REPORT No. : SZ17120211W02

TEST REPORT

APPLICANT	:	ShenZhen Gospell Smarthome Electronic Co., Ltd.
PRODUCT NAME	:	WiFi Video Doorbell
MODEL NAME	:	GT4025
BRAND NAME	:	N/A
FCC ID	:	TW5GT4025
STANDARD(S)	:	47 CFR Part 15 Subpart C
TEST DATE	:	2018-03-07 to 2018-03-09
ISSUE DATE	:	2018-03-09

Tested by: Li Jingzong

Li Jingzong (Test Engineer)

Approved by: Andy Yeh

Andy Yeh (Technical Director)

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DIRECTORY

Change History		
Issue	**Date**	**Reason for change**
1.0	2018-03-09	First edition

1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	ShenZhen Gospell Smarthome Electronic Co., Ltd.
Applicant Address:	F/12 F518 Idea Land Baoyuan Road Baoan Central Area shenzhen City P.R China
Manufacturer:	ShenZhen Gospell Smarthome Electronic Co., Ltd.
Manufacturer Address:	East of 01st-04st Floor,Block A,No.1 Industrial park,Fenghuanggang,South of No.1 Baotian Road,Xixiang street,Bao'an District,Shenzhen City,Guangdong Province 518126,P.R.China

1.2. Equipment Under Test (EUT) Description

Product Name:	WiFi Video Doorbell
Serial No:	(N/A, marked #1 by test site)
Hardware Version:	GT4025_M01
Software Version:	E_900.GT4025.018.026
Modulation Type:	DSSS, OFDM
Operating Frequency Range:	802.11b/g/n-20MHz: 2.412GHz - 2.462GHz
Channel Number:	802.11b/g/n-20MHz: 11
Antenna Type:	FPC Antenna
Antenna Gain:	2.1dBi

Note 1: The EUT is operating at 2.4GHz ISM; it supports 802.11b, 802.11g, 802.11n and they are all tested in this report.

For 802.11b/g/n-20MHz (2.4GHz band), 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).

Note 2: The EUT connected to the serial port of the computer with a serial communication cable, we use the dedicated software to control the EUT continuous transmission.

Note 3: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

1.3. 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 ID Certification:

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

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

No.	Section	Description	Test Date	Test Engineer	Result
1	15.203	Antenna Requirement	N/A	N/A	PASS
2	15.247(b)	Peak Output Power	Mar 08, 2018	Li Jingzong	PASS
3	15.247(a)	Bandwidth	Mar 08, 2018	Li Jingzong	PASS
4	15.247(d)	Conducted Spurious Emission and Band Edge	Mar 08, 2018	Li Jingzong	PASS
5	15.247(d)	Restricted Frequency Bands	Mar 09, 2018	Zheng Fengjian	PASS
6	15.207	Conducted Emission	Mar 09, 2018	Zheng Fengjian	PASS
7	15.209, 15.247(d)	Radiated Emission	Mar 09, 2018	Zheng Fengjian	PASS
8	15.247(e)	Power spectral density (PSD)	Mar 08, 2018	Li Jingzong	PASS
Note1: The tests of Conducted Emission and Radiated Emission were performed according to the method of measurements prescribed in ANSI C63.10 2013 and KDB558074 D01 v04 (04/05/2017).					

1.4. Environmental 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

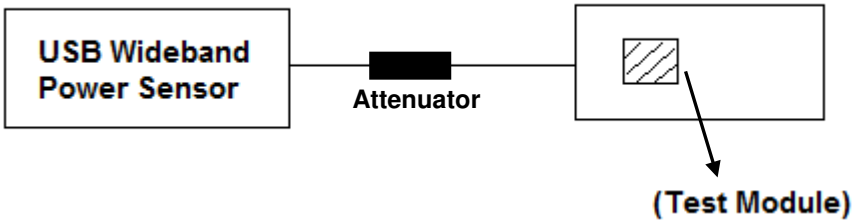
2.2.1. Requirement

According to FCC section 15.247(b)(3), 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

The measured output power was calculated by the reading of the USB Wideband Power Sensor and calibration.

A. Test Setup:



The EUT (Equipment under the test) which is coupled to the USB Wideband Power Sensor; 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:

Please reference ANNEX A(1.5).

2.2.3. Test Result

2.2.3.1 802.11b Test Mode

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
1	2412	19.33	0.08570	30	1	PASS
6	2437	19.10	0.08128			PASS
11	2462	19.11	0.08147			PASS

Channel	Frequency (MHz)	Measured Output Average Power		Limit		Verdict
		dBm	W	dBm	W	
1	2412	17.55	0.05689	30	1	PASS
6	2437	17.19	0.05236			PASS
11	2462	17.25	0.05309			PASS

2.2.3.2 802.11g Test mode

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
1	2412	23.06	0.20230	30	1	PASS
6	2437	22.62	0.18281			PASS
11	2462	22.33	0.17100			PASS

Channel	Frequency (MHz)	Measured Output Average Power		Limit		Verdict
		dBm	W	dBm	W	
1	2412	15.56	0.03597	30	1	PASS
6	2437	15.37	0.03443			PASS
11	2462	15.42	0.03483			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	22.88	0.19409	30	1	PASS
6	2437	22.61	0.18239			PASS
11	2462	22.46	0.17620			PASS

Channel	Frequency (MHz)	Measured Output Average Power		Limit		Verdict
		dBm	W	dBm	W	
1	2412	15.20	0.03311	30	1	PASS
6	2437	15.10	0.03236			PASS
11	2462	15.15	0.03273			PASS

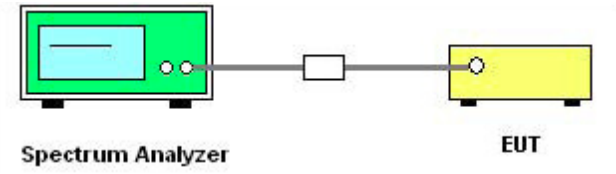
2.3. Bandwidth

2.3.1. Requirement

According to FCC section 15.247(a) (2), 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 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.

KDB 558074 Section 8.1 Option 1 was used in order to prove compliance.

B. Equipments List:

Please reference ANNEX A(1.5).

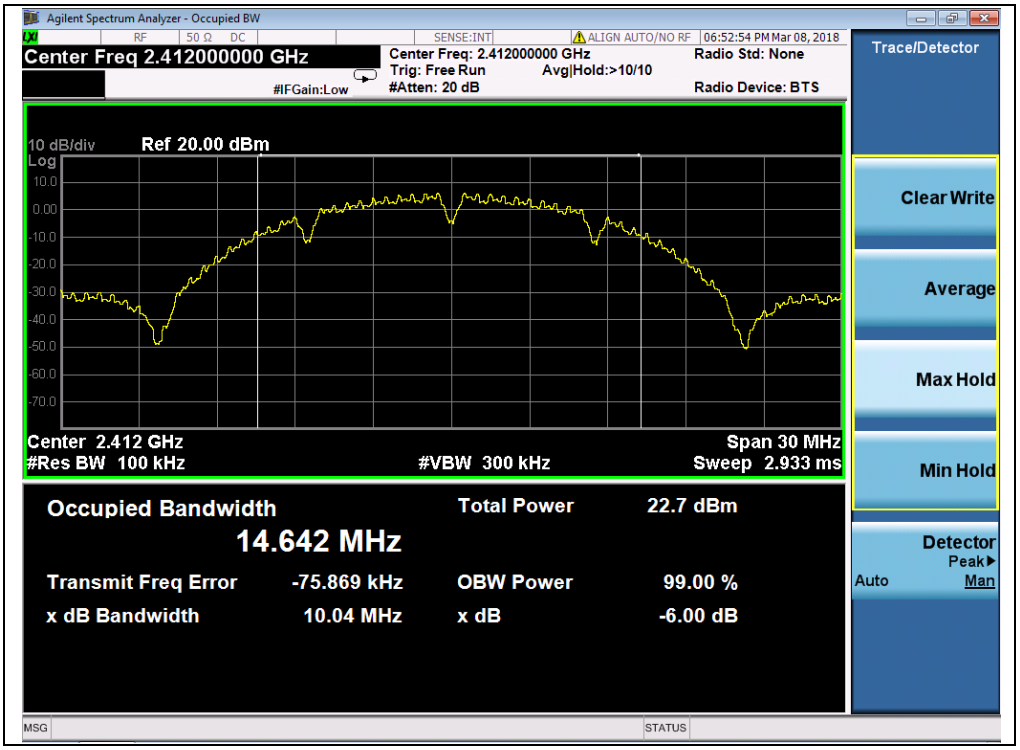
2.3.3. Test Result

2.3.3.1 802.11b Test mode

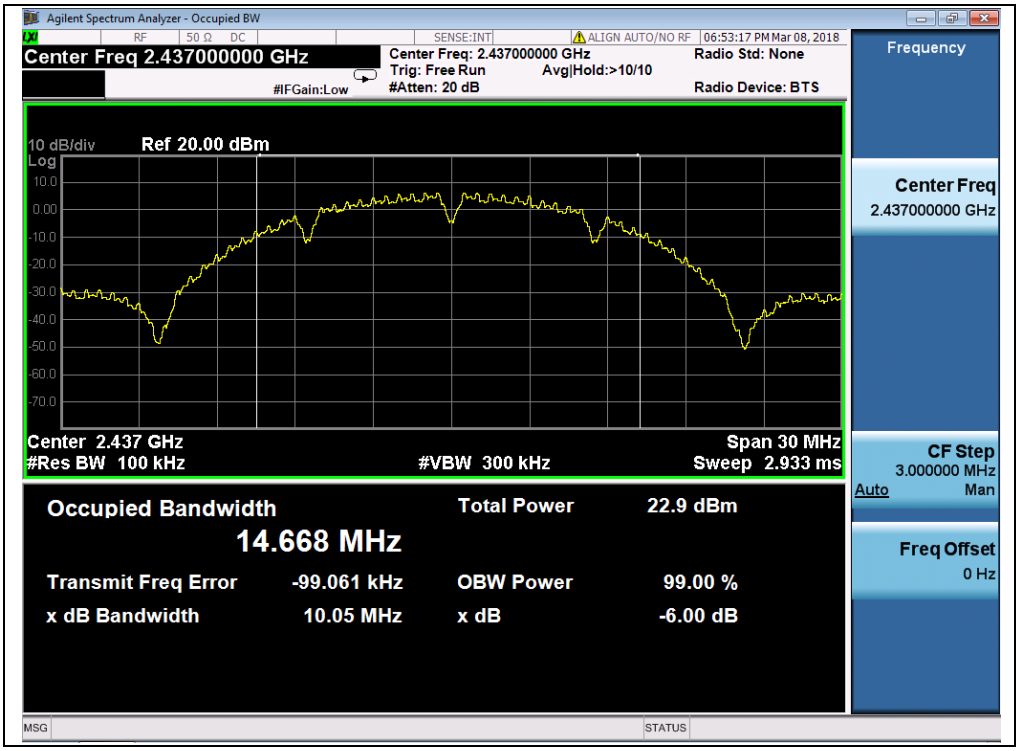
A. Test Verdict:

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limits(kHz)	Result
1	2412	10.04	≥500	PASS
6	2437	10.05	≥500	PASS
11	2462	10.07	≥500	PASS

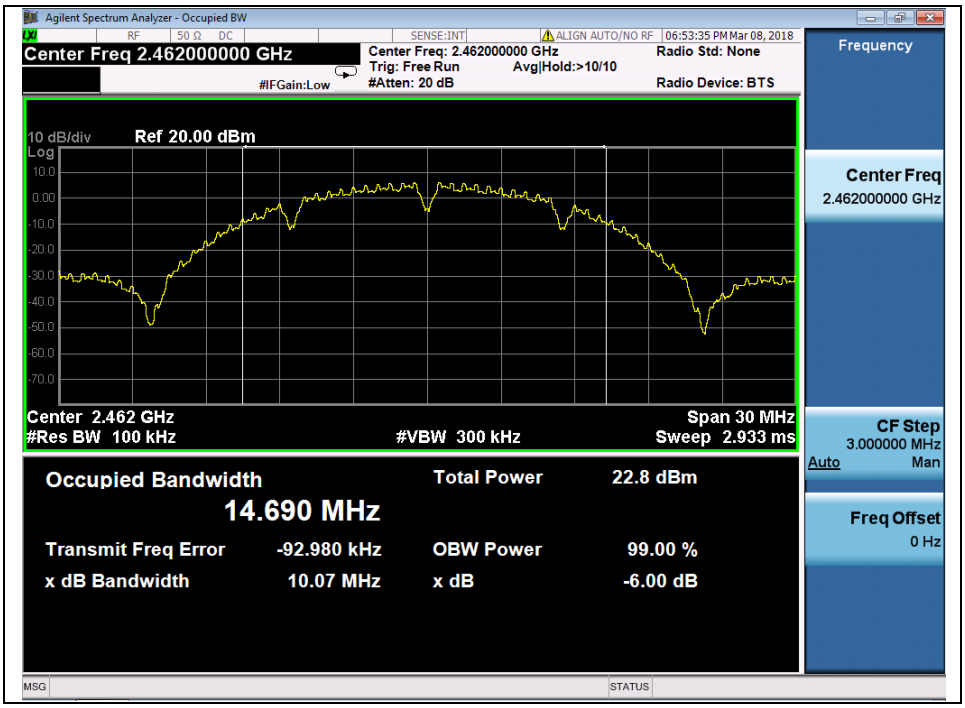
B. Test Plots



(Channel 1, 2412MHz, 802.11b)



(Channel 6, 2437 MHz, 802.11b)



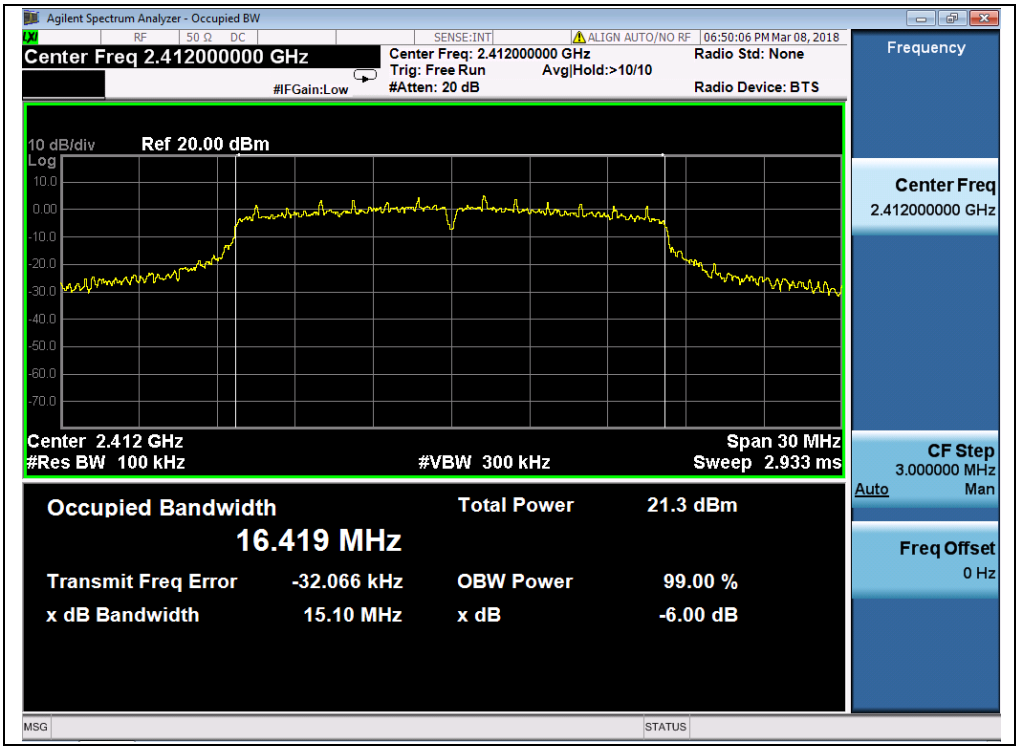
(Channel 11, 2462MHz, 802.11b)

2.3.3.2 802.11g Test mode

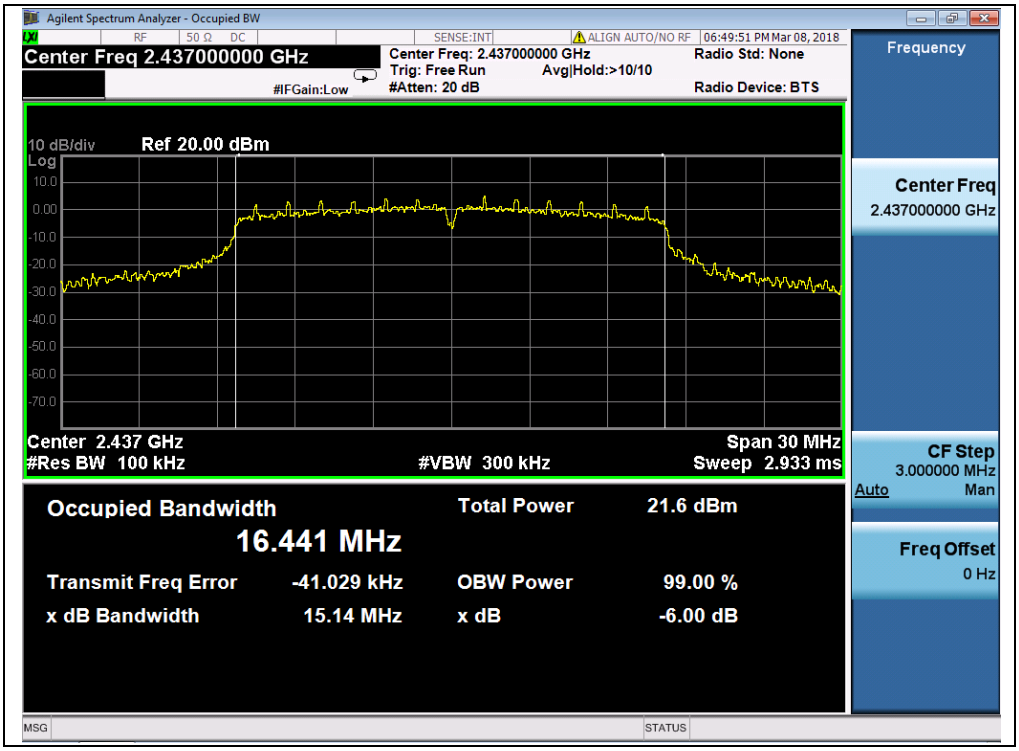
A. Test Verdict:

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limits(kHz)	Result
1	2412	15.10	≥500	PASS
6	2437	15.14	≥500	PASS
11	2462	15.14	≥500	PASS

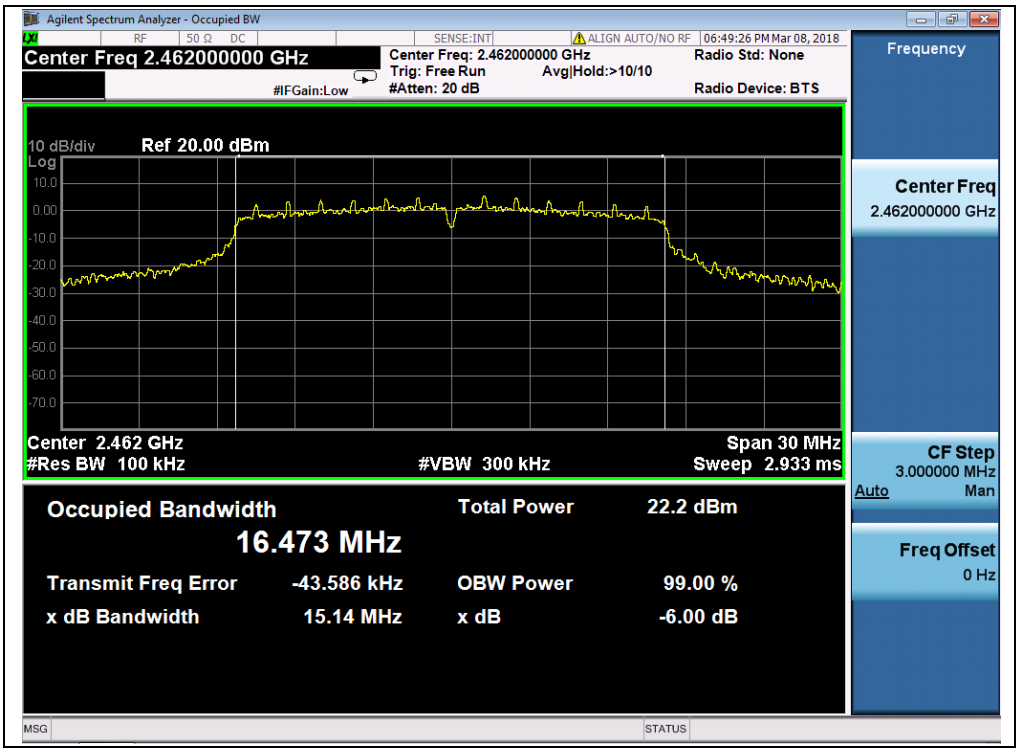
B. Test Plots:



(Channel 1, 2412MHz, 802.11g)



(Channel 6, 2437MHz, 802.11g)



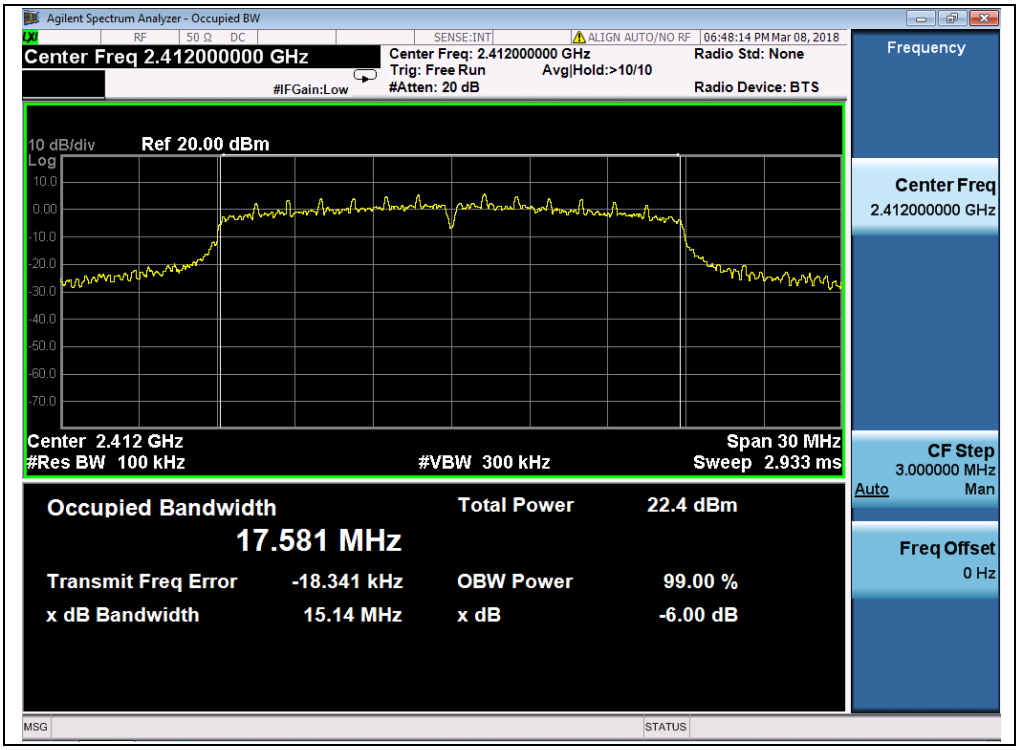
(Channel 11, 2462MHz, 802.11g)

2.3.3.3 802.11n-20 Test mode

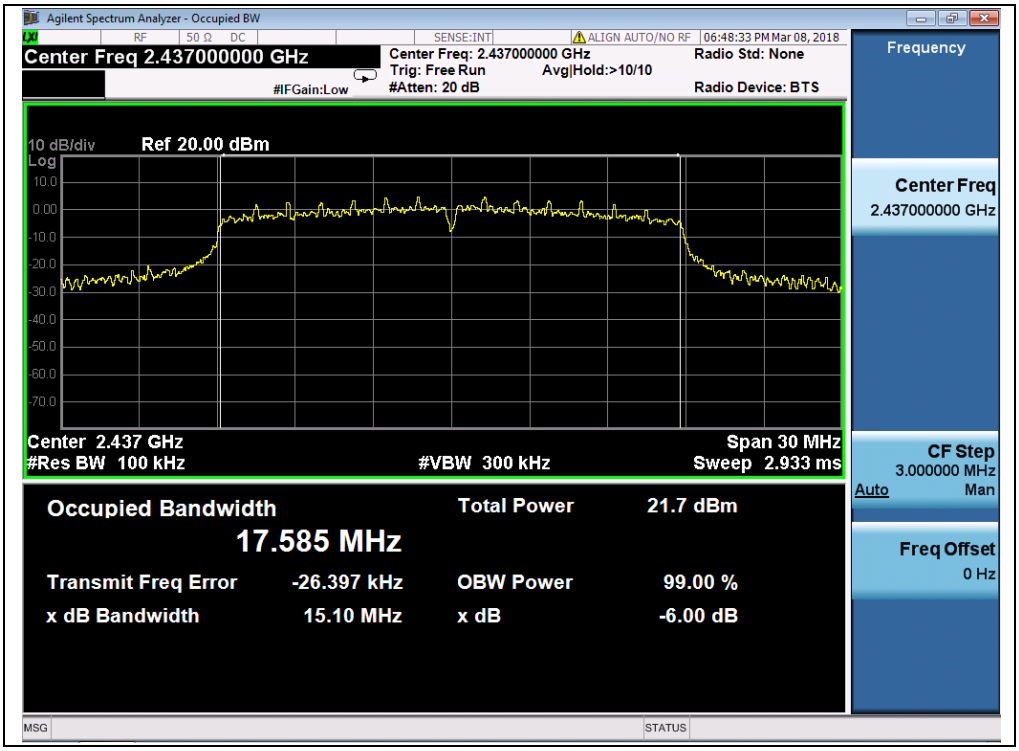
A. Test Verdict:

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limits(kHz)	Result
1	2412	15.14	≥500	PASS
6	2437	15.10	≥500	PASS
11	2462	15.11	≥500	PASS

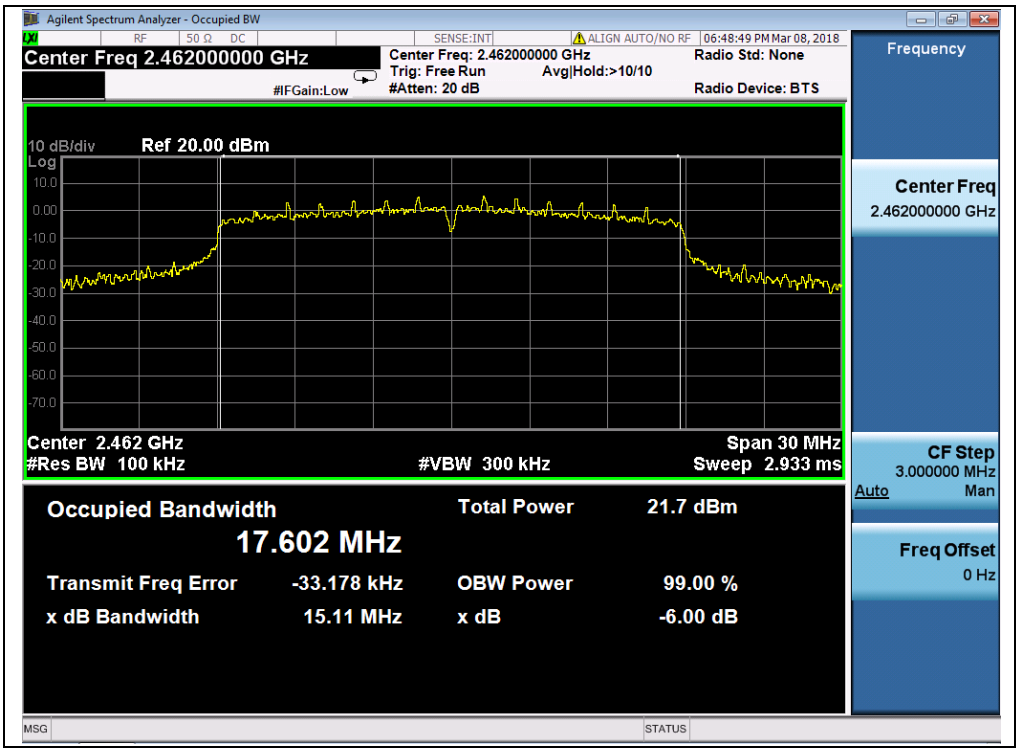
B. Test Plots:



(Channel 1, 2412MHz, 802.11n-20)



(Channel 6, 2437MHz, 802.11n-20)



(Channel 11, 2462MHz, 802.11n-20)

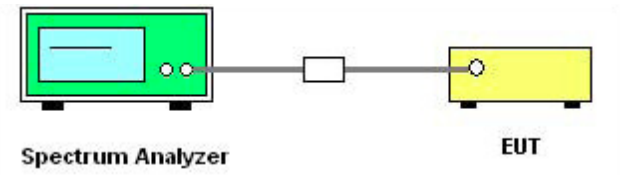
2.4. Conducted Spurious Emissions and Band Edge

2.4.1. 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.

2.4.2. Test Description

A. Test Set:



The EUT 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.

KDB 558074 Section 11.0 was used in order to prove compliance.

B. Equipments List:

Please reference ANNEX A(1.5).

2.4.3. Test Result

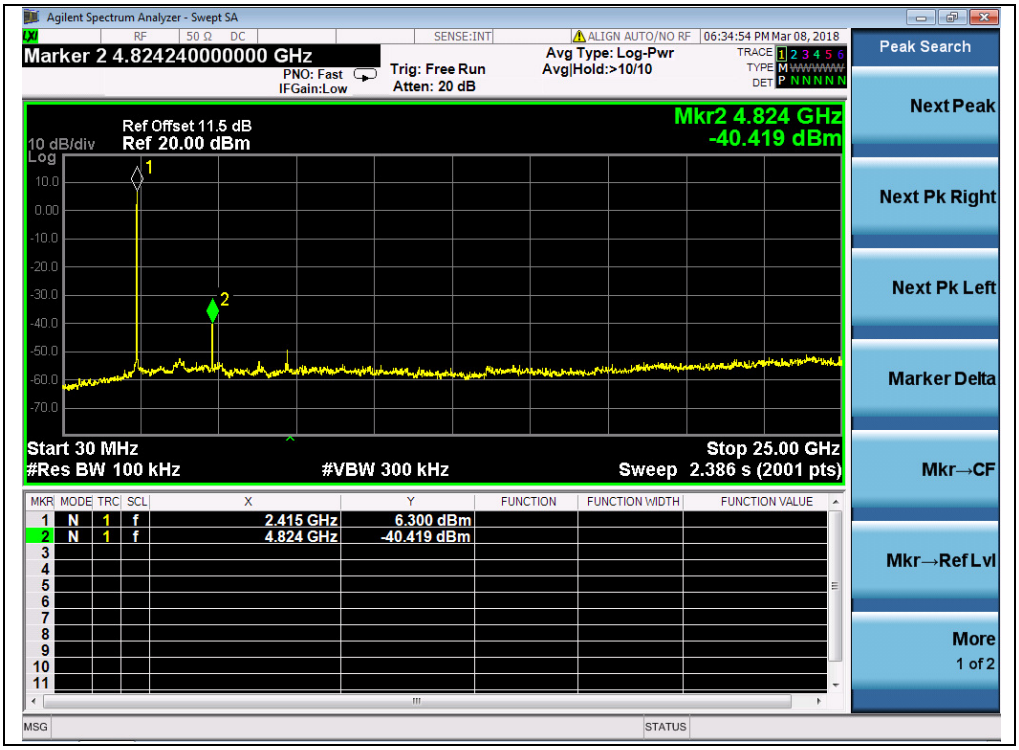
2.4.3.1 802.11b Test mode

A. Test Verdict:

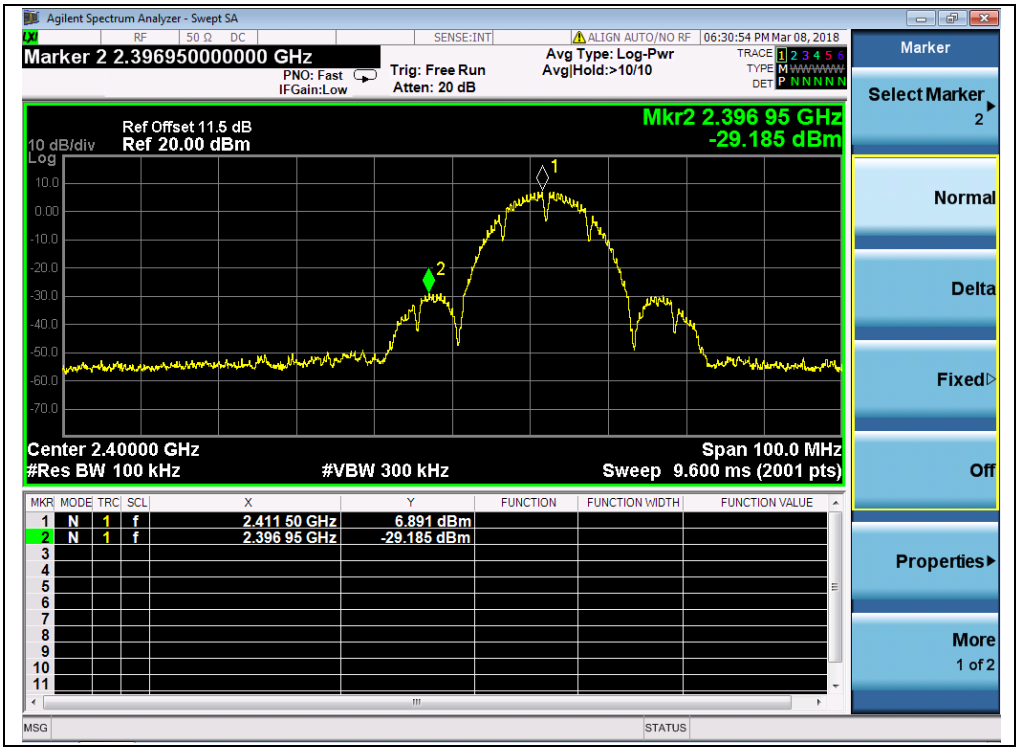
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
1	2412	-40.42	6.30	-13.70	PASS
6	2437	-39.75	5.96	-14.04	PASS
11	2462	-39.54	6.17	-13.83	PASS

B. Test Plots:

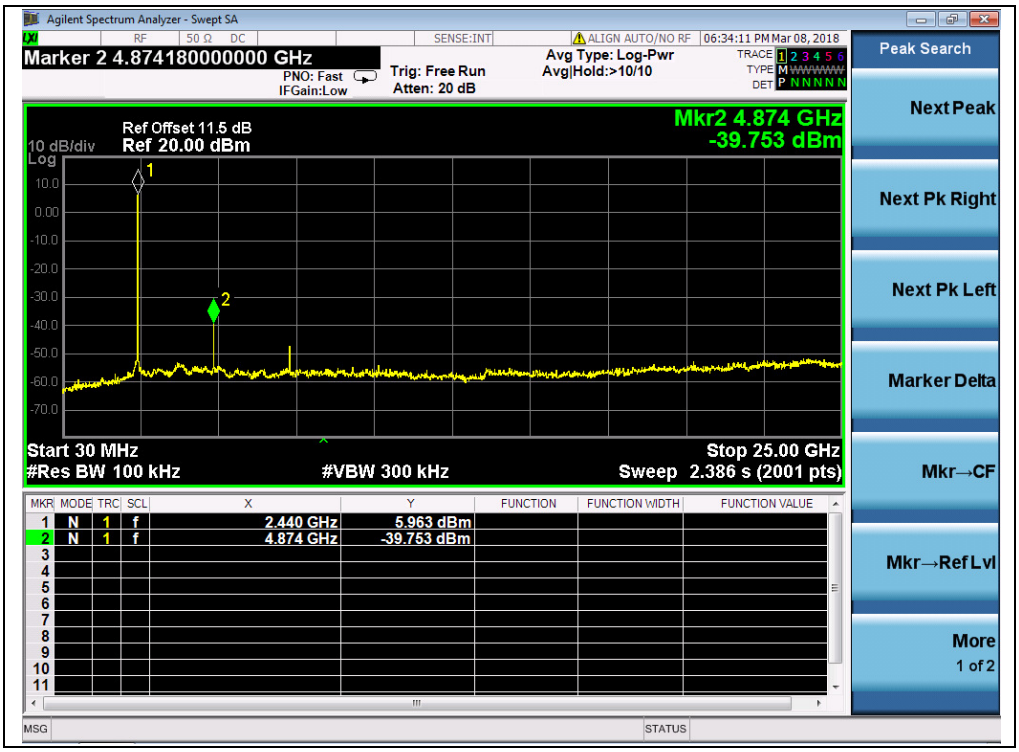
Note: The power of the Module transmitting frequency should be ignored.



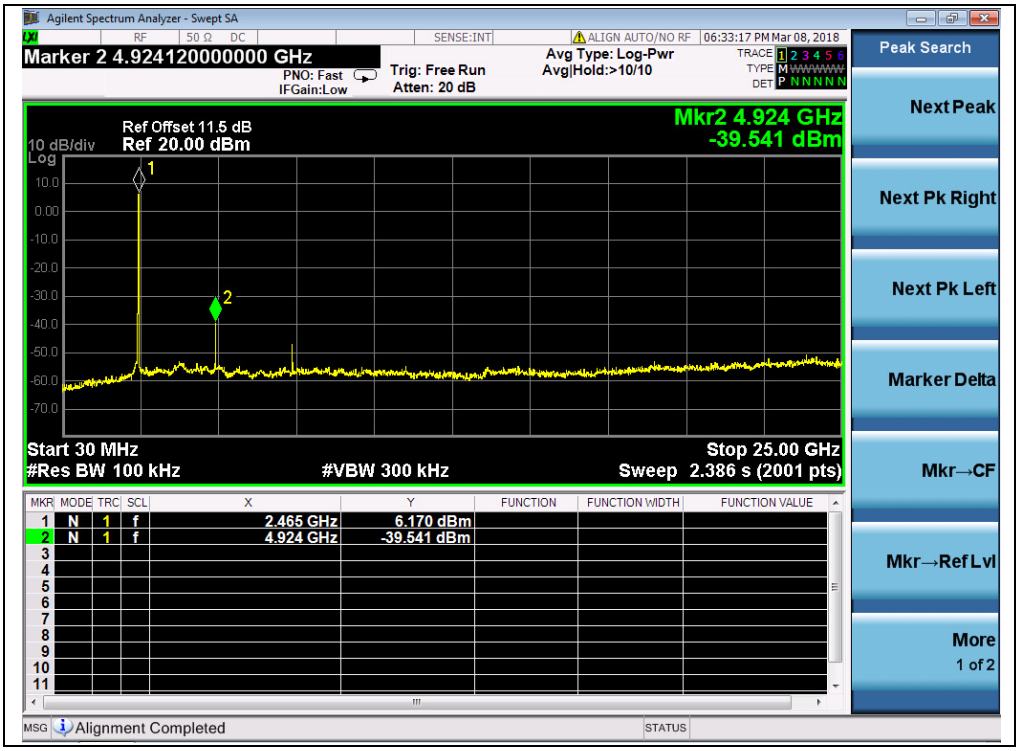
(Channel = 1, 30MHz to 25GHz)



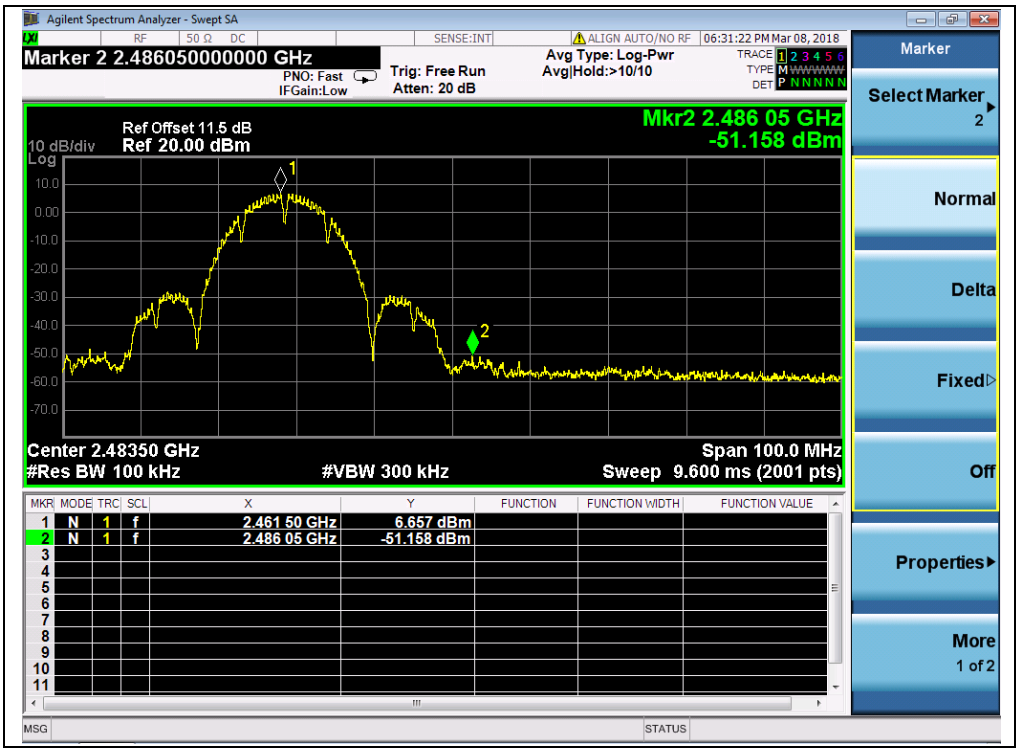
(Band Edge, Channel = 1)



(Channel = 6, 30MHz to 25GHz)



(Channel = 11, 30MHz to 25GHz)



(Band Edge, Channel = 11)

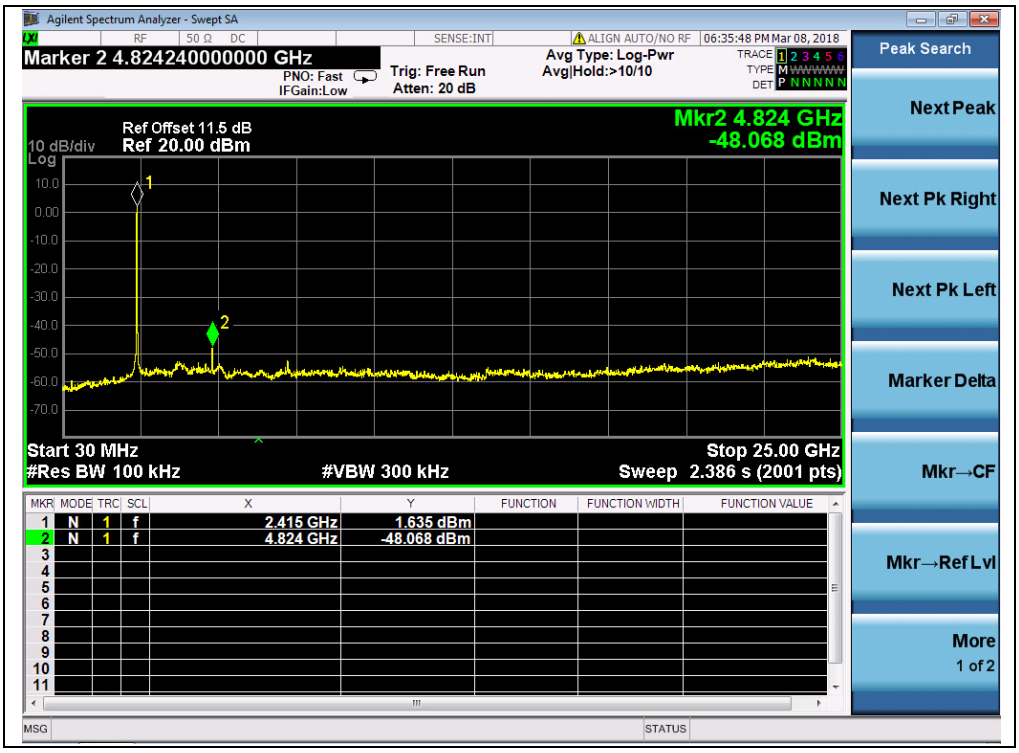
2.4.3.2 802.11g Test mode

A. Test Verdict:

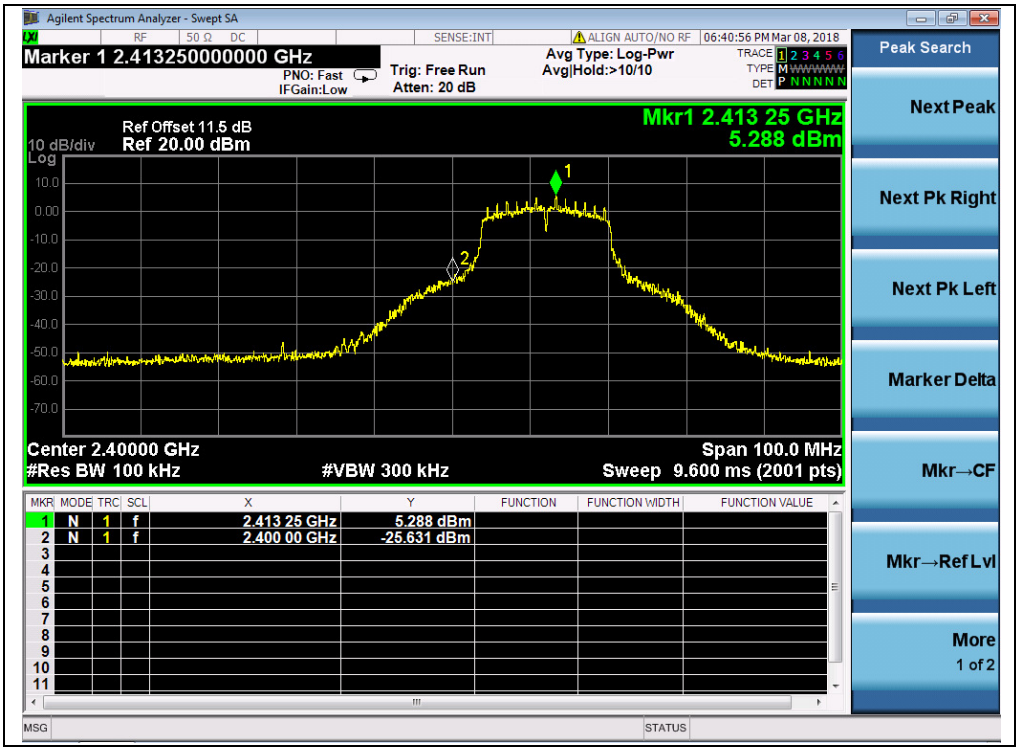
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
1	2412	-48.07	1.64	-18.36	PASS
6	2437	-47.24	4.68	-15.32	PASS
11	2462	-50.04	4.25	-15.75	PASS

B. Test Plots:

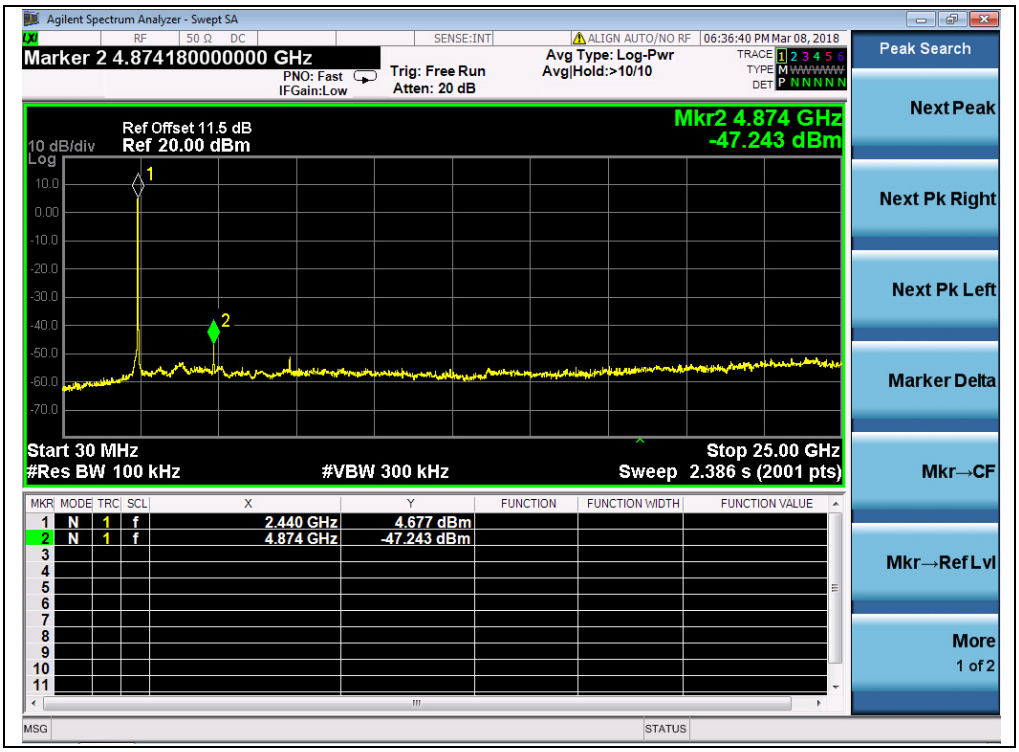
Note: The power of the Module transmitting frequency should be ignored.



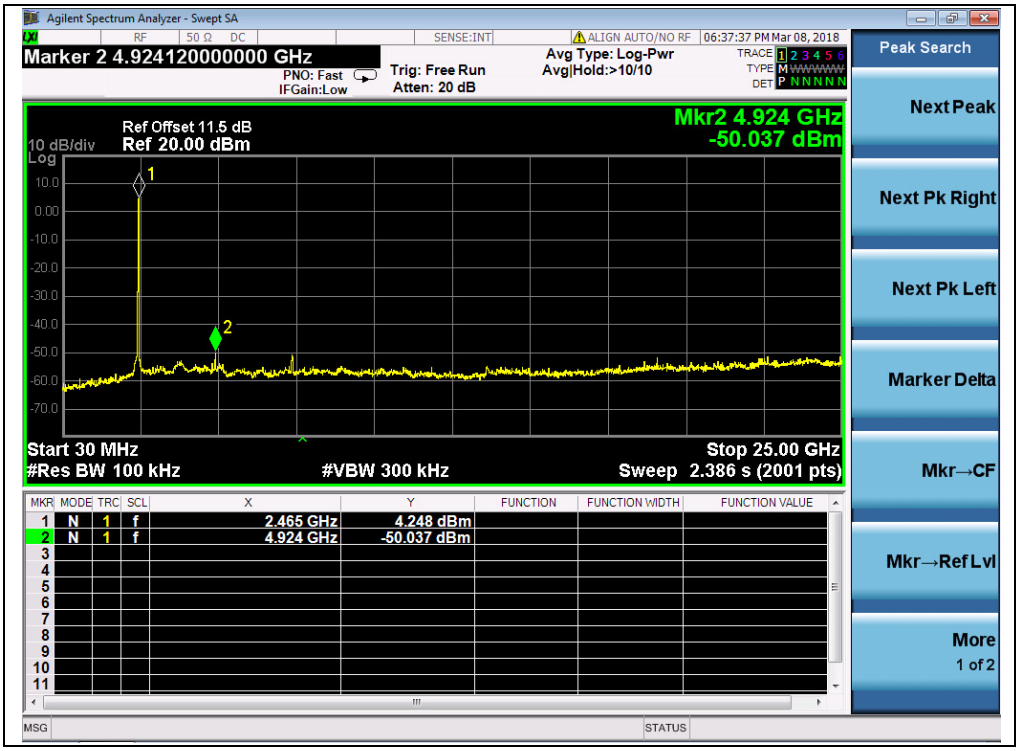
(Channel = 1, 30MHz to 25GHz)



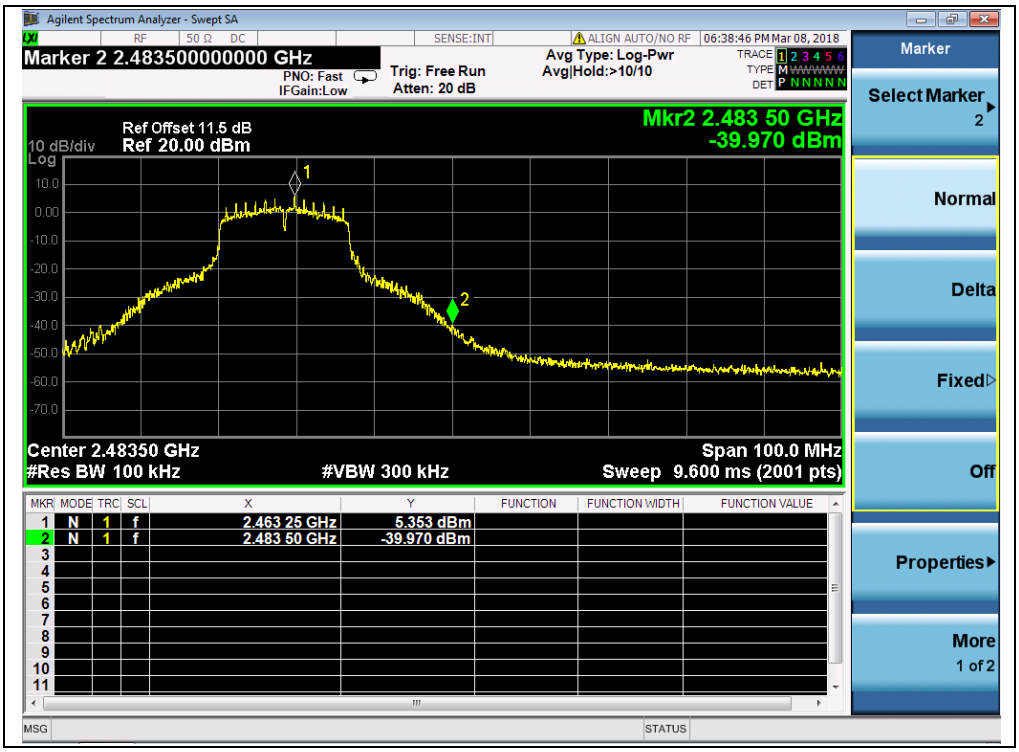
(Band Edge, Channel = 1)



(Channel = 6, 30MHz to 25GHz)



(Channel = 11, 30MHz to 25GHz)



(Band Edge, Channel = 11)

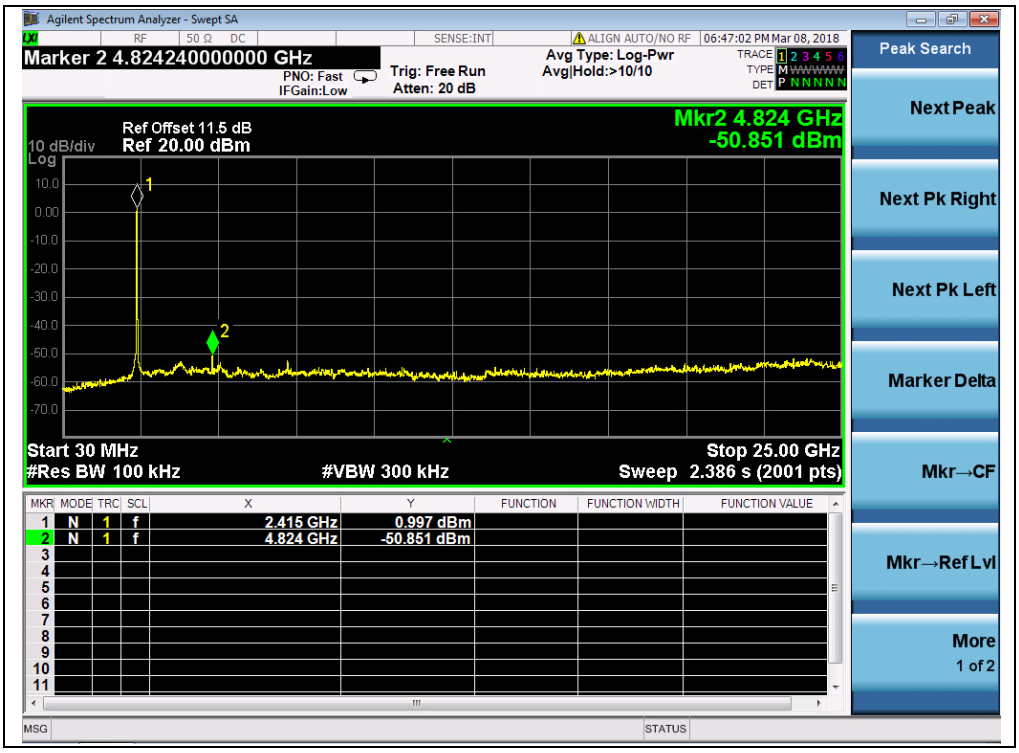
2.4.3.3 802.11n -20MHz Test mode

A. Test Verdict:

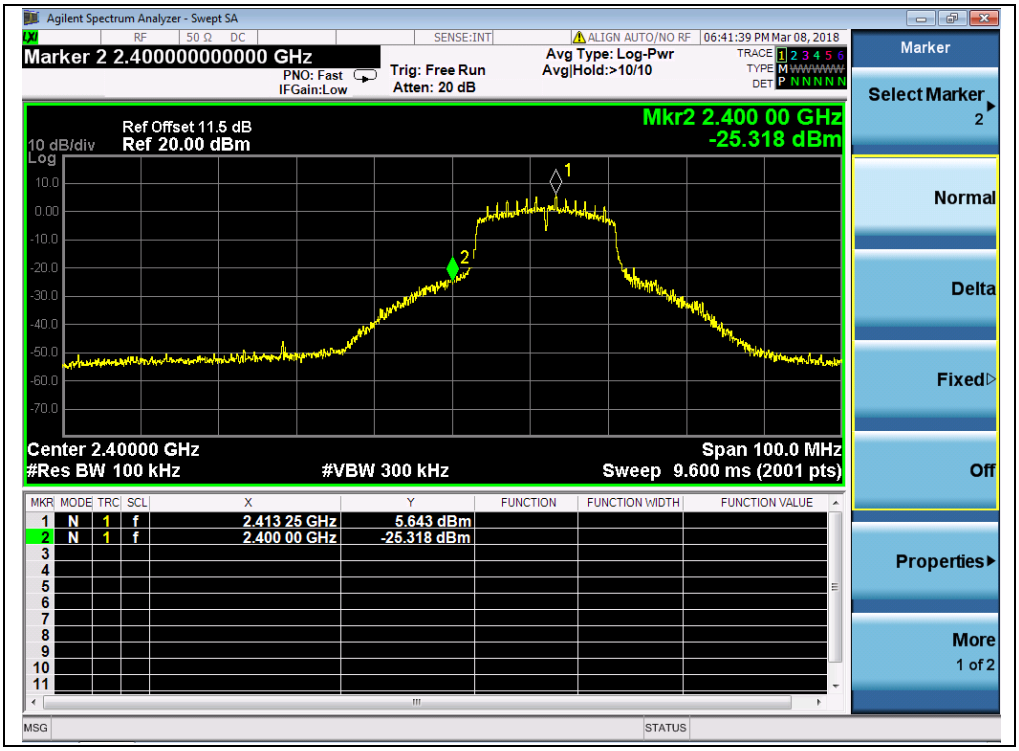
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
1	2412	-50.86	1.00	-19.00	PASS
6	2437	-48.74	3.38	-16.62	PASS
11	2462	-50.17	4.11	-15.89	PASS

B. Test Plots:

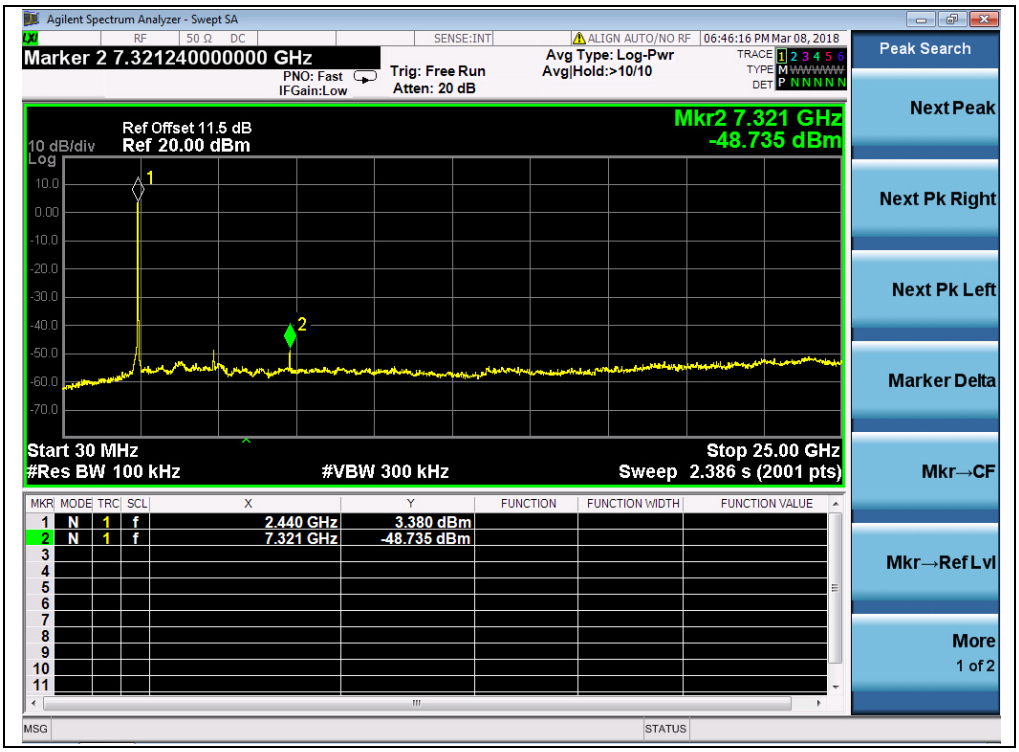
Note: The power of the Module transmitting frequency should be ignored.



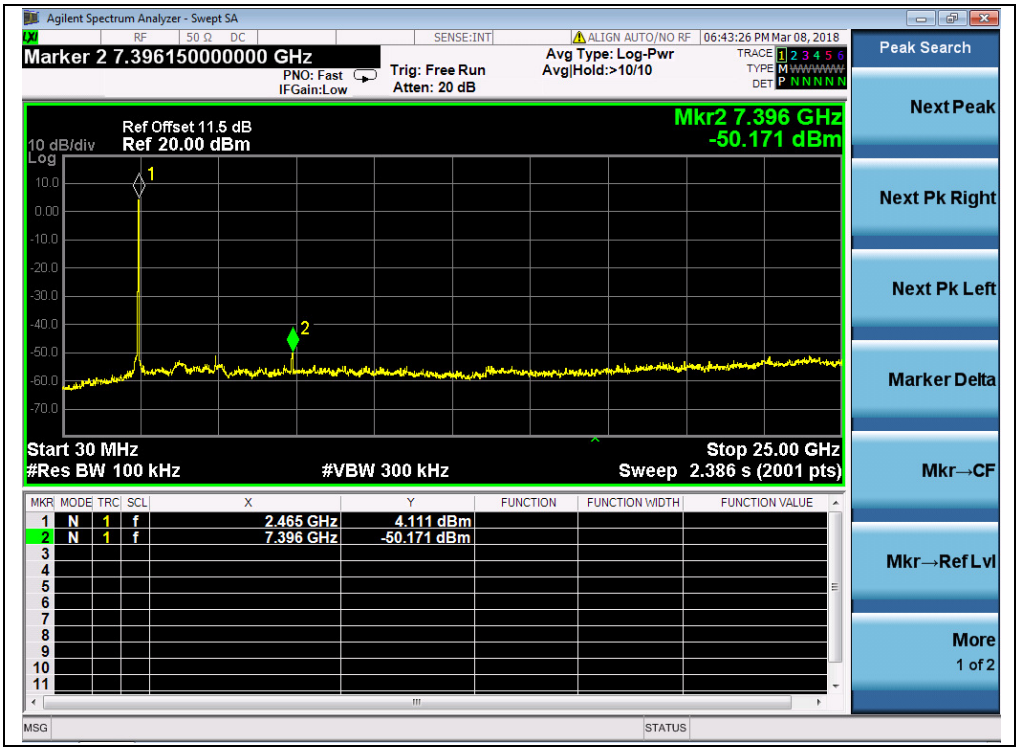
(Channel = 1, 30MHz to 25GHz)



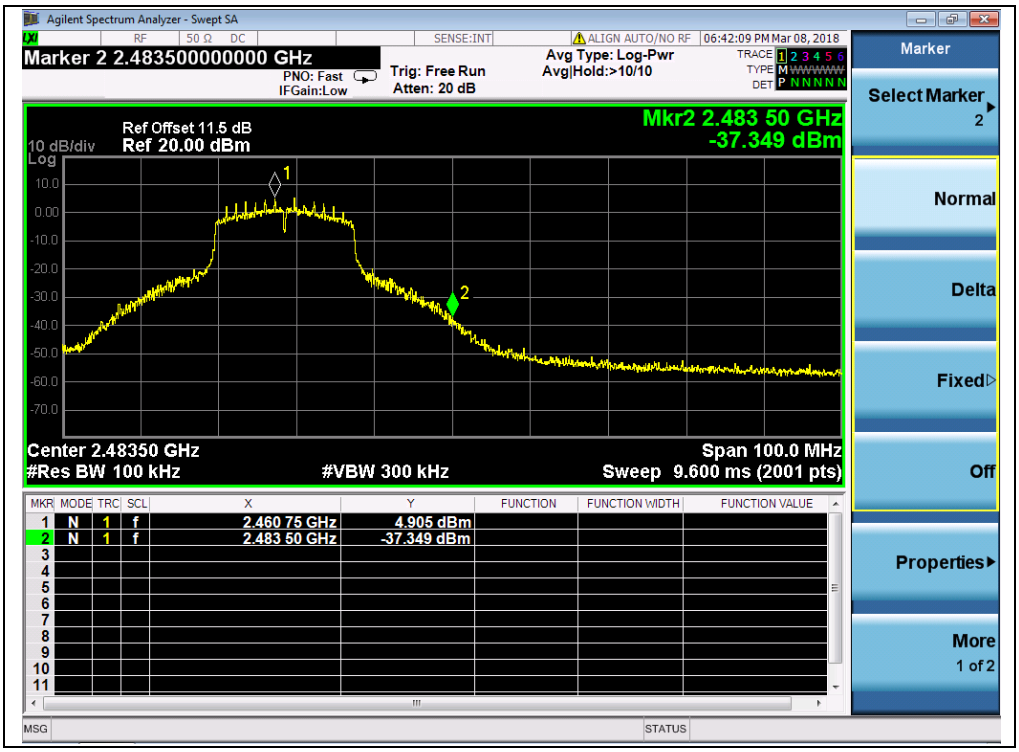
(Band Edge, Channel = 1)



(Channel = 6, 30MHz to 25GHz)



(Channel = 11, 30MHz to 25GHz)



(Band Edge, Channel = 11)

2.5. Power spectral density (PSD)

2.5.1. Requirement

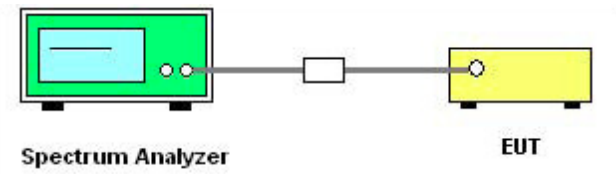
For digitally modulated systems, the power spectral density conducted from the intentional radiator to the antenna shall not be greater than 8dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of 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 procedure

The measured power spectral density was calculated by the reading of the spectrum analyzer and calibration. Following is the test procedure for PSD test:
a) Set analyzer center frequency to channel center frequency.
b) Set the span to 1.5 times DTS
c) Set the RBW to 3 kHz
d) Set the VBW to 10 kHz
e) Detector = peak.
f) Sweep time = auto couple.
g) Trace mode = max hold.
h) Allow trace to fully stabilize.
i) Use the peak marker function to determine the maximum amplitude level within the RBW.

B. Test Set:



The EUT 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.

KDB 558074 Section 10.2 was used in order to prove compliance.

C. Equipments List:

Please reference ANNEX A(1.5).

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)	Limit (dBm/3kHz)	Verdict
1	2412	-9.31	8	PASS
6	2437	-7.37	8	PASS
11	2462	-9.84	8	PASS
Measurement uncertainty: ±1.3dB				

B. Test Plots:

(Channel = 1, 802.11b)

(Channel = 6, 802.11b)

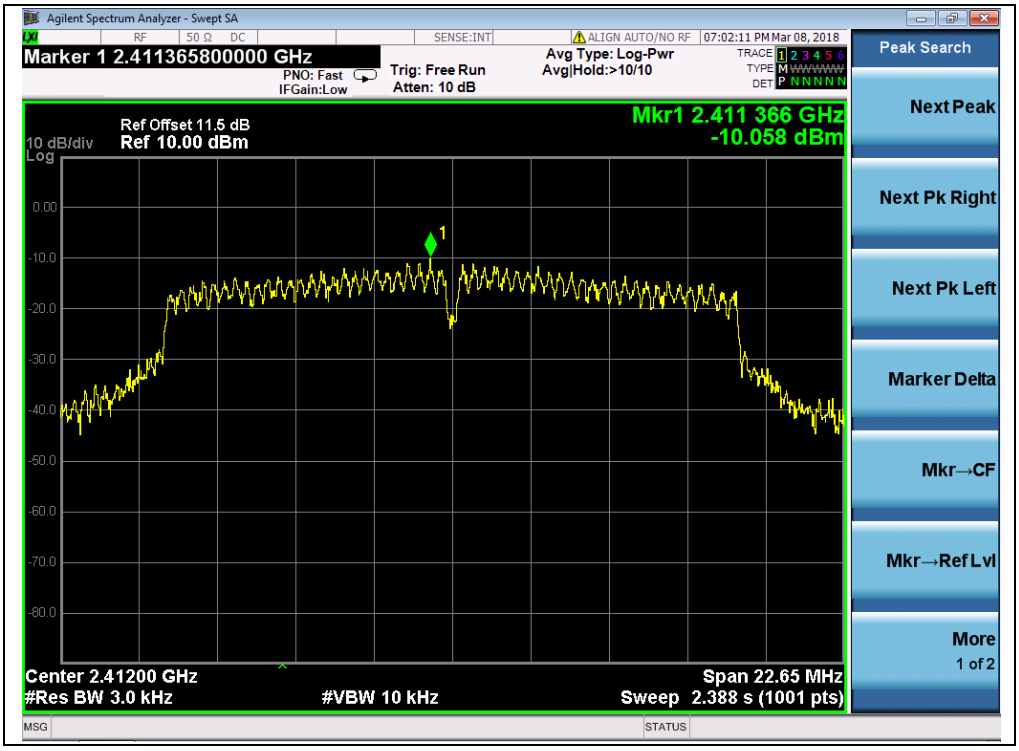
(Channel = 11, 802.11b)

2.5.3.2 802.11g Test mode

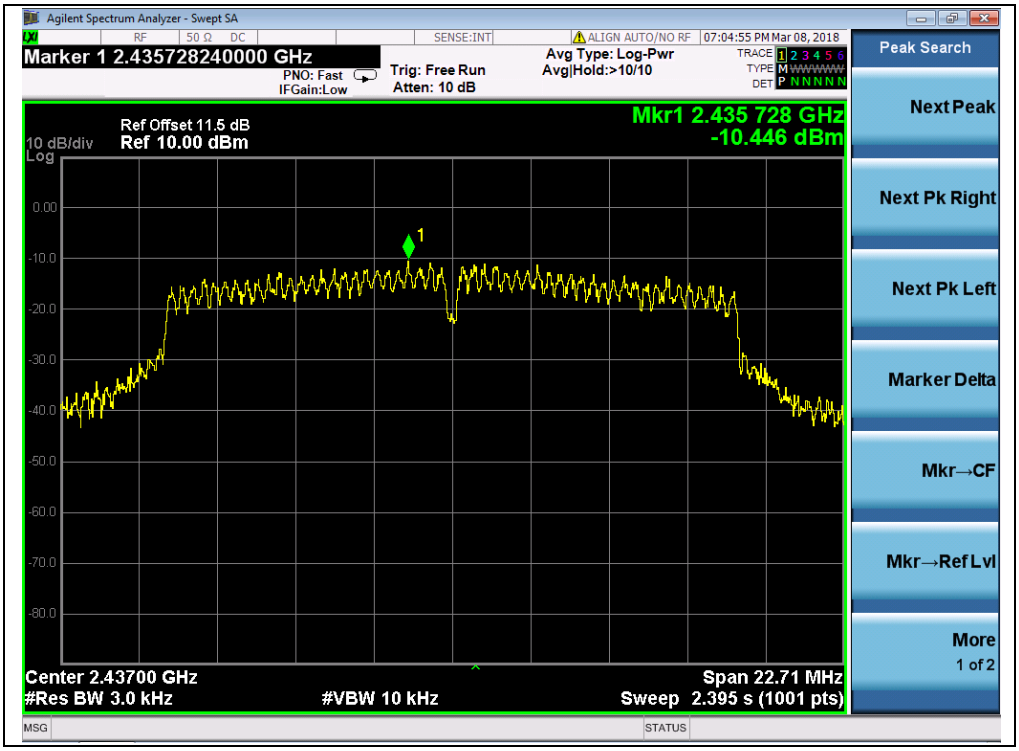
A. Test Verdict:

Spectral power density (dBm/3kHz)				
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
1	2412	-10.06	8	PASS
6	2437	-10.45	8	PASS
11	2462	-10.69	8	PASS
Measurement uncertainty: ±1.3dB				

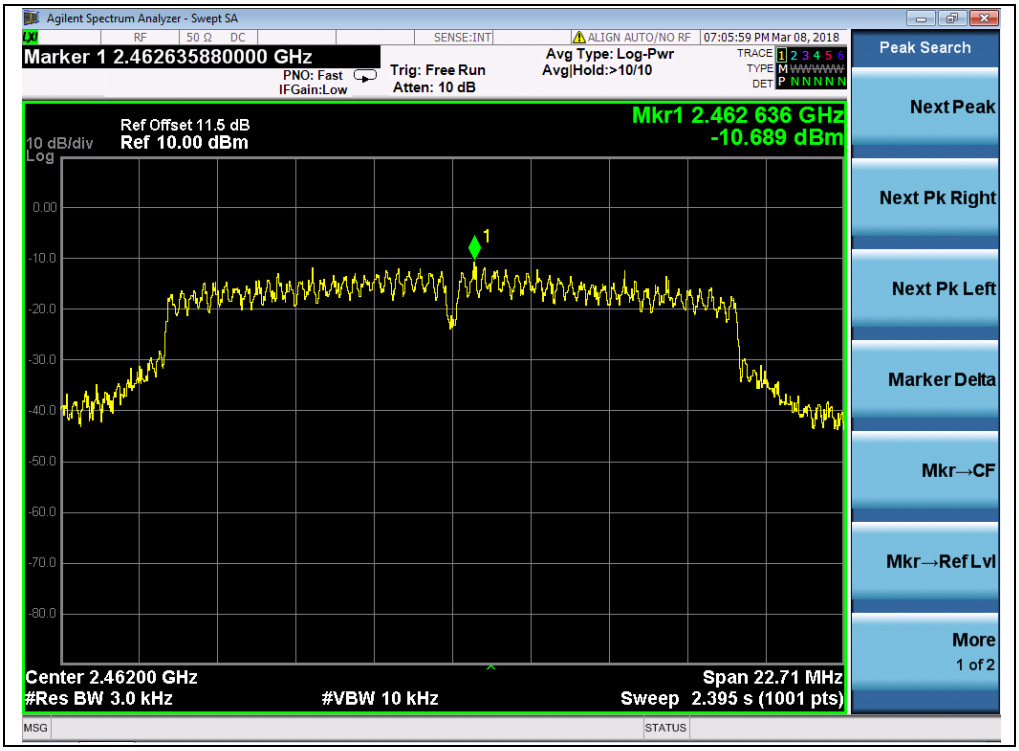
B. Test Plots:



(Channel = 1, 802.11g)



(Channel = 6, 802.11g)



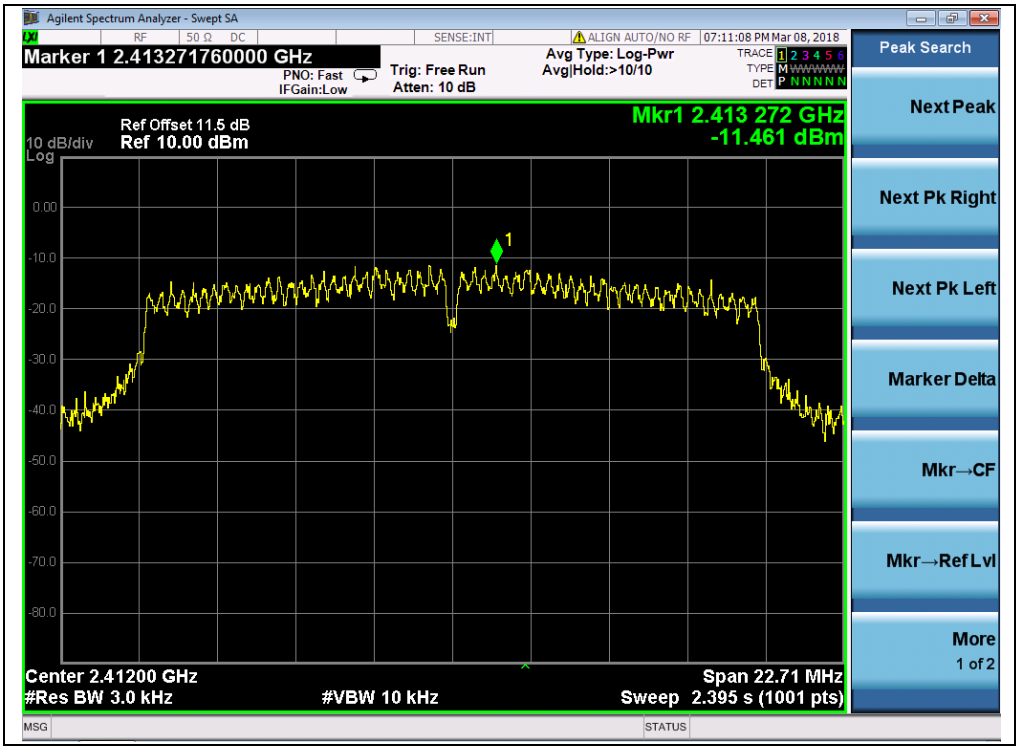
(Channel = 11, 802.11g)

2.5.3.3 802.11n-20MHz Test mode

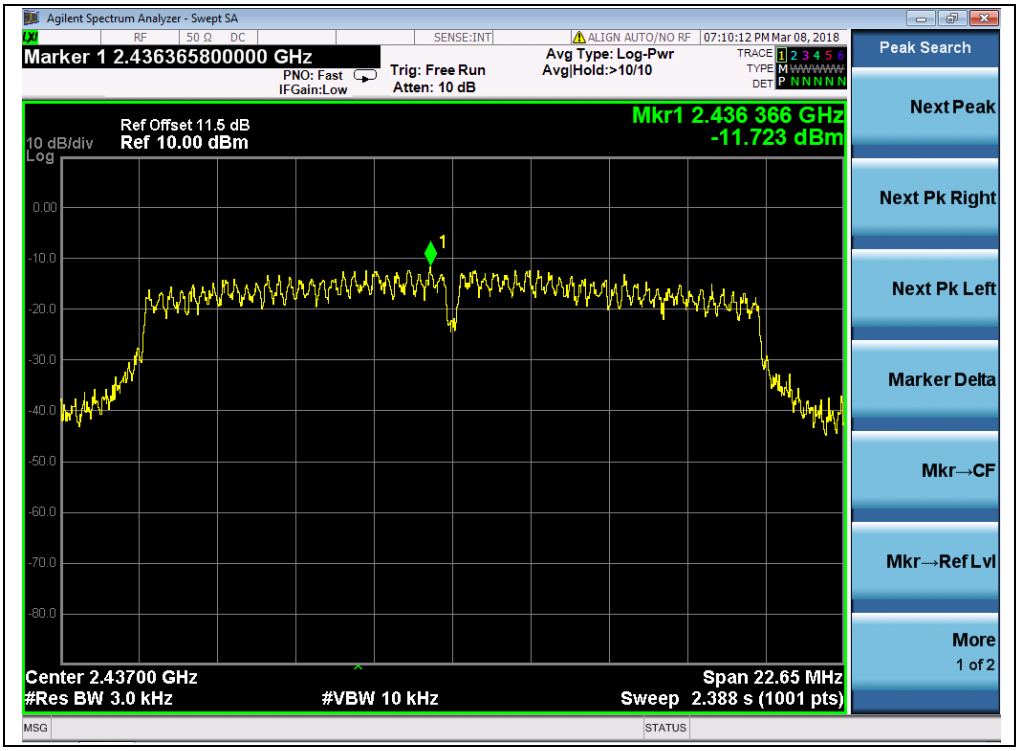
A. Test Verdict:

Spectral power density (dBm/3kHz)				
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
1	2412	-11.46	8	PASS
6	2437	-11.72	8	PASS
11	2462	-10.84	8	PASS
Measurement uncertainty: ±1.3dB				

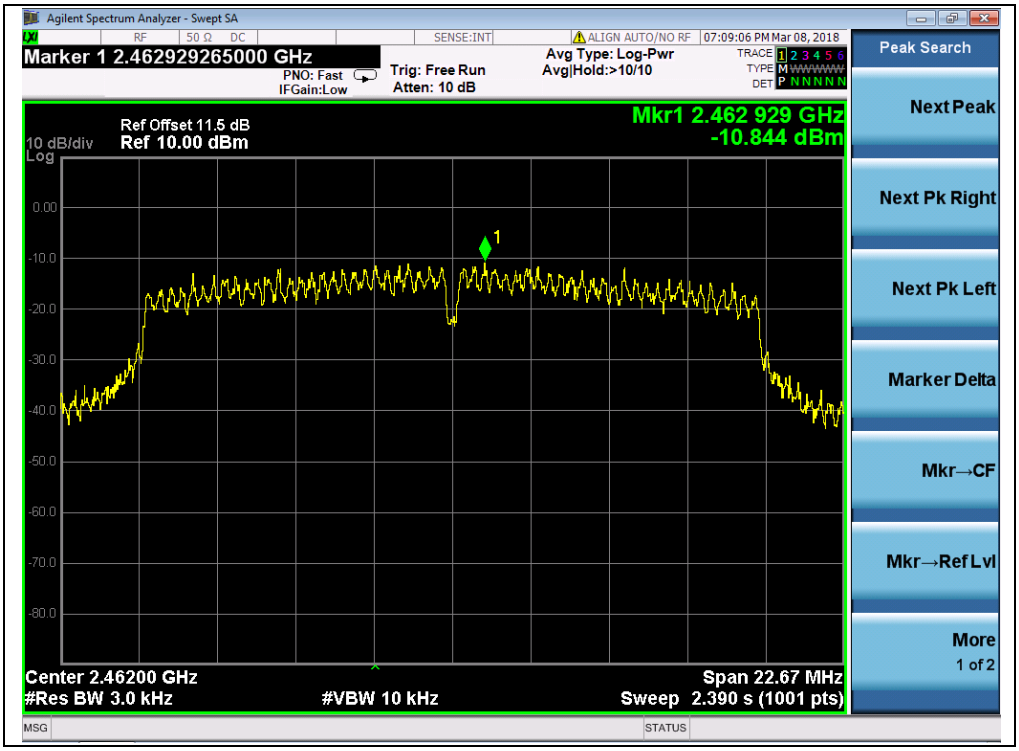
B. Test Plots:



(Channel = 1, 802.11n-20MHz)



(Channel = 6, 802.11n-20MHz)



(Channel = 11, 802.11n-20MHz)

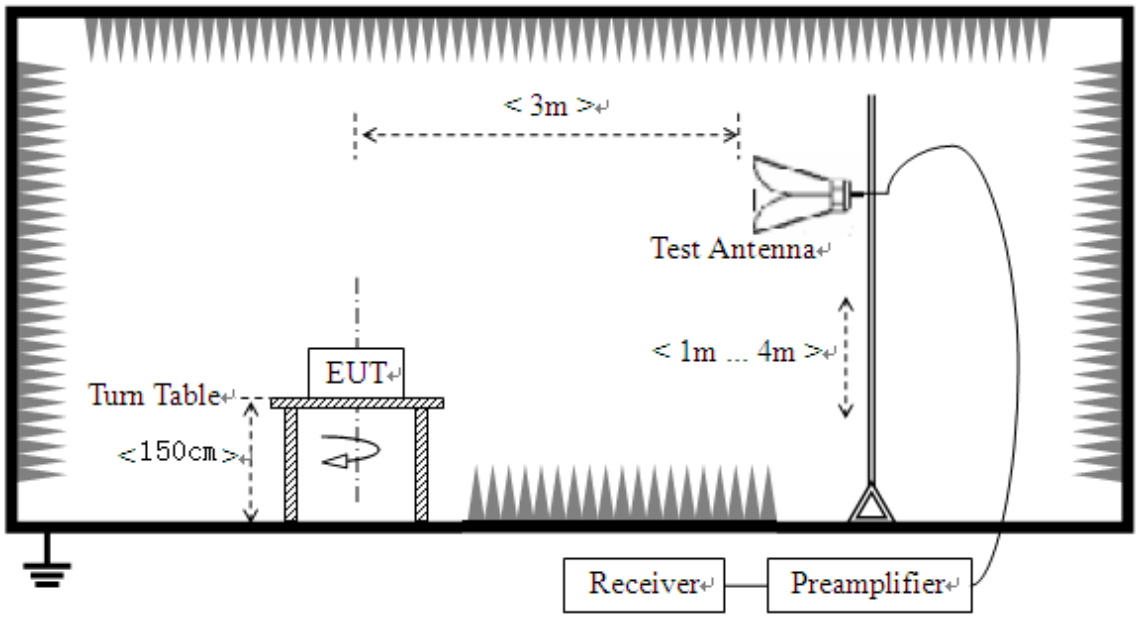
2.6. Restricted Frequency Bands

2.6.1. Requirement

According to FCC section 15.247(d), 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 EUT 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.

KDB 558074 Section 12.1 was used in order to prove compliance.

B. Equipments List:

Please reference ANNEX A(1.5).

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 [dBμV/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

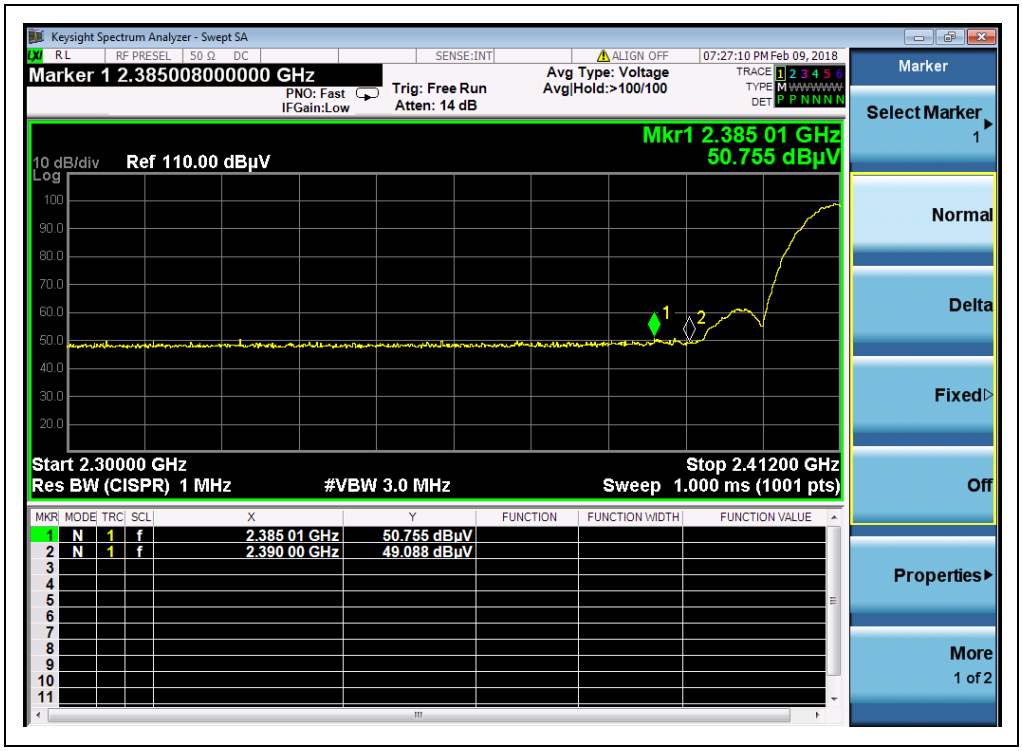
Note: Restricted Frequency Bands were performed when antenna was at vertical and horizontal polarity, and only the worse test condition (vertical) was recorded in this test report.

2.6.3.1 802.11b Test mode

A. Test Verdict:

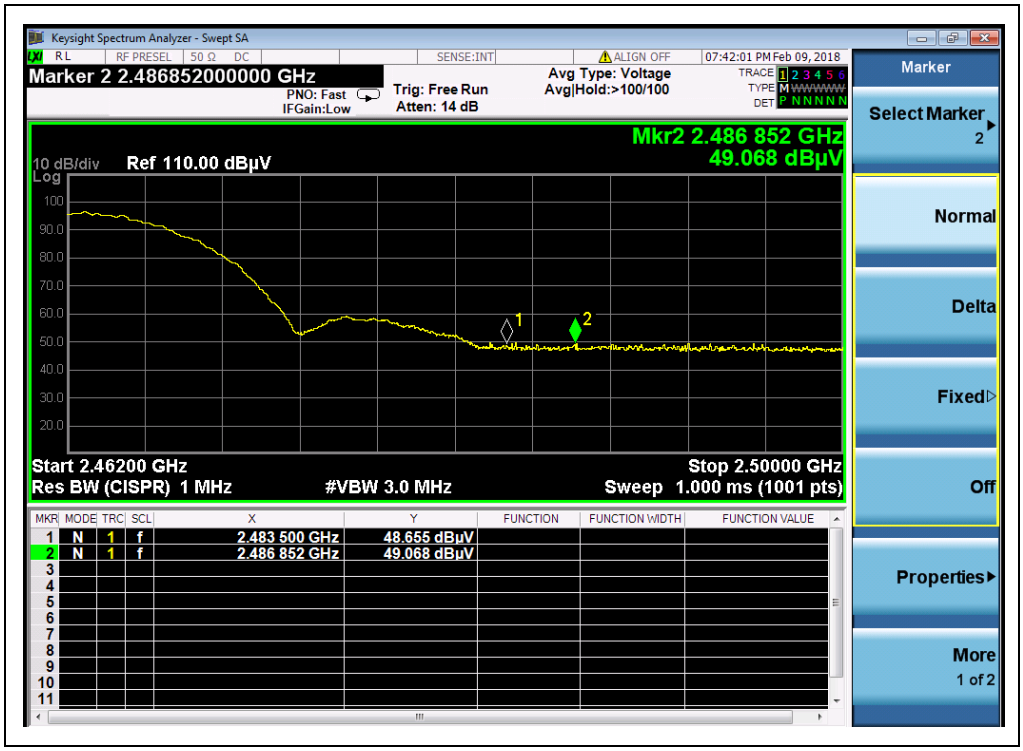
Channel	Frequency (MHz)	Detector	Receiver Reading U_R (dBuV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
		PK/ AV						
1	2385.01	PK	50.76	-33.63	32.56	49.69	74	Pass
1	2385.46	AV	39.13	-33.63	32.56	38.06	54	Pass
11	2486.85	PK	49.07	-33.18	32.5	48.39	74	Pass
11	2486.85	AV	37.05	-33.18	32.5	36.37	54	Pass

B. Test Plots:



(Channel = 1 PEAK, 802.11b)

(Channel = 1 AVG, 802.11b)



(Channel = 11 PEAK, 802.11b)

(Channel = 11 AVG, 802.11b)

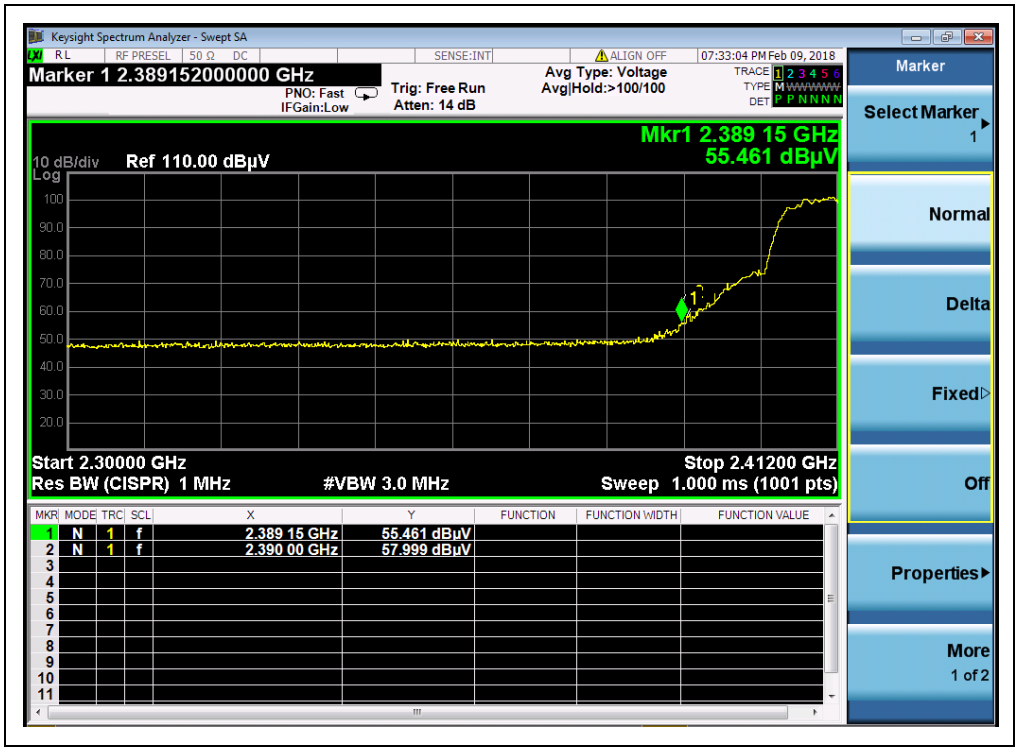
2.6.3.2 802.11g Test mode

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

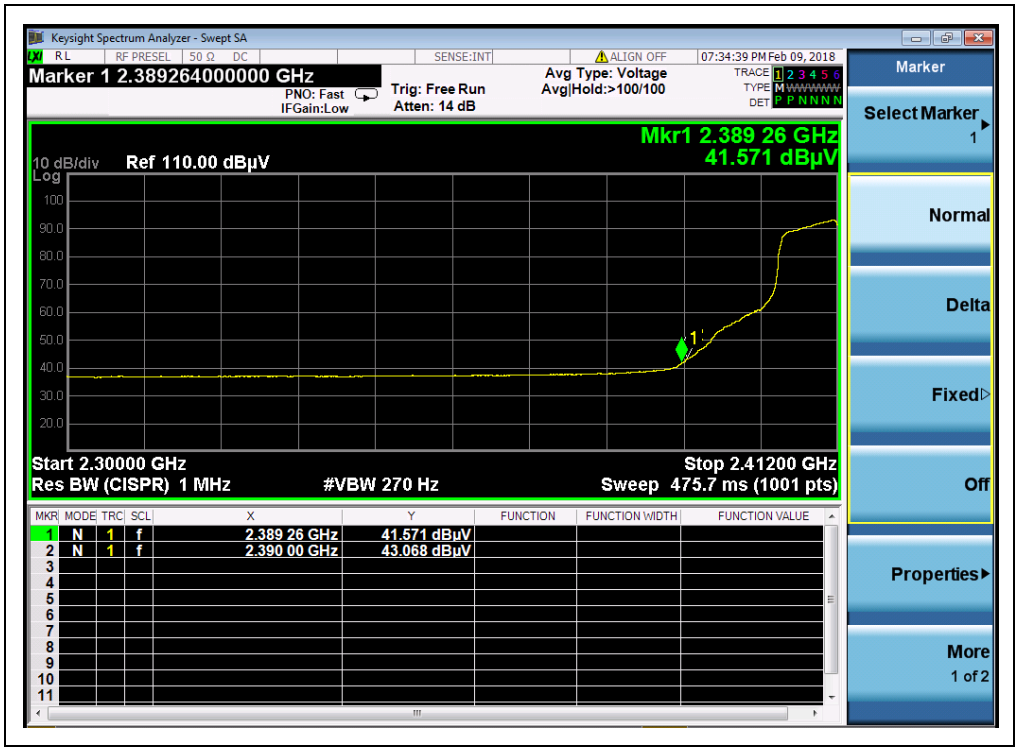
A. Test Verdict:

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading U_R (dBuV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
1	2389.15	PK	55.46	-33.63	32.56	54.39	74	Pass
1	2389.26	AV	41.57	-33.63	32.56	40.50	54	Pass
11	2484.65	PK	52.00	-33.18	32.5	51.32	74	Pass
11	2483.81	AV	40.35	-33.18	32.5	39.67	54	Pass

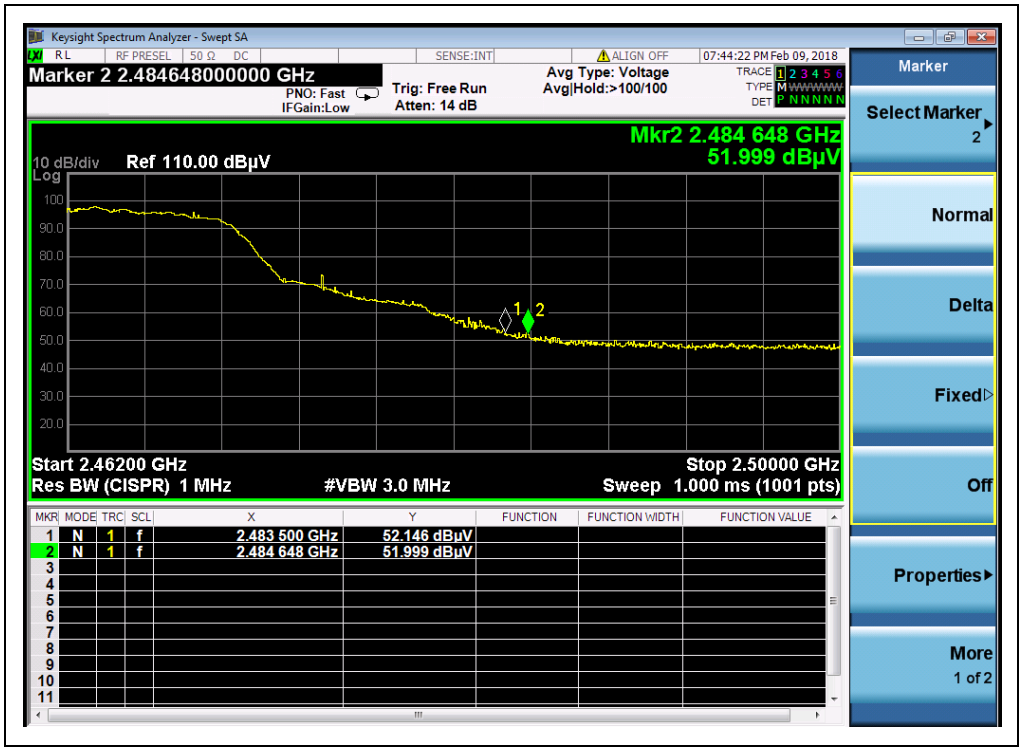
B. Test Plots:



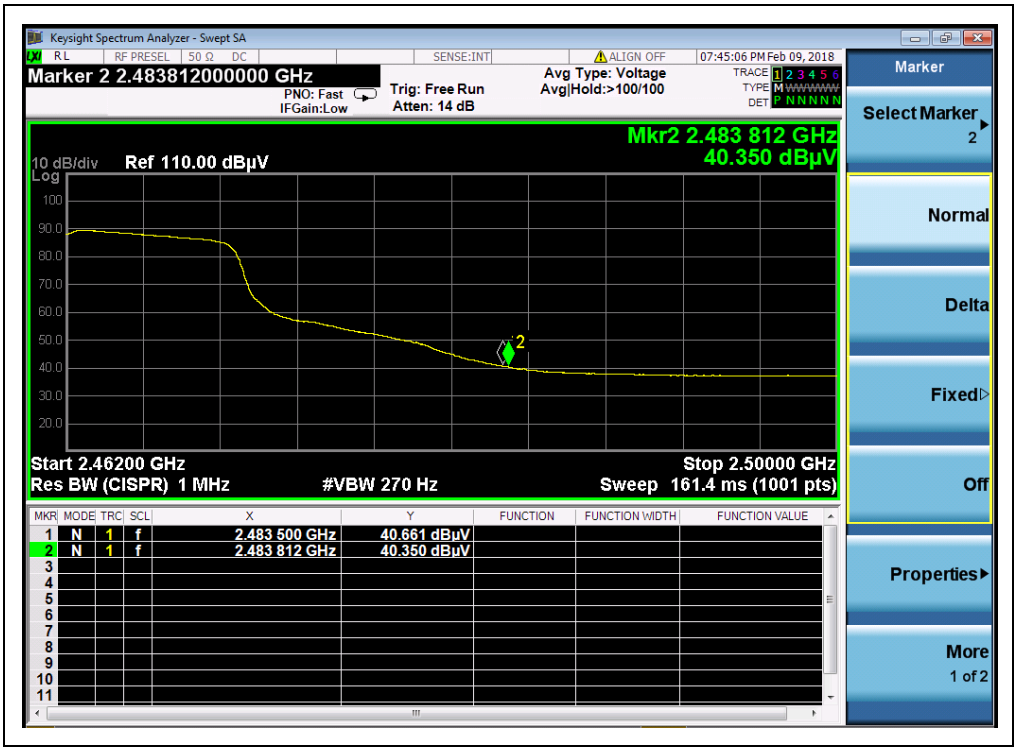
(Channel = 1 PEAK, 802.11g)



(Channel = 1 AVG, 802.11g)



(Channel = 11 PEAK, 802.11g)



(Channel = 11 AVG, 802.11g)

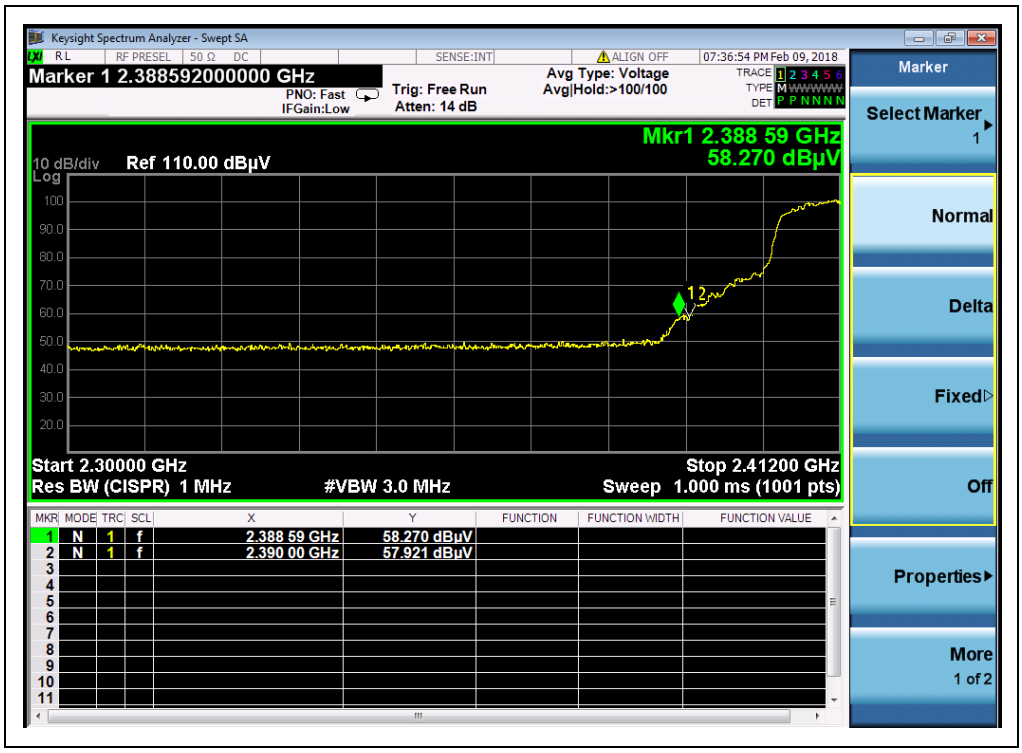
2.6.3.3 802.11n-20MHz Test mode

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

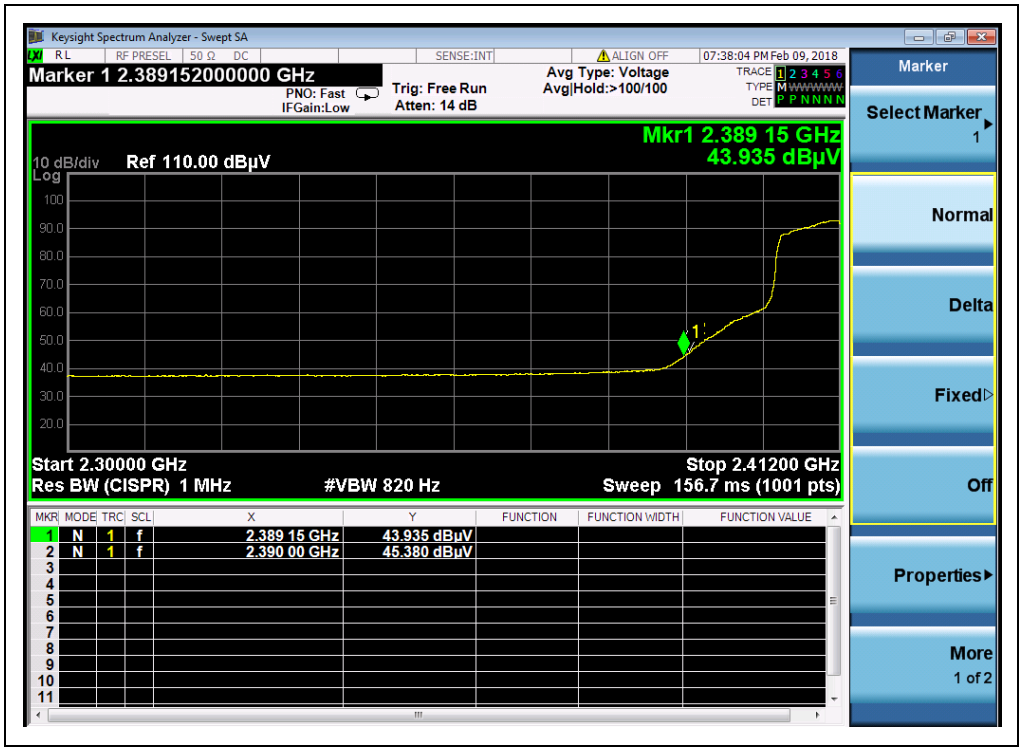
A. Test Verdict:

Channel	Frequency (MHz)	Detector PK/ AV	Receiver Reading U_R (dBuV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBµV/m)	Limit (dBµV/m)	Verdict
1	2388.59	PK	58.27	-33.63	32.56	57.20	74	Pass
1	2389.15	AV	43.94	-33.63	32.56	42.87	54	Pass
11	2484.19	PK	55.47	-33.18	32.5	54.79	74	Pass
11	2483.89	AV	41.73	-33.18	32.5	41.05	54	Pass

B. Test Plots:

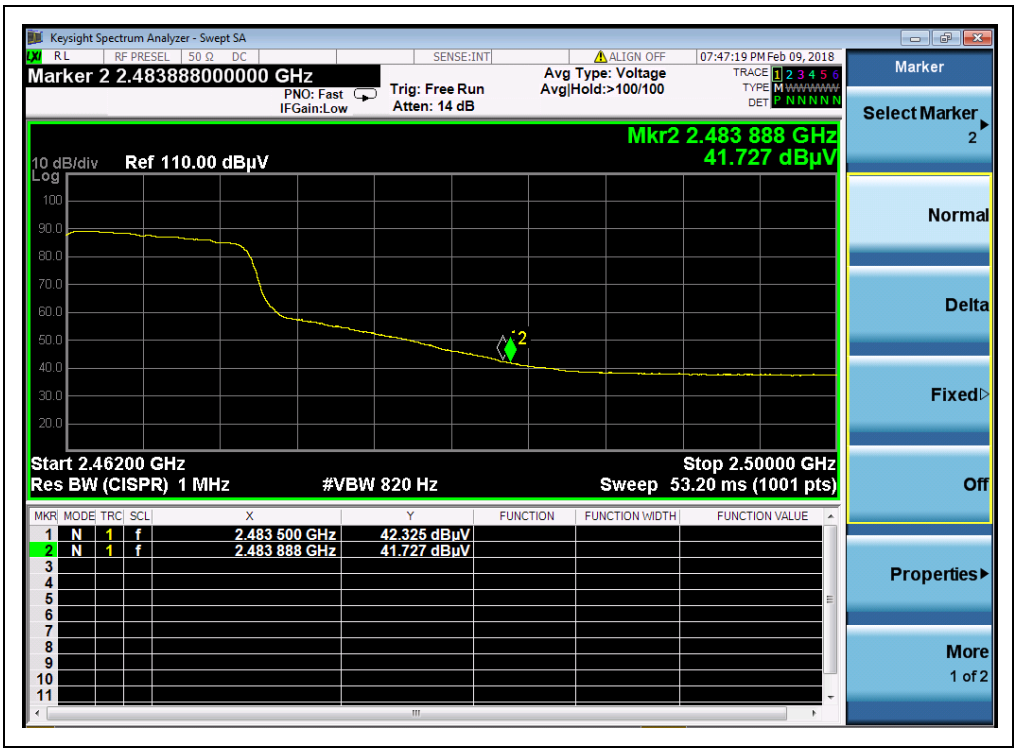


(Channel = 1 PEAK, 802.11n-20)



(Channel = 1 AVG, 802.11n-20)

(Channel = 11 PEAK, 802.11n-20)



(Channel = 11 AVG, 802.11n-20)

2.7. Conducted Emission

2.7.1. 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

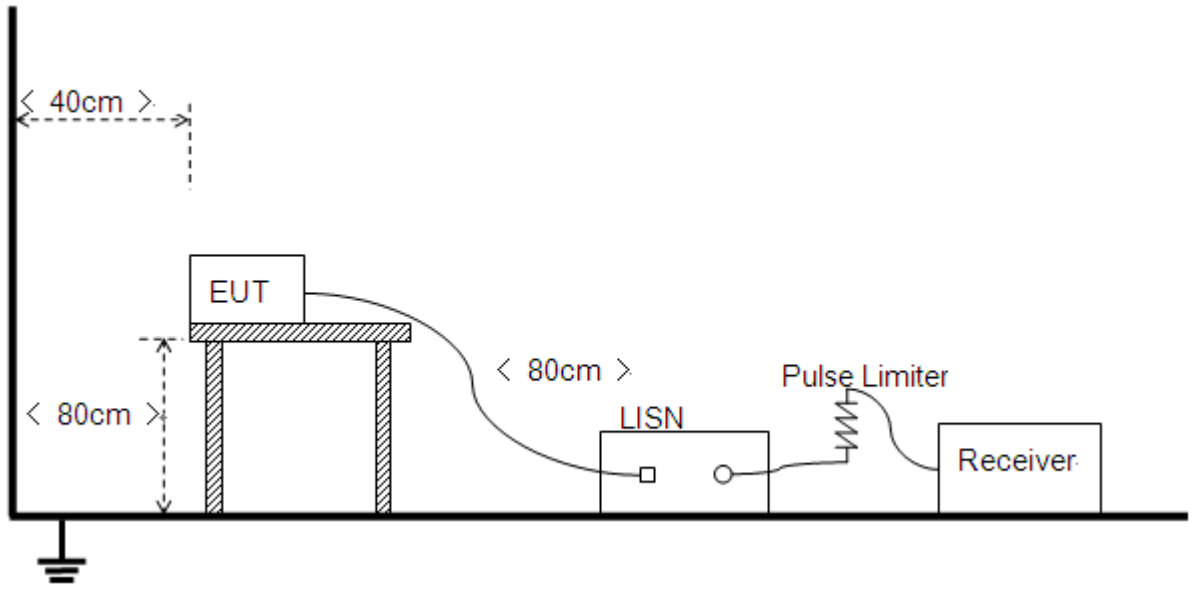
NOTE:

(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.

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 C63.10 2013.

B. Equipments List:

Please reference ANNEX A(1.5).

2.7.3. Test Result

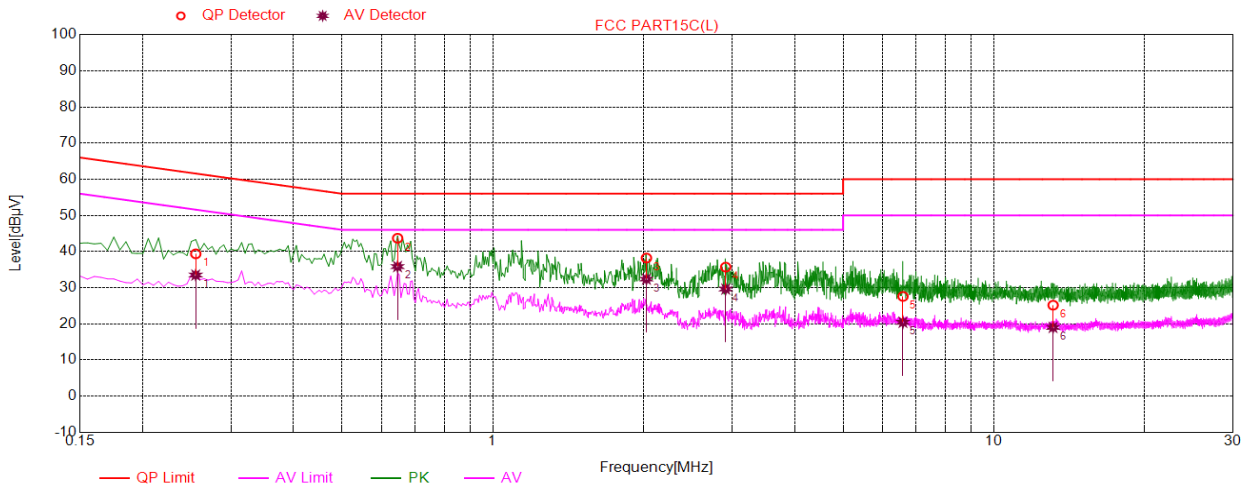
The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT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

A. Test setup:

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

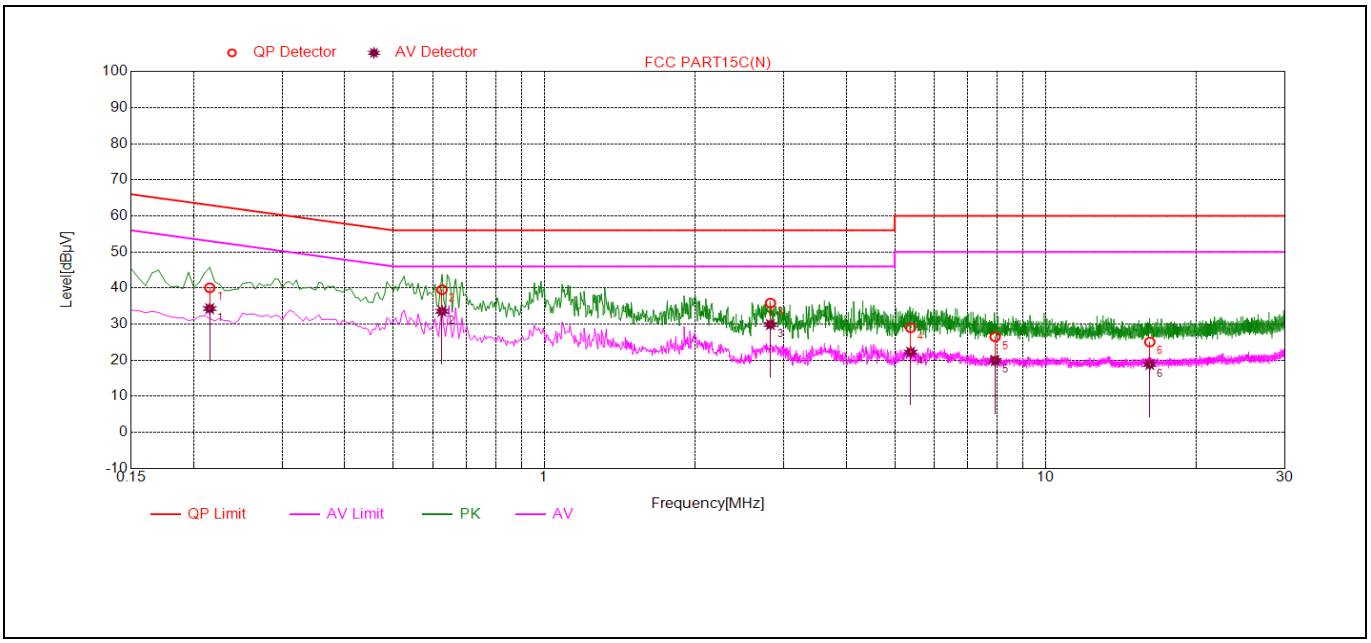
Note: The test voltage is AC 120V/60Hz.

B. Test Plots:



(Plot A: L Phase)

NO.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.26	39.37	33.49	61.59	51.59	Line	PASS
2	0.64	43.69	35.84	56.00	46.00		PASS
3	2.02	38.21	32.36	56.00	46.00		PASS
4	2.92	35.69	29.61	56.00	46.00		PASS
5	6.59	27.57	20.40	60.00	50.00		PASS
6	13.13	25.14	18.99	60.00	50.00		PASS



(Plot B: N Phase)

NO.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.22	40.06	34.29	63.01	53.01	Neutral	PASS
2	0.62	39.52	33.56	56.00	46.00		PASS
3	2.82	35.85	29.87	56.00	46.00		PASS
4	5.38	28.98	22.22	60.00	50.00		PASS
5	7.93	26.47	19.86	60.00	50.00		PASS
6	16.13	25.03	18.81	60.00	50.00		PASS

2.8. Radiated Emission

2.8.1. Requirement

According to FCC section 15.247(d), 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:

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.

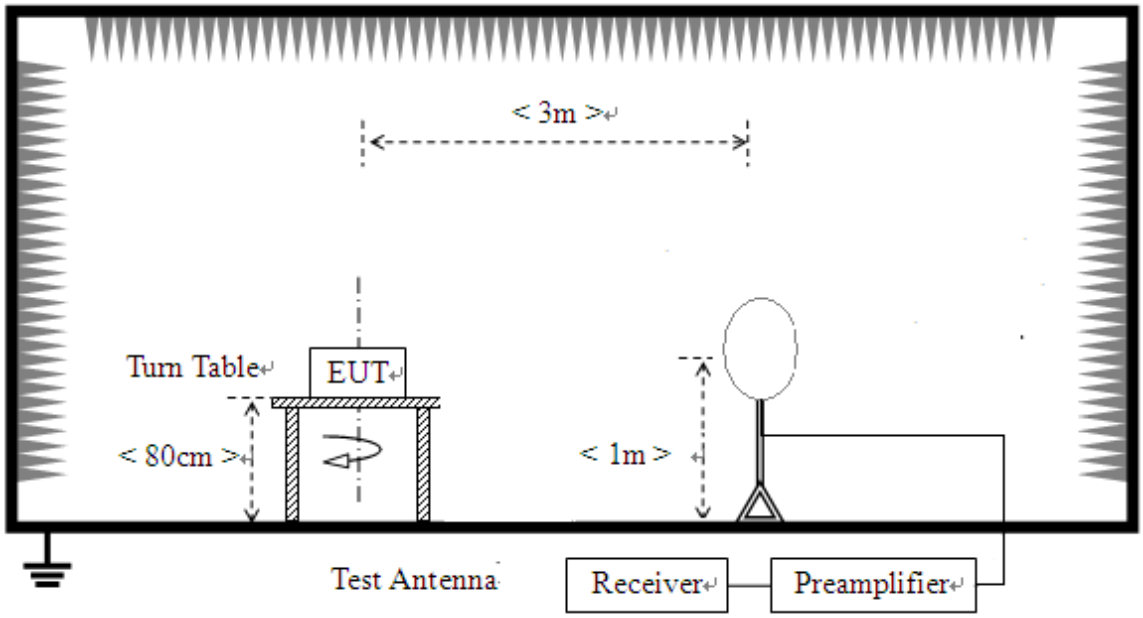
For above 1000MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK)

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)

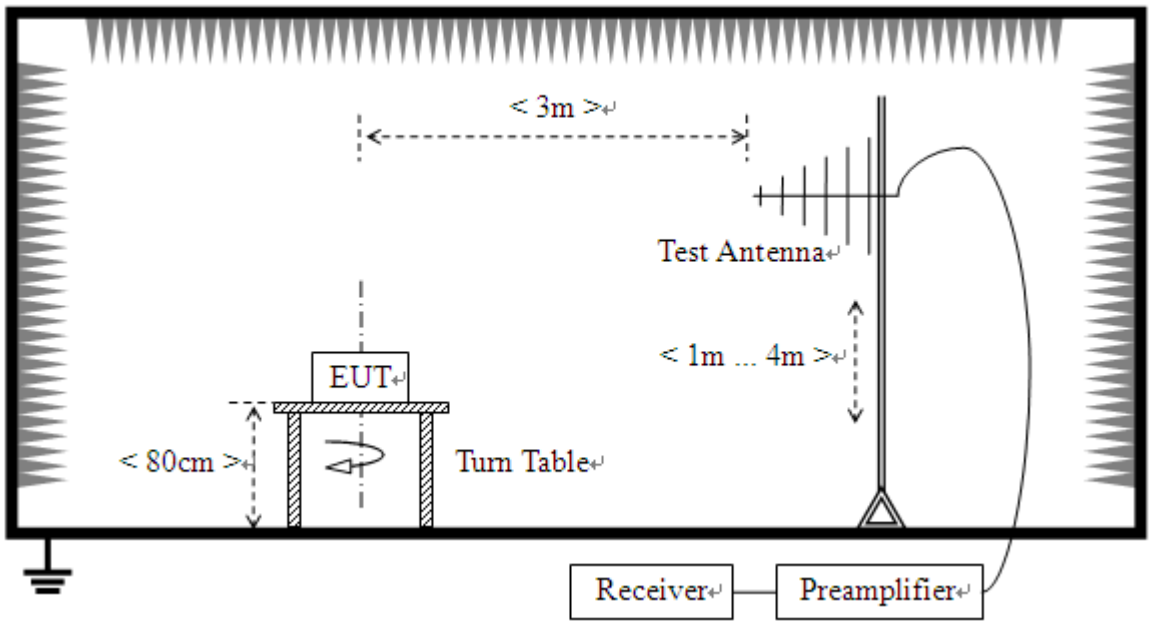
2.8.2. Test Description

A. Test Setup:

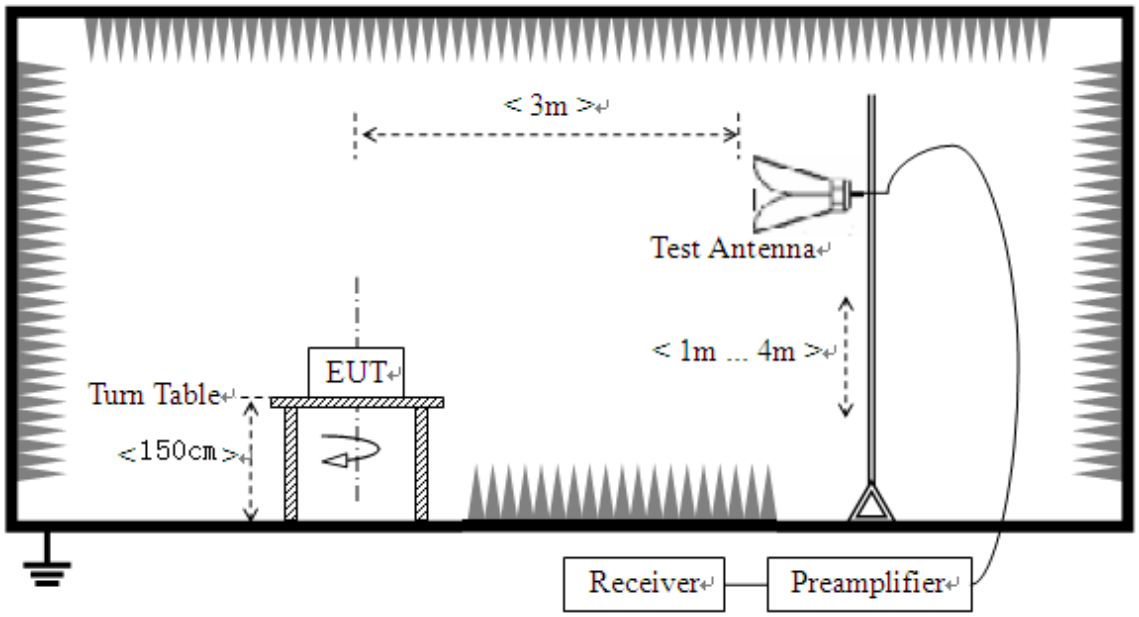
1) For radiated emissions from 9kHz to 30MHz



2) For radiated emissions from 30MHz to1GHz



3) For radiated emissions above 1GHz



The RF absorbing material used on the reference ground plane and on the turntable have a maximum height (thickness) of 30 cm (12 in) and have a minimum-rated attenuation of 20 dB at all frequencies from 1 GHz to 18 GHz. Test site have a minimum area of the ground plane covered with RF absorbing material as specified in Figure 6 of ANSI C63.4: 2014.

The test site semi-anechoic chamber has met the requirement of NSA tolerance 4dB according to the standards: ANSI C63.10 (2013). For radiated emissions below or equal to 1GHz, The EUT was set-up on insulator 80cm above the Ground Plane, For radiated emissions above 1GHz, The EUT was set-up on insulator 150cm above the Ground Plane. The set-up and test methods were according to ANSI C63.10

For the radiated emission test above 1GHz:

Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.

The EUT 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:

(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 1GHz) and Horn Test Antenna (above 1GHz) are used. Place the test antenna at 3m away from area of the EUT, while keeping the test antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The test antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final test antenna elevation shall be that which maximizes the emissions. The test antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane. The emission levels at both horizontal and vertical polarizations should be tested.

A. Equipments List:

Please reference ANNEX A(1.5).

2.8.3. Test Result

According to ANSI C63.10, 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

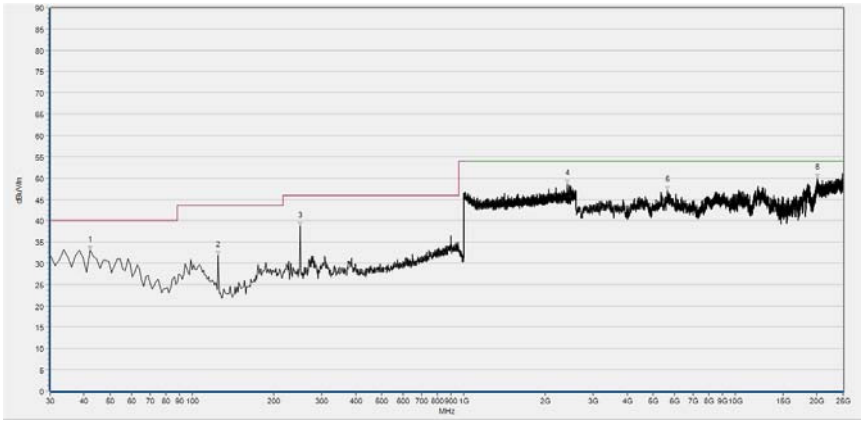
A_{Factor}: Antenna Factor at 3m

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

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.

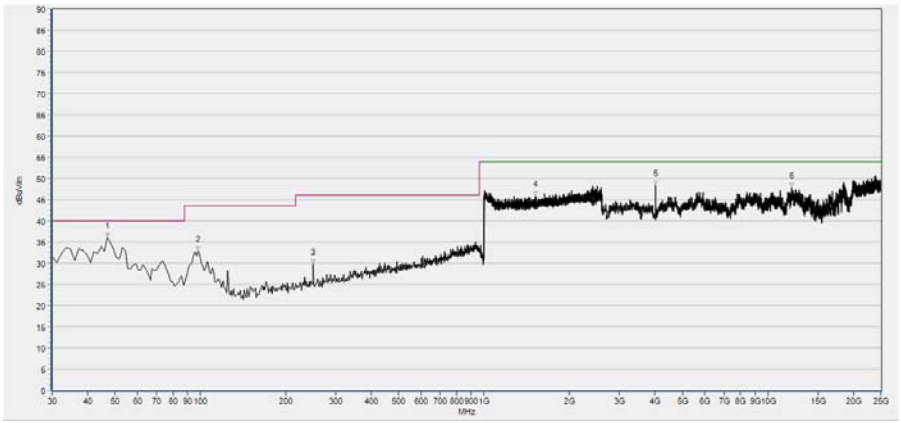
2.8.3.1 802.11b Test mode

Plots for Channel = 1



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
42.140	33.08	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
124.693	31.79	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
249.737	38.78	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2414.326	48.54	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS
5618.440	47.05	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS
20115.912	49.99	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS

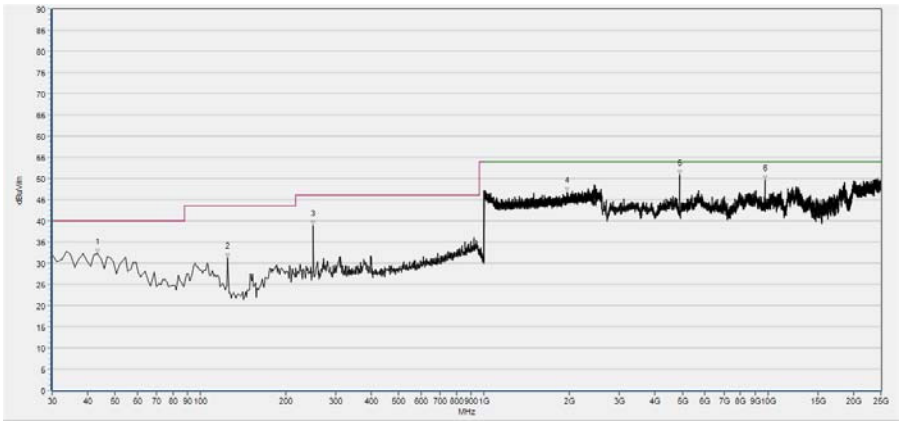
(Antenna Horizontal, 30MHz to 25GHz)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
46.996	36.06	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
97.985	32.87	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
249.737	29.87	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1509.644	45.85	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
4017.567	48.47	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
12083.033	47.94	N/A	N/A	74.0	N/A	54.0	Vertical	PASS

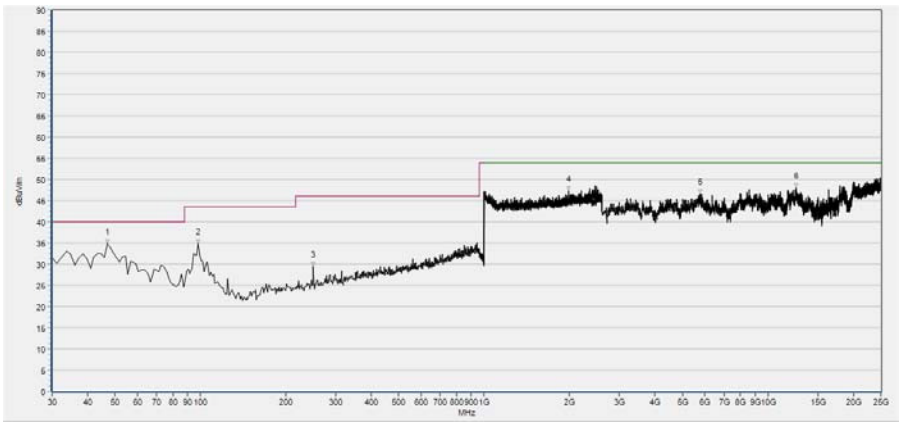
(Antenna Vertical, 30MHz to 25GHz)

Plot for Channel = 6



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
43.354	32.24	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
124.693	31.28	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
249.737	38.86	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1962.945	46.82	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS
4872.995	50.96	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS
9748.936	49.68	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS

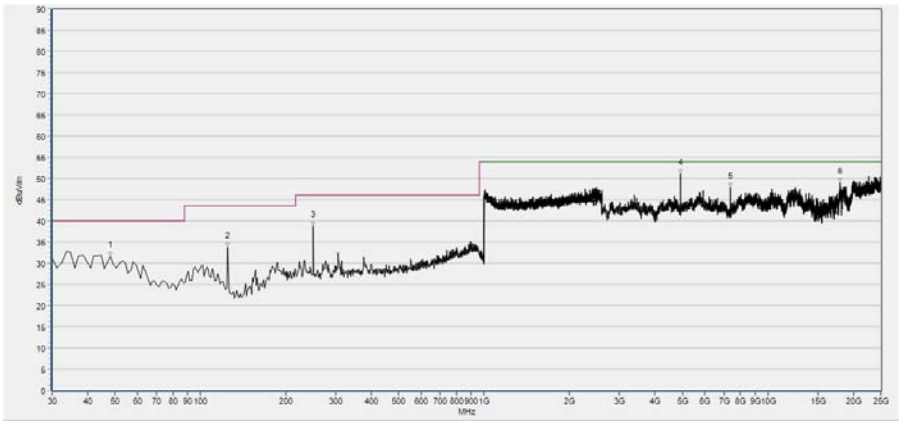
(Antenna Horizontal, 30MHz to 25GHz)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
46.996	34.77	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
97.985	34.77	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
249.737	29.54	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1979.592	47.36	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
5756.938	46.66	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
12539.262	48.00	N/A	N/A	74.0	N/A	54.0	Vertical	PASS

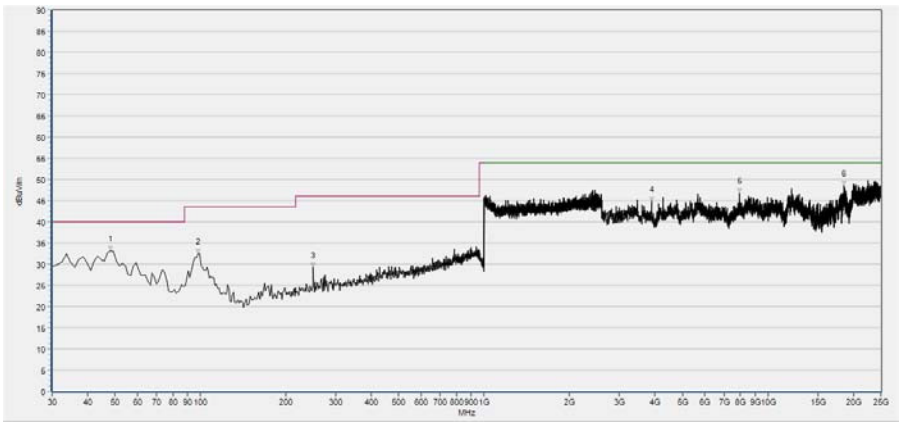
(Antenna Vertical, 30MHz to 25GHz)

Plot for Channel = 11



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
48.210	31.60	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
124.693	33.76	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
249.737	38.80	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
4923.877	51.04	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS
7386.325	46.91	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS
17981.415	48.85	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS

(Antenna Horizontal, 30MHz to 25GHz)

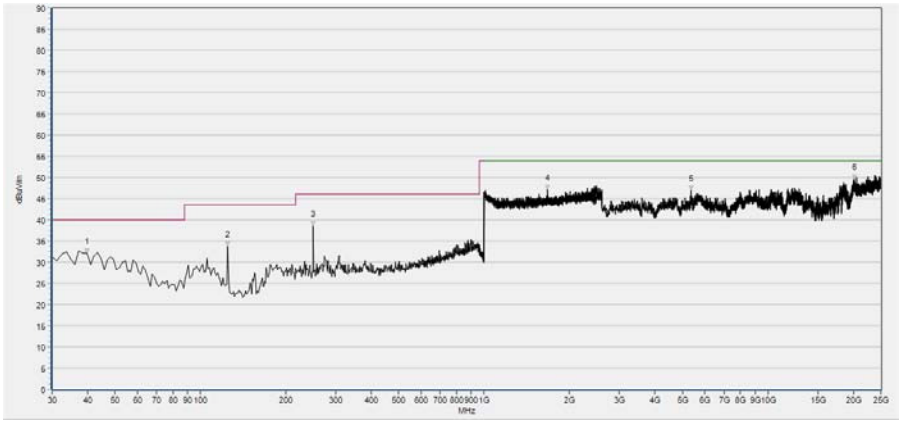


Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
48.210	33.30	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
97.985	32.44	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
249.737	29.37	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
3883.142	44.84	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
7940.316	46.76	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
18563.921	48.65	N/A	N/A	74.0	N/A	54.0	Vertical	PASS

(Antenna Vertical, 30MHz to 25GHz)

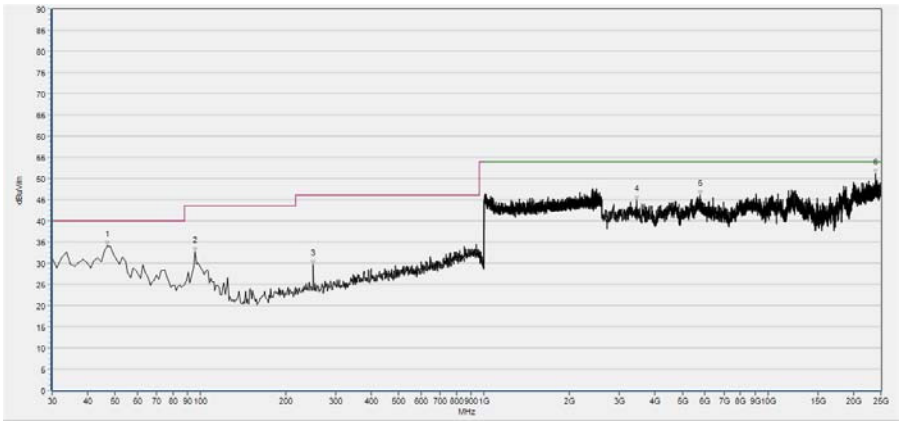
2.8.3.2 802.11g Test mode

Plots for Channel = 1



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
39.712	32.23	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
124.693	33.81	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
249.737	38.66	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1674.830	47.10	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS
5357.738	46.88	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS
20152.573	49.57	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS

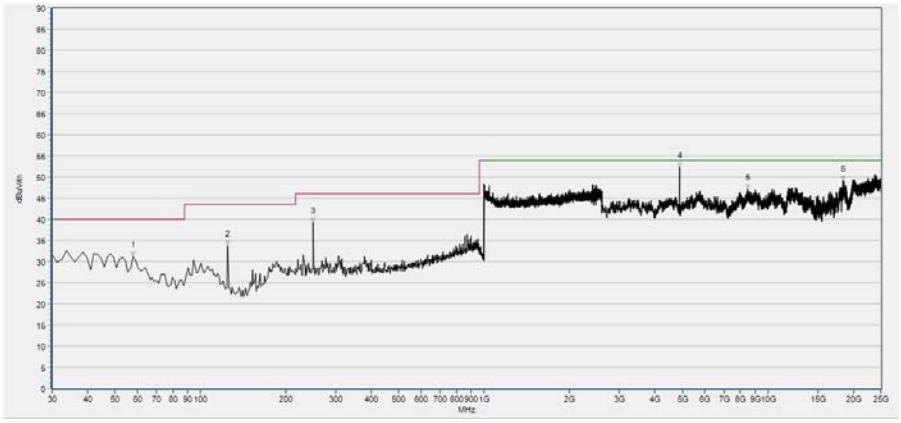
(Antenna Horizontal, 30MHz to 25GHz)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
46.996	34.07	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
95.557	32.66	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
249.737	29.72	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
3451.355	44.78	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
5752.864	46.02	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
23924.604	51.12	N/A	N/A	74.0	N/A	54.0	Vertical	PASS

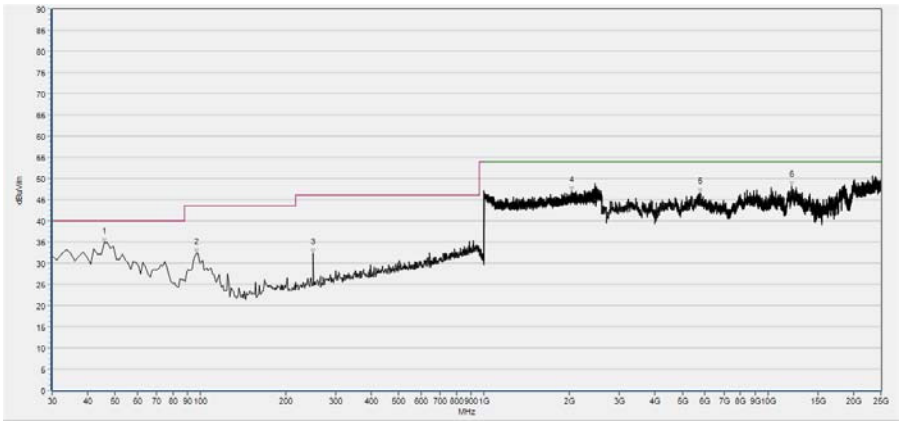
(Antenna Vertical, 30MHz to 25GHz)

Plot for Channel = 6



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
57.922	31.27	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
124.693	33.71	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
249.737	39.25	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
4872.995	52.28	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS
8486.161	47.12	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS
18356.174	49.07	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS

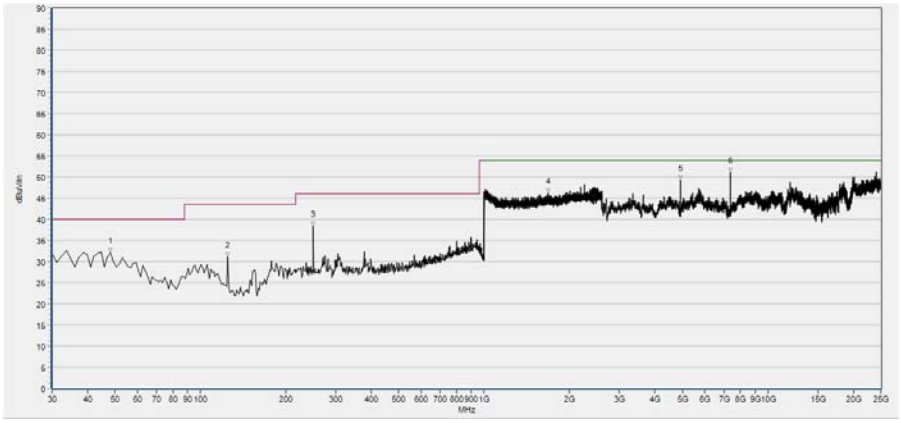
(Antenna Horizontal, 30MHz to 25GHz)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
45.782	34.86	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
96.771	32.34	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
249.737	32.24	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2037.215	46.93	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
5769.158	46.67	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
12111.548	48.21	N/A	N/A	74.0	N/A	54.0	Vertical	PASS

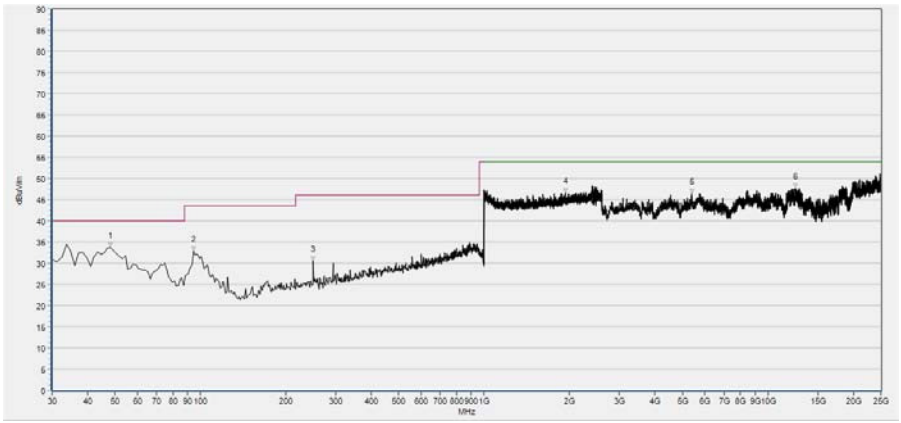
(Antenna Vertical, 30MHz to 25GHz)

Plot for Channel = 11



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
48.210	32.17	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
124.693	30.99	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
249.737	38.45	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1675.470	46.17	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS
4925.950	48.24	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS
7386.325	51.13	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS

(Antenna Horizontal, 30MHz to 25GHz)

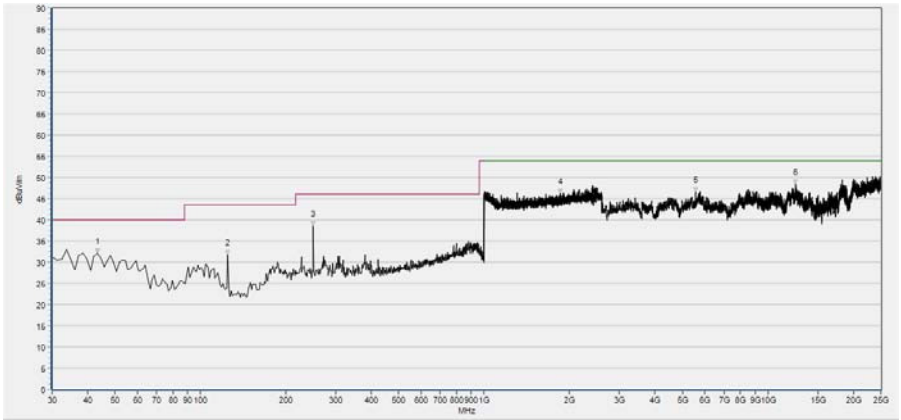


Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
48.210	33.83	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
94.343	32.93	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
249.737	30.52	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1931.573	46.60	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
5378.105	46.36	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
12527.041	47.76	N/A	N/A	74.0	N/A	54.0	Vertical	PASS

(Antenna Vertical, 30MHz to 25GHz)

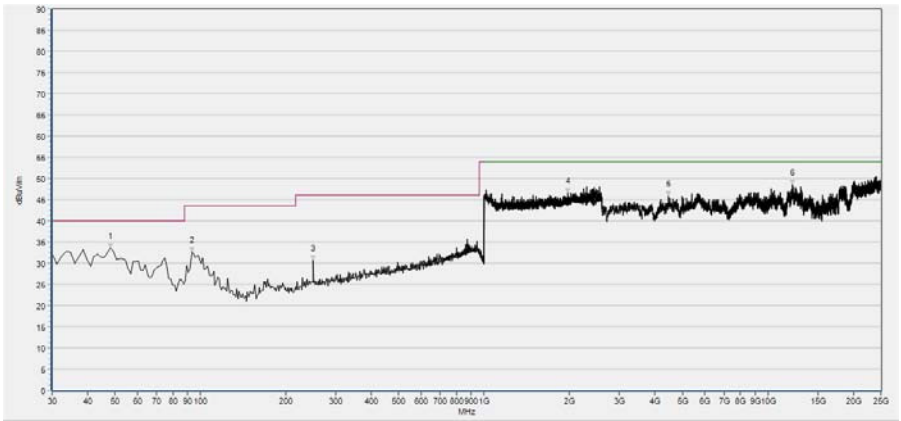
2.8.3.3 802.11n-20MHz Test mode

Plots for Channel = 1



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
43.354	32.10	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
124.693	31.77	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
249.737	38.66	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1857.943	46.32	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS
5549.191	46.64	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS
12531.115	48.43	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS

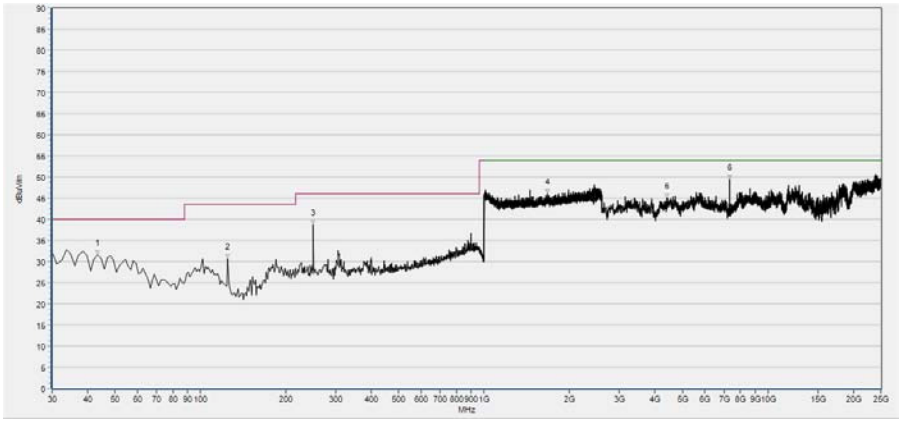
(Antenna Horizontal, 30MHz to 25GHz)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
48.210	33.61	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
93.129	32.74	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
249.737	30.78	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1966.787	46.57	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
4461.575	45.95	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
12221.531	48.53	N/A	N/A	74.0	N/A	54.0	Vertical	PASS

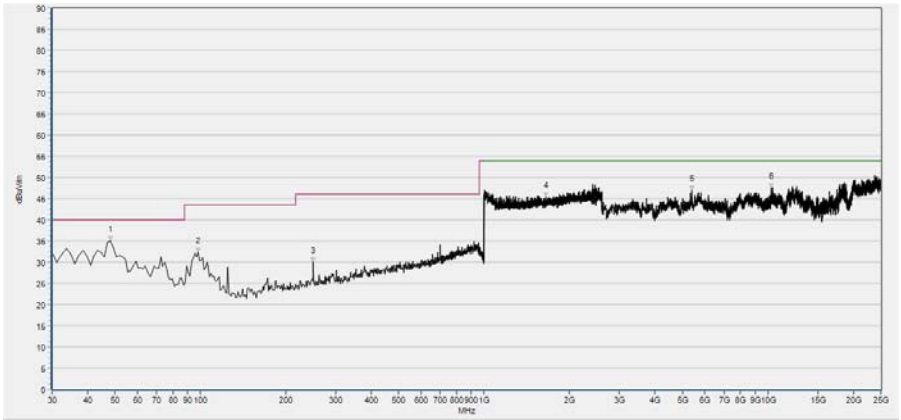
(Antenna Vertical, 30MHz to 25GHz)

Plot for Channel = 6



Fre. (MHz)	Pk (dBµV/m)	QP (dBµV/m)	AV (dBµV/m)	Limit-PK (dBµV/m)	Limit-QP (dBµV/m)	Limit-AV (dBµV/m)	Antenna	Verdict
43.354	31.57	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
124.693	30.74	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
249.737	38.70	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1674.190	46.07	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS
4400.473	44.91	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS
7313.002	49.51	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS

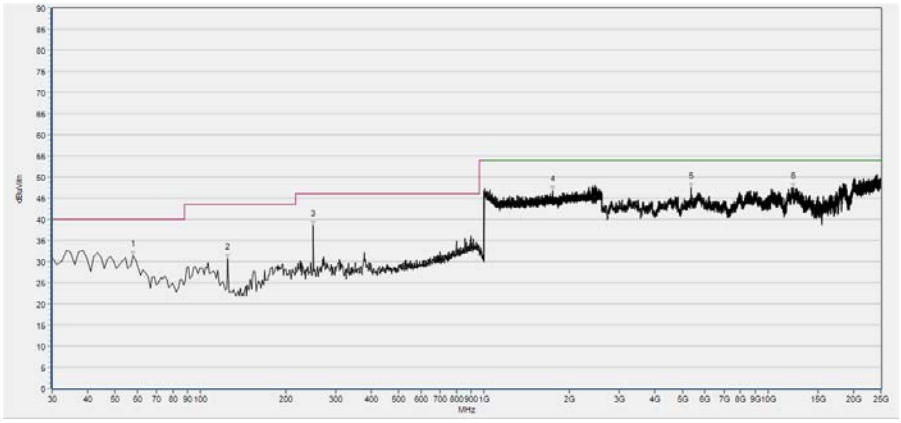
(Antenna Horizontal, 30MHz to 25GHz)



Fre. (MHz)	Pk (dBµV/m)	QP (dBµV/m)	AV (dBµV/m)	Limit-PK (dBµV/m)	Limit-QP (dBµV/m)	Limit-AV (dBµV/m)	Antenna	Verdict
48.210	34.96	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
97.985	32.39	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
249.737	29.99	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1648.579	45.39	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
5386.252	46.94	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
10290.707	47.53	N/A	N/A	74.0	N/A	54.0	Vertical	PASS

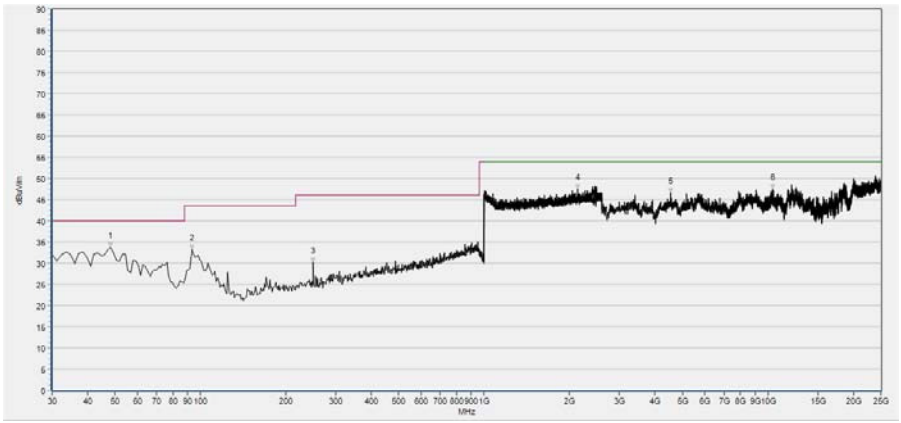
(Antenna Vertical, 30MHz to 25GHz)

Plot for Channel = 11



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
57.922	31.42	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
124.693	30.75	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
249.737	38.55	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1741.417	46.70	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS
5365.885	47.55	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS
12233.752	47.45	N/A	N/A	74.0	N/A	54.0	Horizontal	PASS

(Antenna Horizontal, 30MHz to 25GHz)



Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
48.210	33.81	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
93.129	33.23	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
249.737	30.11	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2130.692	47.51	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
4530.824	46.52	N/A	N/A	74.0	N/A	54.0	Vertical	PASS
10421.058	47.55	N/A	N/A	74.0	N/A	54.0	Vertical	PASS

(Antenna Vertical, 30MHz to 25GHz)

Annex A Test Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for test performed on the EUT as specified in CISPR 16-1-2:

Test items	Uncertainty
Peak Output Power	±2.22dB
Power spectral density (PSD)	±2.22dB
Bandwidth	±5%
Conducted Spurious Emission	±2.77 dB
Restricted Frequency Bands	±5%
Radiated Emission	±2.95dB
Conducted Emission	±2.44dB

This uncertainty represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2

Annex B Testing Laboratory Information

1. Identification of the Responsible Testing Laboratory

Company Name:	Shenzhen Morlab Communications Technology Co., Ltd.
Department:	Morlab Laboratory
Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China
Responsible Test Lab Manager:	Mr. Su Feng
Telephone:	+86 755 36698555
Facsimile:	+86 755 36698525

2. Identification of the Responsible Testing Location

Name:	Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory
Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China

3. Facilities and Accreditations

All measurement facilities used to collect the measurement data are located at FL.3, 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 C63.10-2013 and CISPR Publication 22; the FCC designation number is CN1192.

4. Test Equipments Utilized

4.1 Conducted Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
Power Splitter	NW521	1506A	Weinschel	2017.05.24	2018.05.23
Attenuator 1	(N/A.)	10dB	Resnet	2017.05.24	2018.05.23
Attenuator 2	(N/A.)	3dB	Resnet	2017.05.24	2018.05.23
EXA Signal Analzyer	MY53470836	N9010A	Agilent	2017.12.03	2018.12.02
USB Wideband Power Sensor	MY54210011	U2021XA	Agilent	2017.05.24	2018.05.23
RF cable (30MHz-26GHz)	CB01	RF01	Morlab	N/A	N/A
Coaxial cable	CB02	RF02	Morlab	N/A	N/A
SMA connector	CN01	RF03	HUBER-SUHNER	N/A	N/A

4.2 Conducted Emission Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
Receiver	MY56400093	N9038A	KEYSIGHT	2017.07.13	2018.07.12
LISN	812744	NSLK 8127	Schwarzbeck	2017.05.17	2018.05.16
Pulse Limiter (20dB)	9391	VTSD 9561-D	Schwarzbeck	2017.05.17	2018.05.16
Coaxial cable(BNC) (30MHz-26GHz)	CB01	EMC01	Morlab	N/A	N/A

4.3Auxiliary Test Equipment

Equipment Name	Model No.	Brand Name	Manufacturer	Cal.Date	Cal.Due Date
Computer	T430i	Think Pad	Lenovo	N/A	N/A

4.4 Radiated Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal.Due Date
Receiver	MY54130016	N9038A	Agilent	2017.05.17	2018.05.16
Test Antenna - Bi-Log	9163-519	VULB 9163	Schwarzbeck	2017.05.14	2018.05.13
Test Antenna - Horn	9170C-531	BBHA9170	Schwarzbeck	2017.09.13	2018.09.12
Test Antenna - Loop	1519-022	FMZB1519	Schwarzbeck	2018.03.03	2019.03.02
Test Antenna - Horn	01774	BBHA 9120D	Schwarzbeck	2017.09.13	2018.09.12
Coaxial cable (N male) (9KHz-30MHz)	CB04	EMC04	Morlab	N/A	N/A
Coaxial cable (N male) (30MHz-26GHz)	CB02	EMC02	Morlab	N/A	N/A
Coaxial cable(N male) (30MHz-26GHz)	CB03	EMC03	Morlab	N/A	N/A
1-18GHz pre-Amplifier	MA02	TS-PR18	Rohde& Schwarz	2017.05.17	2018.05.16
18-26.5GHz pre-Amplifier	MA03	TS-PR18	Rohde& Schwarz	2017.05.17	2018.05.16
Anechoic Chamber	N/A	9m*6m*6m	CRT	2017.11.19	2020.11.18

END OF REPORT