TEST REPORT

APPLICANT	:	Anker Innovations Limited
PRODUCT NAME	:	Nebula Prizm II Pro
MODEL NAME	:	D2241
BRAND NAME	:	Nebula
FCC ID	:	2AOKB-D2241
STANDARD(S)	:	47 CFR Part 15 Subpart C
RECEIPT DATE	:	2018-11-08
TEST DATE	:	2018-12-11 to 2018-12-26
ISSUE DATE	:	2018-12-26

Edited by: Zeng Xiaoying (Rapporteur)

Approved by: Peng Huarui (Supervisor)

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Change History		
Version	**Date**	**Reason for change**
1.0	2018-12-26	First edition

1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	Anker Innovations Limited
Applicant Address:	Room 1318-19,Hollywood Plaza,610 Nathan Road, Mongkok, Kowloon, Hong Kong
Manufacturer:	Anker Innovations Limited
Manufacturer Address:	Room 1318-19,Hollywood Plaza,610 Nathan Road, Mongkok, Kowloon, Hong Kong

1.2. Equipment Under Test (EUT) Description

Product Name:	Nebula Prizm II Pro	
Serial No:	(N/A, marked #1 by test site)	
Hardware Version:	A231C	
Software Version:	1.23	
Modulation Type:	DSSS, OFDM	
Operating Frequency Range:	802.11b/g/ n(HT20): 2.412GHz - 2.462GHz	
Channel Number:	802.11b/g/ n(HT20): 11	
Antenna Type:	FPC Antenna	
Antenna Gain:	2.84 dBi	
Accessory Information:	AC Adapter	
	Brand Name:	N/A
	Model No.:	NSA120EC-19063200
	Serial No.:	(N/A, marked #1 by test site)
	Rated Input:	100-240V ～ 50/60Hz 2A
	Rated Output:	19V⎓6.32A

Note1: 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(HT20) (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	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	N/A	Duty Cycle Of Test Signal	Dec 11, 2018	Wang Meng	PASS
3	15.247(b)	Peak Output Power	Dec 11, 2018	Wang Meng	PASS
4	15.247(a)	Bandwidth	Dec 11, 2018	Wang Meng	PASS
5	15.247(d)	Conducted Spurious Emission and Band Edge	Dec 11, 2018	Wang Meng	PASS
6	15.247(e)	Power spectral density (PSD)	Dec 11, 2018	Wang Meng	PASS
7	15.207	Conducted Emission	Dec 24, 2018	Ya Xinhou	PASS
8	15.247(d)	Restricted Frequency Bands	Dec 22, 2018	Ya Xinhou	PASS
9	15.209, 15.247(d)	Radiated Emission	Dec 26, 2018	Ya Xinhou	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 v05.
Note2: The path loss during the RF test is calibrated to correct the results by the offset setting in the test equipments. The ref offset 11dB contains two parts that cable loss 1dB and Attenuator 10dB.

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.

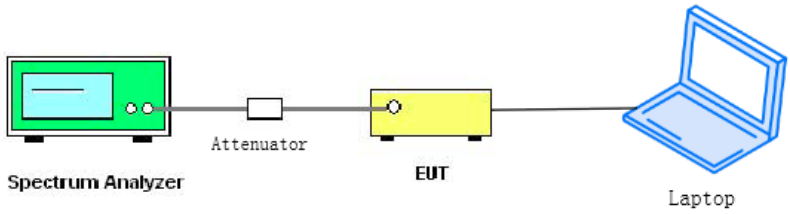
2.2. Duty Cycle Of Test Signal

2.2.1. Requirement

Preferably, all measurements of maximum conducted (average) output power will be performed with the EUT transmitting continuously (i.e., with a duty cycle of greater than or equal to 98%). When continuous operation cannot be realized, then the use of sweep triggering/signal gating techniques can be used to ensure that measurements are made only during transmissions at the maximum power control level. Such sweep triggering/signal gating techniques will require knowledge of the minimum transmission duration (T) over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation. Sweep triggering/signal gating techniques can then be used if the measurement/sweep time of the analyzer can be set such that it does not exceed T at any time that data are being acquired (i.e., no transmitter OFF-time is to be considered).
When continuous transmission cannot be achieved and sweep triggering/signal gating cannot be implemented, alternative procedures are provided that can be used to measure the average power; however, they will require an additional measurement of the transmitter duty cycle (D). Within this subclause, the duty cycle refers to the fraction of time over which the transmitter is ON and is transmitting at its maximum power control level. The duty cycle is considered to be constant if variations are less than ±2%; otherwise, the duty cycle is considered to be nonconstant.

2.2.2. Test Description

A. Test Set:



ANSI C63.10 2013 Clause 11.6 was used in order to prove compliance.

B. Equipments List:

Please refer ANNEX B(4).

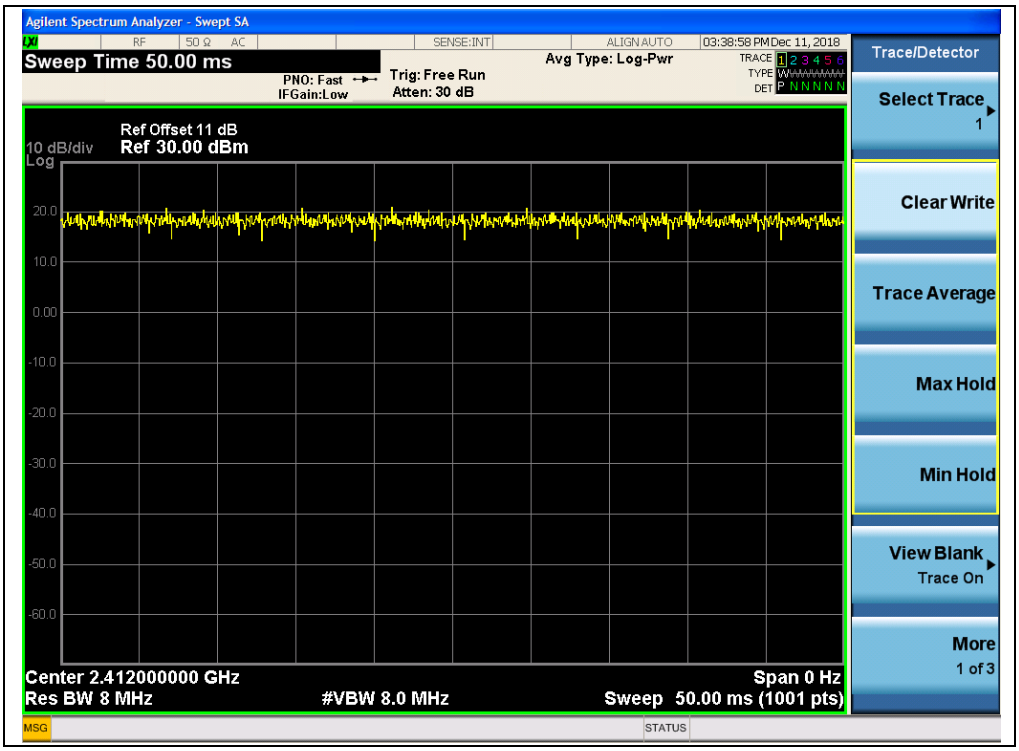
2.2.3. Test Result

A. Test Verdict:

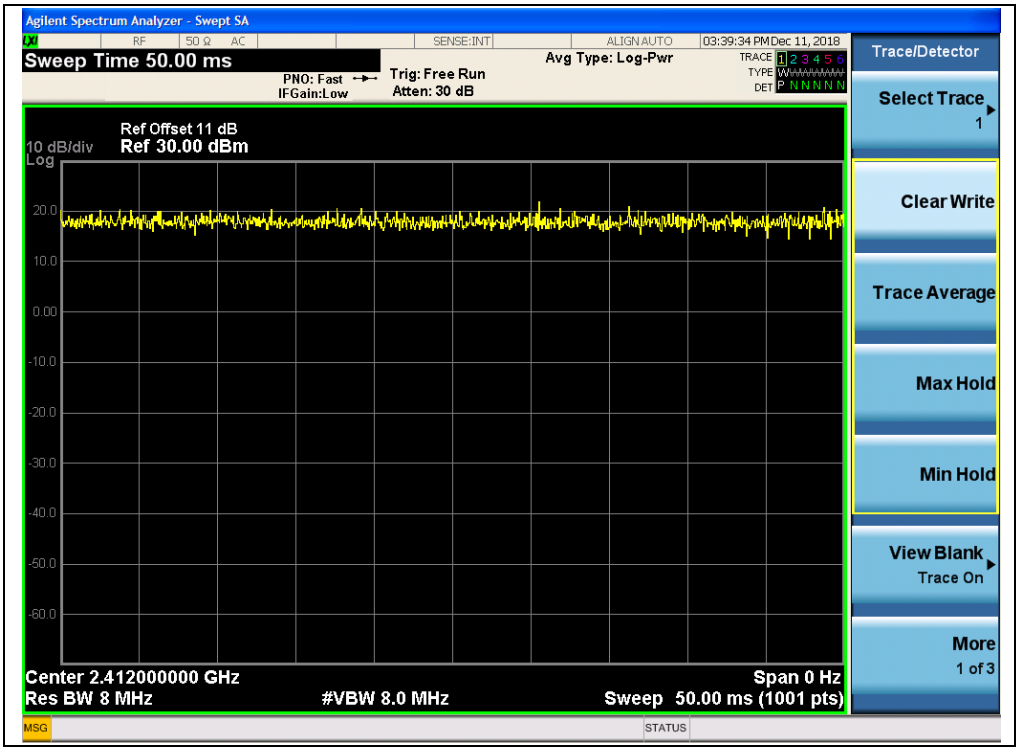
Test Mode	Duty Cycle (%) (D)	Duty Factor (10*lg[1/D])
802.11b	100.00	0.00
802.11g	100.00	0.00
802.11n(HT20)	100.00	0.00

B. Test Plots

(Channel 1, 2412MHz, 802.11b)



(Channel 1, 2412MHz, 802.11g)



(Channel 1, 2412MHz, 802.11 n(HT20))

2.3. Peak Output Power

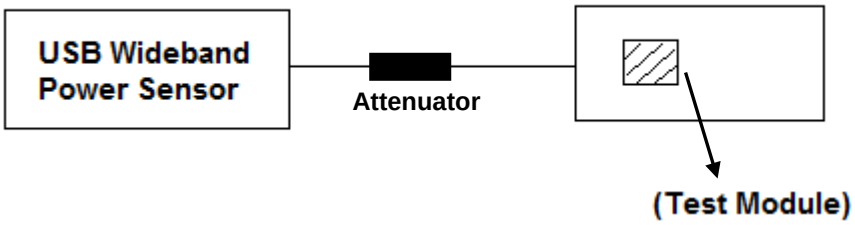
2.3.1. Requirement

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.

2.3.2. 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 refer ANNEX B(4).

2.3.3. Test Result

2.3.3.1 802.11b Test Mode

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
1	2412	16.40	0.044	30	1	PASS
6	2437	16.45	0.044			PASS
11	2462	16.63	0.046			PASS

Channel	Frequency (MHz)	Measured Output Average Power		Limit		Verdict
		dBm	W	dBm	W	
1	2412	13.32	0.021	30	1	PASS
6	2437	13.40	0.022			PASS
11	2462	13.62	0.023			PASS

2.3.3.2 802.11g Test mode

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
1	2412	22.81	0.191	30	1	PASS
6	2437	22.95	0.197			PASS
11	2462	23.11	0.205			PASS

Channel	Frequency (MHz)	Measured Output Average Power		Limit		Verdict
		dBm	W	dBm	W	
1	2412	12.54	0.018	30	1	PASS
6	2437	12.60	0.018			PASS
11	2462	12.88	0.019			PASS

2.3.3.3 802.11n(HT20) Test mode

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
1	2412	22.64	0.184	30	1	PASS
6	2437	22.88	0.194			PASS
11	2462	23.57	0.228			PASS

Channel	Frequency (MHz)	Measured Output Average Power		Limit		Verdict
		dBm	W	dBm	W	
1	2412	12.20	0.017	30	1	PASS
6	2437	12.30	0.017			PASS
11	2462	12.37	0.017			PASS

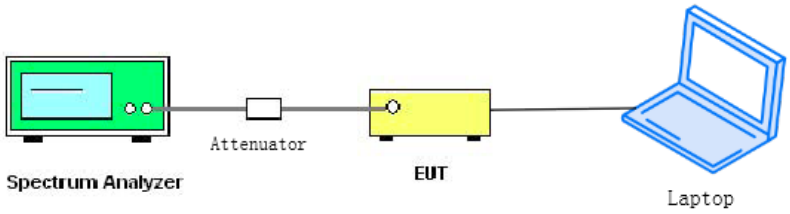
2.4. Bandwidth

2.4.1. 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.

2.4.2. 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 8.1 Option 1 was used in order to prove compliance.

B. Equipments List:

Please refer ANNEX B(4).

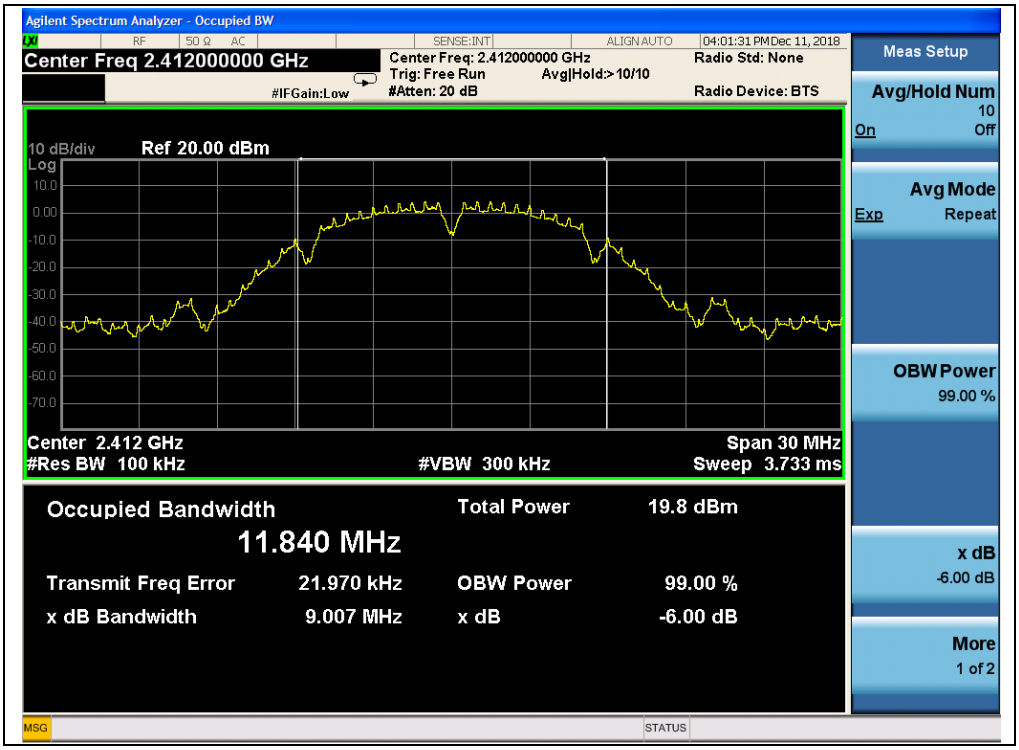
2.4.3. Test Result

2.4.3.1 802.11b Test mode

A. Test Verdict:

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limits(kHz)	Result
1	2412	9.007	≥500	PASS
6	2437	9.013	≥500	PASS
11	2462	8.548	≥500	PASS

B. Test Plots



(Channel 1, 2412MHz, 802.11b)

(Channel 6, 2437 MHz, 802.11b)

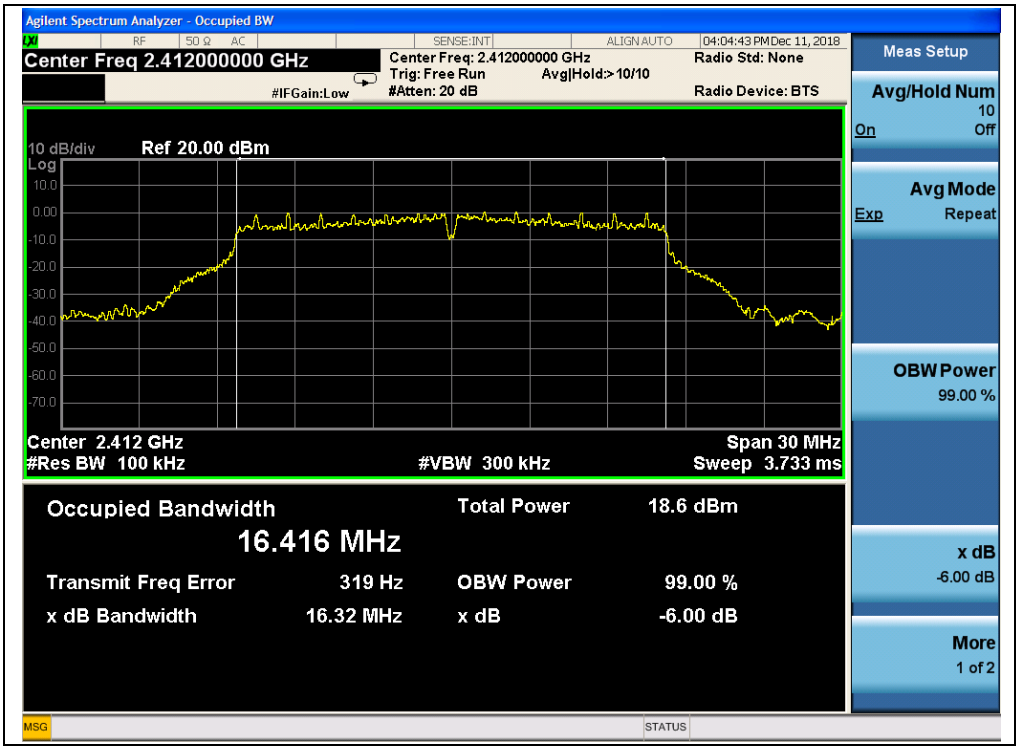
(Channel 11, 2462MHz, 802.11b)

2.4.3.2 802.11g Test mode

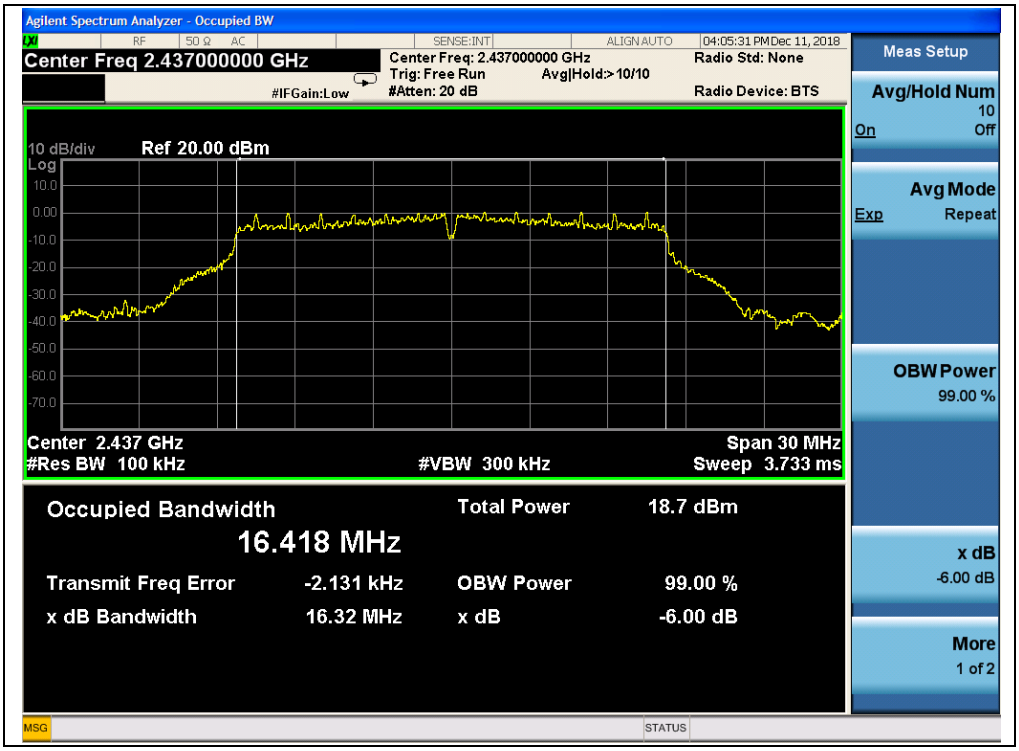
A. Test Verdict:

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limits (kHz)	Result
1	2412	16.32	≥500	PASS
6	2437	16.32	≥500	PASS
11	2462	16.27	≥500	PASS

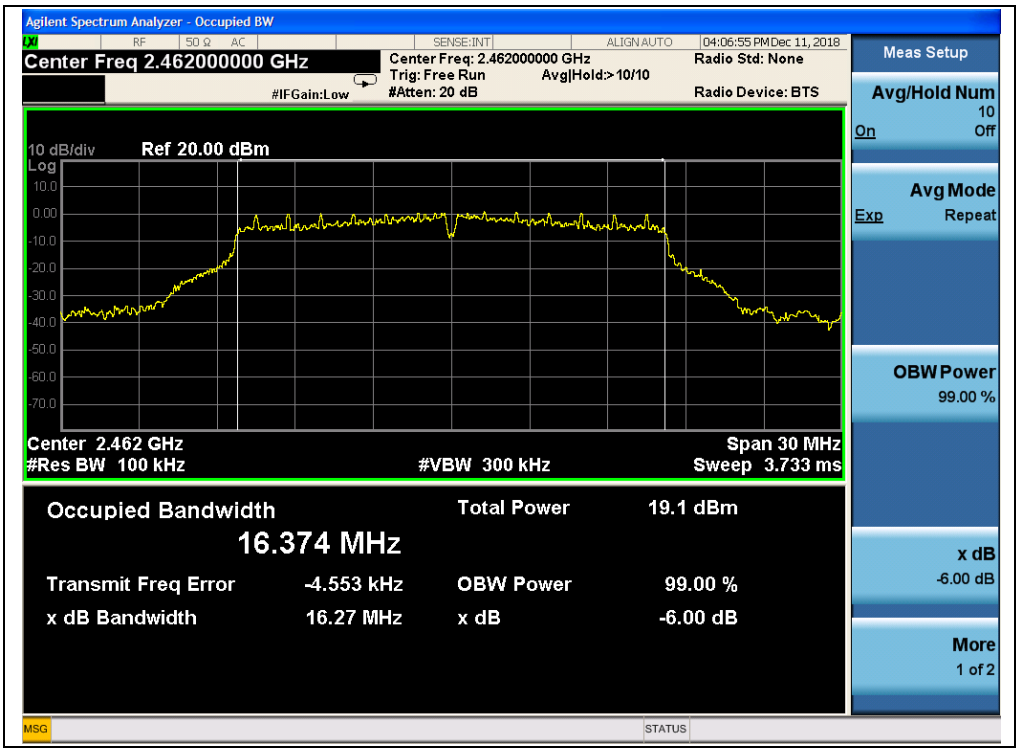
B. Test Plots:



(Channel 1, 2412MHz, 802.11g)



(Channel 6, 2437MHz, 802.11g)



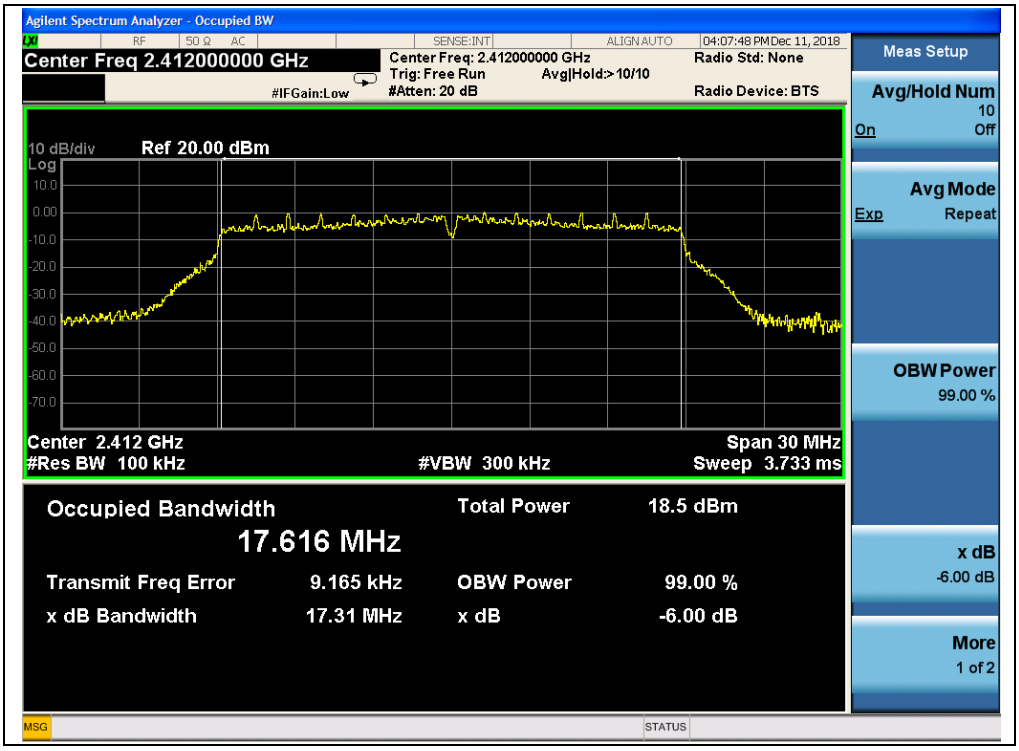
(Channel 11, 2462MHz, 802.11g)

2.4.3.3 802.11n(HT20) Test mode

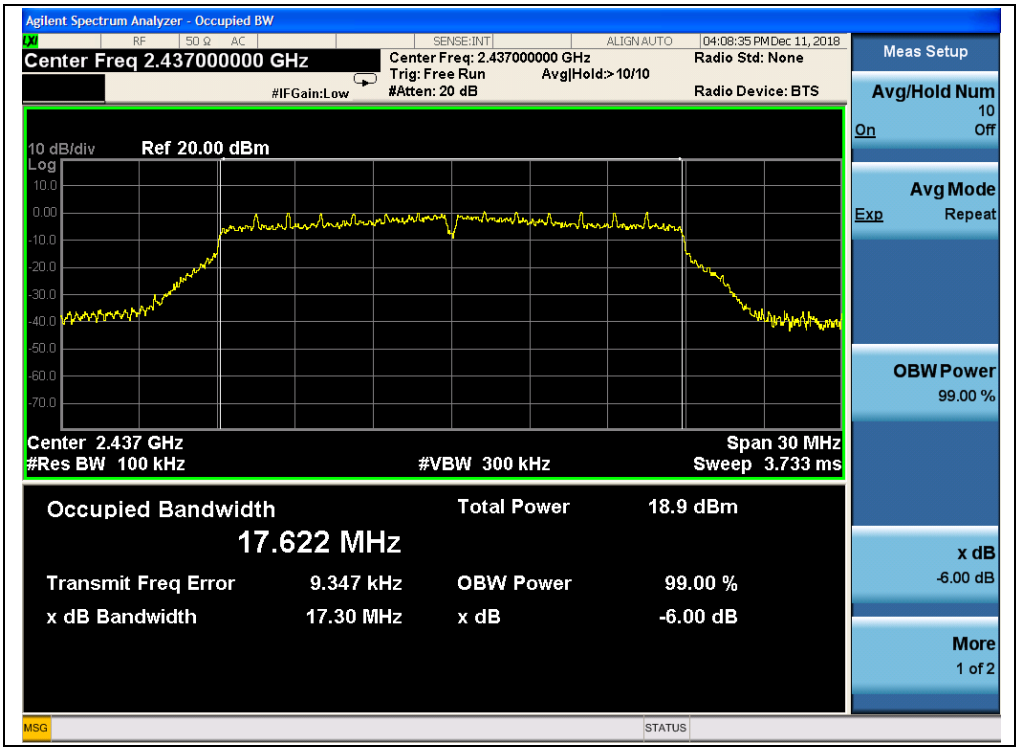
A. Test Verdict:

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limits (kHz)	Result
1	2412	17.31	≥500	PASS
6	2437	17.30	≥500	PASS
11	2462	17.00	≥500	PASS

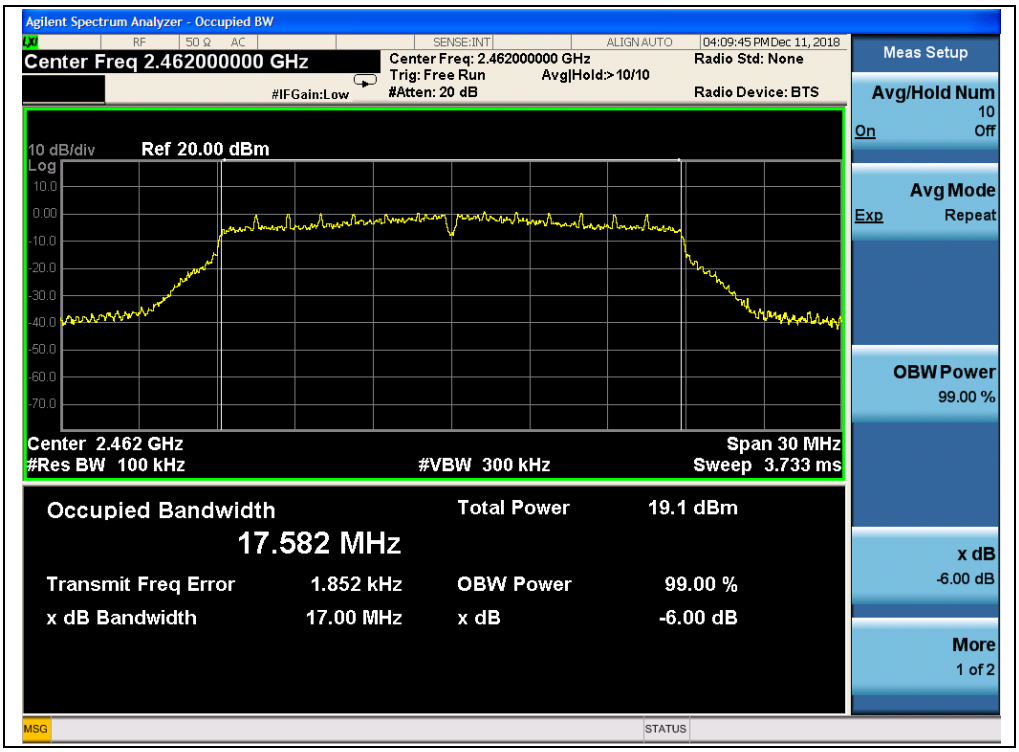
B. Test Plots:



(Channel 1, 2412MHz, 802.11n(HT20))



(Channel 6, 2437MHz, 802.11n(HT20))



(Channel 11, 2462MHz, 802.11n(HT20))

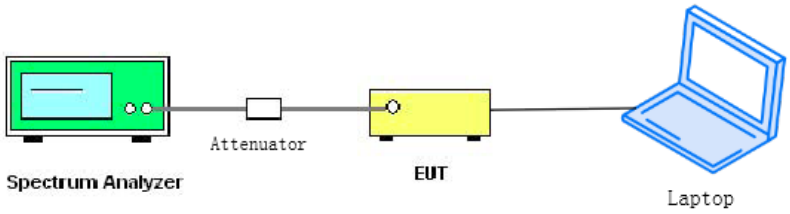
2.5. Conducted Spurious Emissions and Band Edge

2.5.1. Requirement

According to FCC section 15.247(c), in any 100kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

2.5.2. 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 refer ANNEX B(4).

2.5.3. Test Result

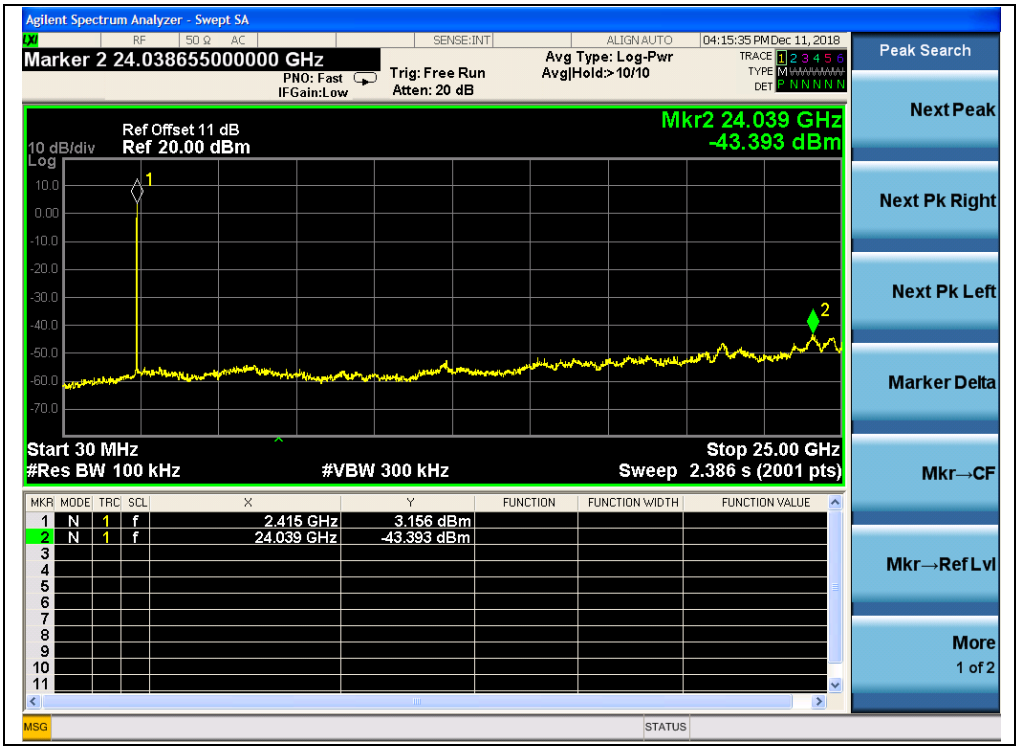
2.5.3.1 802.11b Test mode

A. Test Verdict:

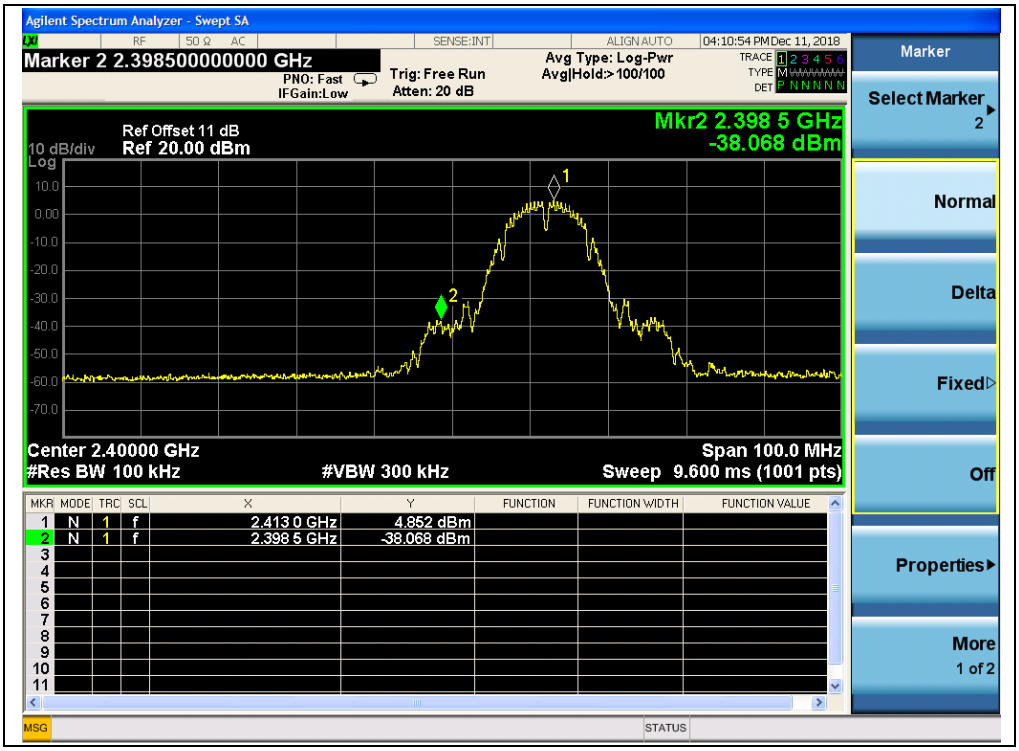
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
1	2412	-43.39	3.16	-16.84	PASS
6	2437	-43.24	4.12	-15.88	PASS
11	2462	-44.04	4.77	-15.23	PASS

B. Test Plots:

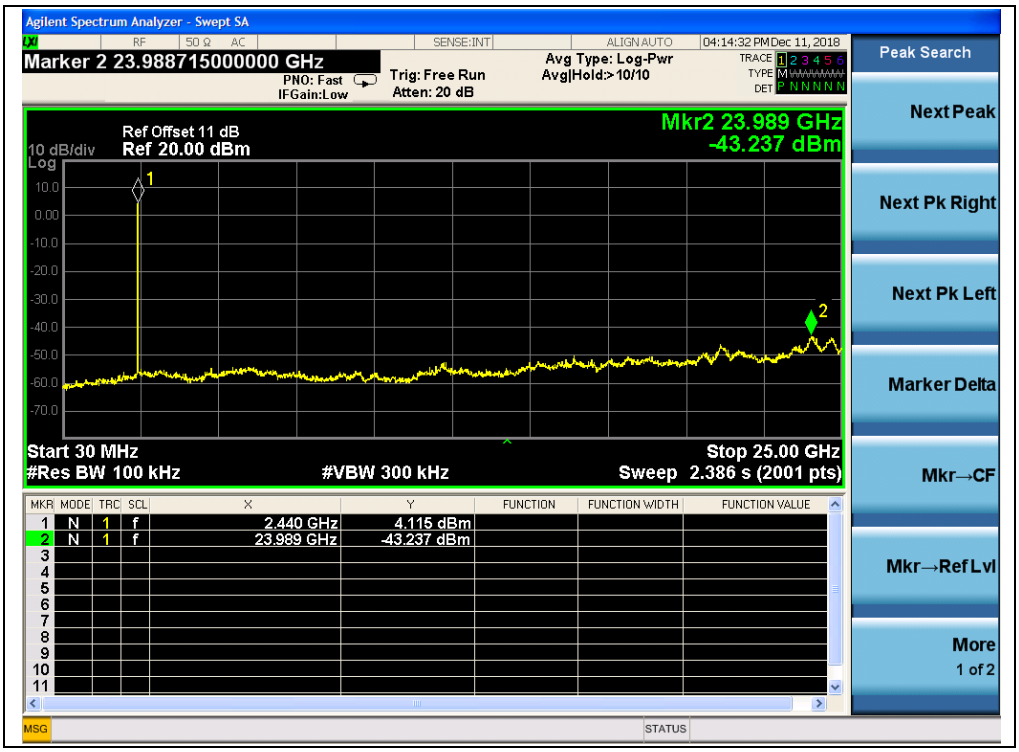
Note: The power of the Module transmitting frequency should be ignored.



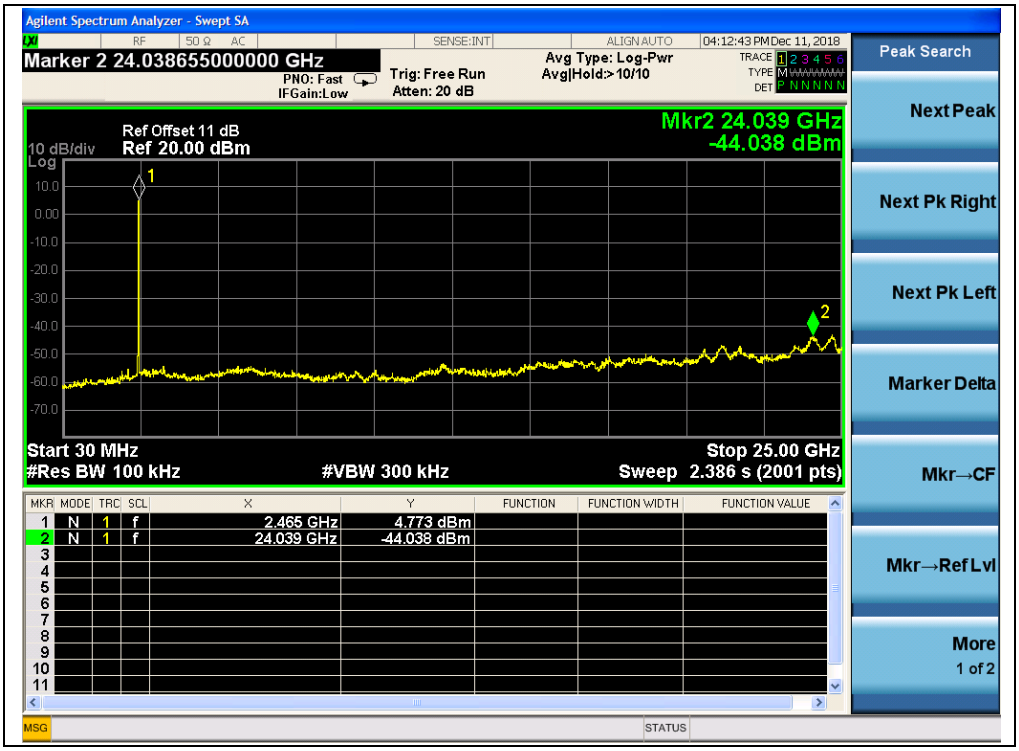
(Channel = 1, 30MHz to 25GHz)



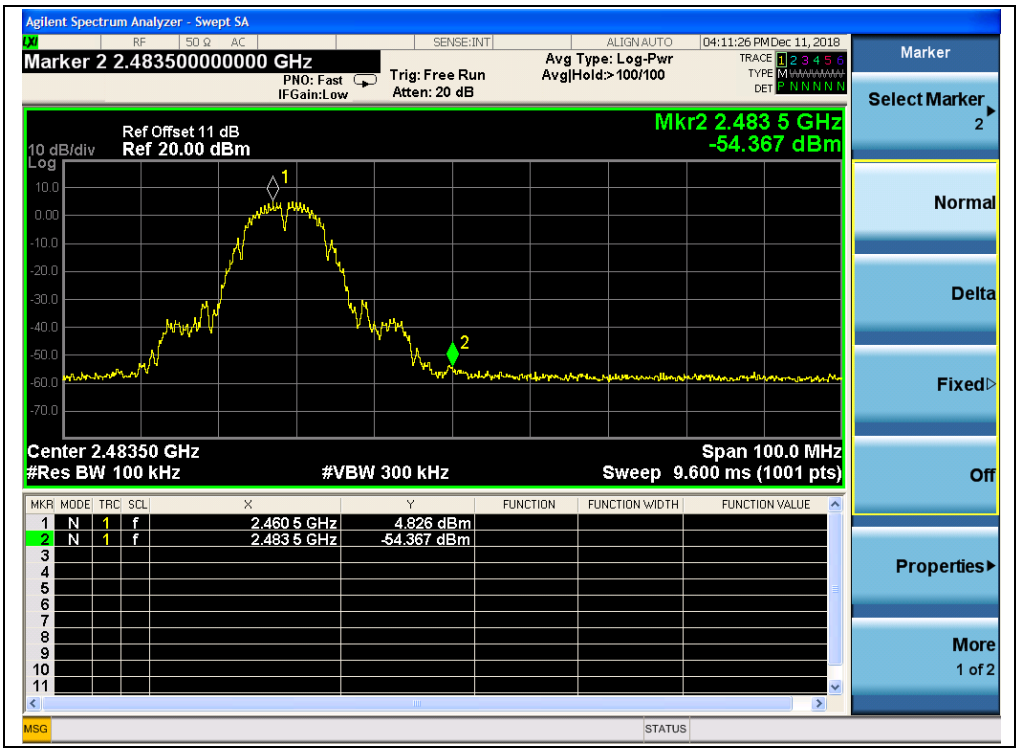
(Band Edge, Channel = 1)



(Channel = 6, 30MHz to 25GHz)



(Channel = 11, 30MHz to 25GHz)



(Band Edge, Channel = 11)

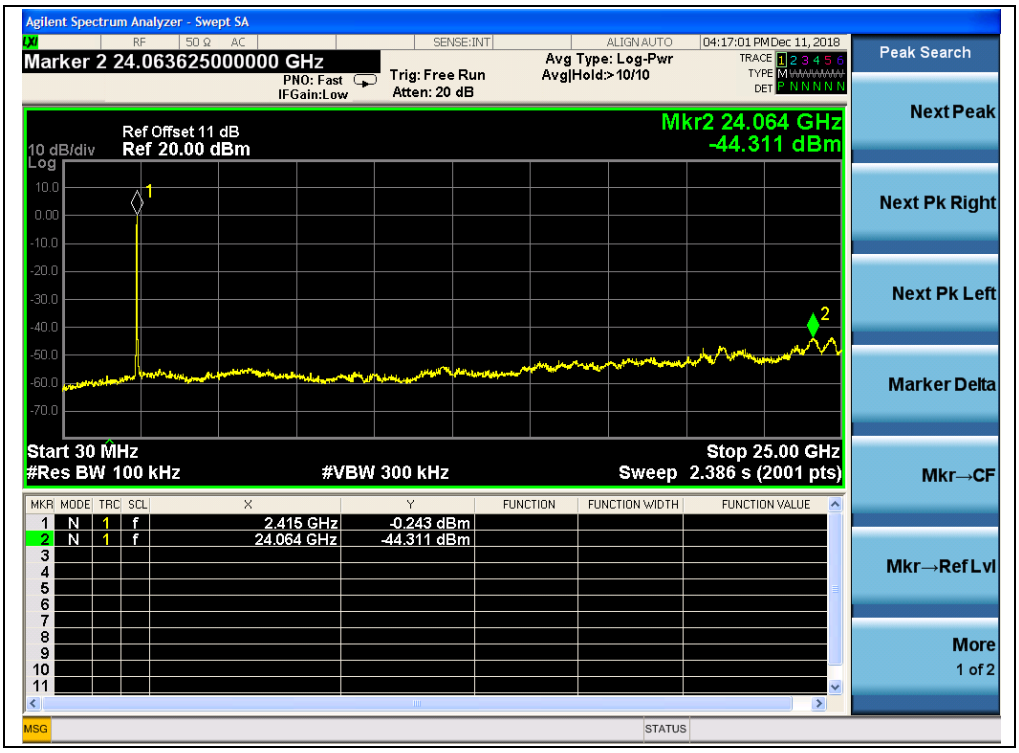
2.5.3.2 802.11g Test mode

A. Test Verdict:

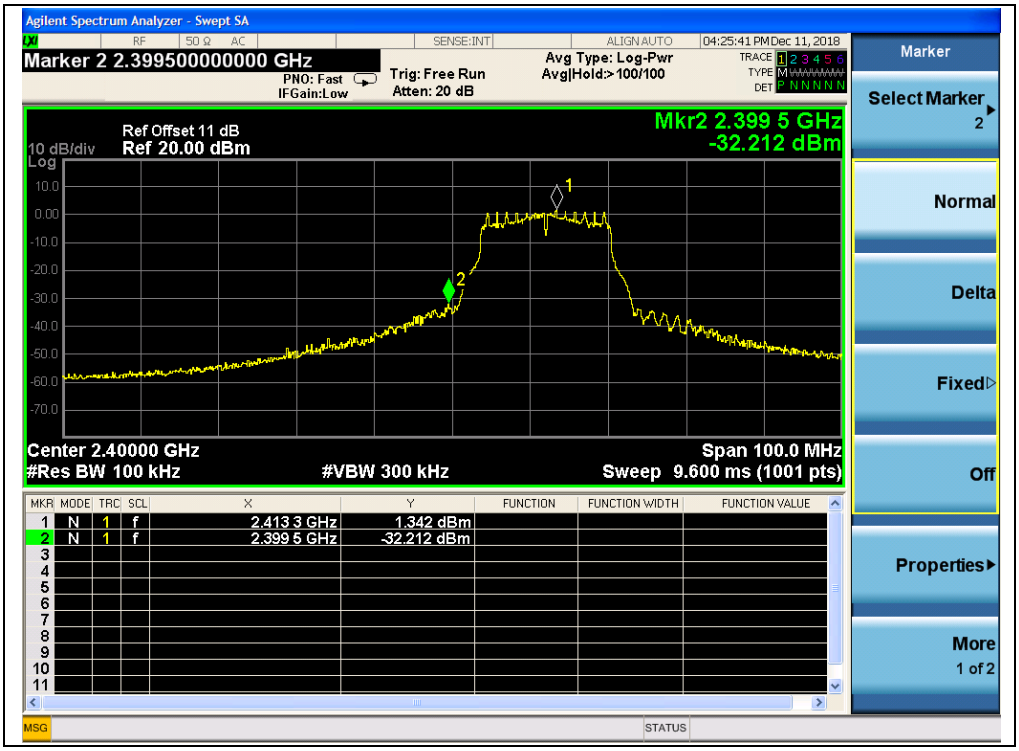
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
1	2412	-44.31	-0.24	-20.24	PASS
6	2437	-42.61	-0.11	-20.11	PASS
11	2462	-42.78	0.70	-19.30	PASS

B. Test Plots:

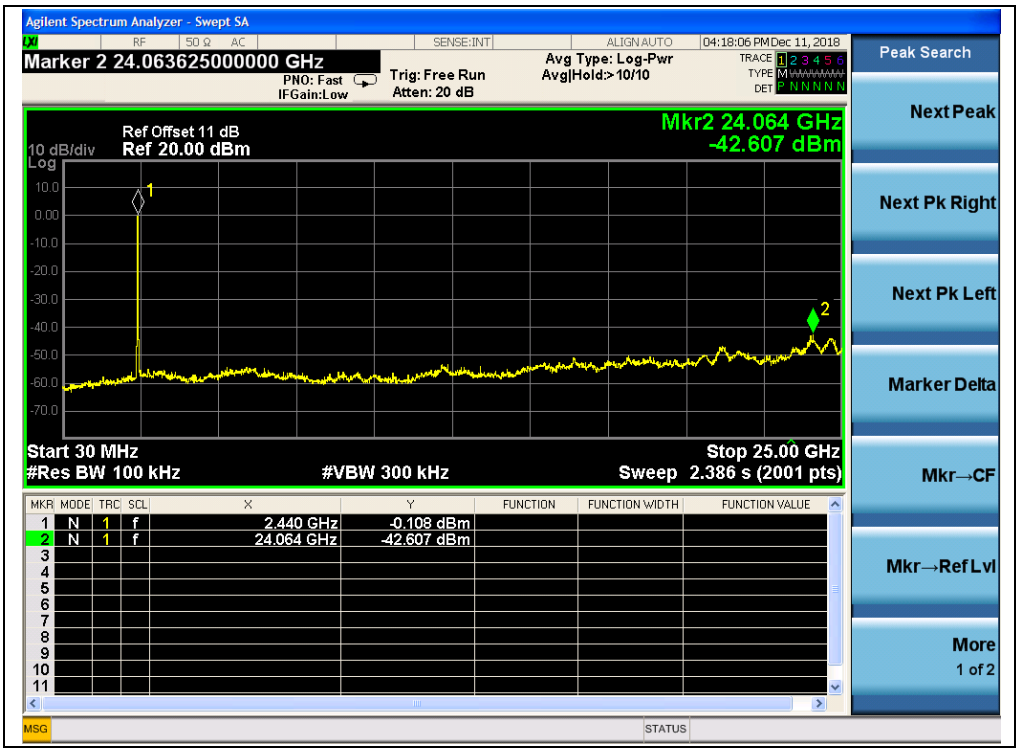
Note: The power of the Module transmitting frequency should be ignored.



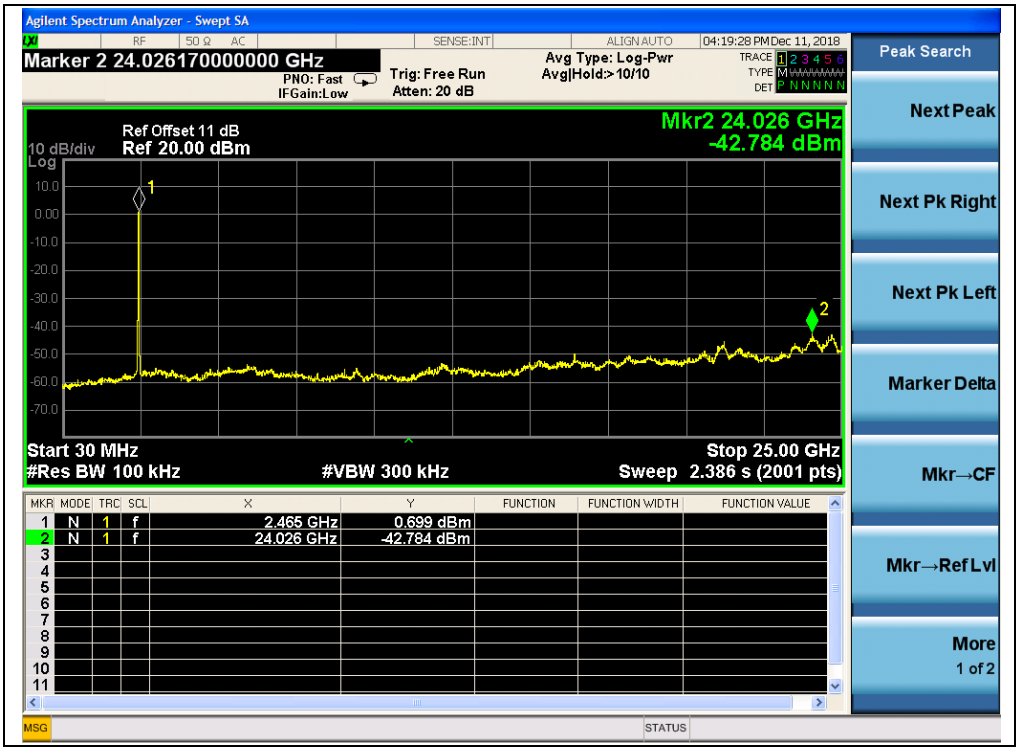
(Channel = 1, 30MHz to 25GHz)



(Band Edge, Channel = 1)



(Channel = 6, 30MHz to 25GHz)



(Channel = 11, 30MHz to 25GHz)

(Band Edge, Channel = 11)

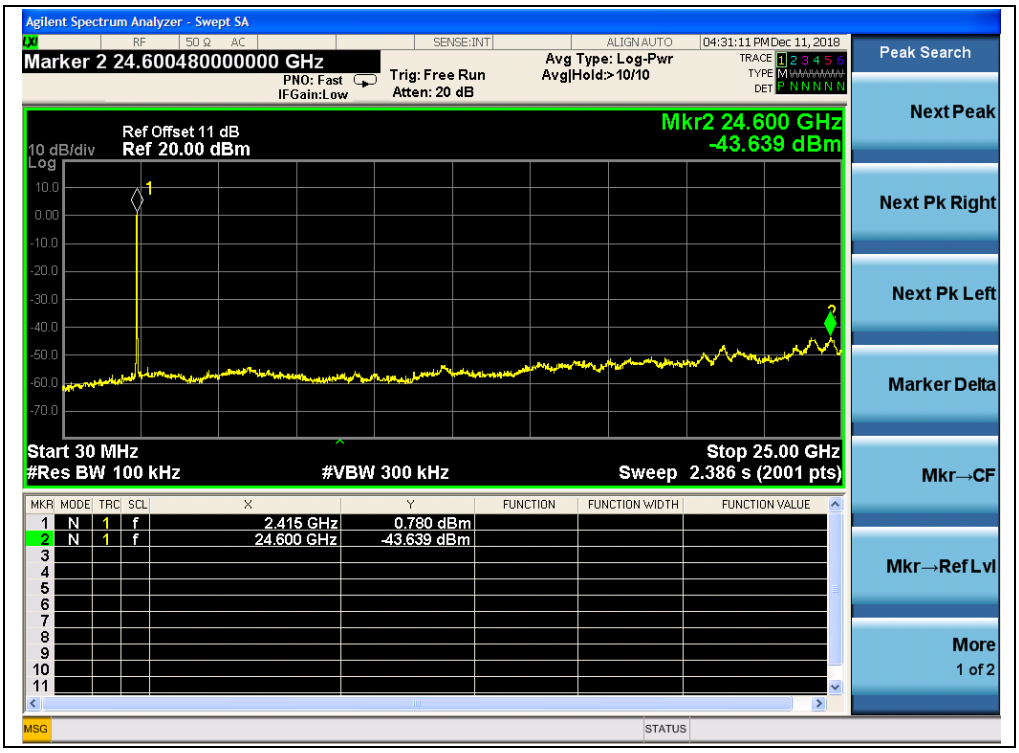
2.5.3.3 802.11n(HT20) Test mode

A. Test Verdict:

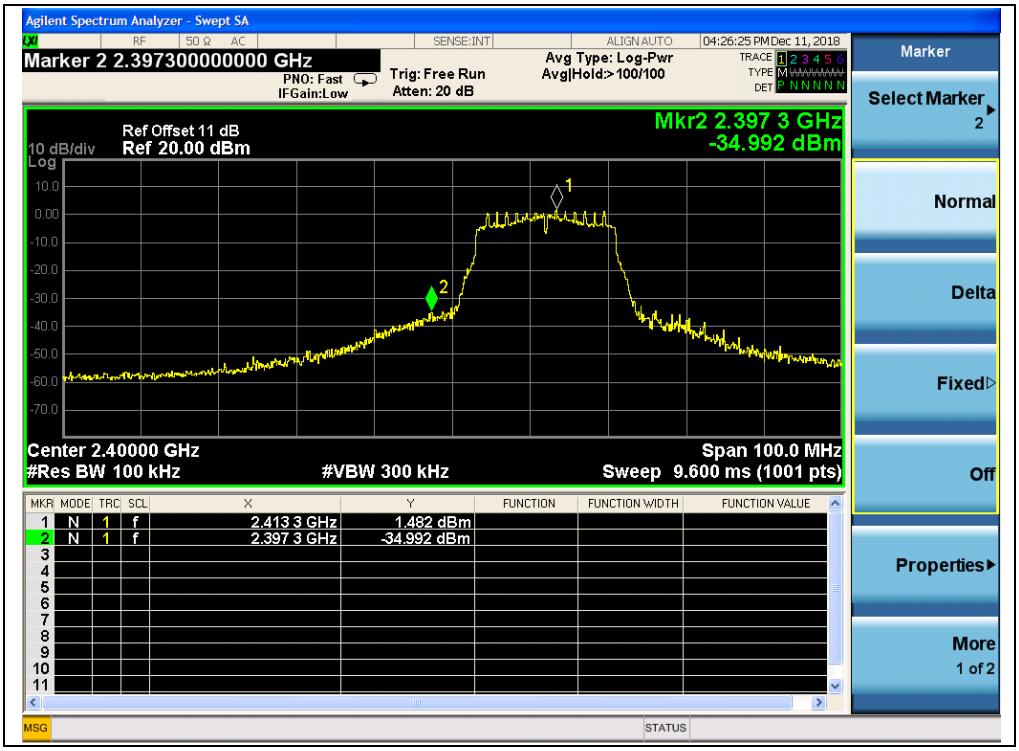
Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
1	2412	-43.64	0.78	-19.22	PASS
6	2437	-43.07	1.06	-18.94	PASS
11	2462	-43.86	0.46	-19.54	PASS

B. Test Plots:

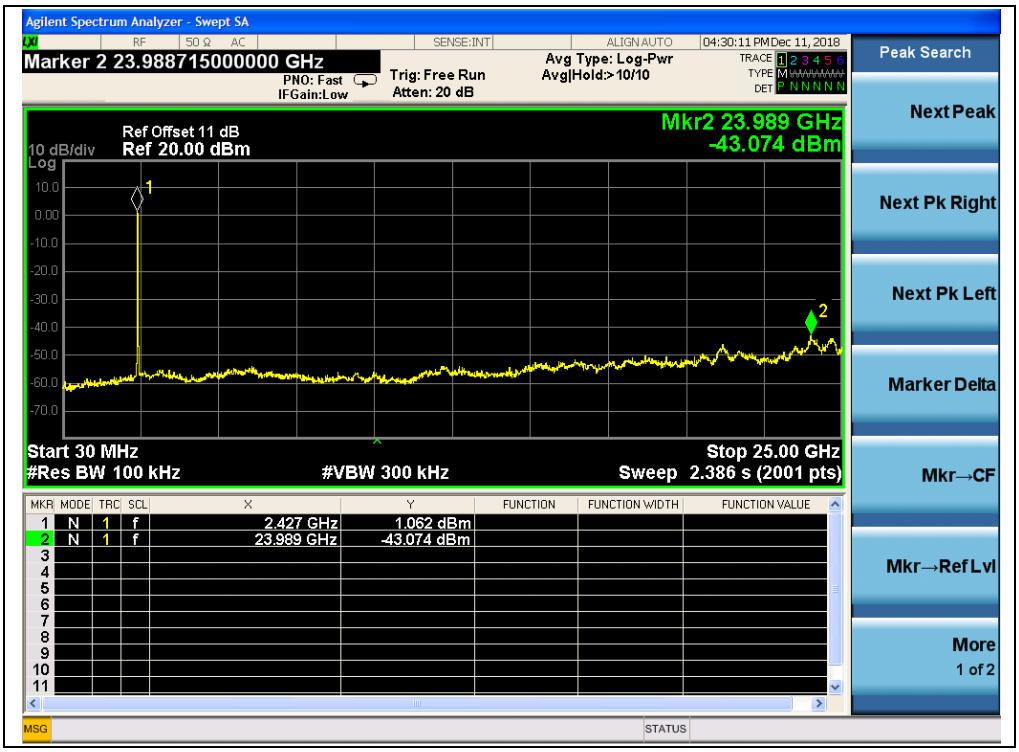
Note: The power of the Module transmitting frequency should be ignored.



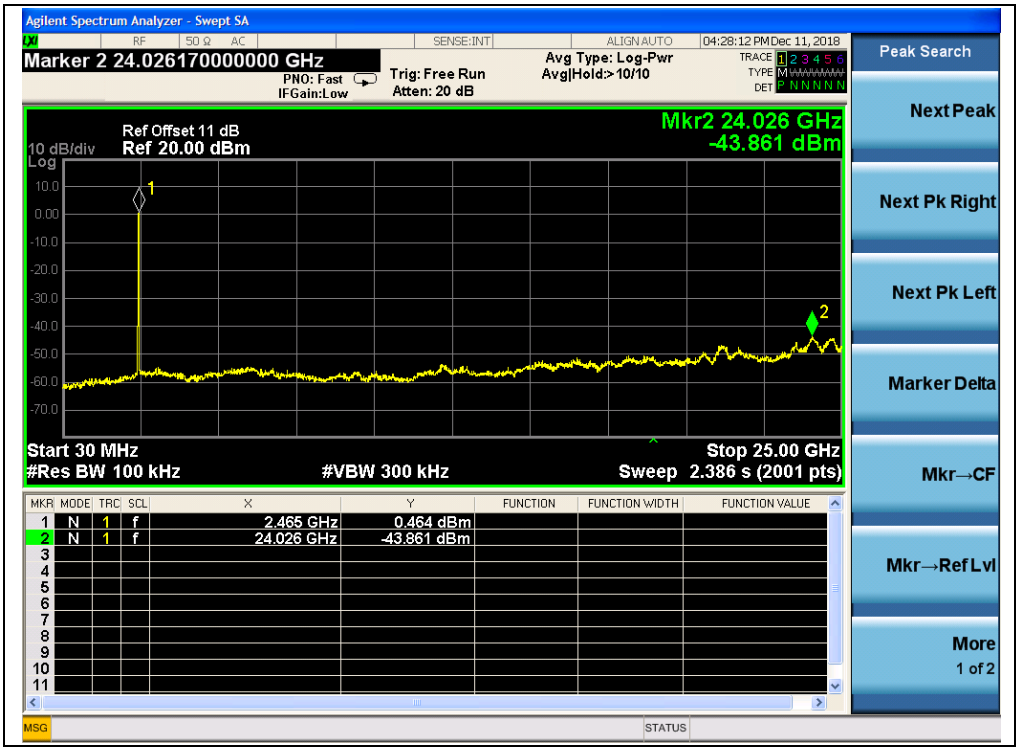
(Channel = 1, 30MHz to 25GHz)



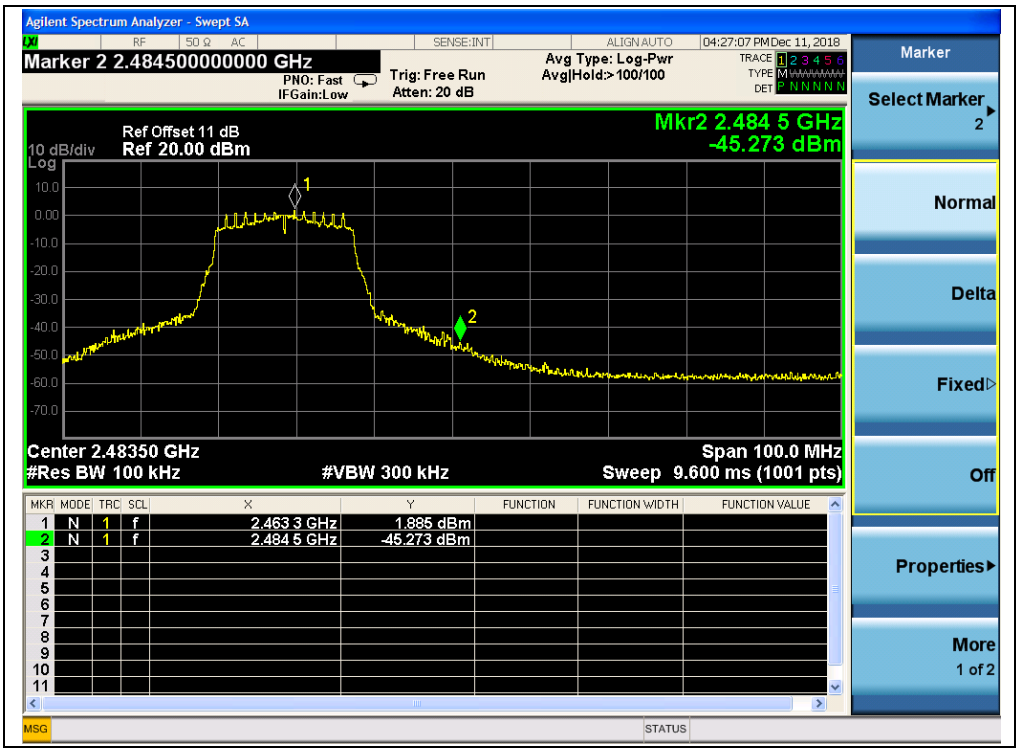
(Band Edge, Channel = 1)



(Channel = 6, 30MHz to 25GHz)



(Channel = 11, 30MHz to 25GHz)



(Band Edge, Channel = 11)

2.6. Power spectral density (PSD)

2.6.1. 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.

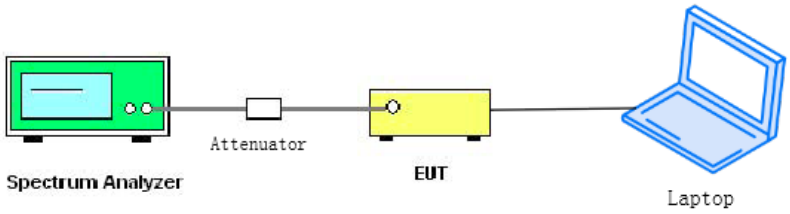
2.6.2. Test Description

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 refer ANNEX B(4).

2.6.3. Test Result

2.6.3.1 802.11b Test mode

A. Test Verdict:

Spectral power density (dBm/3kHz)				
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
1	2412	-8.30	8	PASS
6	2437	-8.82	8	PASS
11	2462	-8.64	8	PASS

B. Test Plots:

(Channel = 1, 802.11b)

(Channel = 6, 802.11b)

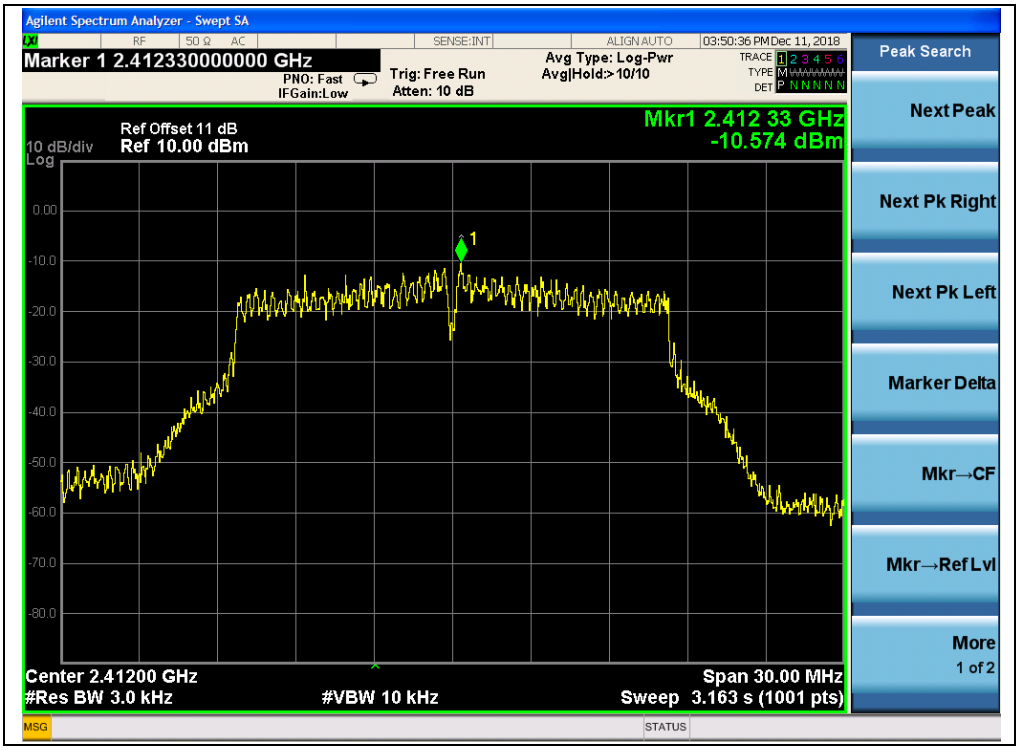
(Channel = 11, 802.11b)

2.6.3.2 802.11g Test mode

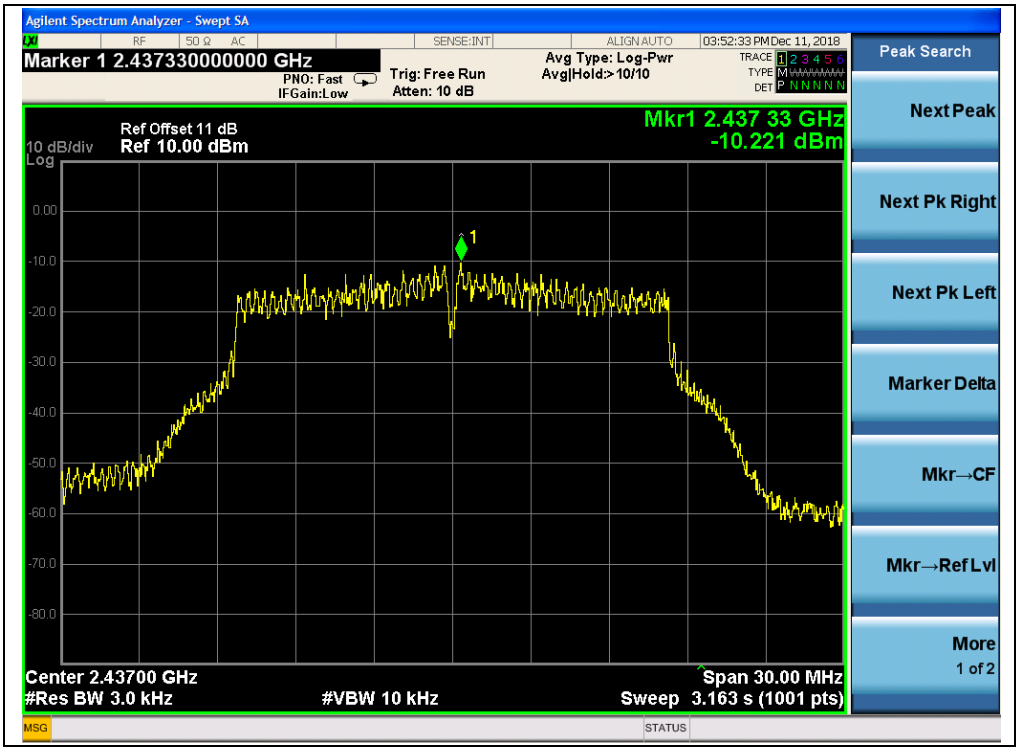
A. Test Verdict:

Spectral power density (dBm/3kHz)				
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
1	2412	-10.57	8	PASS
6	2437	-10.22	8	PASS
11	2462	-10.37	8	PASS

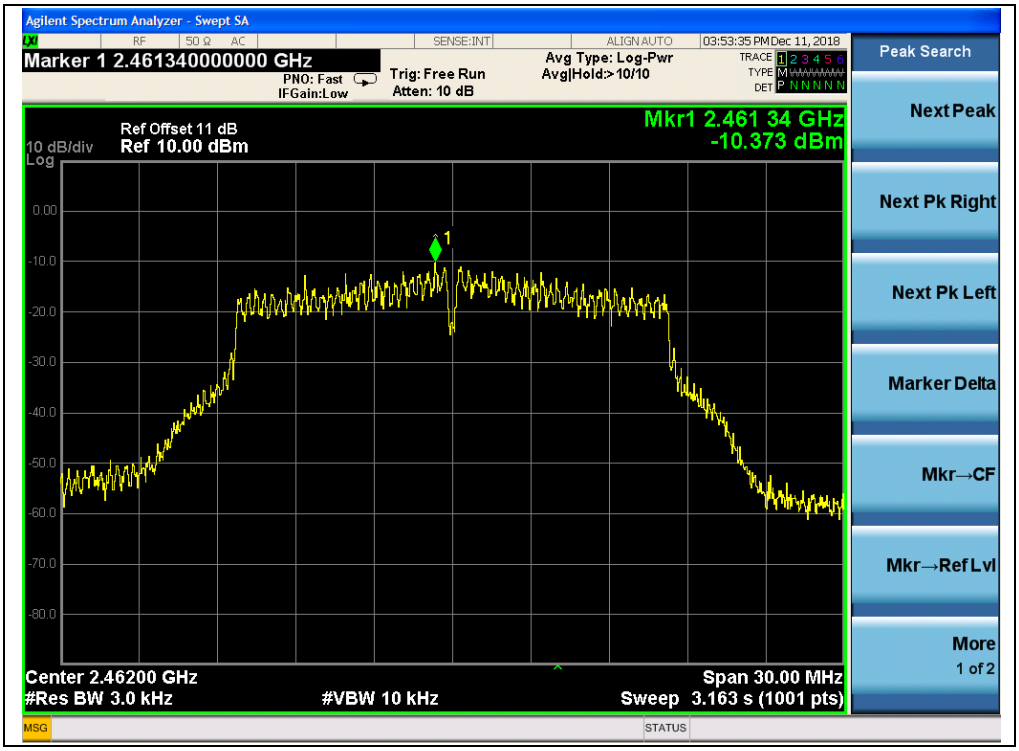
B. Test Plots:



(Channel = 1, 802.11g)



(Channel = 6, 802.11g)



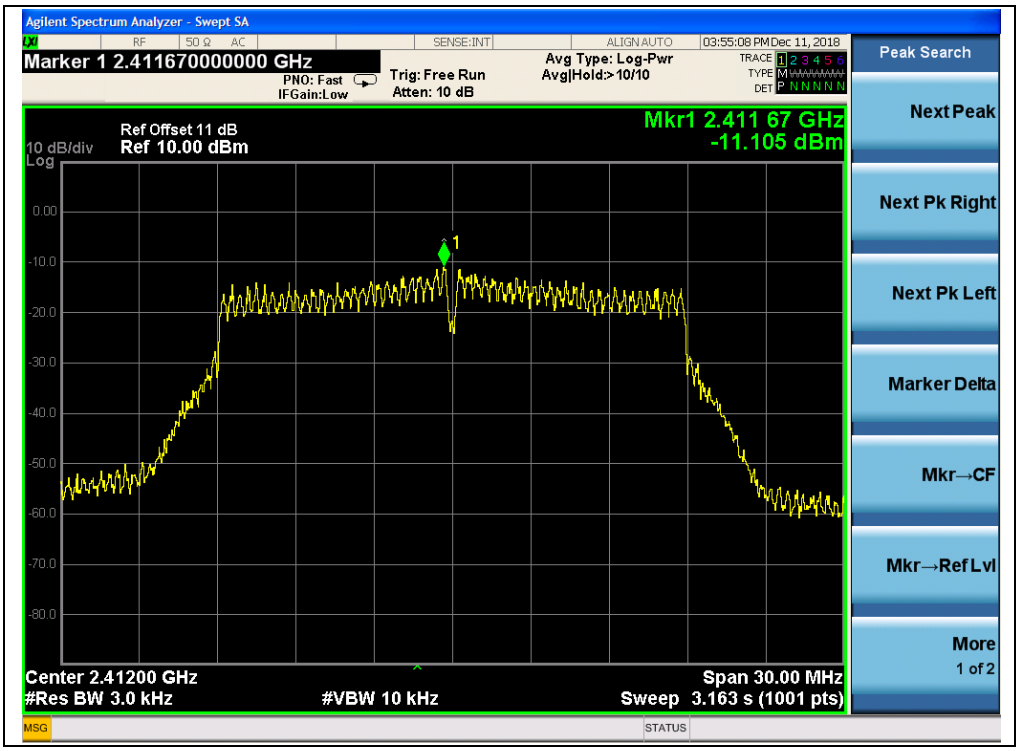
(Channel = 11, 802.11g)

2.6.3.3 802.11n(HT20) Test mode

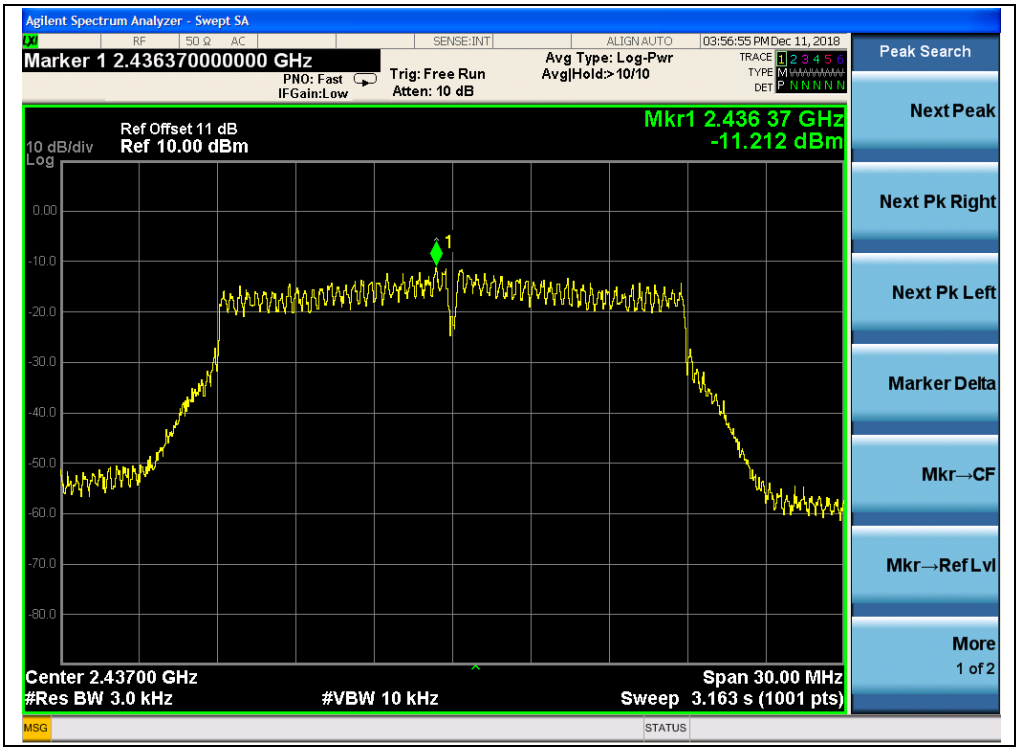
A. Test Verdict:

Spectral power density (dBm/3kHz)				
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
1	2412	-11.11	8	PASS
6	2437	-11.21	8	PASS
11	2462	-10.99	8	PASS

B. Test Plots:



(Channel = 1, 802.11n(HT20))



(Channel = 6, 802.11n(HT20))

(Channel = 11, 802.11n(HT20))

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

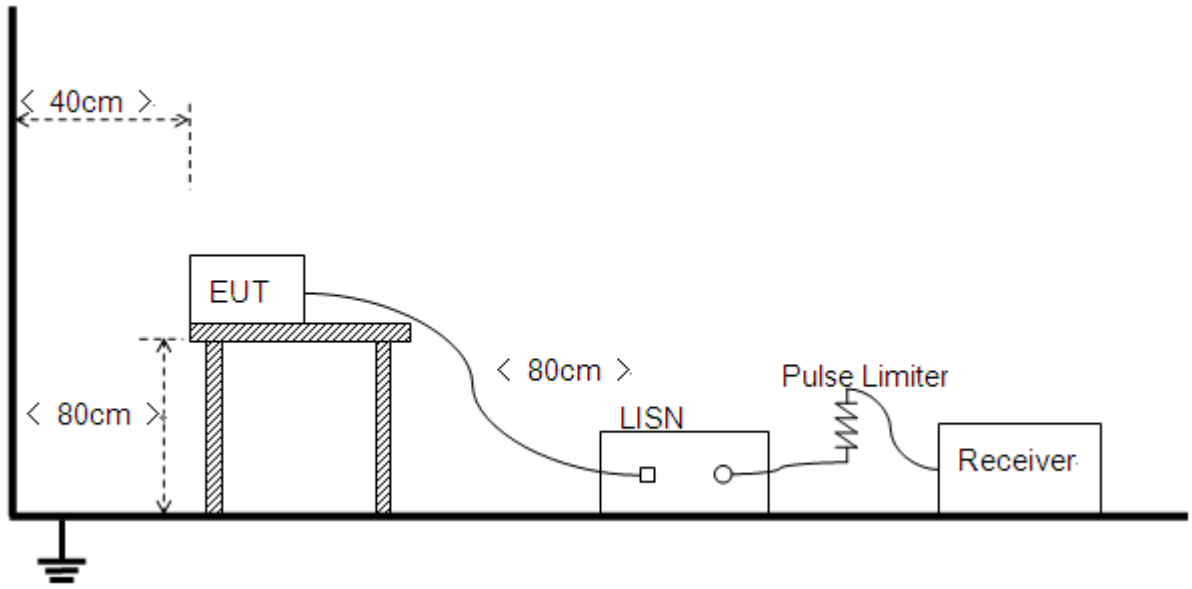
NOTE:

(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 refer ANNEX B(4).

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.

Note: Both of the test voltage AC 120V/60Hz and AC 230V/50Hz were considered and tested respectively, only the results of the worst case AC 120V/60Hz were recorded in this report.

A. Test setup:

Test Mode: EUT+ADAPTER+WIFI TX

Test Voltage: AC 120V/60Hz

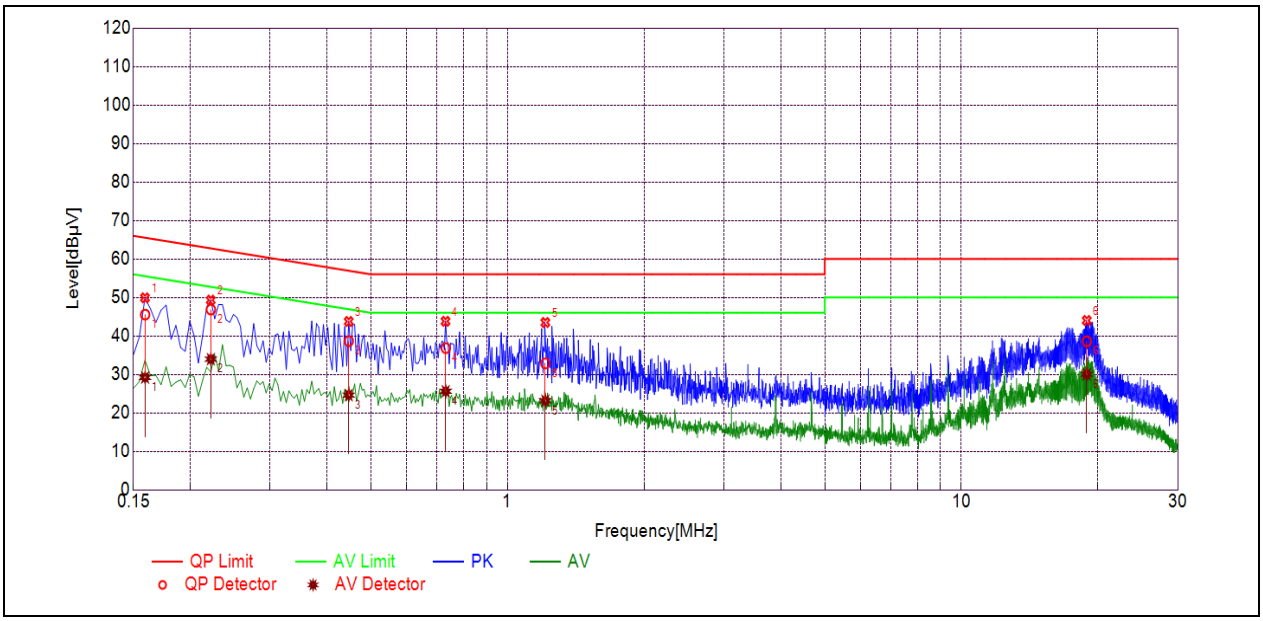
The measurement results are obtained as below:

E [dBμV] $=U_R + L_{Cable\ loss}$ [dB] + A_{Factor}

U_R: Receiver Reading

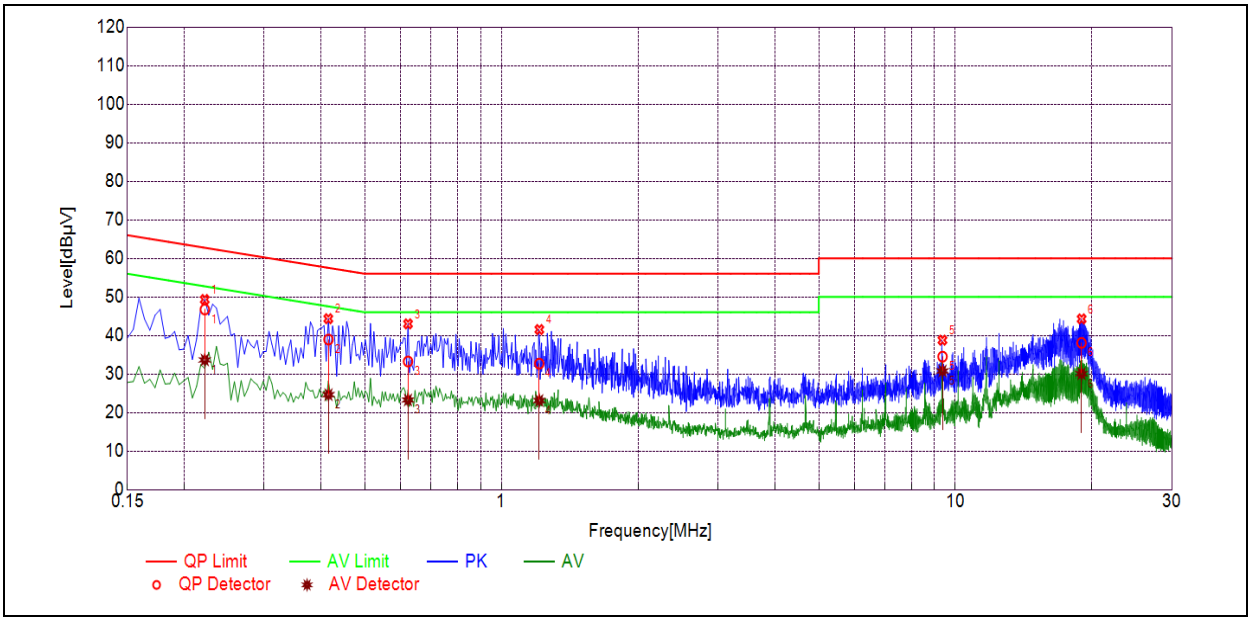
A_{Factor}: Voltage division factor of LISN

B. Test Plots:



(L Phase)

NO.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1591	45.54	29.19	65.51	55.51	Line	PASS
2	0.2221	46.84	33.95	62.74	52.74		PASS
3	0.4470	38.66	24.62	56.93	46.93		PASS
4	0.7311	36.83	25.61	56.00	46.00		PASS
5	1.2117	32.85	23.16	56.00	46.00		PASS
6	18.8918	38.61	30.02	60.00	50.00		PASS



(N Phase)

NO.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.2220	46.75	33.65	62.75	52.75	Neutral	PASS
2	0.4158	38.94	24.64	57.53	47.53		PASS
3	0.6224	33.26	23.26	56.00	46.00		PASS
4	1.2113	32.70	23.12	56.00	46.00		PASS
5	9.3688	34.50	30.79	60.00	50.00		PASS
6	18.9607	38.07	30.08	60.00	50.00		PASS

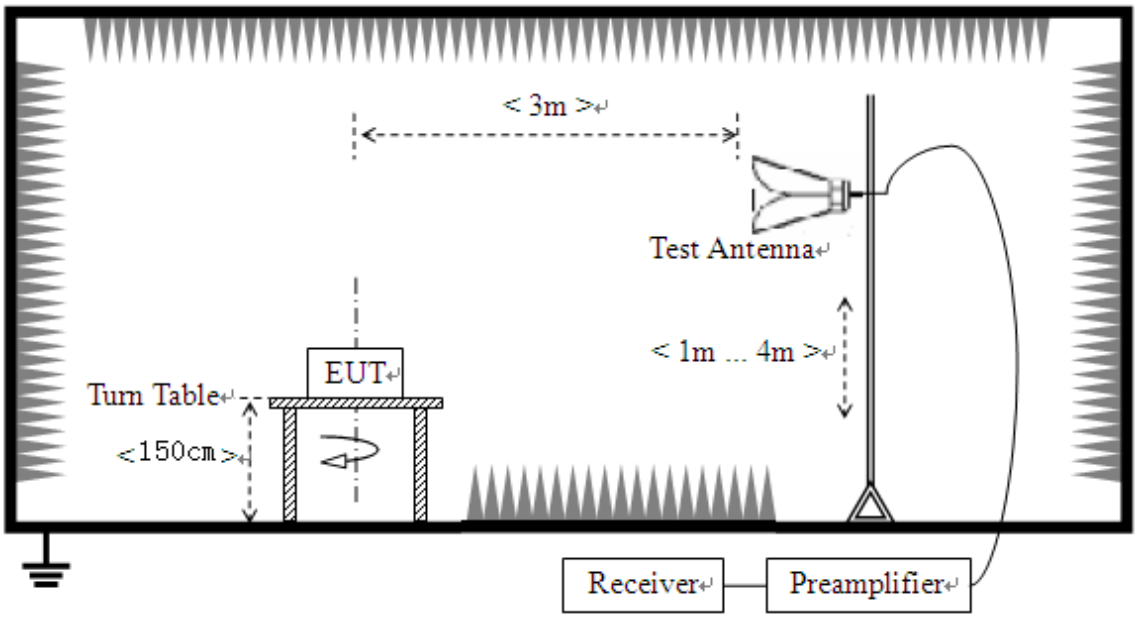
2.8. Restricted Frequency Bands

2.8.1. 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).

2.8.2. 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 refer ANNEX B(4).

2.8.3. 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.

2.7.3.1 802.11b Test mode

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	2375.98	PK	47.75	-29.67	32.56	50.64	74	PASS
1	2390.00	AV	36.01	-29.67	32.56	38.90	54	PASS
11	2485.75	PK	48.54	-29.67	32.56	51.43	74	PASS
11	2483.50	AV	36.60	-29.67	32.56	39.49	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)

2.7.3.2 802.11g Test mode

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	2390.00	PK	55.04	-29.67	32.56	57.93	74	PASS
1	2390.00	AV	39.84	-29.67	32.56	42.73	54	PASS
11	2483.50	PK	57.10	-29.67	32.56	59.99	74	PASS
11	2483.50	AV	41.25	-29.67	32.56	44.14	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)

2.7.3.3 802.11n(HT20) Test mode

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	2390.00	PK	58.34	-29.67	32.56	61.23	74	PASS
1	2390.00	AV	41.15	-29.67	32.56	44.04	54	PASS
11	2483.50	0	63.20	-29.67	32.56	66.09	74	PASS
11	2483.50	AV	41.00	-29.67	32.56	43.89	54	PASS

B. Test Plots:

(Channel = 1 PEAK, 802.11n(HT20))

(Channel = 1 AVG, 802.11n(HT20))

(Channel = 11 PEAK, 802.11n(HT20))

(Channel = 11 AVG, 802.11n(HT20))

2.9. Radiated Emission

2.9.1. 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.

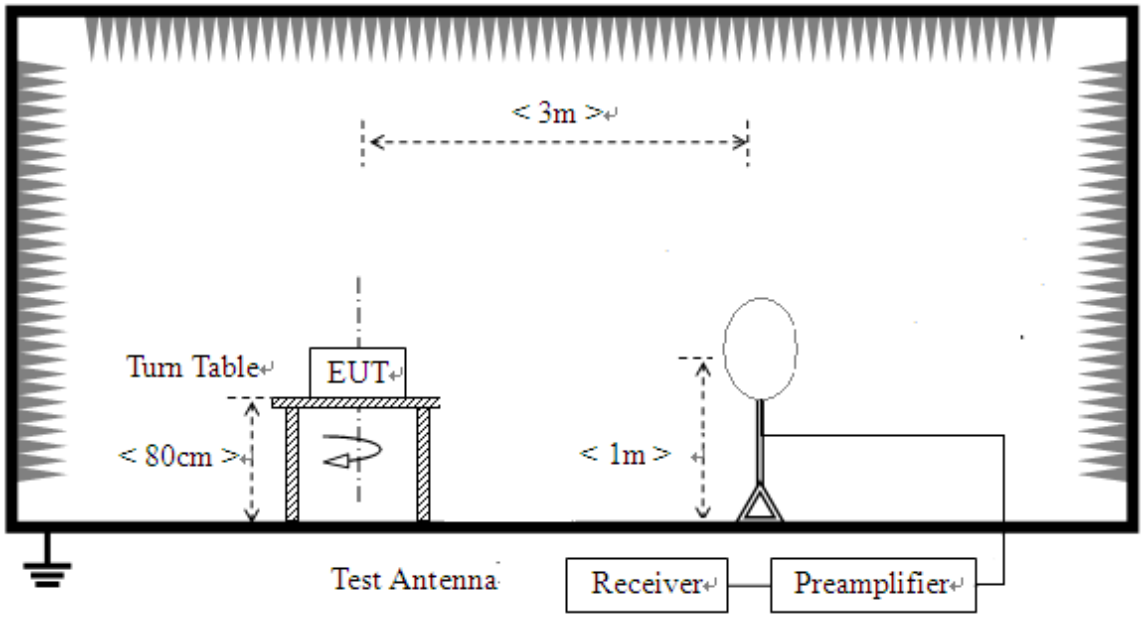
For above 1000MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK)

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)

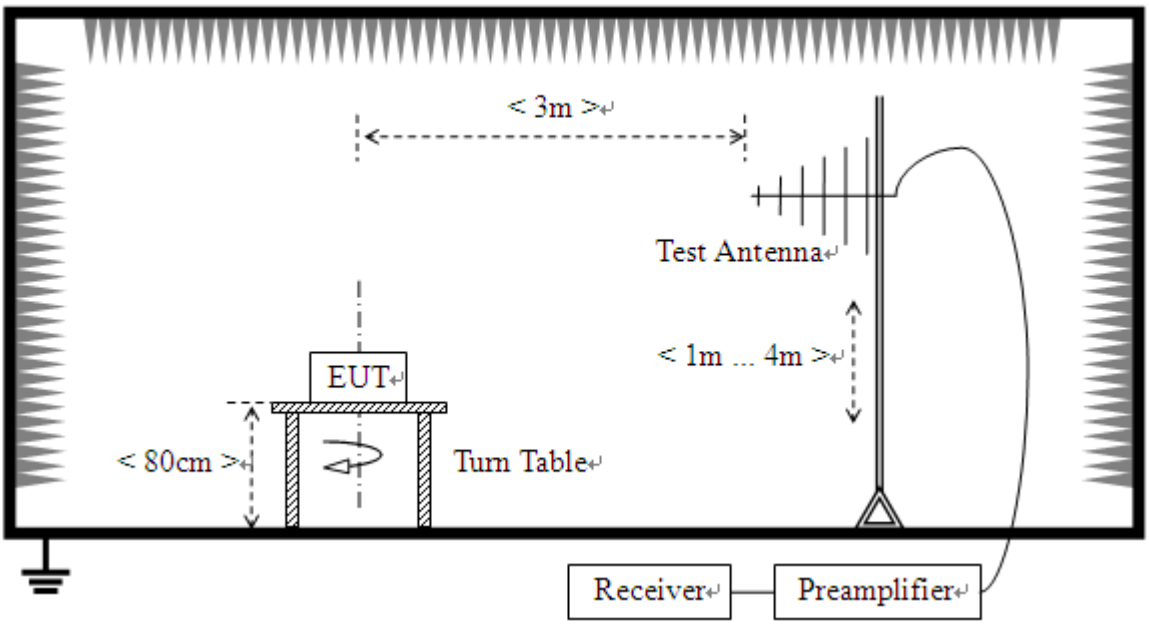
2.9.2. Test Description

A. Test Setup:

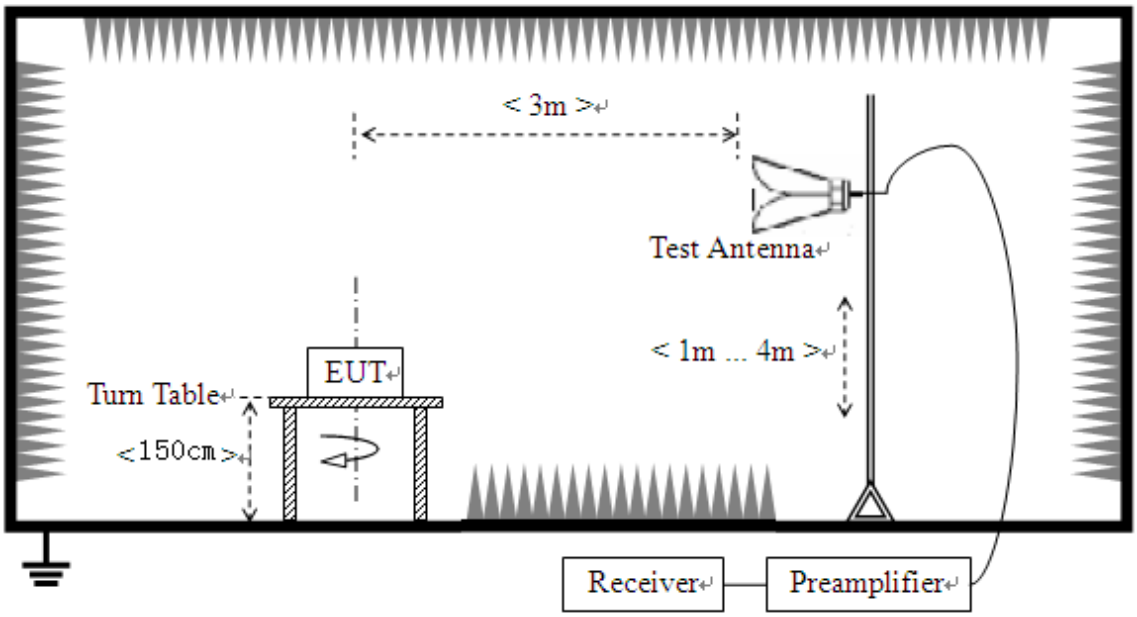
1) For radiated emissions from 9kHz to 30MHz



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 refere ANNEX B(4).

2.9.3. 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 [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

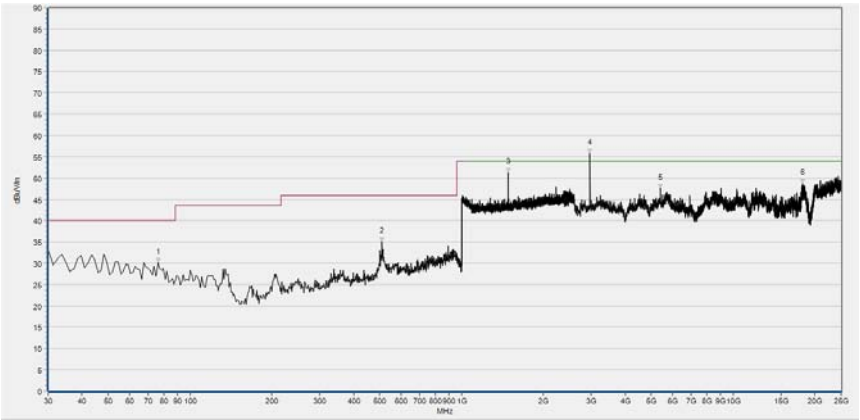
A_{Factor}: Antenna Factor at 3m

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

Note1: 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.
Note2: For the frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit was not recorded.
Note3: For the frequency, which started from 25GHz to 40GHz, was pre-scanned and the result which was 20dB lower than the limit was not recorded.

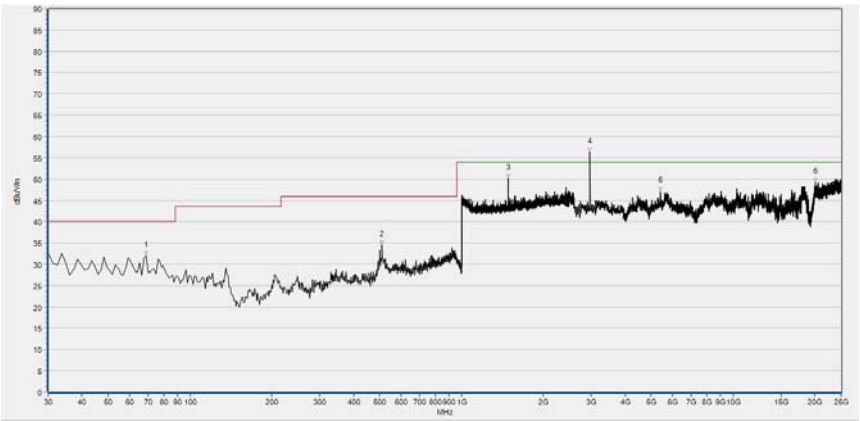
2.9.3.1 802.11b Test mode

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
76.133	30.20	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
509.537	34.99	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1484.674	51.21	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2969.600	56.26	N/A	46.39	74.00	N/A	54.00	Horizontal	PASS
5402.546	47.63	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
17989.562	48.85	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

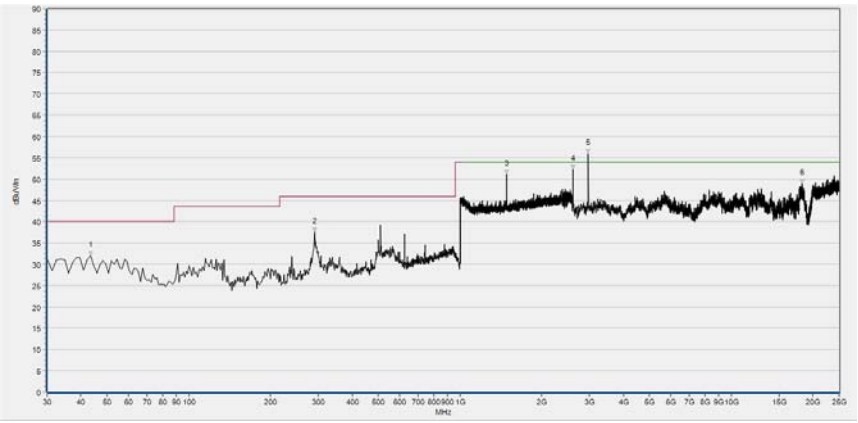
(Antenna Horizontal, 30MHz to 25GHz)



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
68.849	31.93	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
509.537	34.54	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1484.034	50.08	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2969.600	56.68	N/A	45.70	74.00	N/A	54.00	Vertical	PASS
5390.326	47.11	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
20058.883	49.36	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

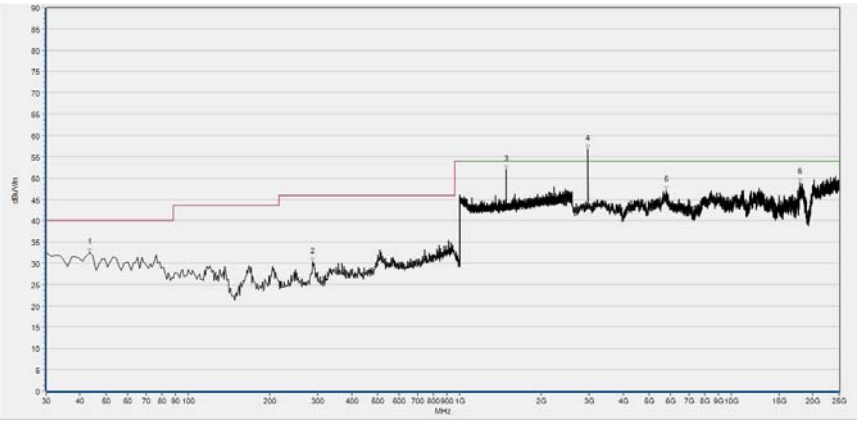
(Antenna Vertical, 30MHz to 25GHz)

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	31.96	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
291.014	37.46	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1484.674	51.04	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2613.600	52.48	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2970.686	55.92	N/A	32.85	74.00	N/A	54.00	Horizontal	PASS
18278.778	48.94	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

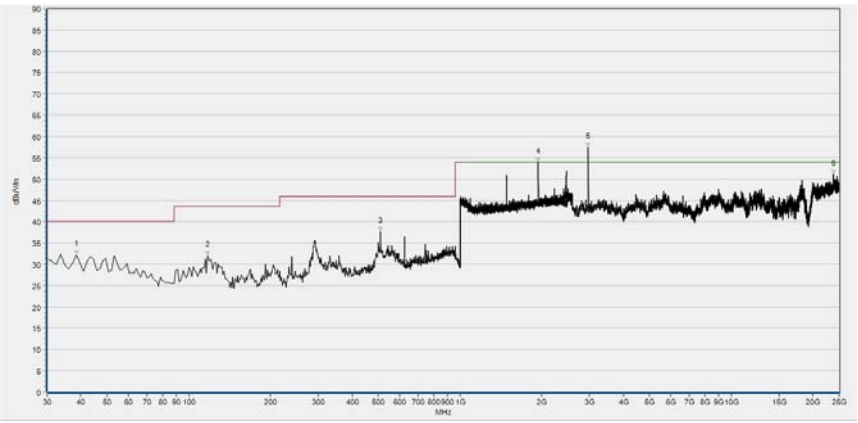
(Antenna Horizontal, 30MHz to 25GHz)



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
43.354	32.52	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
287.372	30.33	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1485.314	51.95	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2970.400	57.66	N/A	46.12	74.00	N/A	54.00	Vertical	PASS
5752.864	47.14	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
17936.607	48.87	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

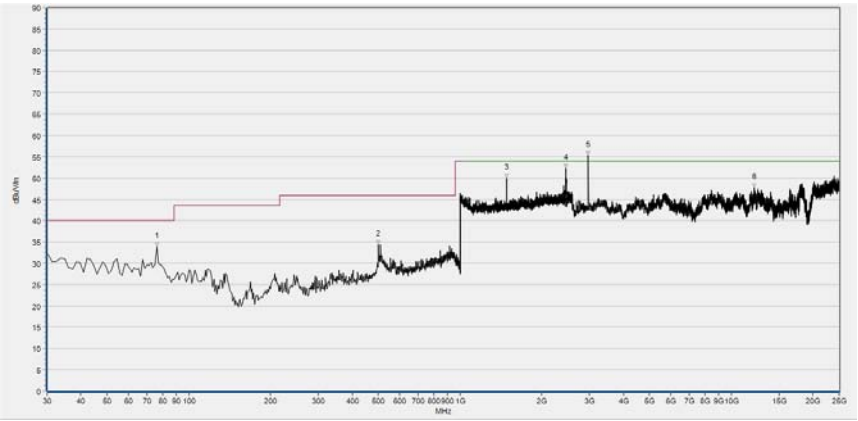
(Antenna Vertical, 30MHz to 25GHz)

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
38.498	32.23	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
117.409	32.03	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
509.537	37.64	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1940.800	54.74	N/A	32.40	74.00	N/A	54.00	Horizontal	PASS
2969.600	57.67	N/A	46.68	74.00	N/A	54.00	Horizontal	PASS
23782.033	51.19	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 25GHz)

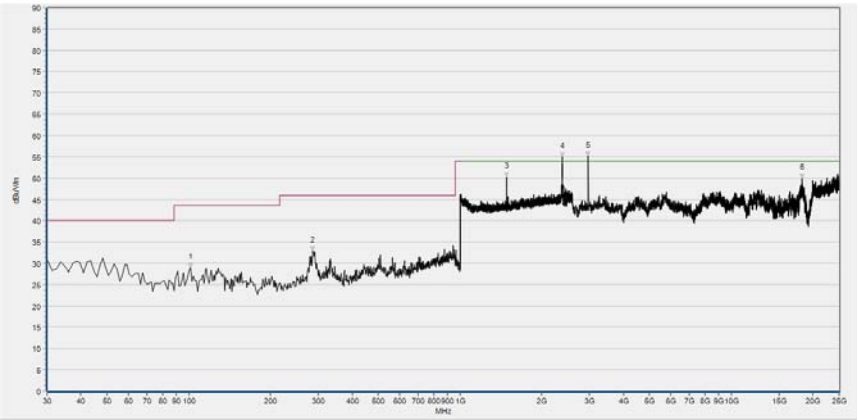


Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
76.133	33.79	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
499.825	34.39	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1485.314	49.99	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2457.100	52.56	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2971.300	54.05	N/A	39.69	74.00	N/A	54.00	Vertical	PASS
12184.870	47.79	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 25GHz)

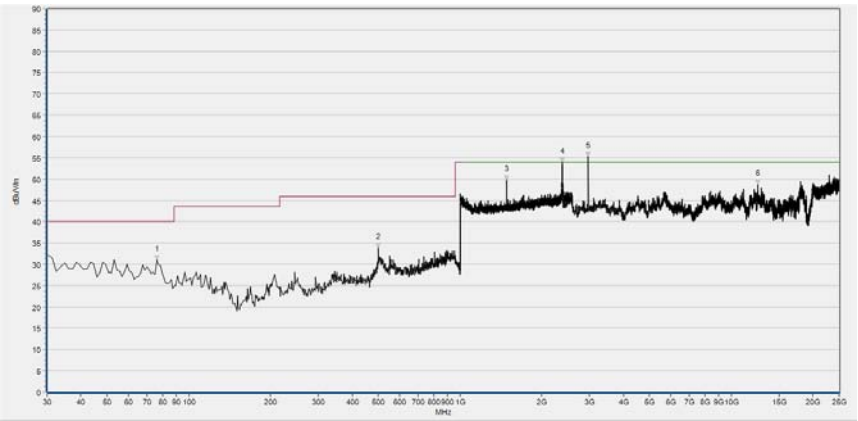
2.9.3.2 802.11g Test mode

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
101.627	28.96	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
286.158	32.91	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1485.314	50.33	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2384.400	55.86	N/A	37.45	74.00	N/A	54.00	Horizontal	PASS
2970.200	55.20	N/A	44.35	74.00	N/A	54.00	Horizontal	PASS
18233.970	50.00	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

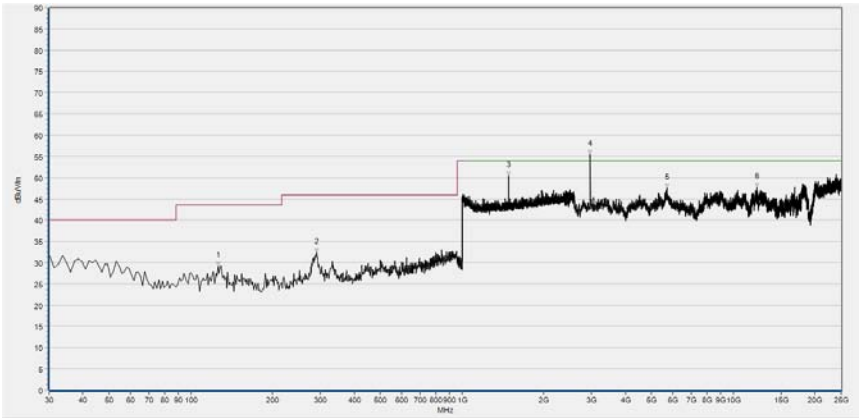
(Antenna Horizontal, 30MHz to 25GHz)



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
76.133	31.02	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
499.825	33.93	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1484.034	49.76	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2384.200	53.82	N/A	37.11	74.00	N/A	54.00	Vertical	PASS
2970.000	55.76	N/A	44.95	74.00	N/A	54.00	Vertical	PASS
12518.894	48.70	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

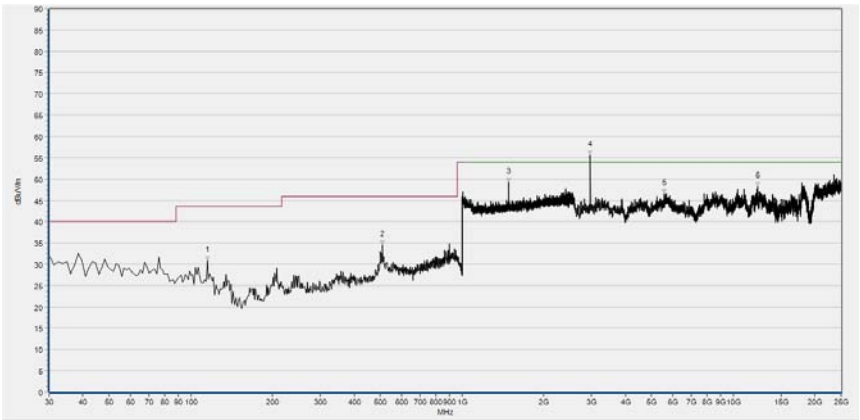
(Antenna Vertical, 30MHz to 25GHz)

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
125.907	29.12	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
291.014	32.31	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1485.314	50.41	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2970.600	55.21	N/A	45.48	74.00	N/A	54.00	Horizontal	PASS
5695.836	47.61	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12205.237	47.70	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

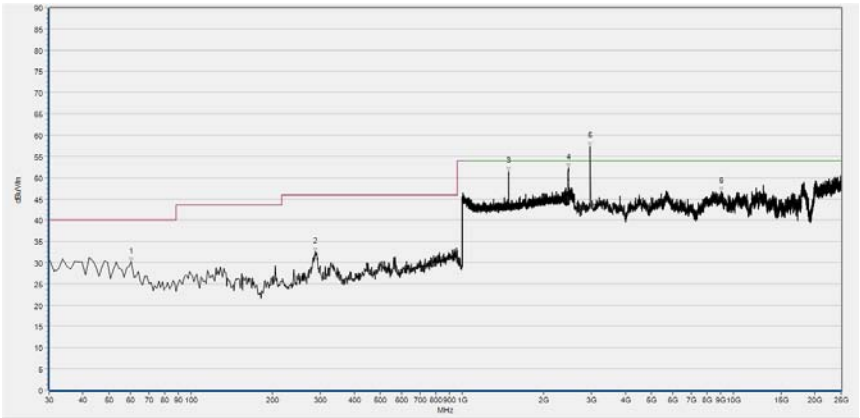
(Antenna Horizontal, 30MHz to 25GHz)



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
114.981	30.89	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
509.537	34.54	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1484.034	49.22	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2971.000	55.80	N/A	43.82	74.00	N/A	54.00	Vertical	PASS
5565.485	46.55	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12311.147	48.30	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

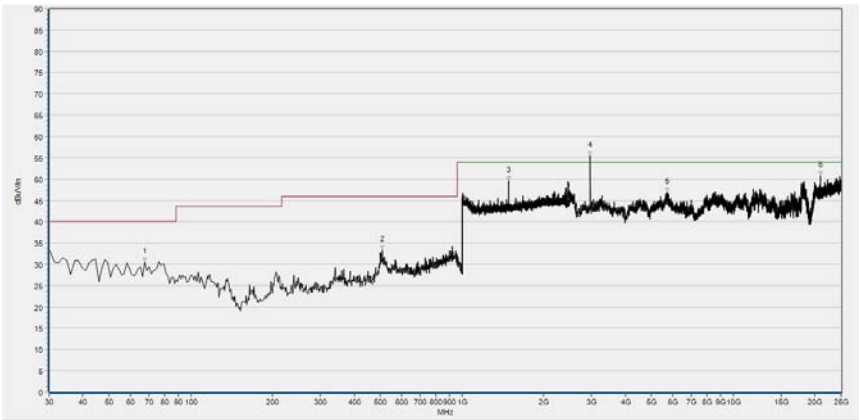
(Antenna Vertical, 30MHz to 25GHz)

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
60.350	30.13	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
287.372	32.52	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1484.674	51.53	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2463.625	52.28	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2971.200	57.93	N/A	45.38	74.00	N/A	54.00	Horizontal	PASS
9015.712	46.69	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 25GHz)

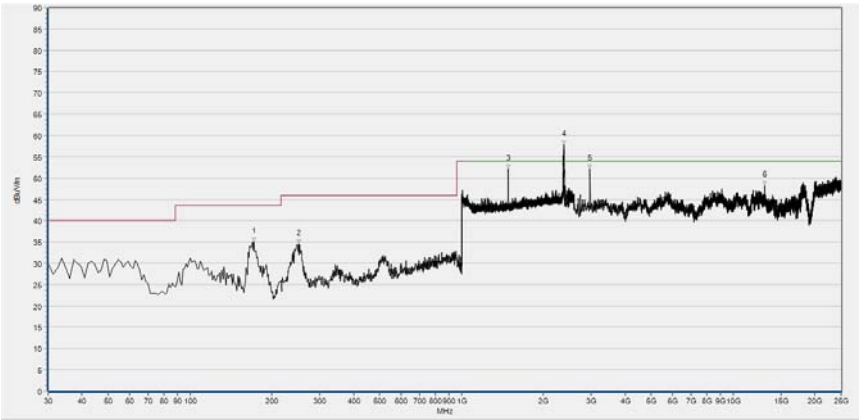


Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
67.635	30.51	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
509.537	33.27	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1485.314	49.55	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2969.000	55.97	N/A	45.48	74.00	N/A	54.00	Vertical	PASS
5687.689	46.99	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
20942.826	50.80	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 25GHz)

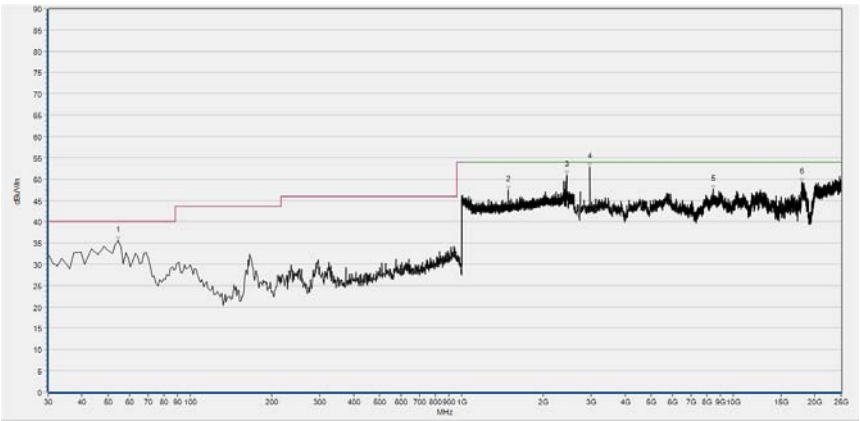
2.9.3.3 802.11n(HT20) Test mode

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
172.040	35.02	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
250.951	34.50	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1484.674	52.17	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2381.700	58.30	N/A	37.66	74.00	N/A	54.00	Horizontal	PASS
2970.686	52.06	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
13081.033	48.30	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

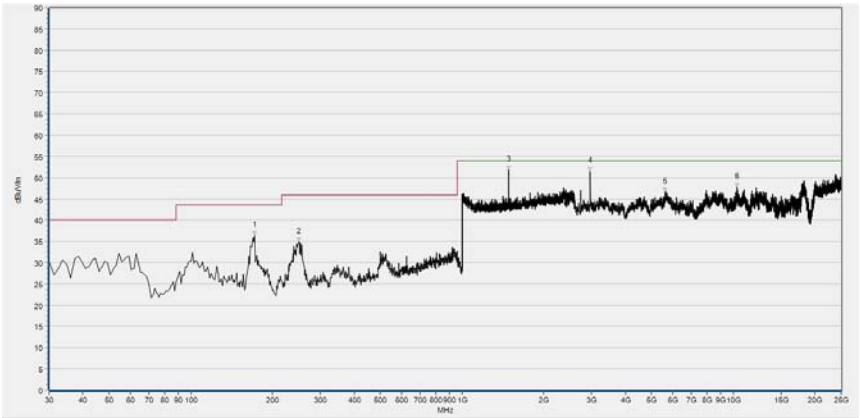
(Antenna Horizontal, 30MHz to 25GHz)



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
54.280	35.58	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
1485.314	47.45	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2438.015	50.94	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2970.900	53.53	N/A	40.06	74.00	N/A	54.00	Vertical	PASS
8457.647	47.61	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
17948.827	49.24	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

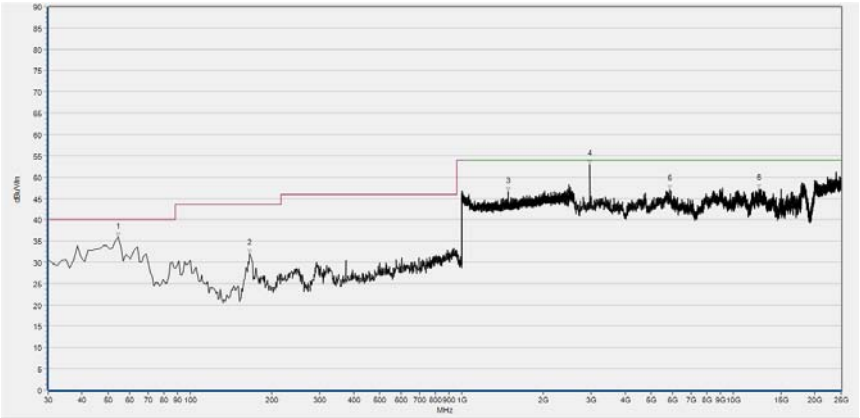
(Antenna Vertical, 30MHz to 25GHz)

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
172.040	36.42	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
249.737	34.83	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1484.674	51.85	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2970.686	51.44	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5614.366	46.65	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
10298.854	47.75	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

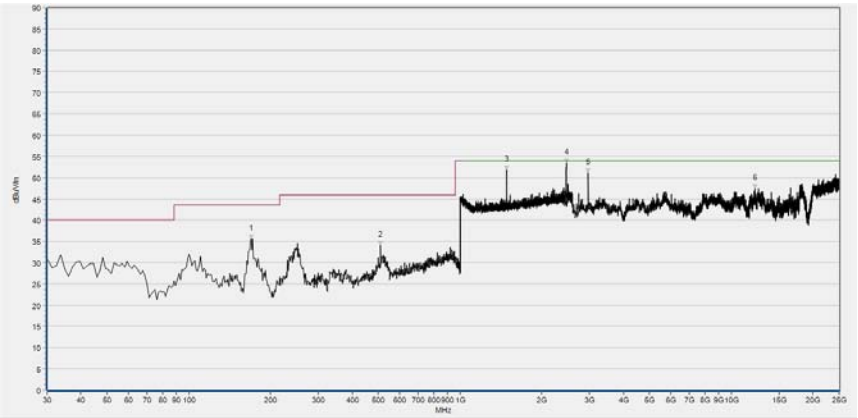
(Antenna Horizontal, 30MHz to 25GHz)



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
54.280	35.93	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
165.970	32.07	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
1484.674	46.51	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2969.600	53.09	N/A	39.61	74.00	N/A	54.00	Vertical	PASS
5826.187	47.05	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12470.013	47.34	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

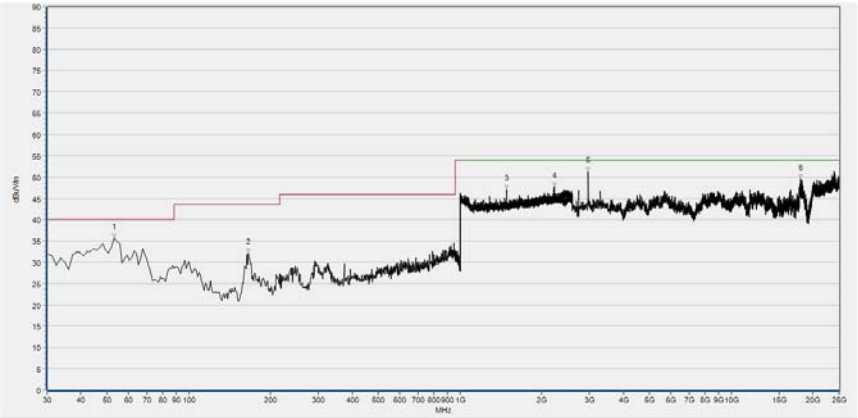
(Antenna Vertical, 30MHz to 25GHz)

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
169.612	35.50	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
509.537	34.04	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1484.674	51.84	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2465.300	53.43	N/A	42.95	74.00	N/A	54.00	Horizontal	PASS
2970.686	51.10	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12217.458	47.48	N/A	N/A	74.00	N/A	54.00	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
53.066	35.64	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
165.970	32.23	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
1484.034	47.01	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2226.731	47.85	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2970.800	51.44	N/A	39.40	74.00	N/A	54.00	Vertical	PASS
18001.782	49.65	N/A	N/A	74.00	N/A	54.00	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

Laboratory Name:	Shenzhen Morlab Communications Technology Co., Ltd. Morlab Laboratory
Laboratory Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, GuangDong Province, P. R. China
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, the test firm registration number is 226174.

4. Test Equipments Utilized

4.1 Conducted Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
Attenuator 1	(N/A.)	10dB	Resnet	2018.04.17	2019.04.16
EXA Signal Analzyer	MY53470836	N9010A	Agilent	2018.11.06	2019.11.05
USB Wideband Power Sensor	MY54210011	U2021XA	Agilent	2018.04.17	2019.04.16
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
Computer	T430i	Think Pad	Lenovo	N/A	N/A

4.2 Conducted Emission Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
Receiver	MY56400093	N9038A	KEYSIGHT	2018.05.08	2019.05.07
LISN	812744	NSLK 8127	Schwarzbeck	2018.05.08	2019.05.07
Pulse Limiter (20dB)	9391	VTSD 9561-D	Schwarzbeck	2018.05.08	2019.05.07
Coaxial cable(BNC) (30MHz-26GHz)	CB01	EMC01	Morlab	N/A	N/A

4.3 List of Software Used

Description	Manufacturer	Software Version
Test system	Tonscend	V2.6
Power Panel	Agilent	V3.8
MORLAB EMCR V1.2	MORLAB	V 1.0

4.4 Radiated Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
Receiver	MY54130016	N9038A	Agilent	2018.08.04	2019.08.03
Test Antenna - Bi-Log	9163-519	VULB 9163	Schwarzbeck	2018.05.18	2019.05.17
Test Antenna - Loop	1519-022	FMZB1519	Schwarzbeck	2018.03.03	2019.03.02
Test Antenna – Horn	01774	BBHA 9120D	Schwarzbeck	2018.08.06	2019.08.05
Test Antenna – Horn	BBHA9170 #774	BBHA9170	Schwarzbeck	2018.08.02	2019.08.01
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	2018.05.08	2019.05.07
18-26.5GHz pre-Amplifier	MA03	TS-PR18	Rohde& Schwarz	2018.05.08	2019.05.07
Notch Filter	N/A	WRCG-2400-2483.5-60SS	Wainwright	2018.12.01	2019.11.30
Anechoic Chamber	N/A	9m*6m*6m	CRT	2017.11.19	2020.11.18

END OF REPORT