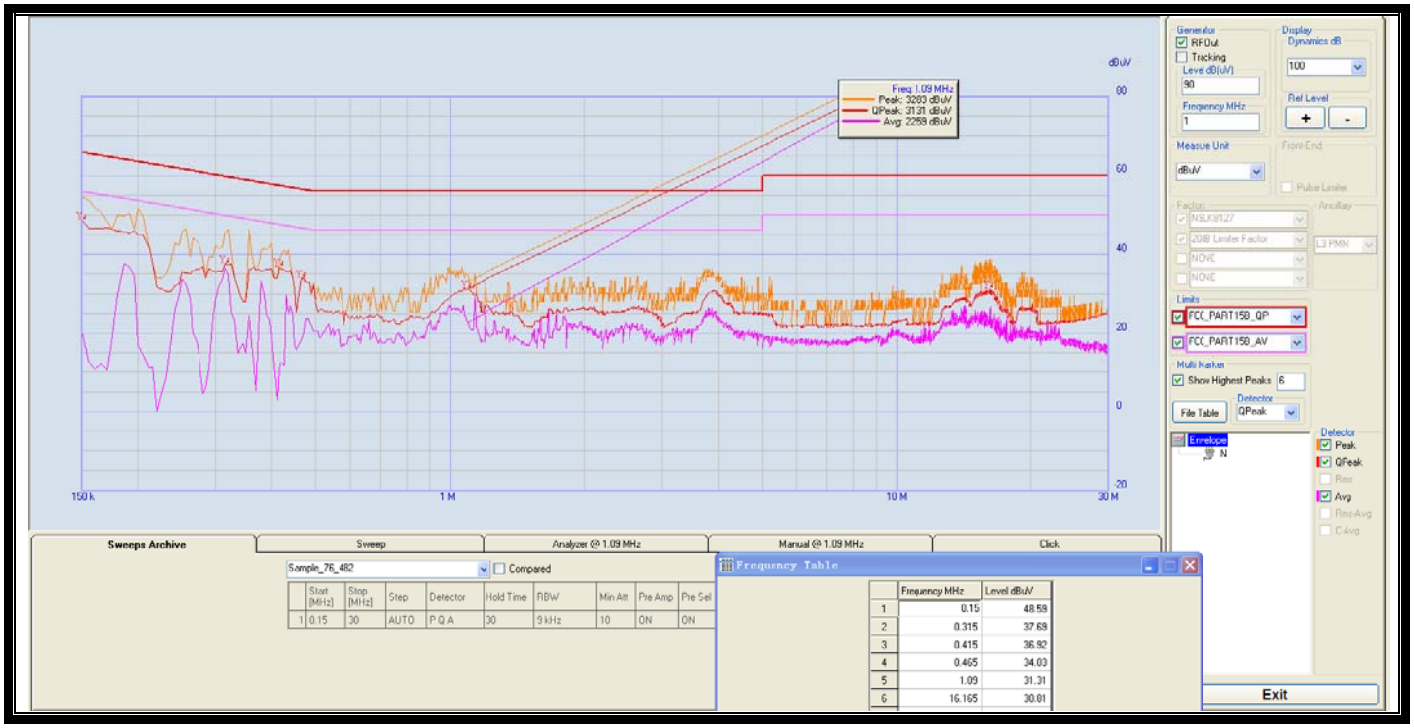
2.7.3. Test Result

The maximum conducted interference is searched using Peak (PK), if 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.

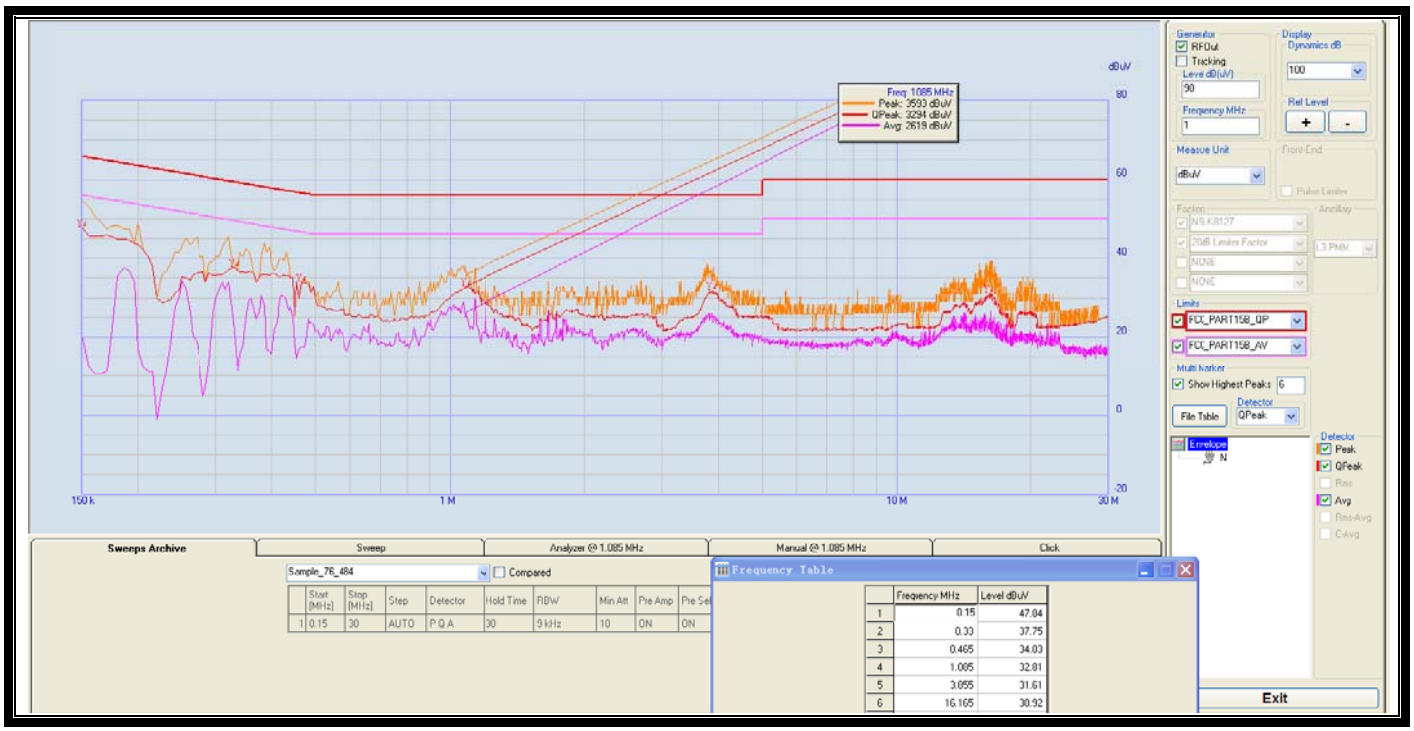
A. Test setup:

The EUT configuration of the emission tests is EUT + Link.

B. Test Plots:



(Plot A:L Phase)



(Plot B:N Phase)

2.8. Radiated Emission

2.8.1. Requirement

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)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/F(kHz)	30
1.705 - 30.0	30	30
30 - 88	100	3
88 - 216	150	3
216 - 960	200	3
Above 960	500	3

Note:

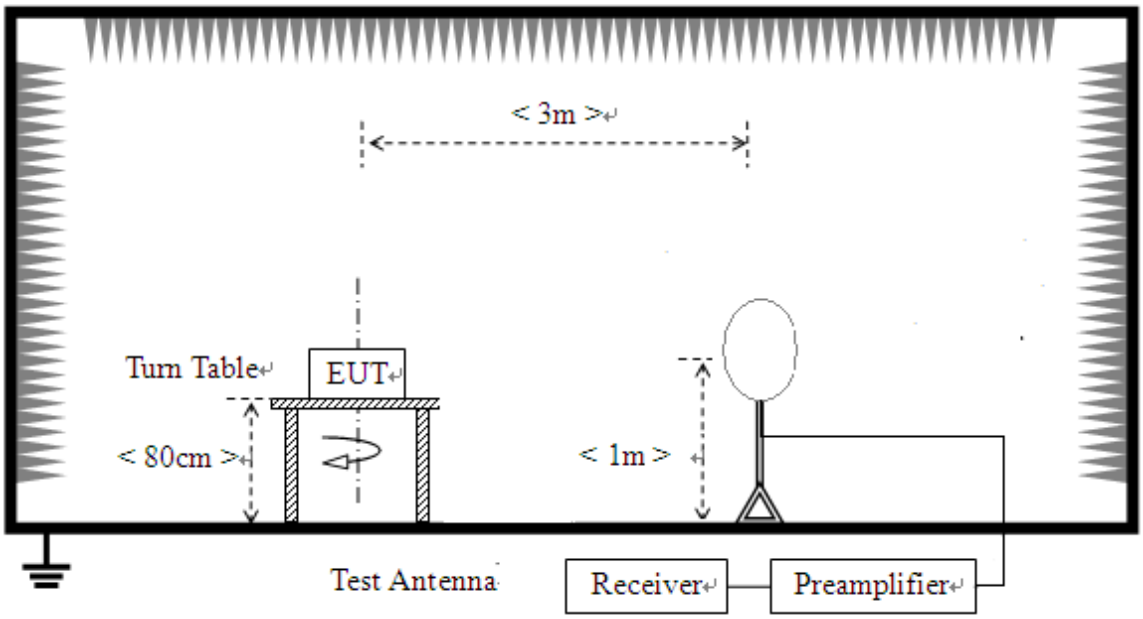
1. For Above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
2. For above 1000MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK)

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)

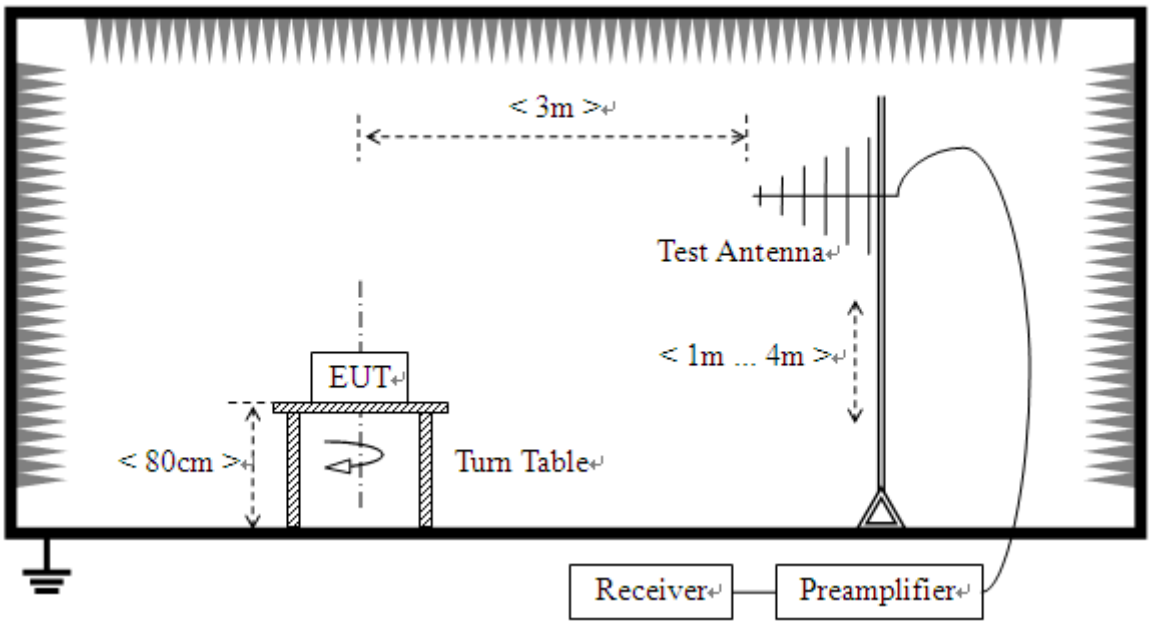
2.8.2. Test Description

A. Test Setup:

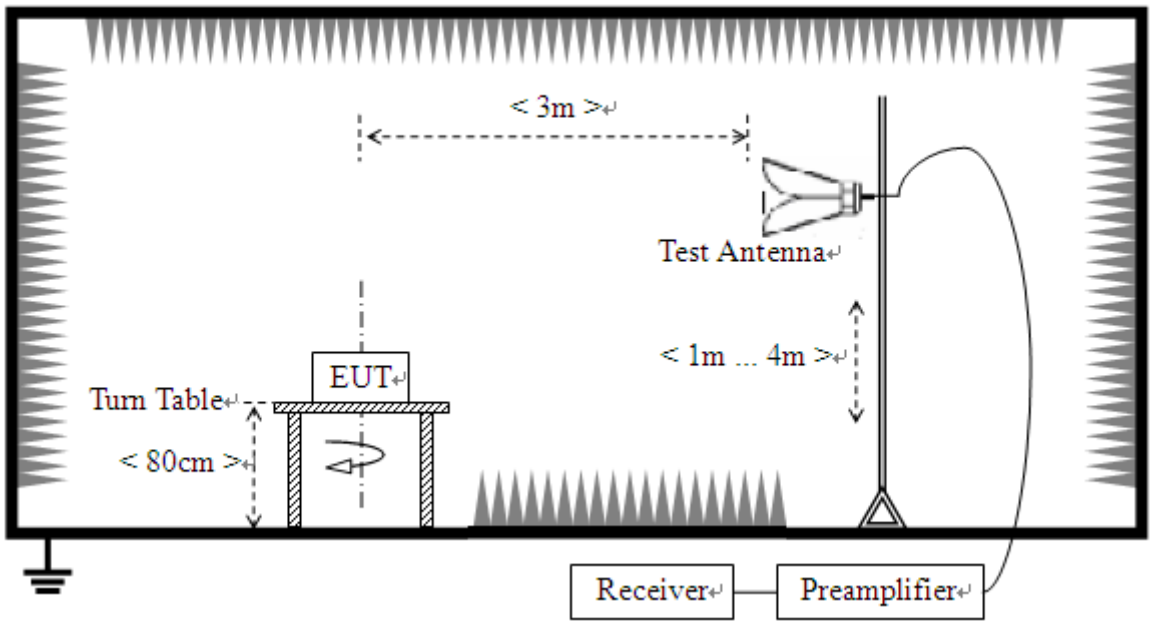
1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to1GHz



3) For radiated emissions above 1GHz



The test site semi-anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSI C63.4 (2009). 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 EUT of the EUT is powered by the Battery charged with the AC Adapter which is powered by 120V, 60Hz AC mains supply. 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. During the measurement, the EUT is activated and controlled by the Wireless Router via a Common Antenna, and is set to operate under hopping-on test mode.

For the Test Antenna:

(a) In the frequency range of 9kHz to 30MHz, magnetic field is measured with Loop Test Antenna. The Test Antenna is positioned with its plane vertical at 1m distance from the EUT. The center of the Loop Test Antenna is 1m above the ground. During the measurement the Loop Test Antenna rotates about its vertical axis for maximum response at each azimuth about the EUT.
(b) In the frequency range above 30MHz, Bi-Log Test Antenna (30MHz to 2GHz) and Horn Test Antenna (above 2GHz) 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 emission levels at both horizontal and vertical polarizations should be tested.

B. Equipments List:

Description	Manufacturer	Model	Serial No.	Cal. Date	Cal. Due
System Simulator	R&S	CMU200	100448	2014.02.26	2015.02.25
Receiver	Agilent	E7405A	US44210471	2014.02.26	2015.02.25
Full-Anechoic Chamber	Albatross	9m*6m*6m	(n.a.)	2014.02.26	2015.02.25
Test Antenna - Bi-Log	Schwarzbeck	VULB 9163	9163-274	2014.02.26	2015.02.25
Test Antenna - Horn	Schwarzbeck	BBHA 9120D	9120D-963	2014.02.26	2015.02.25
Test Antenna - Horn	R&S	HL050S7	71688	2014.02.26	2015.02.25
Test Antenna -Loop	Schwarzbeck	FMZB 1519	1519-022	2014.02.26	2015.02.25

2.8.3. Test Result

According to ANSI C63.4 selection 4.2.2, because of peak detection will yield amplitudes equal to or greater than amplitudes measured with the quasi-peak (or average) detector, the measurement data from a spectrum analyzer peak detector will represent the worst-case results, if the peak measured value complies with the quasi-peak limit, it is unnecessary to perform an quasi-peak measurement.

The measurement results are obtained as below:

$E\ [dB\mu V/m] = U_R + A_T + A_{Factor}\ [dB]$; $A_T = L_{Cable\ loss}\ [dB] - G_{preamp}\ [dB]$

A_T: Total correction Factor except Antenna

U_R: Receiver Reading

G_{preamp}: Preamplifier Gain

A_{Factor}: Antenna Factor at 3m

During the test, the total correction Factor A_T and A_{Factor} were built in test software.

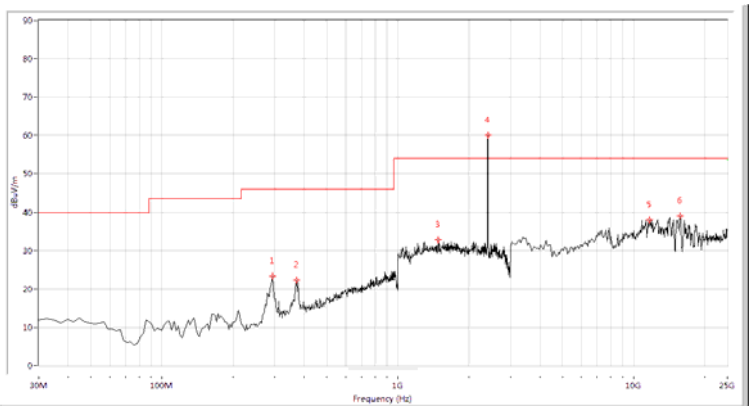
Note: All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

The low frequency, which started from 9KHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per 15.31(o) was not reported.

2.8.3.1. 802.11b Test mode

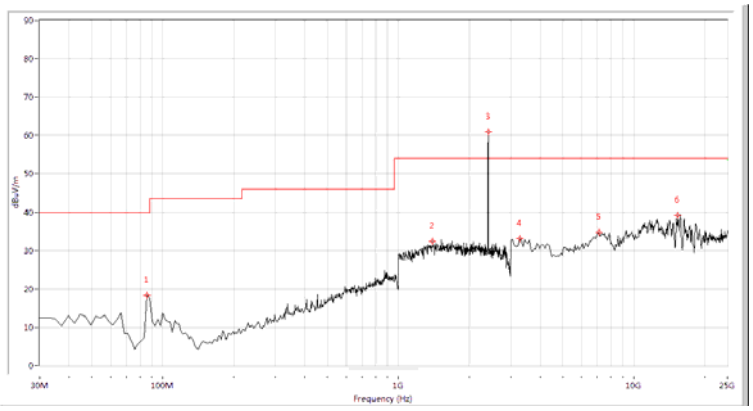
A. Test Plots for the Whole Measurement Frequency Range:

Plots for Channel = 1



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
293.666	23.31	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
371.072	22.24	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
1478.803	32.71	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS
2412.000	60.00	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
11668.329	37.93	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS
15728.180	39.11	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

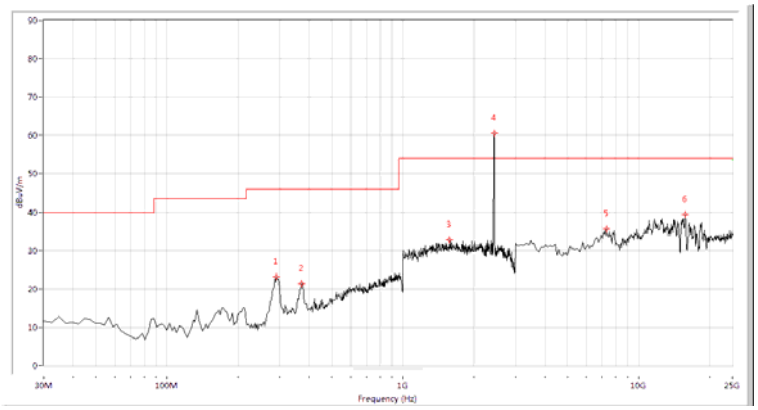
(Plot A.2: Antenna Horizontal, 30MHz to 25GHz)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
85.636	18.31	N.A	N.A	N.A	40.0	N.A	Vertical	PASS
1394.015	32.42	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
2412.000	60.90	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
3274.314	33.13	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
7114.713	34.79	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
15399.002	39.17	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

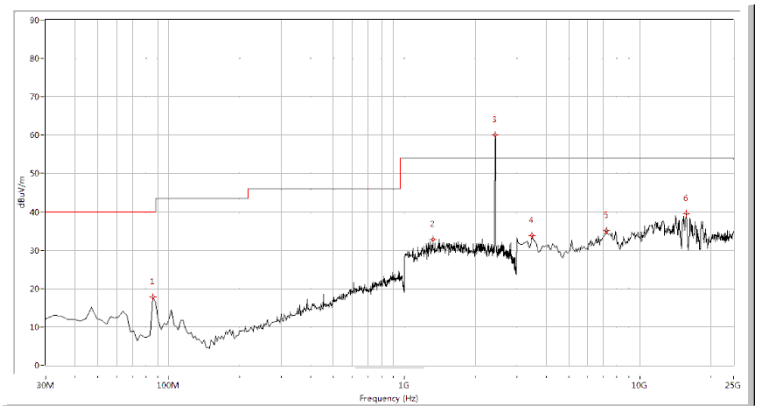
(Plot A.3: Antenna Vertical, 30MHz to 25GHz)

Plot for Channel = 6



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
291.247	23.19	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
371.072	21.36	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
1578.554	32.82	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS
2437.000	60.52	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
7334.165	35.60	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS
15728.180	39.36	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

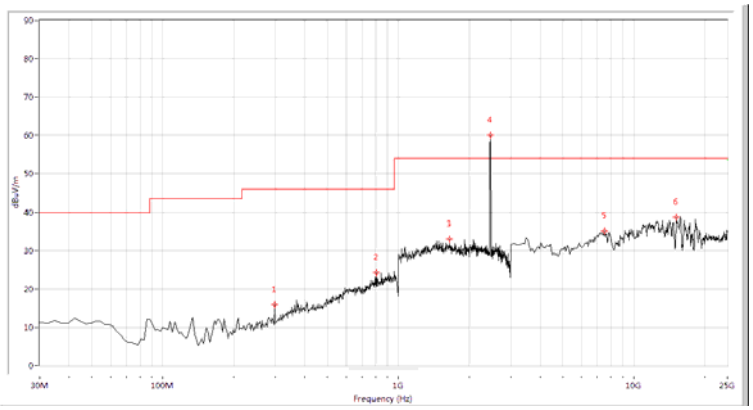
(Plot B.2: Antenna Horizontal, 30MHz to 25GHz)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
85.636	17.82	N.A	N.A	N.A	40.0	N.A	Vertical	PASS
1319.202	32.72	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
2437.000	60.09	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
3493.766	33.80	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
7224.439	35.10	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
15728.180	39.61	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

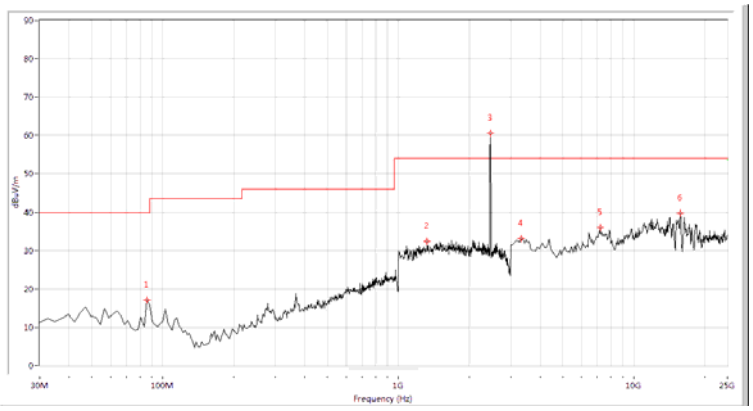
(Plot B.3: Antenna Vertical, 30MHz to 25GHz)

Plot for Channel = 11



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
298.504	15.86	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
806.484	24.17	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
1653.367	33.00	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS
2462.000	60.02	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
7498.753	35.07	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS
15179.551	38.70	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

(Plot C.2: Antenna Horizontal, 30MHz to 25GHz)



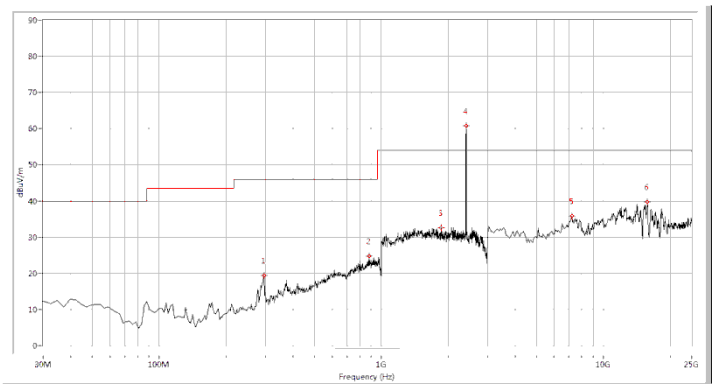
Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
85.636	17.11	N.A	N.A	N.A	40.0	N.A	Vertical	PASS
1324.190	32.36	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
2462.000	60.68	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
3329.177	33.16	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
7224.439	36.05	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
15783.042	39.75	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

(Plot C.3: Antenna Vertical, 30MHz to 25GHz)

2.8.3.2. 802.11g Test mode

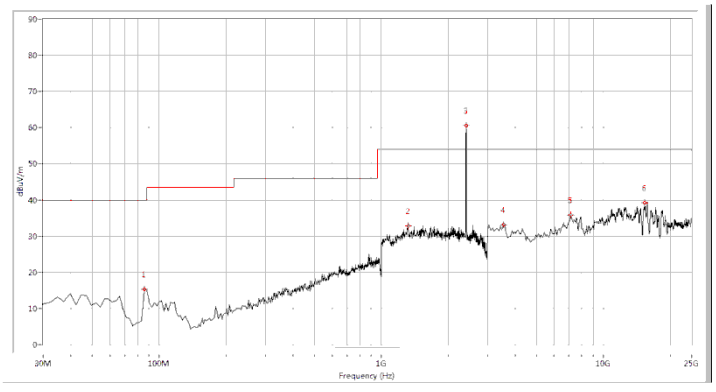
A. Test Plots for the Whole Measurement Frequency Range:

Plots for Channel = 1



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
296.085	19.43	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
879.052	24.85	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
1862.843	32.67	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS
2412.000	60.78	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
7224.439	35.74	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS
15783.042	39.74	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

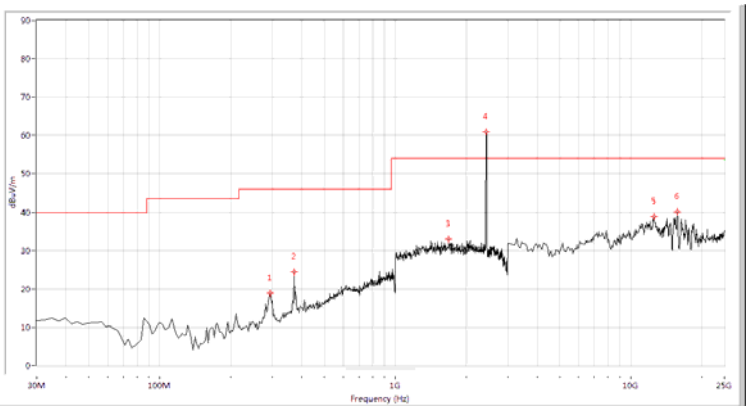
(Plot D.2: Antenna Horizontal, 30MHz to 25GHz)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
85.636	15.29	N.A	N.A	N.A	40.0	N.A	Vertical	PASS
1324.190	32.74	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
2412.000	60.54	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
3548.628	33.08	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
7114.713	35.90	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
15399.002	39.18	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

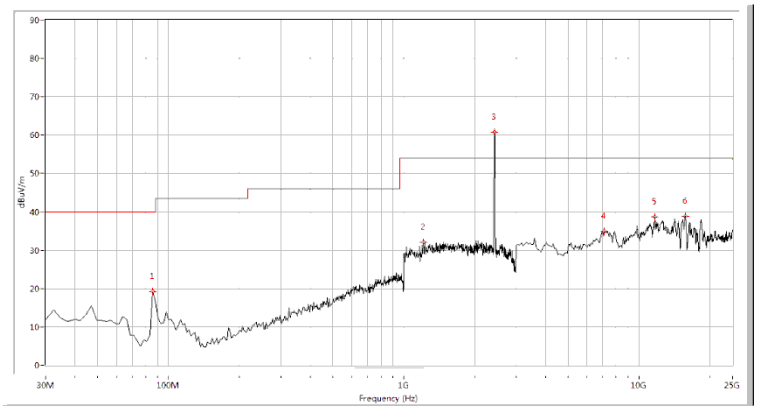
(Plot D.3: Antenna Vertical, 30MHz to 25GHz)

Plot for Channel = 6



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
293.666	18.93	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
371.072	24.41	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
1688.279	32.95	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS
2437.000	60.91	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
12546.135	38.83	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS
15783.042	40.12	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

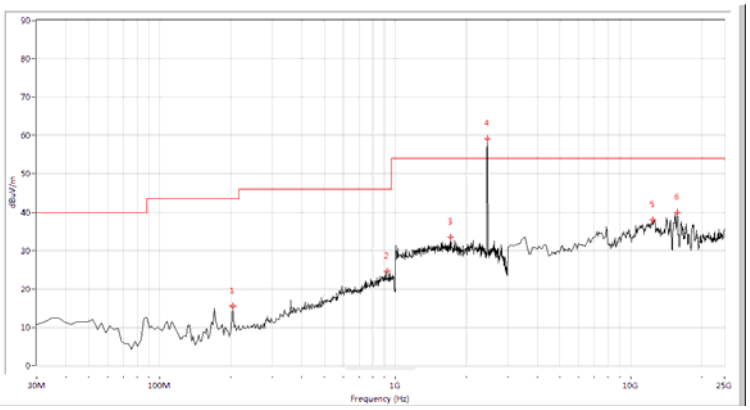
(Plot E.2: Antenna Horizontal, 30MHz to 25GHz)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
85.636	19.22	N.A	N.A	N.A	40.0	N.A	Vertical	PASS
1214.464	32.15	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
2437.000	60.79	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
7114.713	34.85	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
11668.329	38.61	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
15728.180	38.77	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

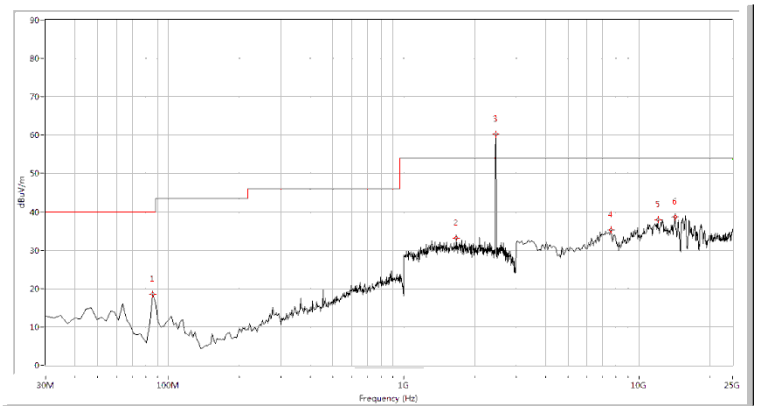
(Plot E.3: Antenna Vertical, 30MHz to 25GHz)

Plot for Channel = 11



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
204.165	15.48	N.A	N.A	N.A	43.5	N.A	Horizontal	PASS
922.594	24.63	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
1713.217	33.50	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS
2462.000	59.23	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
12436.409	38.00	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS
15783.042	39.90	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

(Plot F.2: Antenna Horizontal, 30MHz to 25GHz)



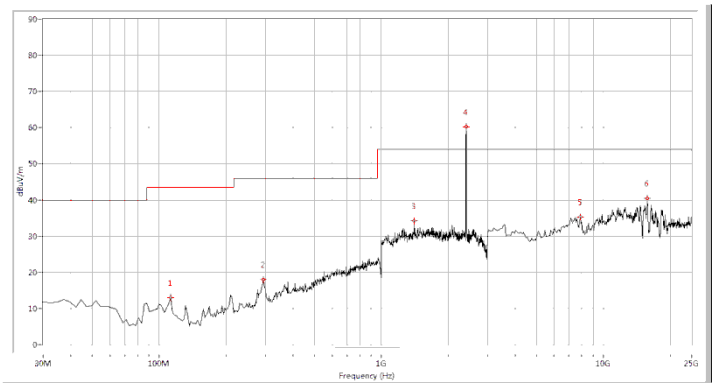
Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
85.636	18.59	N.A	N.A	N.A	40.0	N.A	Vertical	PASS
1673.317	33.20	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
2462.000	60.24	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
7608.479	35.25	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
12052.369	38.03	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
14246.883	38.63	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

(Plot F.3: Antenna Vertical, 30MHz to 25GHz)

2.8.3.3. 802.11n-20MHz Test mode

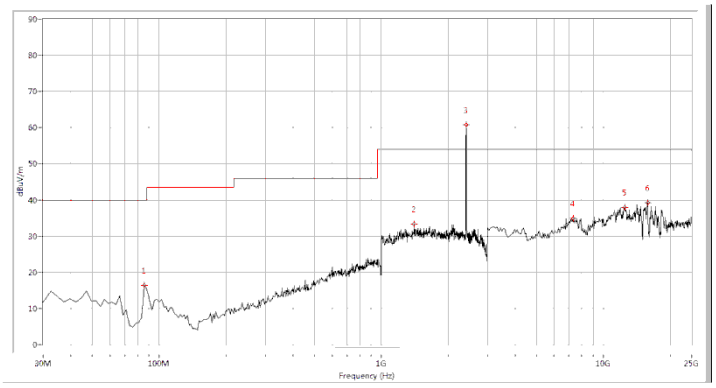
A. Test Plots for the Whole Measurement Frequency Range:

Plots for Channel = 1



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
112.244	13.04	N.A	N.A	N.A	43.5	N.A	Horizontal	PASS
293.666	18.05	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
1408.978	34.16	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS
2412.000	60.19	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
7882.793	35.24	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS
15783.042	40.52	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

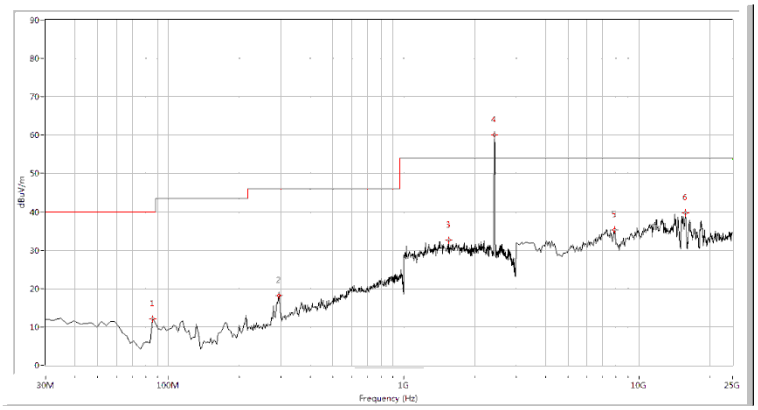
(Plot G.2: Antenna Horizontal, 30MHz to 25GHz)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
85.636	16.48	N.A	N.A	N.A	40.0	N.A	Vertical	PASS
1408.978	33.28	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
2412.000	60.86	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
7334.165	34.96	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
12491.272	38.05	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
15837.905	39.13	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

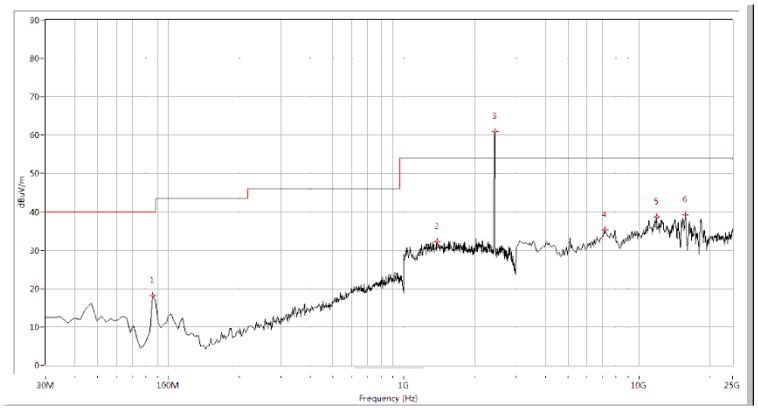
(Plot G.3: Antenna Vertical, 30MHz to 25GHz)

Plot for Channel = 6



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
85.636	12.12	N.A	N.A	N.A	40.0	N.A	Horizontal	PASS
293.666	18.10	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
1558.603	32.56	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS
2437.000	60.08	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
7882.793	35.23	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS
15783.042	39.76	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

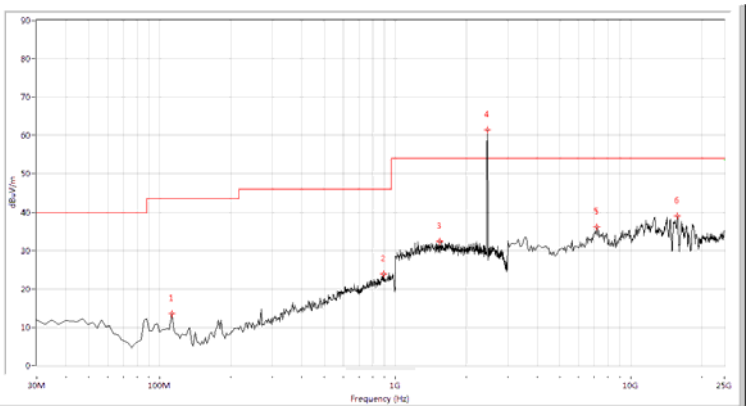
(Plot H.2: Antenna Horizontal, 30MHz to 25GHz)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
85.636	18.21	N.A	N.A	N.A	40.0	N.A	Vertical	PASS
1389.027	32.29	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
2437.000	61.04	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
7169.576	35.26	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
11887.781	38.71	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
15783.042	39.22	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

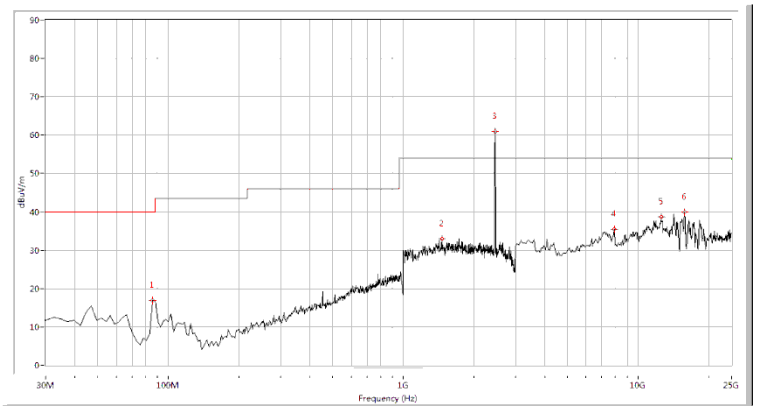
(Plot H.3: Antenna Vertical, 30MHz to 25GHz)

Plot for Channel = 11



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
112.244	13.62	N.A	N.A	N.A	43.5	N.A	Horizontal	PASS
891.147	23.85	N.A	N.A	N.A	46.0	N.A	Horizontal	PASS
1538.653	32.49	N.A	N.A	54.0	N.A	54.0	Horizontal	PASS
2462.000	61.54	N.A	N.A	N.A	N.A	N.A	Horizontal	N.A
7169.576	36.21	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS
15783.042	38.96	N.A	N.A	74.0	N.A	54.0	Horizontal	PASS

(Plot I.2: Antenna Horizontal, 30MHz to 25GHz)



Fre. (MHz)	Pk	QP	AV	Limit-PK	Limit-QP	Limit-AV	Antenna	Verdict
85.636	16.90	N.A	N.A	N.A	40.0	N.A	Vertical	PASS
1463.840	32.98	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
2462.000	60.98	N.A	N.A	N.A	N.A	N.A	Vertical	N.A
7937.656	35.43	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
12546.135	38.64	N.A	N.A	74.0	N.A	54.0	Vertical	PASS
15783.042	39.91	N.A	N.A	74.0	N.A	54.0	Vertical	PASS

(Plot I.3: Antenna Vertical, 30MHz to 25GHz)

2.9. RF exposure evaluation

2.9.1. Requirement

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

$$S = \frac{PG}{4\pi R^2}$$

Where:
S = power density
P = power input to the antenna
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna

2.9.2. Limits for Maximum Permissible Exposure

According to FCC Part 1.1307, systems operating under the provisions of this section shall be operated in a manner the ensures that the public is not exposed to radio frequency energy level in excess of the commission's guidelines.
According to FCC Part 1.1310 RF exposure is calculated.

Limits for General Population/ Uncontrolled Exposure			
Frequency Range (MHz)	Electric Field Strength(E)(V/m)	Magnetic Field Strength (H)(A/m)	Power Density (S)(mW/cm2)
0.3-1.34	614	1.63	(100)*
1.34-30	824/f	2.19/f	(180/f2)*
30-300	27.5	0.073	0.2
300-1500			f/1500
1500-100,000			1.0

2.9.3. Test result

Maximum peak output power at antenna input terminal(dBm):	16.82
Maximum peak output power at antenna input terminal(mW):	48.084
Source-based time-averaged output power:	--
Prediction distance(cm):	20
Predication frequency(MHz):	2412
Antenna Gain (typical) (dBi):	-0.25
Power density at predication frequency at 20 cm(mW/cm^2):	0.00903
MPE limit for RF exposure at prediction frequency(mW/cm^2):	1.0

2.9.4. Conclusion

Since the test result is passed, the SAR measurement is not required.

2.9.5. Result

Please refer to SAR report.

** END OF REPORT **