TEST REPORT

APPLICANT	:	Hangzhou Vision Insight Technology Co., Ltd.
PRODUCT NAME	:	Smart Outdoor Camera
MODEL NAME	:	A21C, A21, A21S, A21D, A21F
BRAND NAME	:	blurams
FCC ID	:	2ASAQ-A21C
STANDARD(S)	:	47 CFR Part 15 Subpart C
RECEIPT DATE	:	2019-06-28
TEST DATE	:	2019-07-09 to 2019-07-17
ISSUE DATE	:	2019-07-25

Edited by: Zeng Xiaoying (Rapporteur)

Approved by: Peng Huarui (Supervisor)

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MORLAB

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Change History		
Version	**Date**	**Reason for change**
1.0	2019-07-25	First edition

1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	Hangzhou Vision Insight Technology Co., Ltd.
Applicant Address:	Room 203, South Floor 2, Building 5, 90 Wensan Road, Xihu District, Hangzhou, Zhejiang
Manufacturer:	Hangzhou Vision Insight Technology Co., Ltd.
Manufacturer Address:	Room 203, South Floor 2, Building 5, 90 Wensan Road, Xihu District, Hangzhou, Zhejiang

1.2. Equipment Under Test (EUT) Description

Product Name:	Smart Outdoor Camera	
Serial No:	(N/A, marked #1 by test site)	
Hardware Version:	A21C-MB-V1.01	
Software Version:	19.0621.704.3683	
Equipment type:	WLAN2.4G	
Modulation Type:	DSSS, OFDM	
Operating Frequency Range:	802.11b/g/ n(HT20): 2.412GHz - 2.472GHz	
Antenna Type:	Metal Antenna	
Antenna Gain:	3.0 dBi	
Accessory Information:	AC Adapter	
	Brand Name:	Aohai
	Model No.:	A8A-050200U-US1
	Serial No.:	(N/A, marked #1 by test site)
	Rated Output:	5V⎓2A
	Rated Input:	100-240V ~ 50/60Hz 0.35A

Note 1: According to the certificate holder, they declared that the models: A21C, A21, A21S, A21D, A21F only the model name and package are different, the others are the same. The main measuring model is A21C, only the results for A21C were recorded in this report.

Note 2: We use the dedicated software to control the EUT continuous transmission. For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

1.3. The channel number and frequency

Test Mode	Channel	Frequency (MHz)	Channel	Frequency (MHz)
802.11b/g/ n(HT20)	**1**	**2412**	8	2447
	2	2417	9	2452
	3	2422	10	2457
	4	2427	11	2462
	5	2432	12	2467
	6	2437	**13**	**2472**
	7	**2442**		

Note1: The Lowest Channel (1), Middle Channel (7) and Highest Channel (13) was selected test for 802.11b/g/n(HT20) mode;

1.4. 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	Jul 09, 2019	Ouyang Feng	**PASS**
3	15.247(b)	Maximum Peak and Average Conducted Output Power	Jul 09, 2019	Ouyang Feng	**PASS**
4	15.247(a)	Bandwidth	Jul 09, 2019	Ouyang Feng	**PASS**
5	15.247(d)	Conducted Spurious Emission and Band Edge	Jul 09, 2019	Ouyang Feng	**PASS**
6	15.247(e)	Power spectral density (PSD)	Jul 09, 2019	Ouyang Feng	**PASS**
7	15.207	Conducted Emission	Jul 17, 2019	Li Zihao	**PASS**
8	15.247(d)	Restricted Frequency Bands	Jul 15, 2019	Li Zihao	**PASS**
9	15.209, 15.247(d)	Radiated Emission	Jul 15, 2019	Li Zihao	**PASS**

Note 1: The tests were performed according to the method of measurements prescribed in ANSIC63.10-2013, KDB558074 D01 v05r02 and KDB594280 D01 v02r01.

Note 2: The path loss during the RF test is calibrated to correct the results by the offset setting in the test equipments. The ref offset 12dB contains two parts that cable loss 2dB and Attenuator 10dB.

1.5. 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.

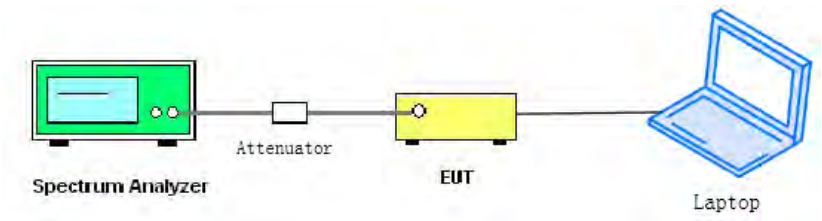
2.2. Duty Cycle Of Test Signal

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:



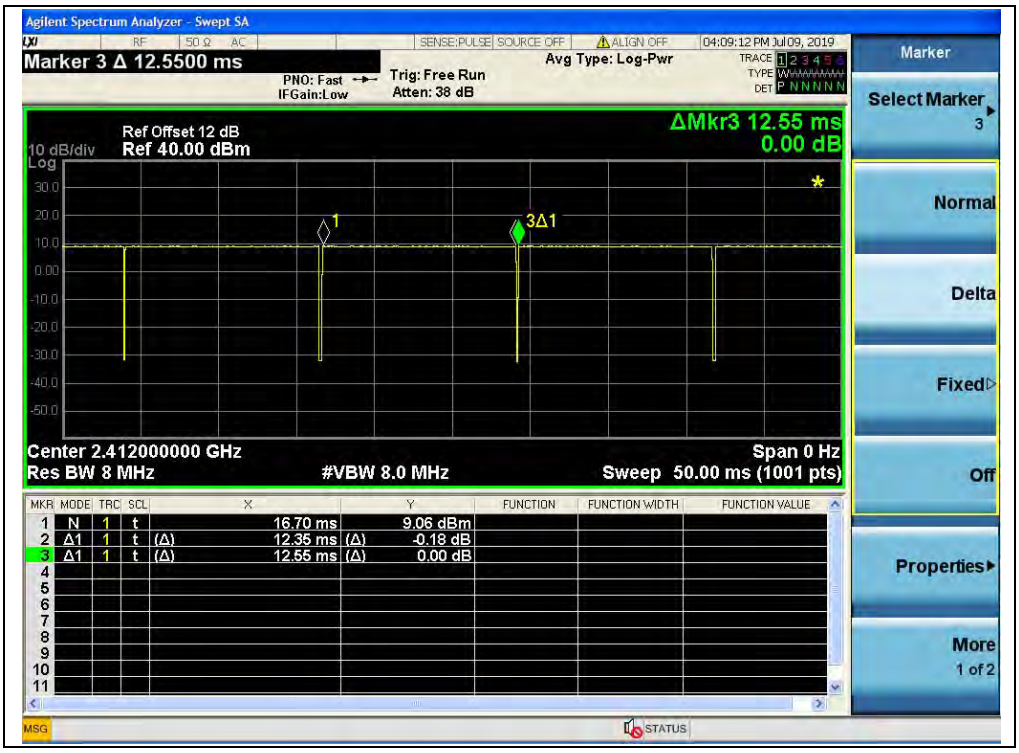
ANSI C63.10 2013 Clause 11.6 was used in order to prove compliance.

2.2.3. Test Result

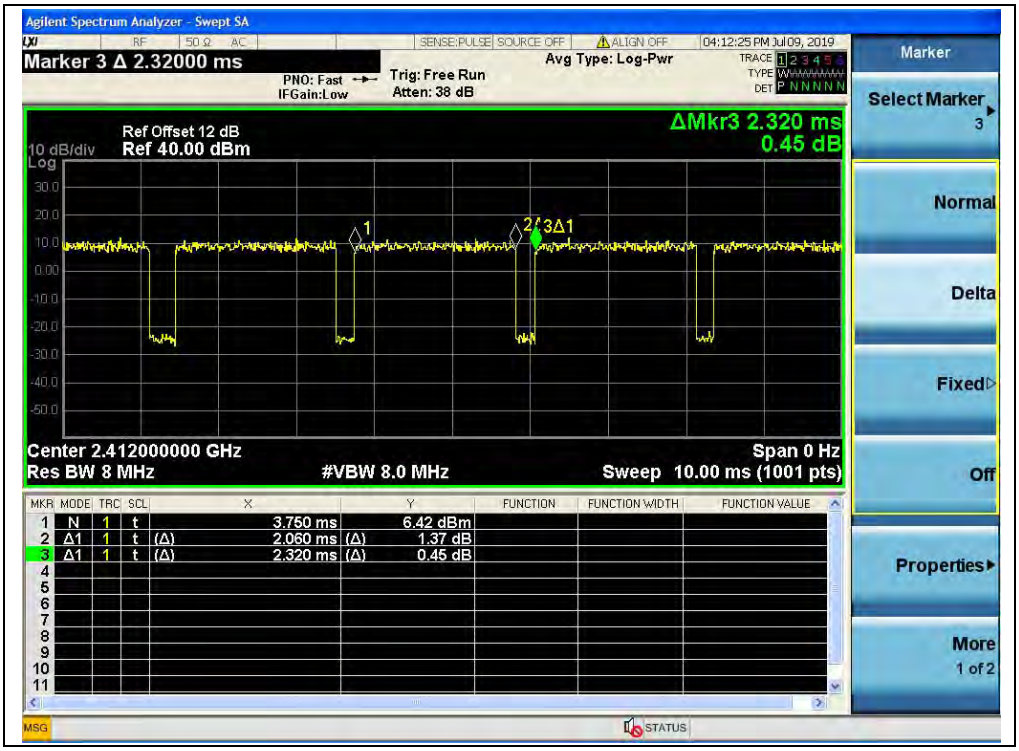
A. Test Verdict:

Test Mode	Duty Cycle (%) (D)	Duty Factor (10*lg[1/D])
802.11b	97.51	0.11
802.11g	87.18	0.60
802.11n(HT20)	86.44	0.63

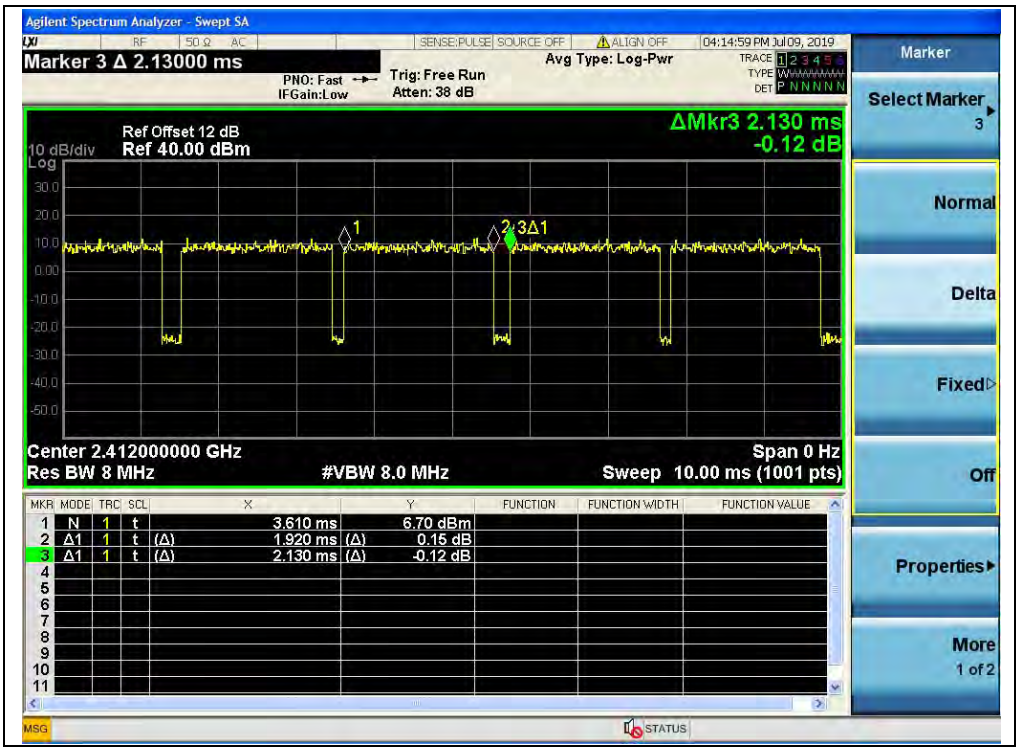
B. Test Plots



(Channel 1, 2412MHz, 802.11b)



(Channel 1, 2412MHz, 802.11g)



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

2.3. Maximum Peak and Average Conducted Output Power

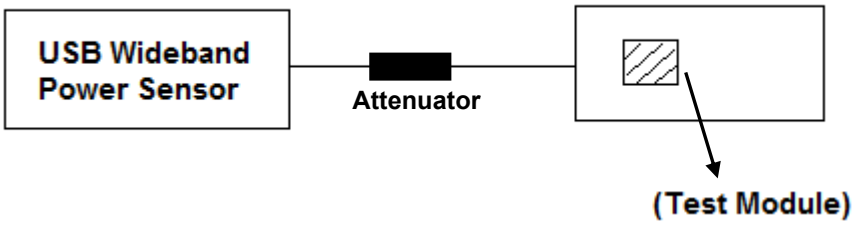
2.3.1. Requirement

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.

2.3.3. Test Result

Maximum Peak Conducted Output Power

802.11b Test Mode

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
1	2412	12.74	0.019	30	1	PASS
7	2442	13.29	0.021			PASS
13	2472	13.84	0.024			PASS

802.11g Test mode

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
1	2412	14.31	0.027	30	1	PASS
7	2442	14.92	0.031			PASS
13	2472	16.25	0.042			PASS

802.11n(HT20) Test mode

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
1	2412	13.96	0.025	30	1	PASS
7	2442	14.78	0.030			PASS
13	2472	15.14	0.033			PASS

Maximum Average Conducted Output Power

802.11b Test Mode

Channel	Frequency (MHz)	Average Power			Limit		Verdict
		Measured	Duty factor Calculated				
		dBm	dBm	W	dBm	W	
1	2412	9.91	10.02	0.010	30	1	PASS
7	2442	10.92	11.03	0.013			PASS
13	2472	11.39	11.50	0.014			PASS

802.11g Test mode

Channel	Frequency (MHz)	Average Power			Limit		Verdict
		Measured	Duty factor Calculated				
		dBm	dBm	W	dBm	W	
1	2412	4.46	5.06	0.003	30	1	PASS
7	2442	5.35	5.95	0.004			PASS
13	2472	6.12	6.72	0.005			PASS

802.11n(HT20) Test mode

Channel	Frequency (MHz)	Average Power			Limit		Verdict
		Measured	Duty factor Calculated				
		dBm	dBm	W	dBm	W	
1	2412	4.45	5.08	0.003	30	1	PASS
7	2442	5.25	5.88	0.004			PASS
13	2472	6.30	6.93	0.005			PASS

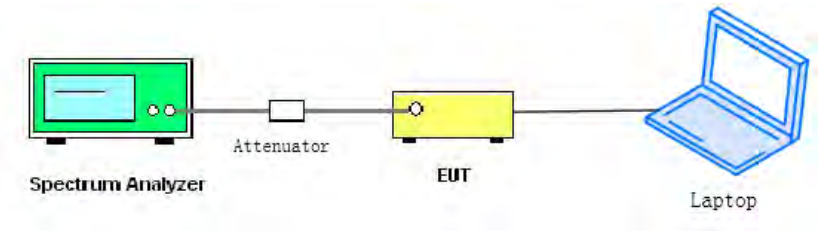
2.4. Bandwidth

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.

2.4.3. Test procedure

KDB 558074 Section 8.2 was used in order to prove compliance.

2.4.4. Test Result

802.11b Test mode

A. Test Verdict:

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limits(kHz)	Result
1	2412	9.046	≥500	PASS
7	2442	9.023	≥500	PASS
13	2472	9.050	≥500	PASS

B. Test Plots

(Channel 1, 2412MHz, 802.11b)

(Channel 7, 2442 MHz, 802.11b)

(Channel 13, 2472MHz, 802.11b)

802.11g Test mode

A. Test Verdict:

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limits (kHz)	Result
1	2412	16.36	≥500	PASS
7	2442	16.35	≥500	PASS
13	2472	16.37	≥500	PASS

B. Test Plots:

(Channel 1, 2412MHz, 802.11g)

(Channel 7, 2442MHz, 802.11g)

(Channel 13, 2472MHz, 802.11g)

802.11n(HT20) Test mode

A. Test Verdict:

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limits (kHz)	Result
1	2412	17.54	≥500	PASS
7	2442	17.56	≥500	PASS
13	2472	17.54	≥500	PASS

B. Test Plots:

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

(Channel 7, 2442MHz, 802.11n(HT20))

(Channel 13, 2472MHz, 802.11n(HT20))

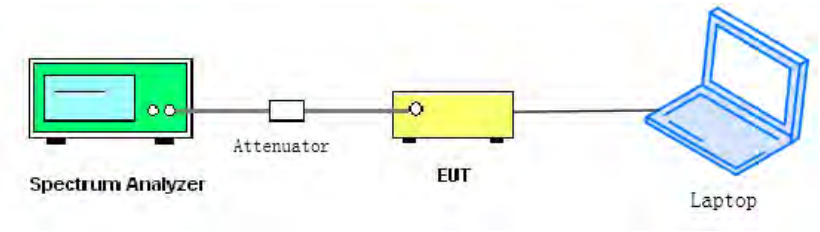
2.5. Conducted Spurious Emissions and Band Edge

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.

2.5.3. Test procedure

KDB 558074 Section 8.5 and 8.7 was used in order to prove compliance.

2.5.4. Test Result

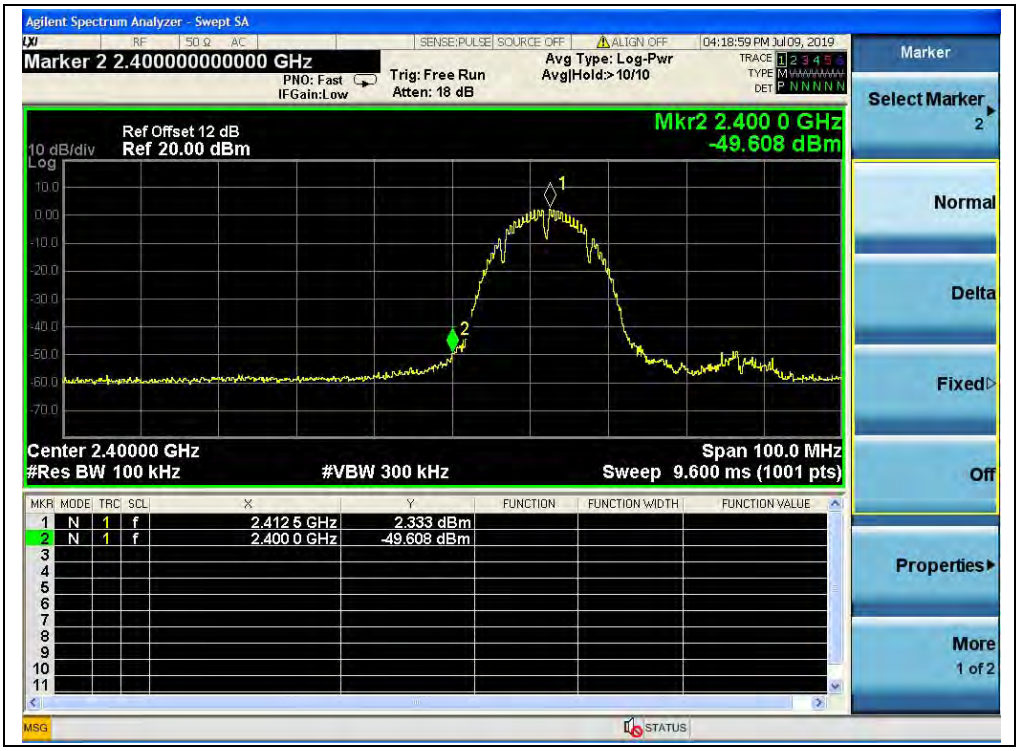
802.11b Test mode

A. Test Verdict:

Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
1	2412	-44.25	0.04	-19.96	PASS
7	2442	-44.15	1.87	-18.13	PASS
13	2472	-43.86	2.75	-17.25	PASS

B. Test Plots:

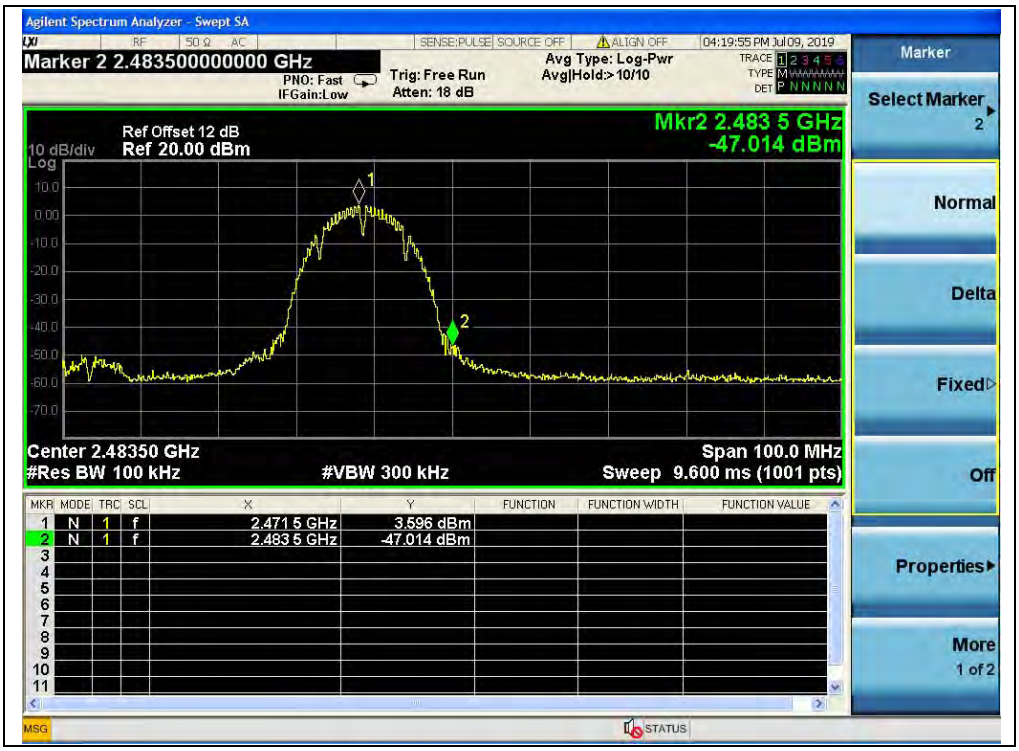
(Channel = 1, 30MHz to 25GHz)



(Band Edge, Channel = 1)

(Channel = 7, 30MHz to 25GHz)

(Channel = 13, 30MHz to 25GHz)



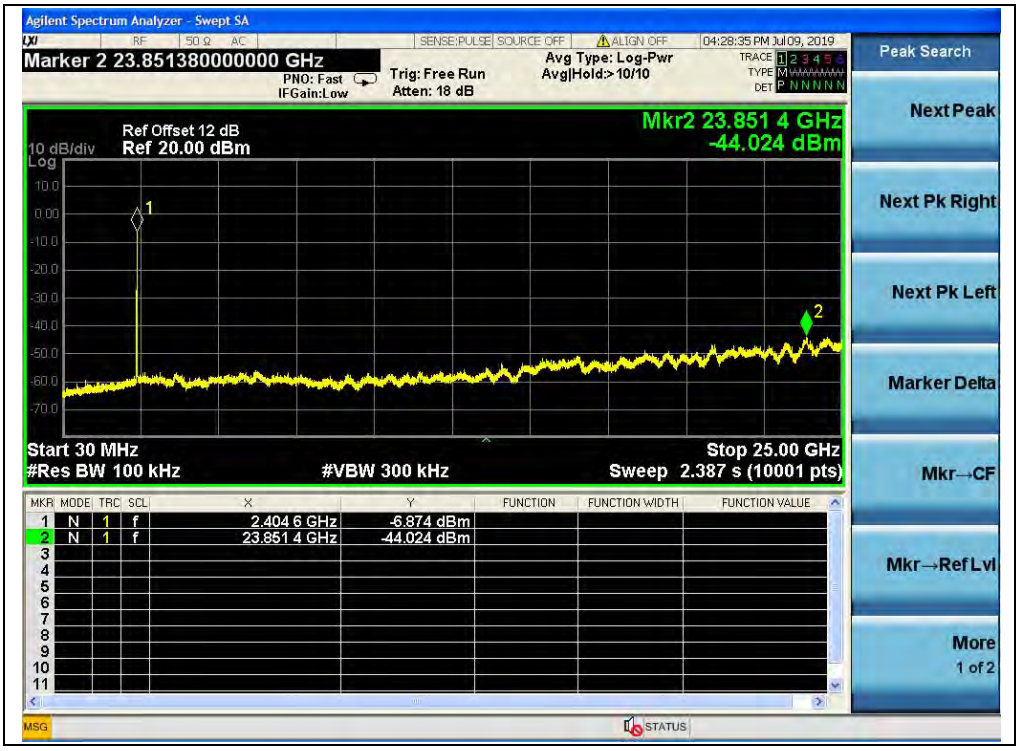
(Band Edge, Channel = 13)

802.11g Test mode

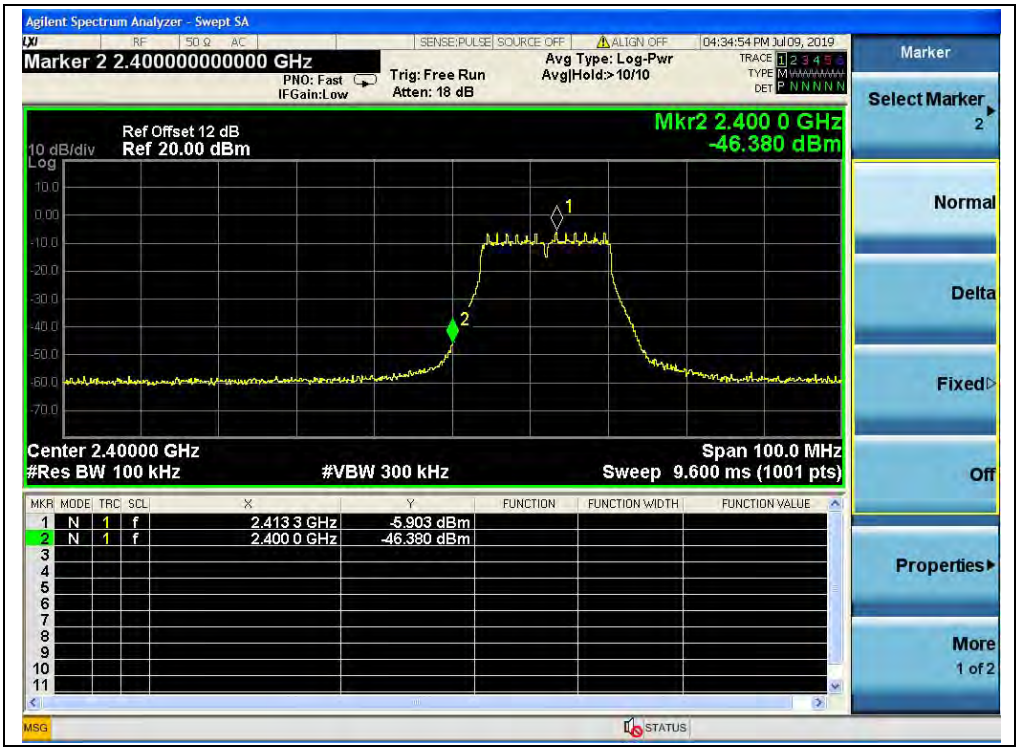
A. Test Verdict:

Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
1	2412	-44.02	-6.87	-26.87	PASS
7	2442	-43.47	-7.45	-27.45	PASS
13	2472	-43.39	-6.02	-26.02	PASS

B. Test Plots:



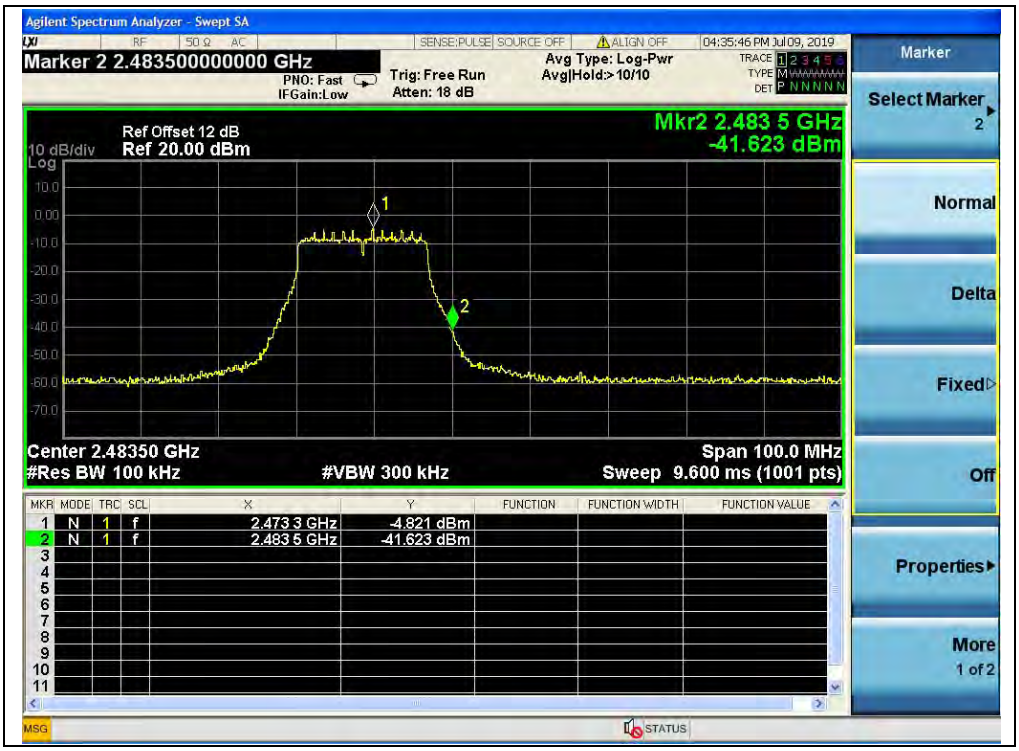
(Channel = 1, 30MHz to 25GHz)



(Band Edge, Channel = 1)

(Channel = 7, 30MHz to 25GHz)

(Channel = 13, 30MHz to 25GHz)



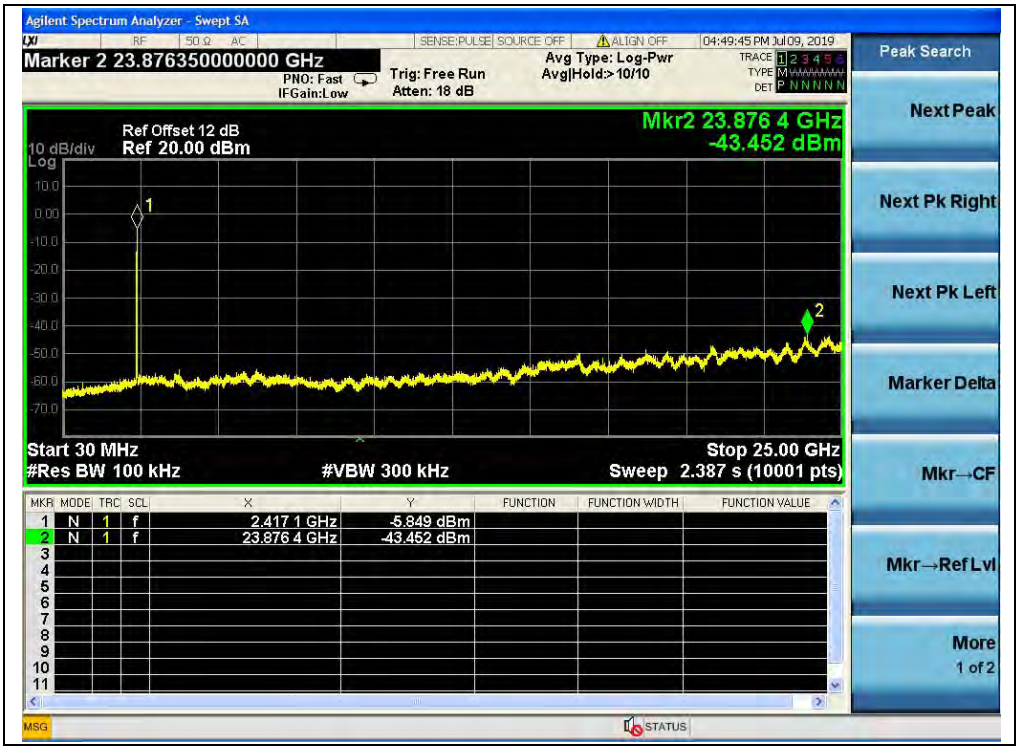
(Band Edge, Channel = 13)

802.11n(HT20) Test mode

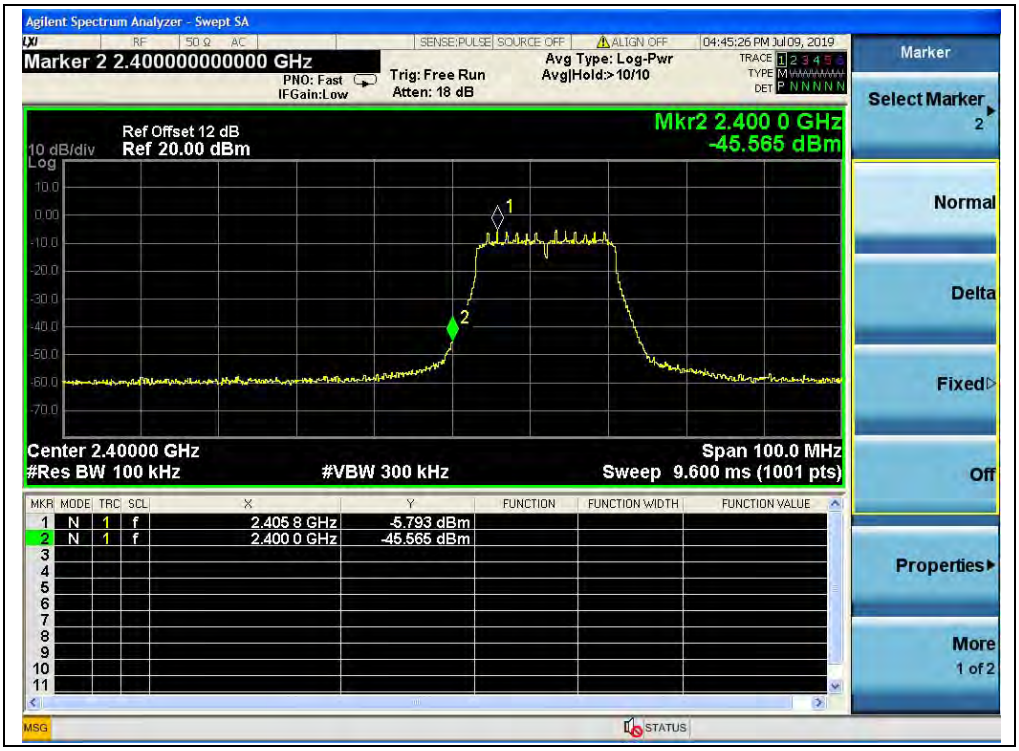
A. Test Verdict:

Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
1	2412	-43.45	-5.85	-25.85	PASS
7	2442	-43.90	-6.28	-26.28	PASS
13	2472	-44.02	-7.38	-27.38	PASS

B. Test Plots:



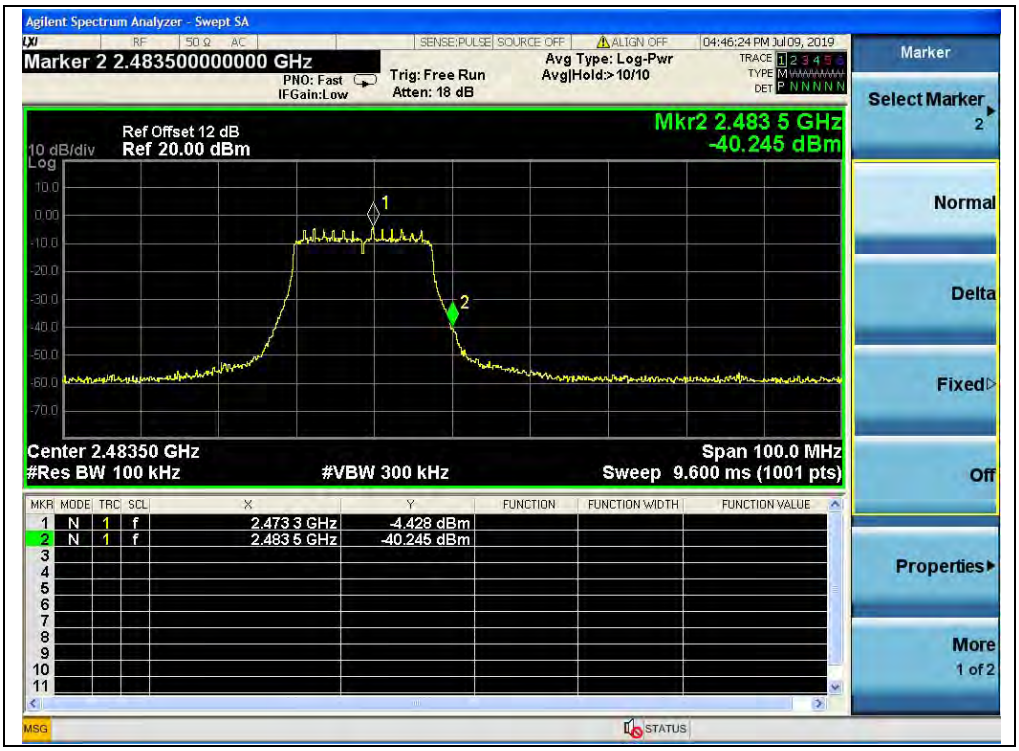
(Channel = 1, 30MHz to 25GHz)



(Band Edge, Channel = 1)

(Channel = 7, 30MHz to 25GHz)

(Channel = 13, 30MHz to 25GHz)



(Band Edge, Channel = 13)

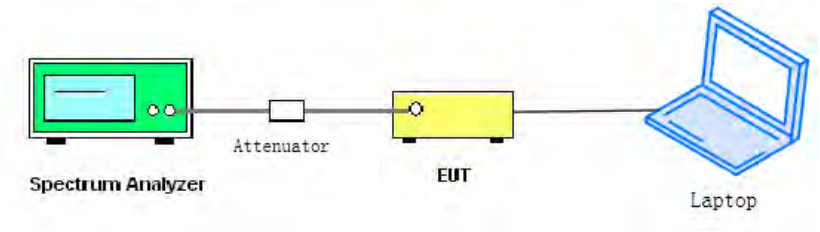
2.6. Power spectral density (PSD)

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 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.

2.6.3. Test procedure

KDB 558074 Section 8.4 was used in order to prove compliance.

2.6.4. Test Result

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	-11.89	8	PASS
7	2442	-10.46	8	PASS
13	2472	-10.25	8	PASS

B. Test Plots:

(Channel = 1, 802.11b)

(Channel = 7, 802.11b)

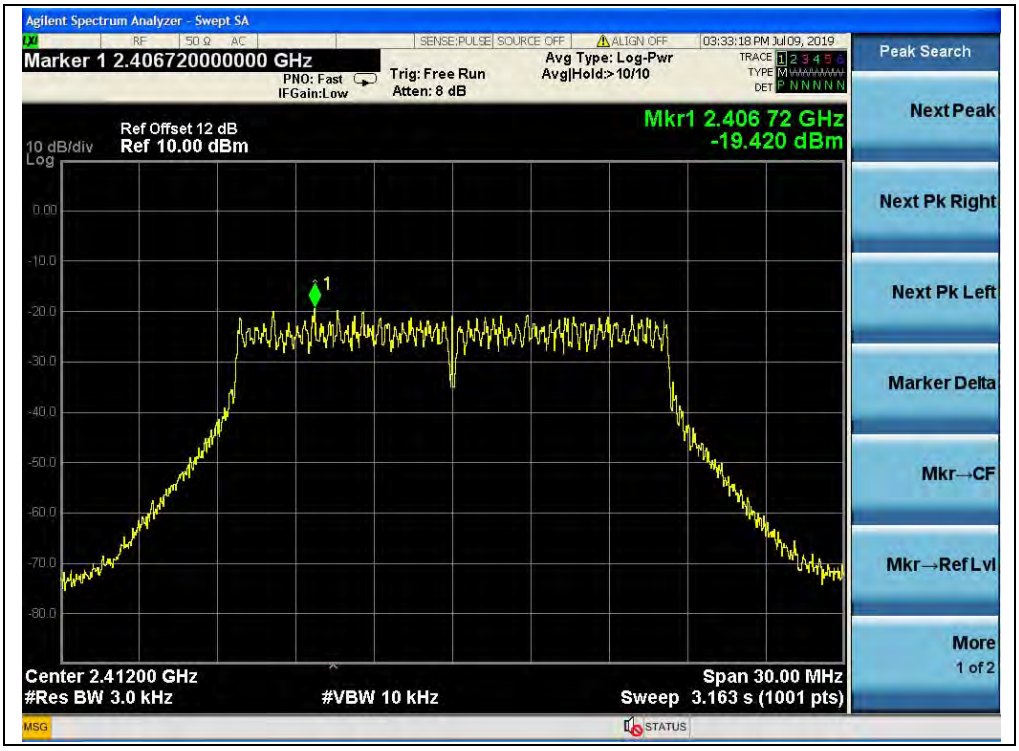
(Channel = 13, 802.11b)

802.11g Test mode

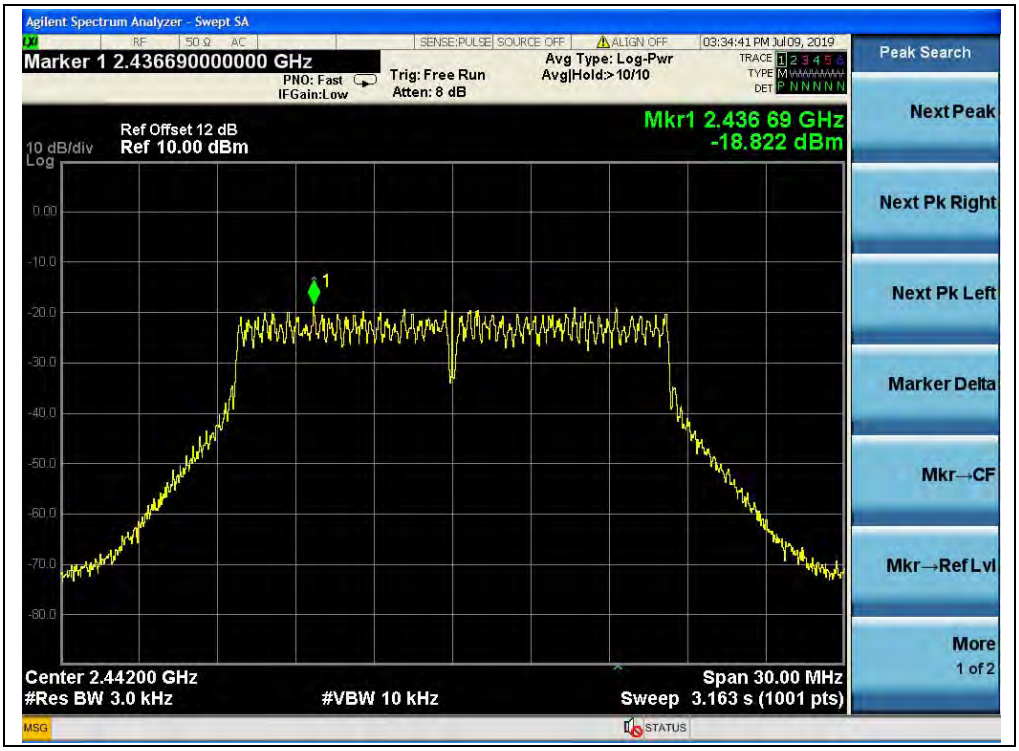
A. Test Verdict:

Spectral power density (dBm/3kHz)				
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
1	2412	-19.42	8	PASS
7	2442	-18.82	8	PASS
13	2472	-18.11	8	PASS

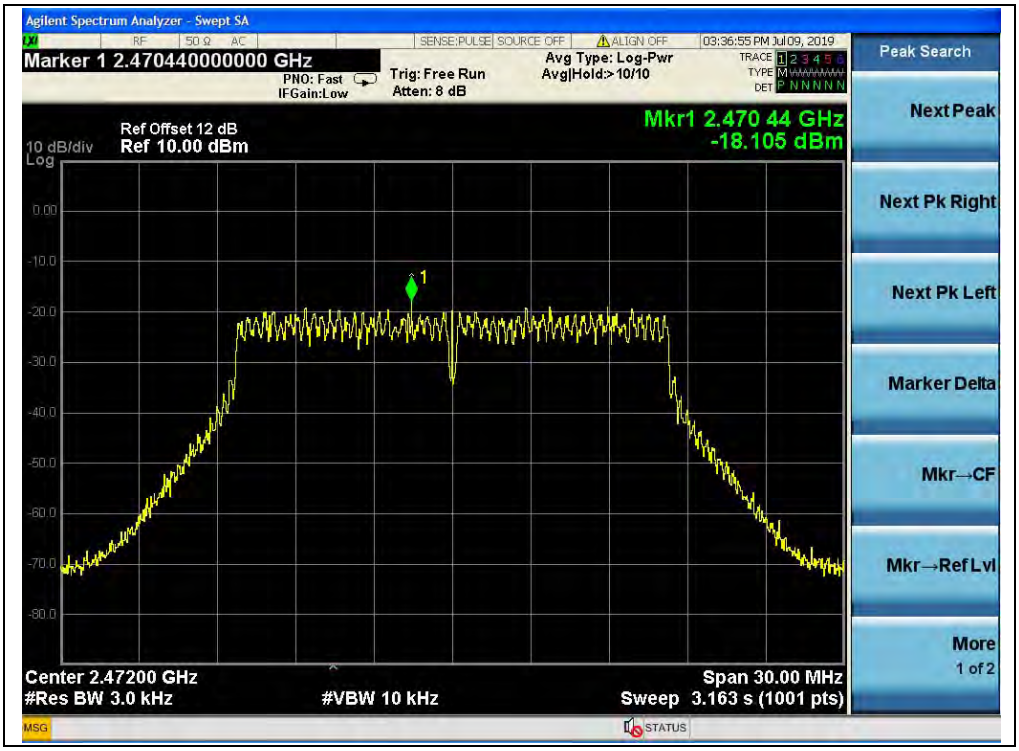
B. Test Plots:



(Channel = 1, 802.11g)



(Channel = 7, 802.11g)



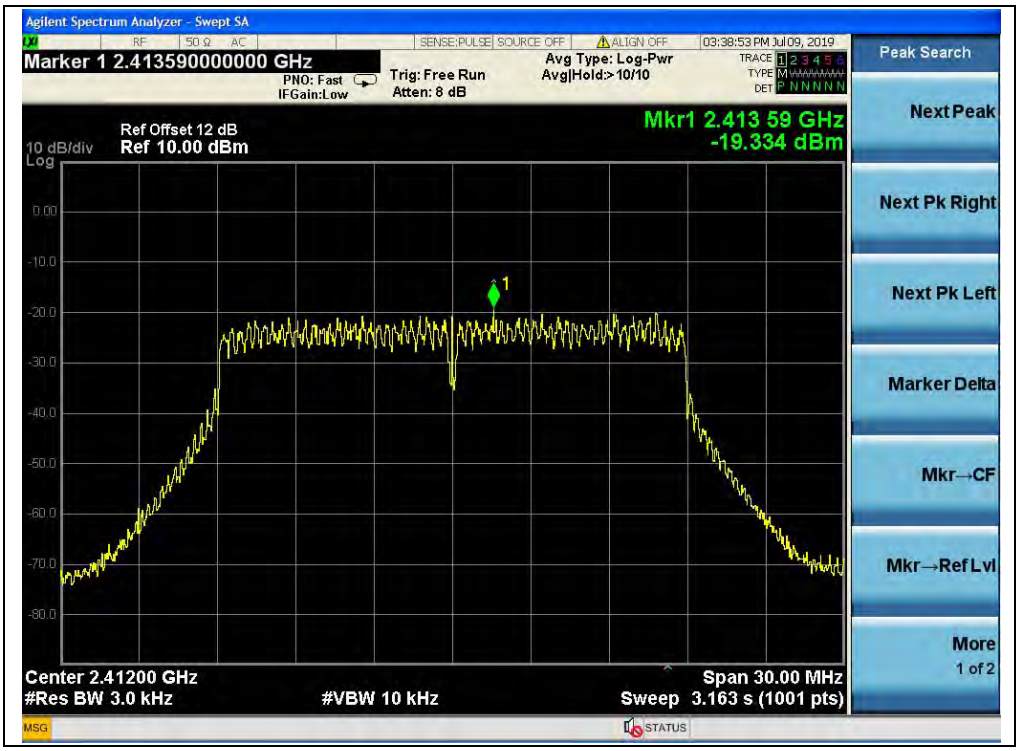
(Channel = 13, 802.11g)

802.11n(HT20) Test mode

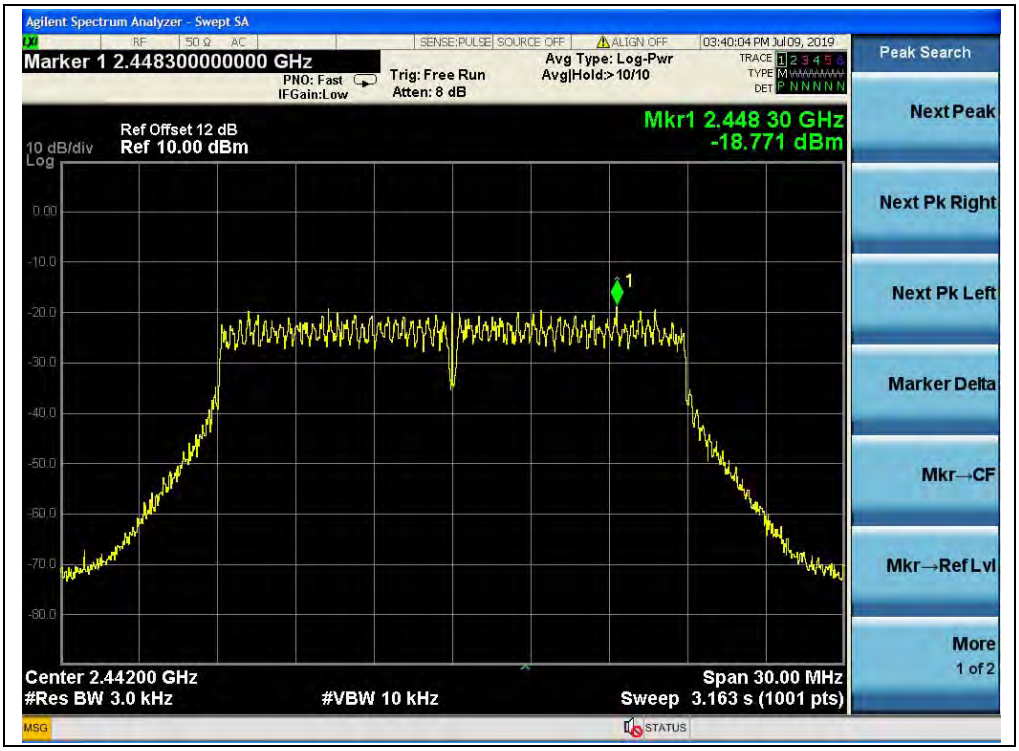
A. Test Verdict:

Spectral power density (dBm/3kHz)				
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
1	2412	-19.33	8	PASS
7	2442	-18.77	8	PASS
13	2472	-18.62	8	PASS

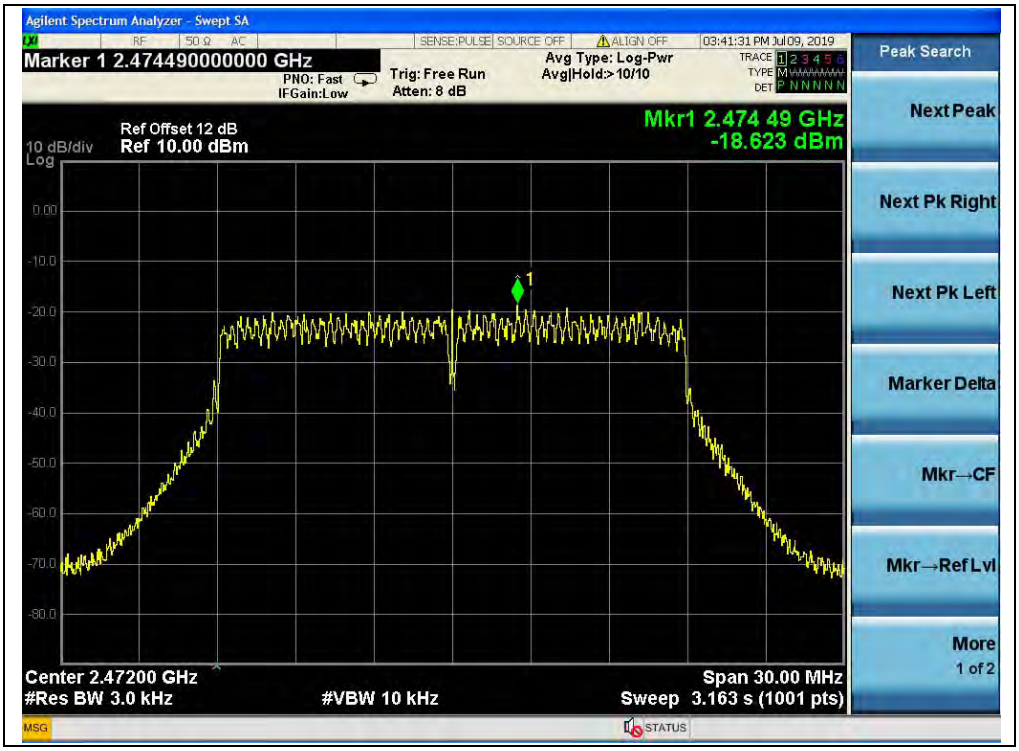
B. Test Plots:



(Channel = 1, 802.11n(HT20))



(Channel = 7, 802.11n(HT20))



(Channel = 13, 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

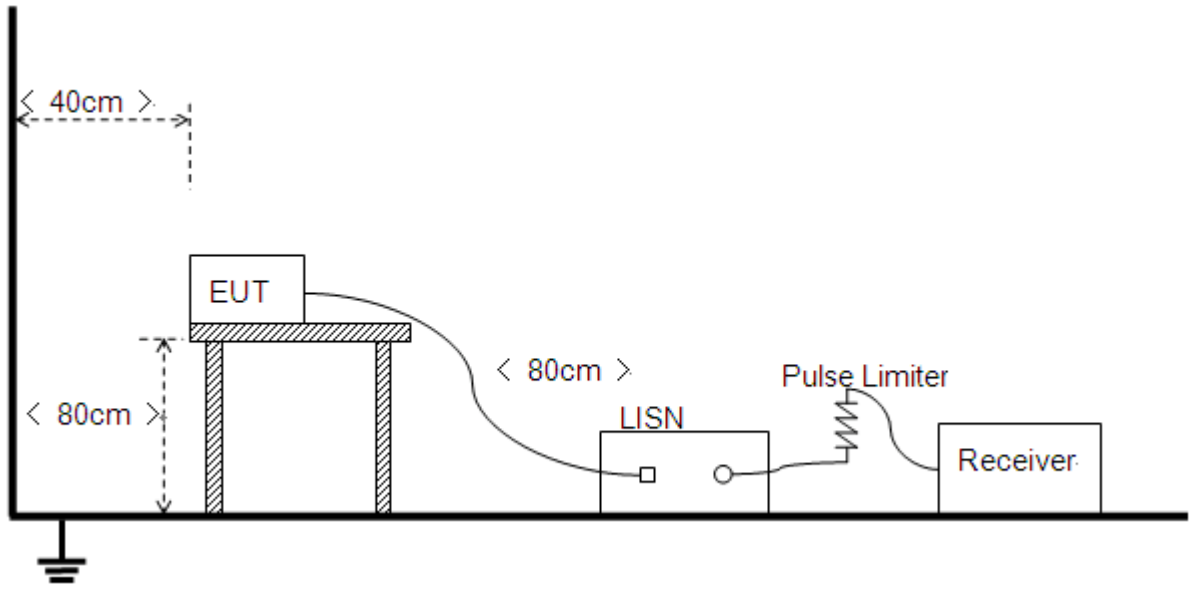
NOTE:

(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.

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 Link (Recording)+ T-flash card+2.4GWIFI TX

Test Voltage: AC 120V/60Hz

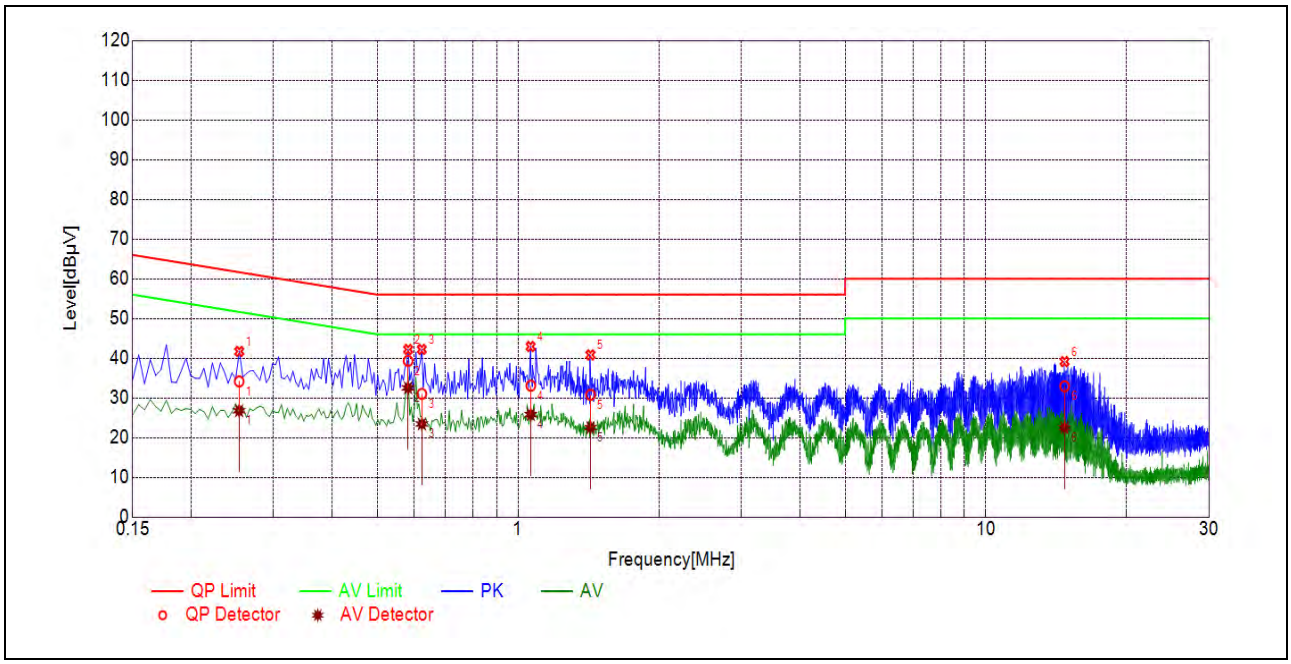
The measurement results are obtained as below:

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

U_R: Receiver Reading

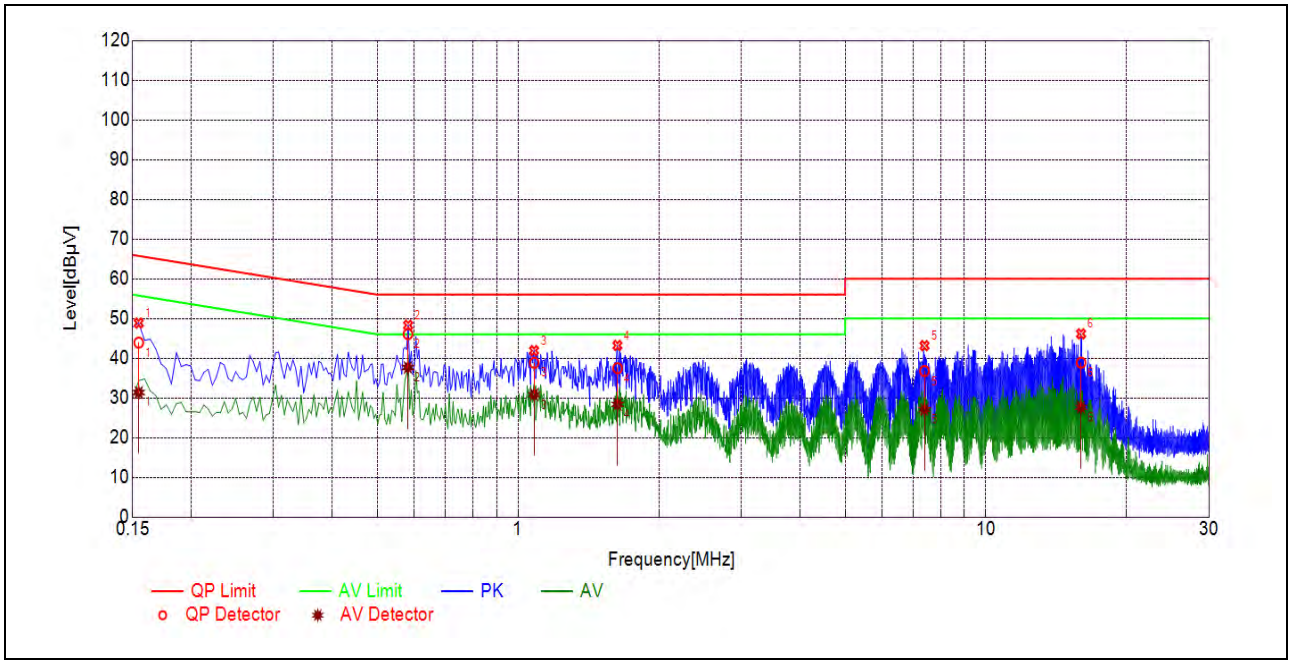
A_{Factor}: Voltage division factor of LISN

B. Test Plots:



(L Phase)

NO.	Fre. (MHz)	Emission Level (dBµV)		Limit (dBµV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.2533	34.15	26.78	61.65	51.65	Line	PASS
2	0.5818	39.31	32.53	56.00	46.00		PASS
3	0.6226	31.02	23.43	56.00	46.00		PASS
4	1.0644	33.09	25.81	56.00	46.00		PASS
5	1.4284	30.78	22.54	56.00	46.00		PASS
6	14.7266	32.94	22.44	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	0.1545	43.93	31.39	65.76	55.76	Neutral	PASS
2	0.5814	46.07	37.66	56.00	46.00		PASS
3	1.0820	38.84	30.82	56.00	46.00		PASS
4	1.6311	37.48	28.40	56.00	46.00		PASS
5	7.3894	36.76	27.08	60.00	50.00		PASS
6	15.9739	38.90	27.67	60.00	50.00		PASS

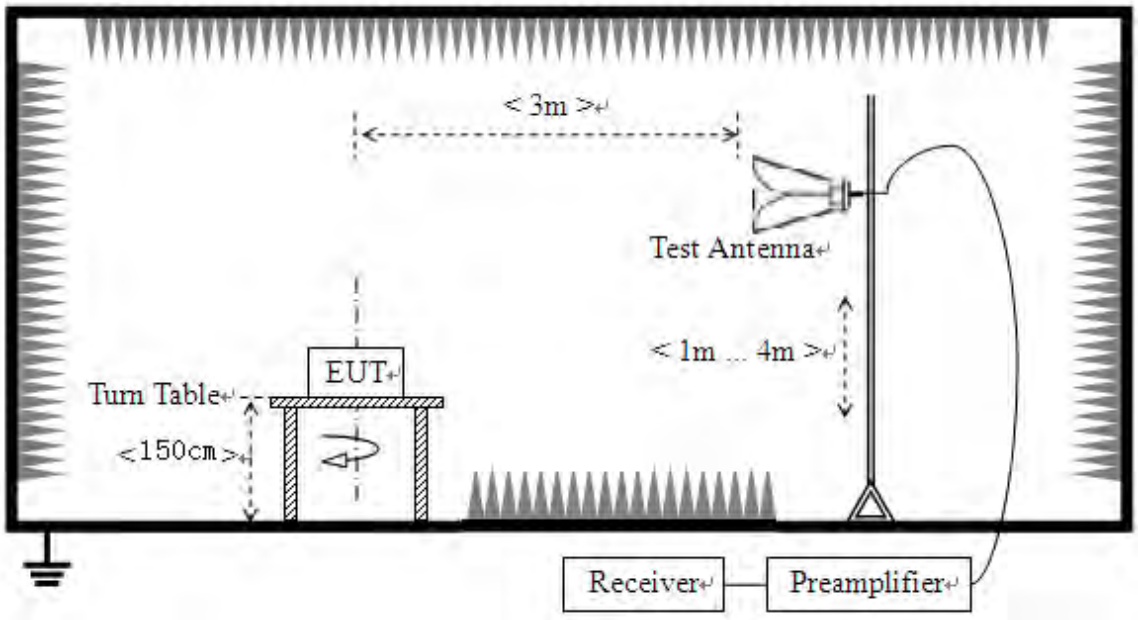
2.8. Restricted Frequency Bands

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.

2.8.3. Test procedure

KDB 558074 Section 8.6 and 8.7 was used in order to prove compliance.

2.8.4. 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

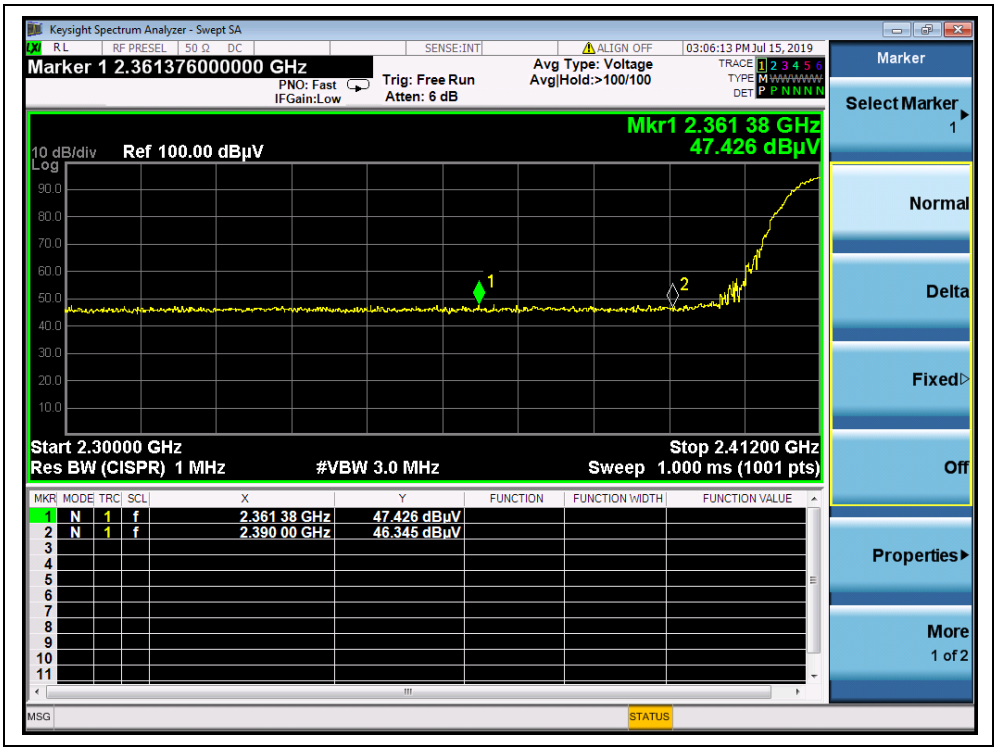
Note: Restricted Frequency Bands were performed when antenna was at vertical and horizontal polarity, and only the worse test condition (vertical) was recorded in this test report.

802.11b Test mode

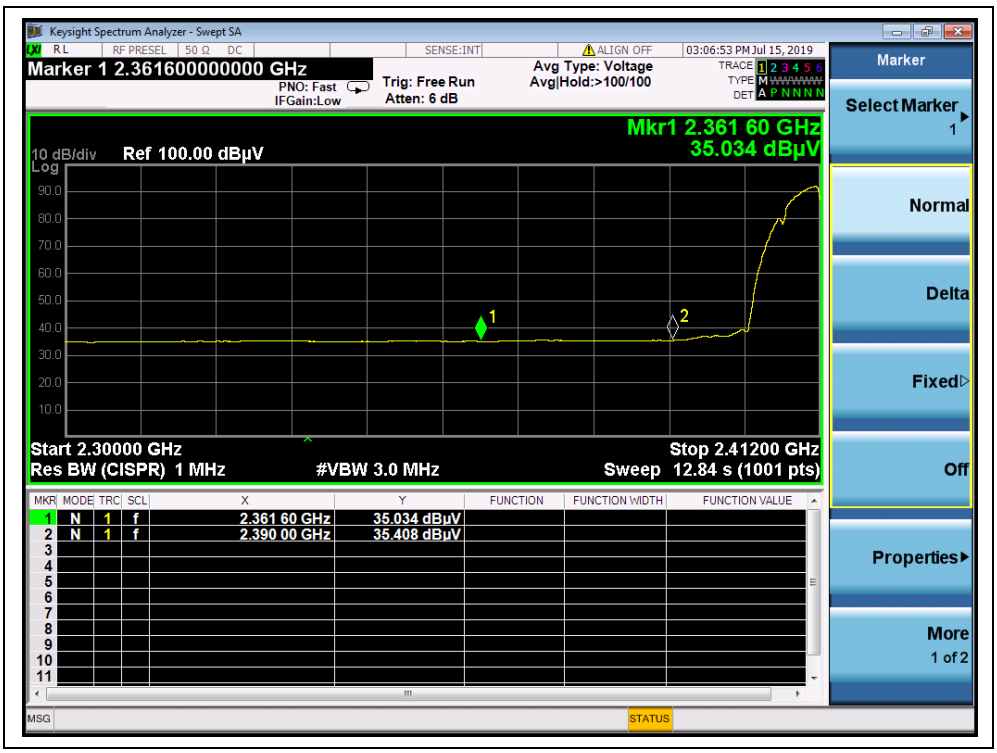
A. Test Verdict:

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	2361.38	PK	47.43	-29.67	32.56	50.32	74	PASS
1	2390.00	AV	35.41	-29.67	32.56	38.30	54	PASS
13	2483.76	PK	59.44	-29.67	32.56	62.33	74	PASS
13	2483.82	AV	37.92	-29.67	32.56	40.81	54	PASS

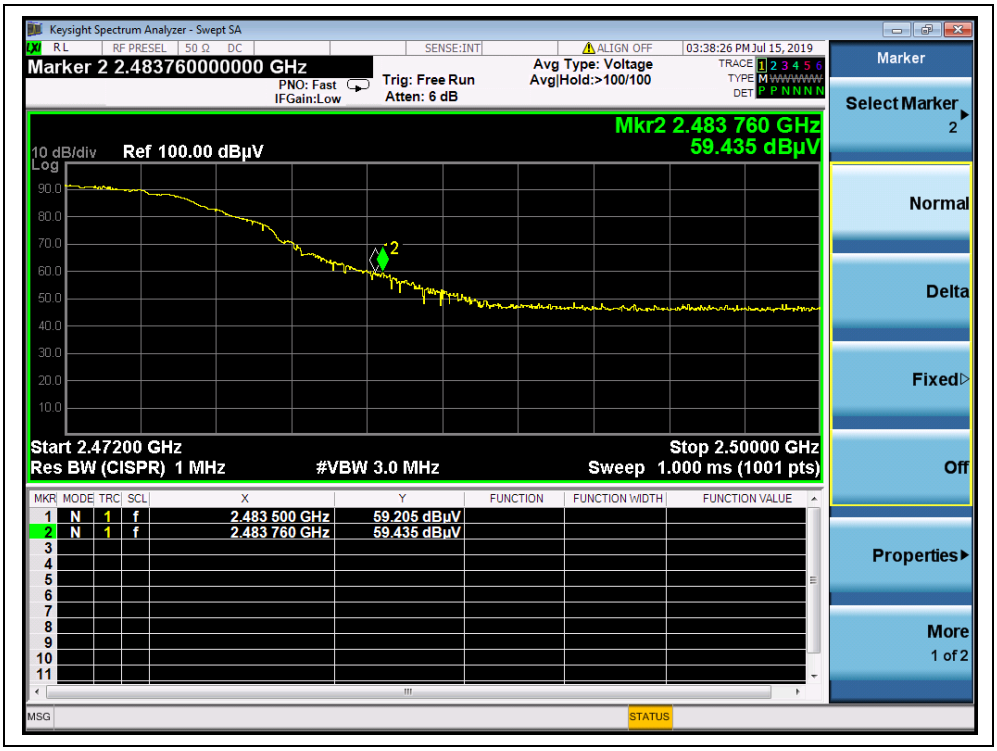
B. Test Plots:



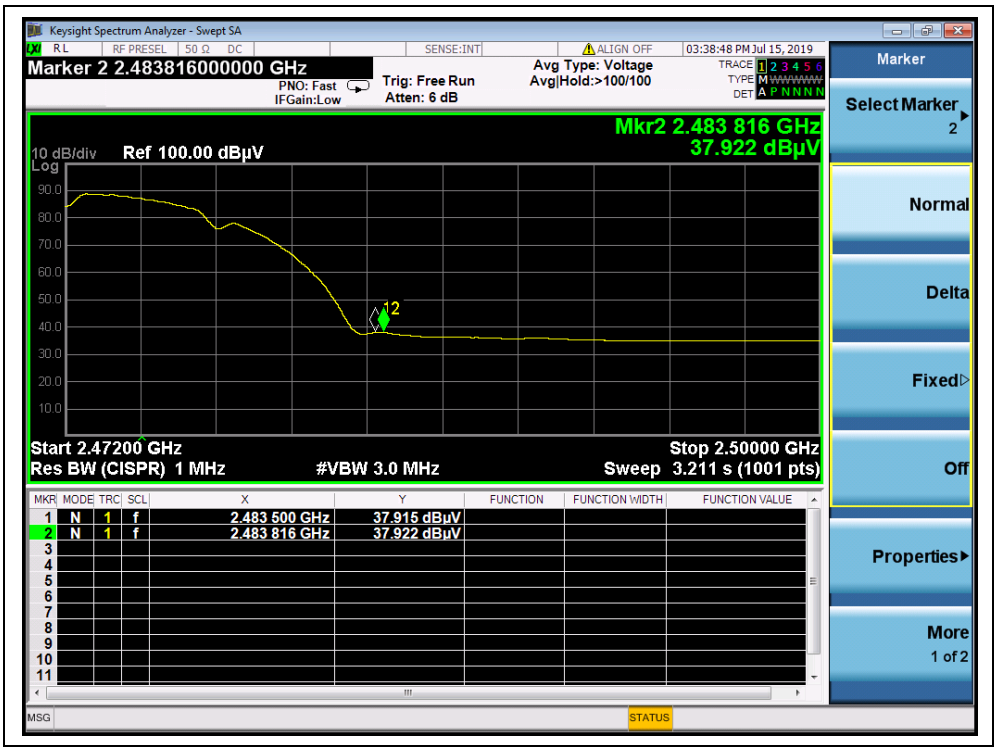
(Channel = 1 PEAK, 802.11b)



(Channel = 1 AVG, 802.11b)



(Channel = 13 PEAK, 802.11b)



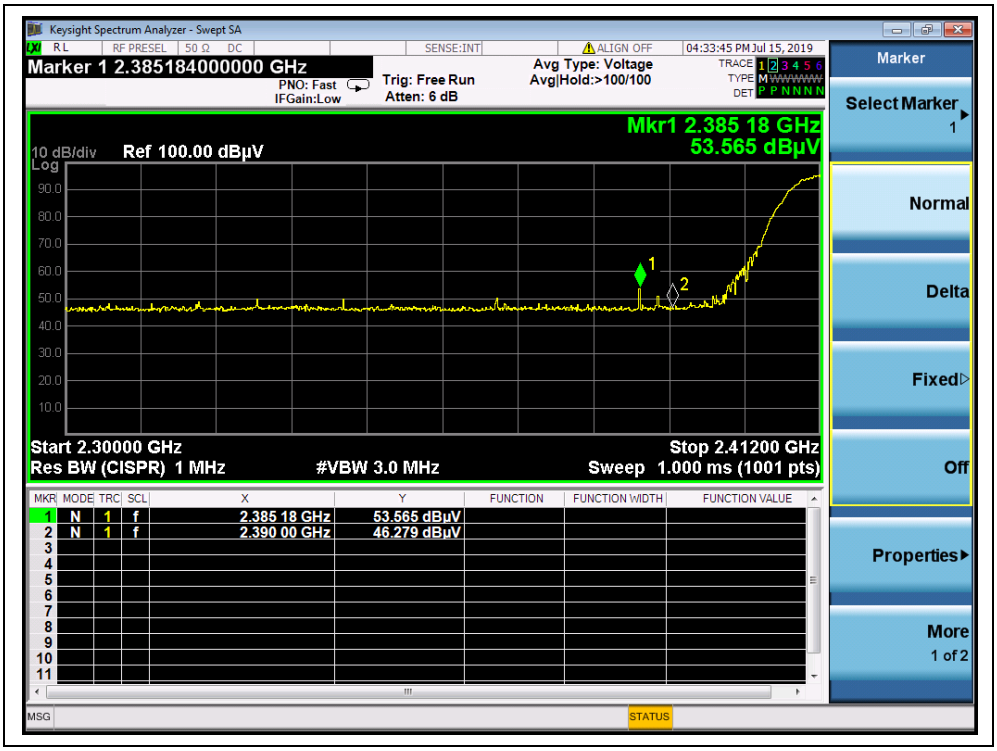
(Channel = 13 AVG, 802.11b)

802.11g Test mode

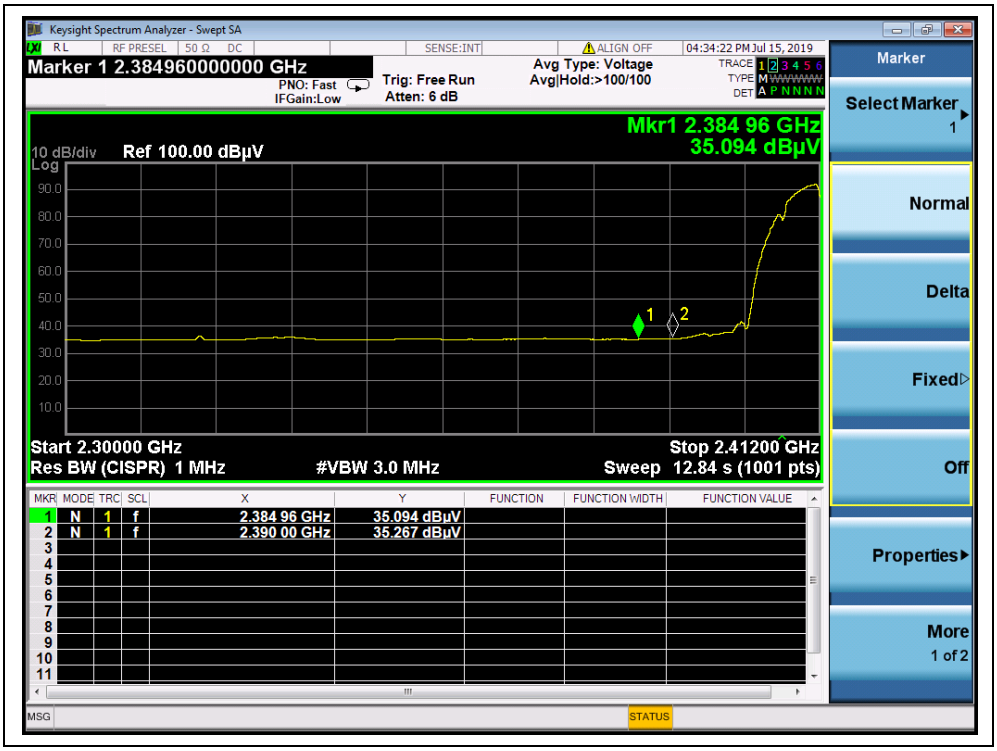
A. Test Verdict:

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	2385.18	PK	53.57	-29.67	32.56	56.46	74	PASS
1	2390.0	AV	35.27	-29.67	32.56	38.16	54	PASS
13	2483.70	PK	58.72	-29.67	32.56	61.61	74	PASS
13	2483.82	AV	40.02	-29.67	32.56	42.91	54	PASS

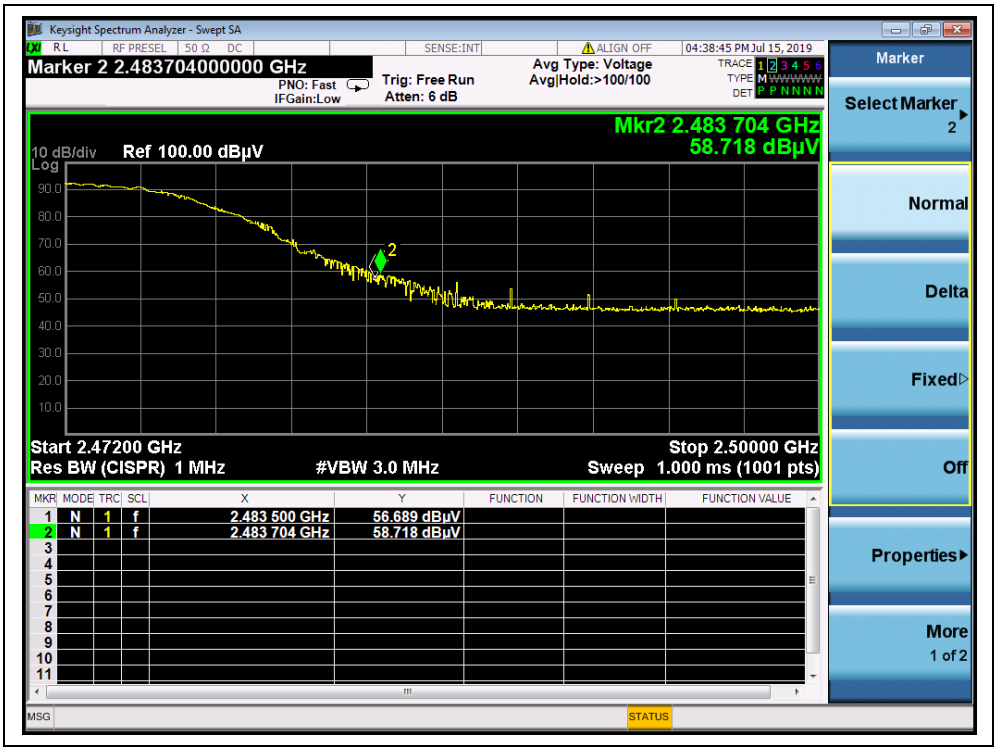
B. Test Plots:



(Channel = 1 PEAK, 802.11g)



(Channel = 1 AVG, 802.11g)



(Channel = 13 PEAK, 802.11g)

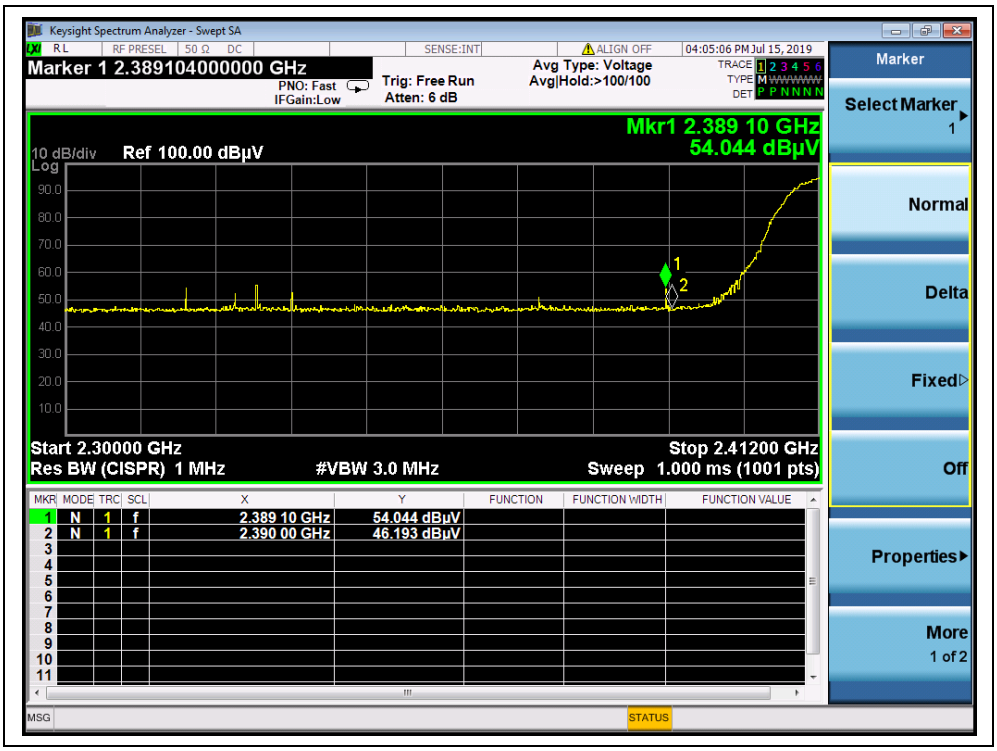
(Channel = 13 AVG, 802.11g)

802.11 n(HT20) Test mode

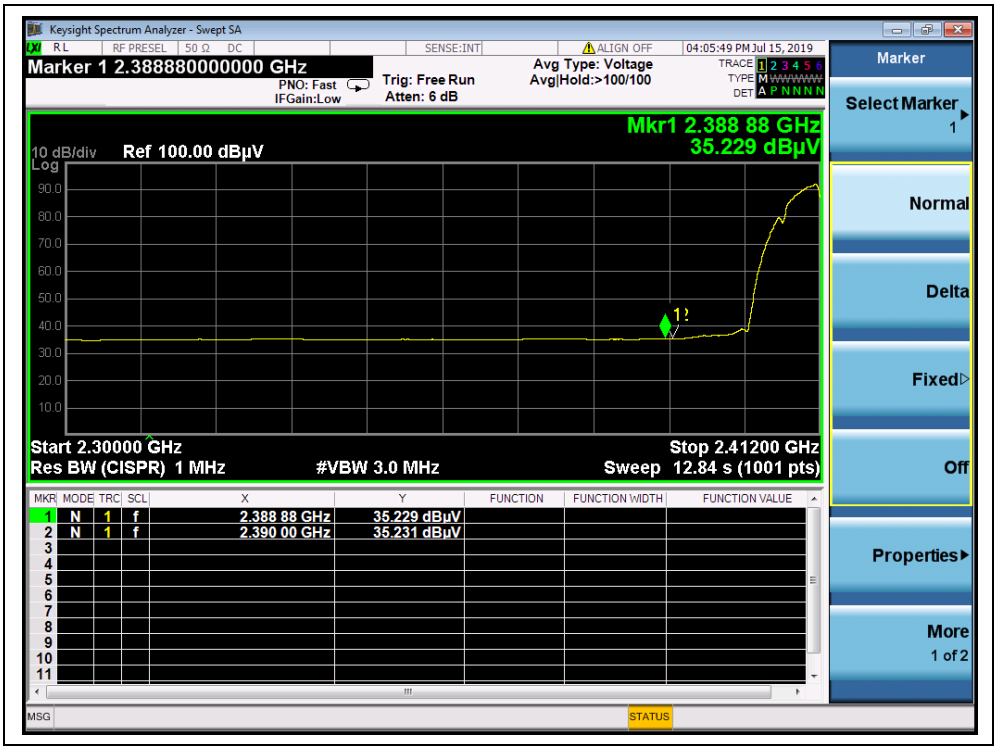
A. Test Verdict:

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	2389.10	PK	54.04	-29.67	32.56	56.93	74	PASS
1	2390.00	AV	35.23	-29.67	32.56	38.12	54	PASS
13	2483.65	PK	58.58	-29.67	32.56	61.47	74	PASS
13	2483.70	AV	38.03	-29.67	32.56	40.92	54	PASS

B. Test Plots:



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



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

(Channel = 13 PEAK, 802.11n(HT20))

(Channel = 13 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.

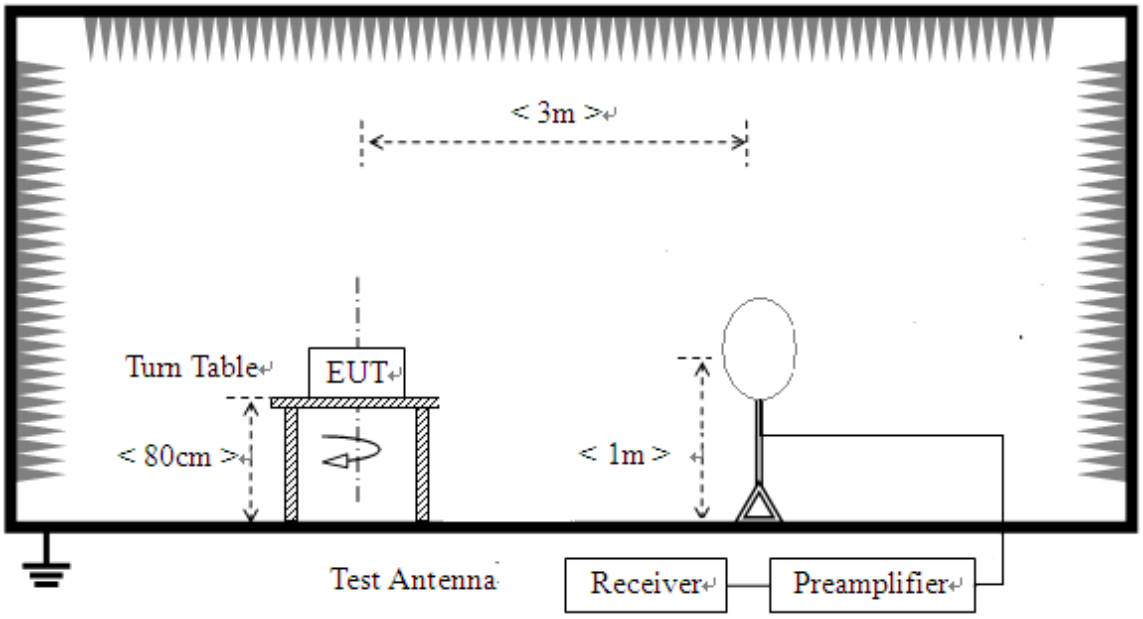
For above 1000MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK)

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)

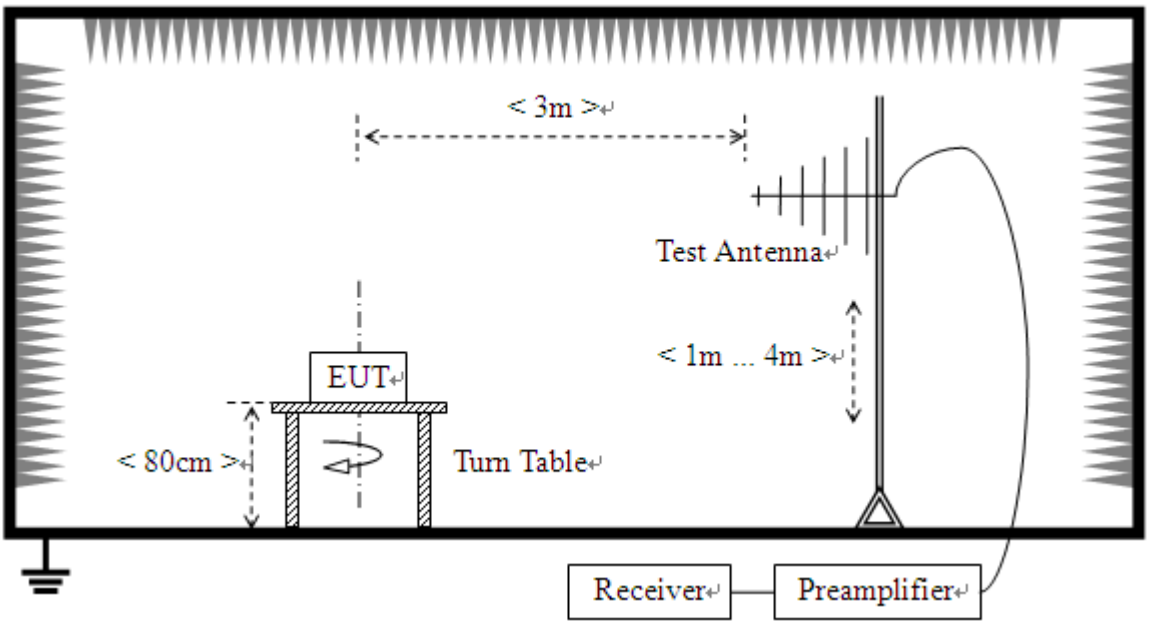
2.9.2. Test Description

A. Test Setup:

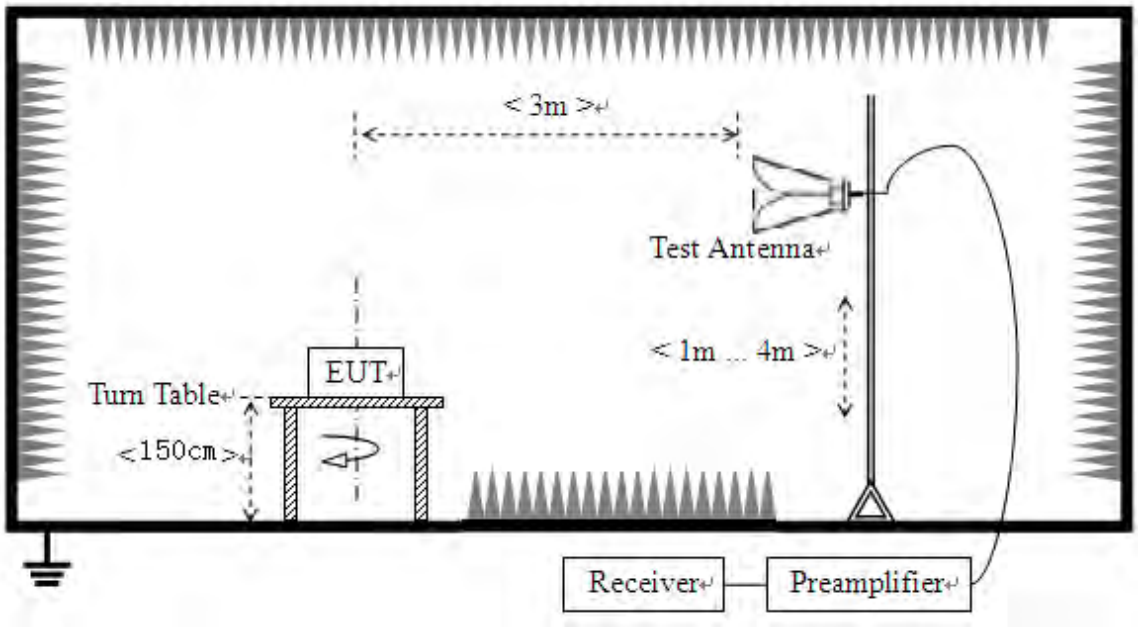
1) For radiated emissions from 9kHz to 30MHz



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.

2.9.3. Test Result

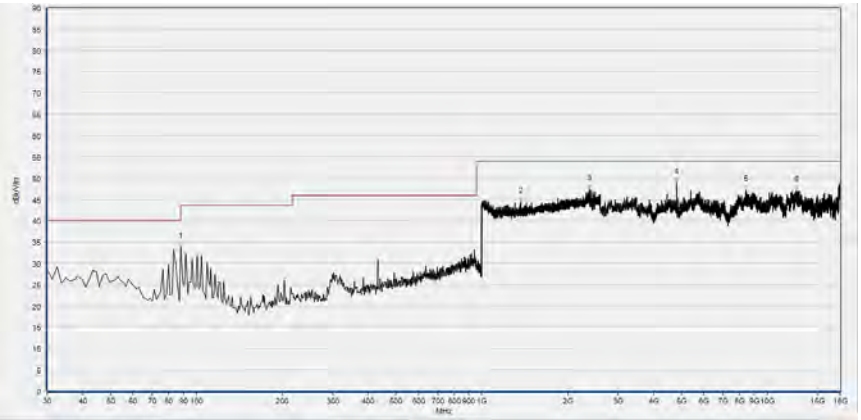
According to ANSI C63.10, because of peak detection will yield amplitudes equal to or greater than amplitudes measured with the quasi-peak (or average) detector, the measurement data from a spectrum analyzer peak detector will represent the worst-case results, if the peak measured value complies with 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.

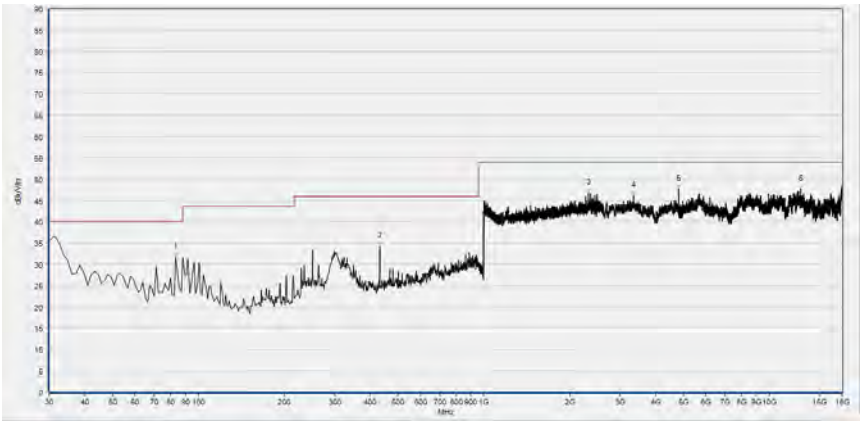
802.11b Test mode

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
88.273	33.86	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1371.349	44.35	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2377.191	47.49	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4823.604	48.90	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8394.254	47.24	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12667.831	47.04	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

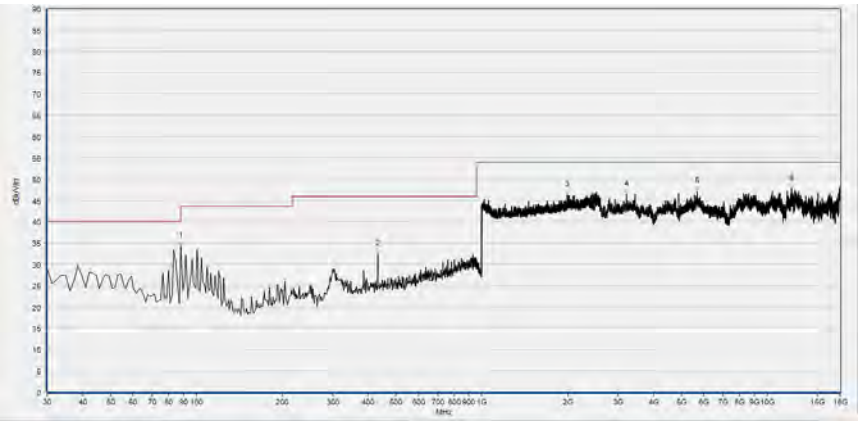
(Antenna Horizontal, 30MHz to 25GHz)



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
83.417	31.70	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
431.840	34.12	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2331.092	46.75	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
3344.935	46.03	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4823.604	47.52	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12897.472	47.68	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

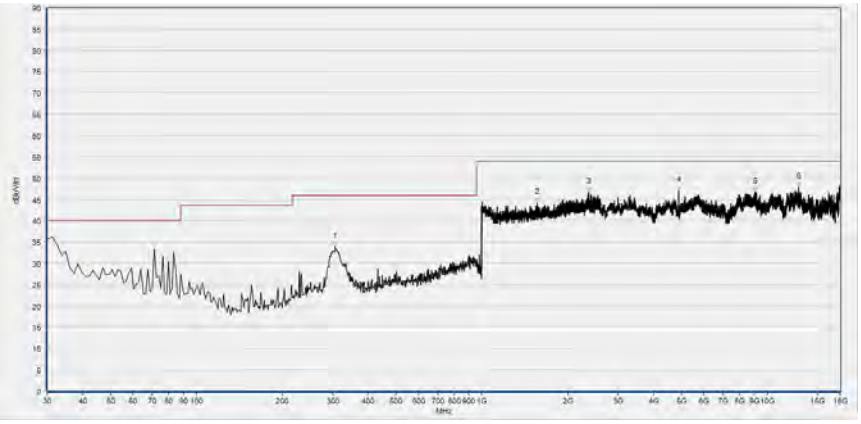
(Antenna Vertical, 30MHz to 25GHz)

Plot for Channel = 7



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
88.273	34.26	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
431.840	32.41	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1991.757	46.29	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3207.710	46.39	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5674.959	47.03	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12138.534	47.75	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

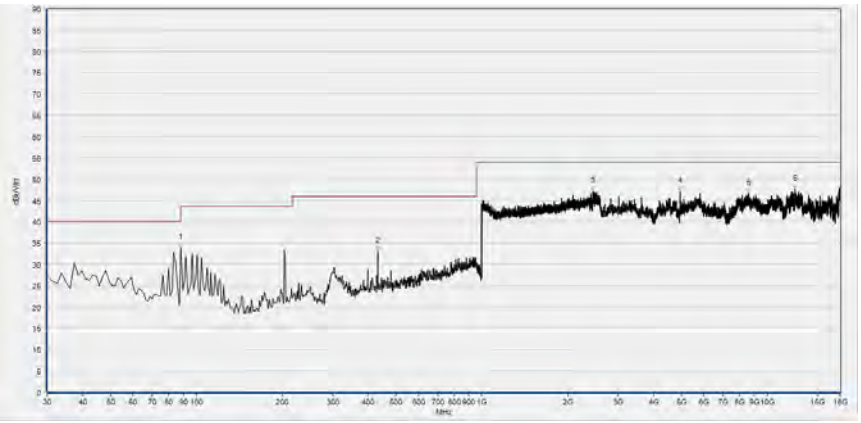
(Antenna Horizontal, 30MHz to 25GHz)



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
306.796	33.85	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1565.346	44.17	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2363.745	46.75	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4885.215	47.14	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
9071.977	46.73	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12919.876	47.86	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

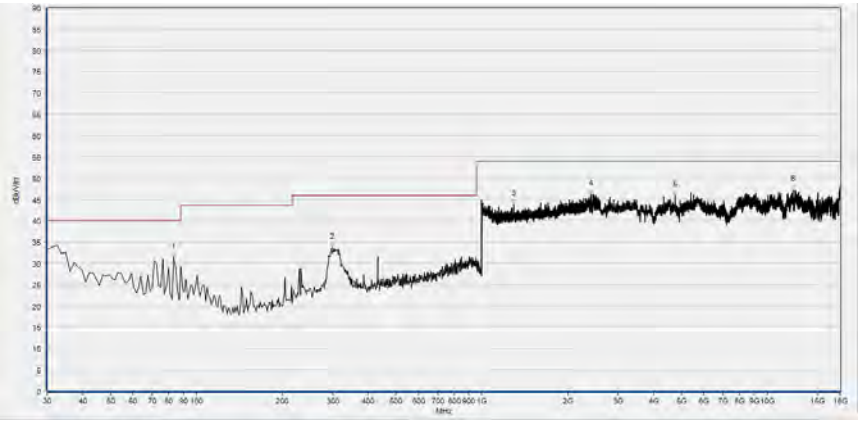
(Antenna Vertical, 30MHz to 25GHz)

Plot for Channel = 13



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
88.273	33.77	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
431.840	33.03	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2448.259	47.03	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4944.026	47.08	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8590.289	46.55	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12513.803	47.54	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 25GHz)

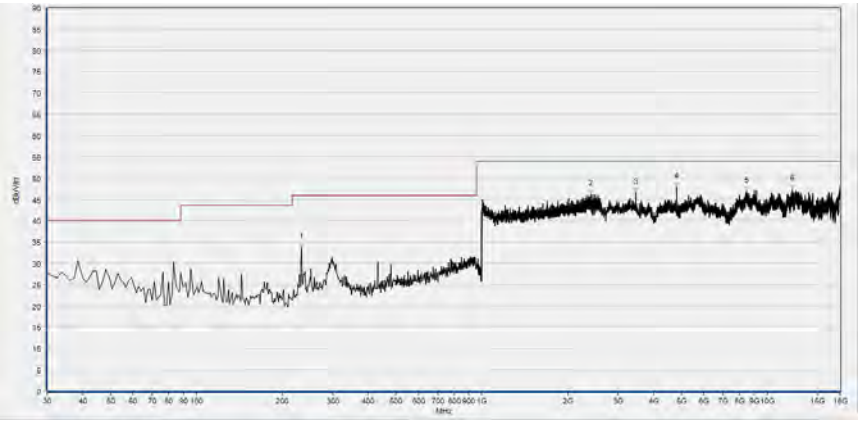


Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
83.417	31.30	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
298.298	33.65	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1295.798	43.89	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2408.563	46.20	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4756.392	45.84	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12284.161	47.32	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 25GHz)

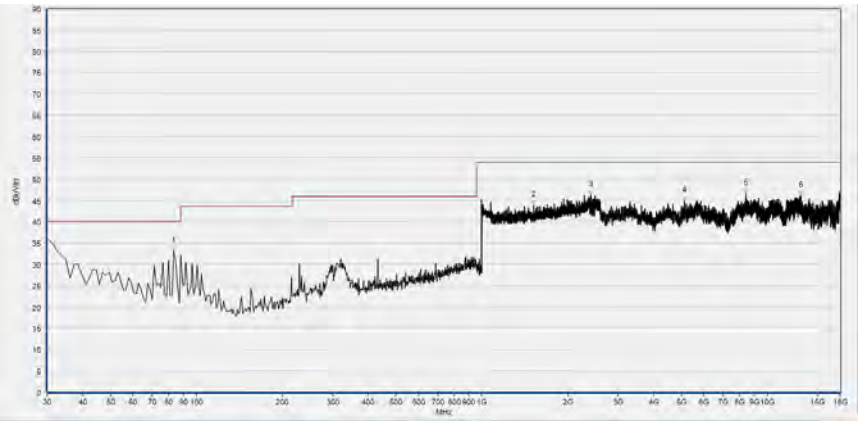
802.11g Test mode

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
233.955	33.75	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2409.204	46.20	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3456.956	46.56	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4823.604	47.91	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8444.663	46.94	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12205.746	47.40	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

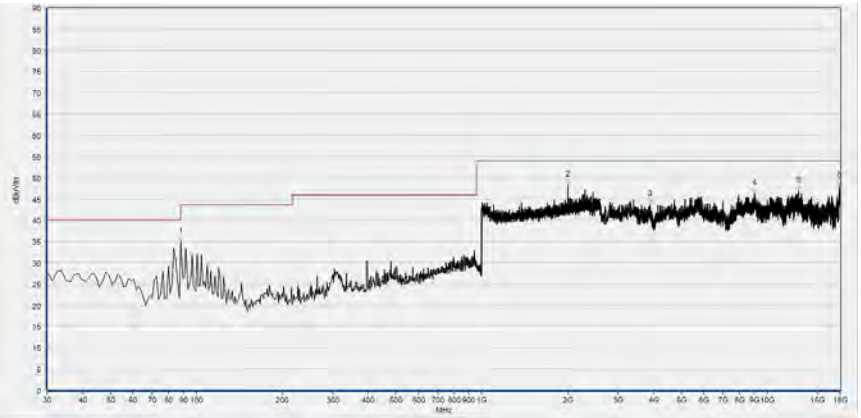
(Antenna Horizontal, 30MHz to 25GHz)



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
83.417	33.25	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
1517.327	43.88	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2405.362	46.22	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5131.660	44.94	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8419.458	46.57	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
13101.909	46.10	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

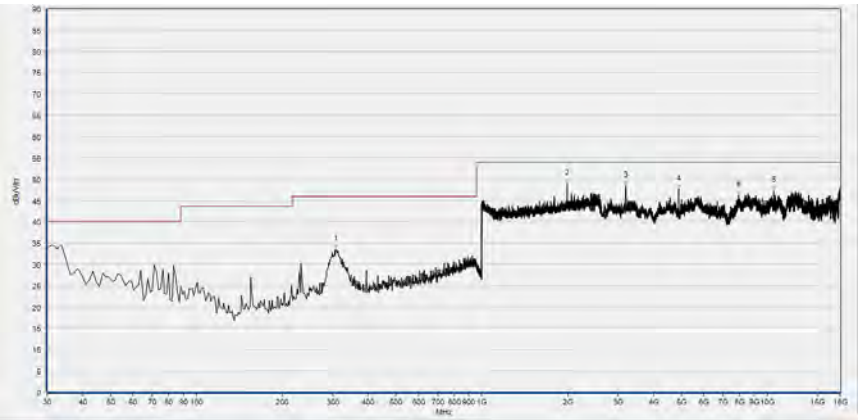
(Antenna Vertical, 30MHz to 25GHz)

Plot for Channel = 7



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
88.273	34.82	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1999.440	48.28	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3891.035	43.82	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
9035.570	46.23	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12891.871	46.94	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
17859.975	48.10	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

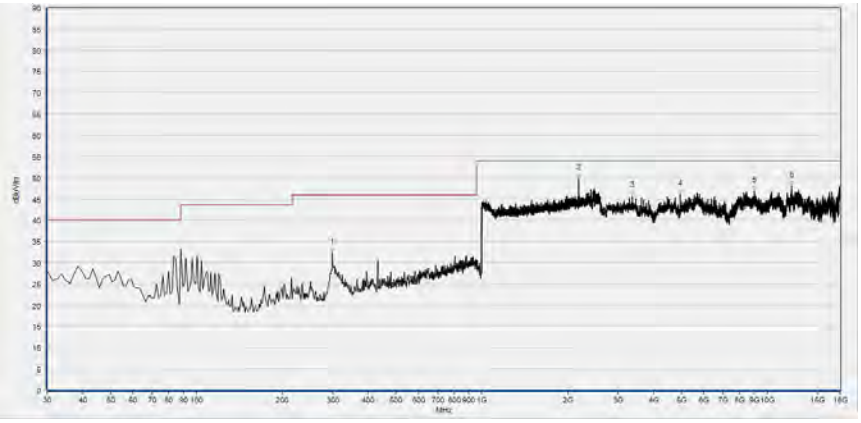
(Antenna Horizontal, 30MHz to 25GHz)



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
308.010	33.44	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1995.598	48.86	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
3188.107	48.38	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4885.215	47.57	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
7946.172	46.27	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
10531.042	47.27	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

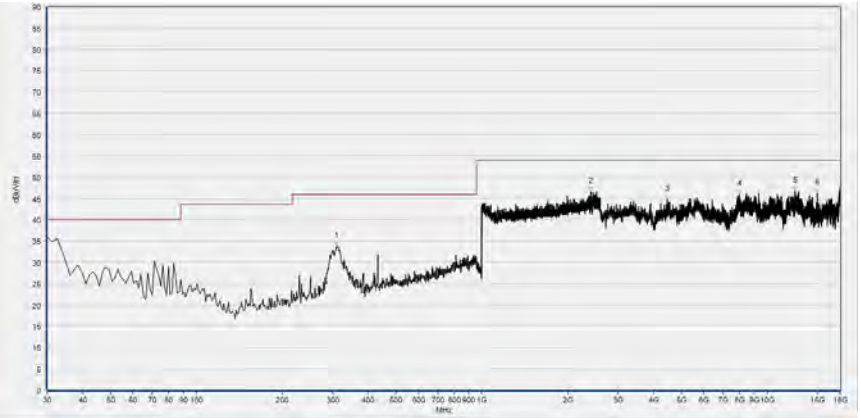
(Antenna Vertical, 30MHz to 25GHz)

Plot for Channel = 13



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
299.512	32.27	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2179.992	49.81	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3372.941	45.78	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4944.026	46.11	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
9015.967	46.88	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12160.938	48.09	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 25GHz)

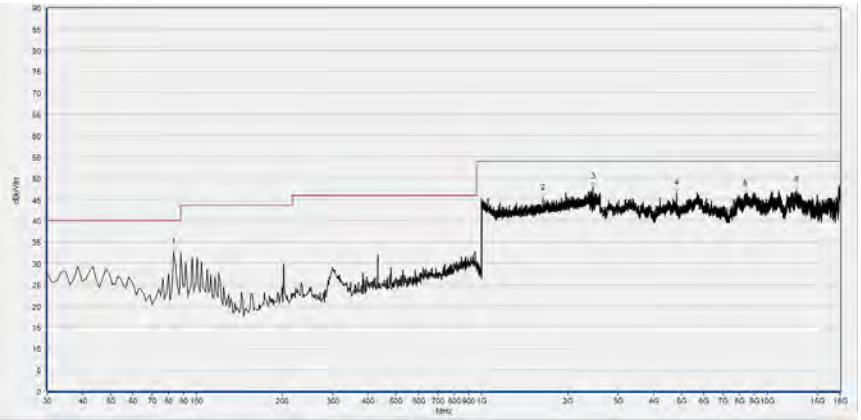


Fre. (MHz)	Pk (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
309.224	33.68	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2409.844	46.63	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4465.139	44.76	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
7993.781	45.85	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12553.010	46.81	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
15009.056	46.22	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 25GHz)

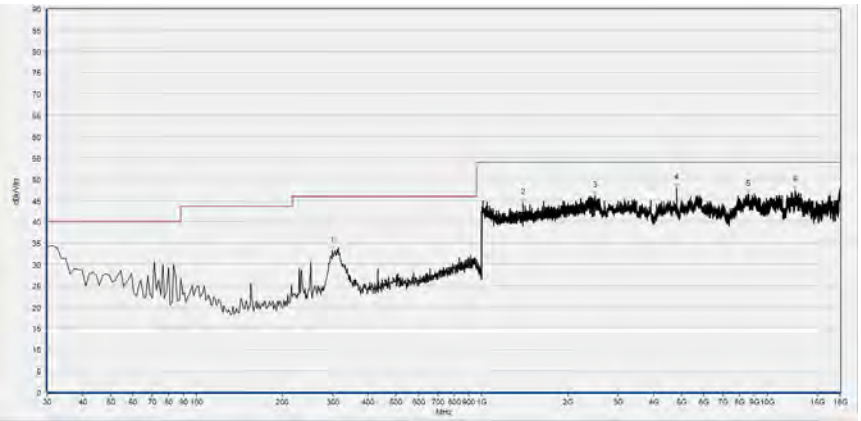
802.11n(HT20) Test mode

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
83.417	32.47	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
1640.256	45.30	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
2451.461	47.93	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4823.604	46.43	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8385.852	46.23	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12687.434	47.09	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

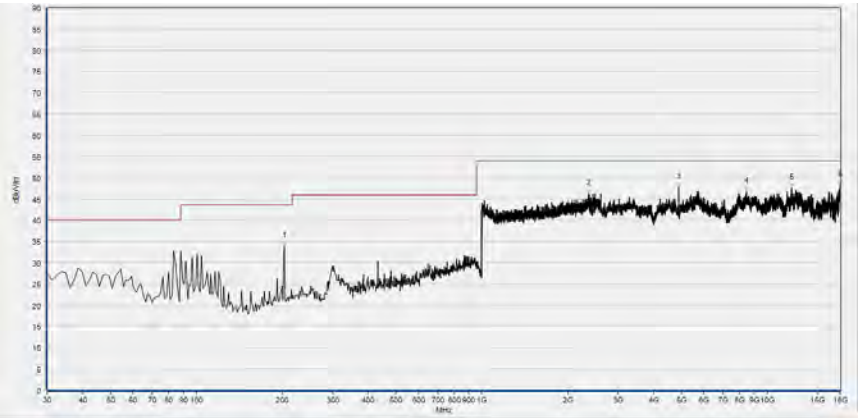
(Antenna Horizontal, 30MHz to 25GHz)



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
299.512	33.26	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1396.319	44.39	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
2495.638	46.07	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4823.604	47.91	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8579.087	46.35	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12519.404	47.50	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

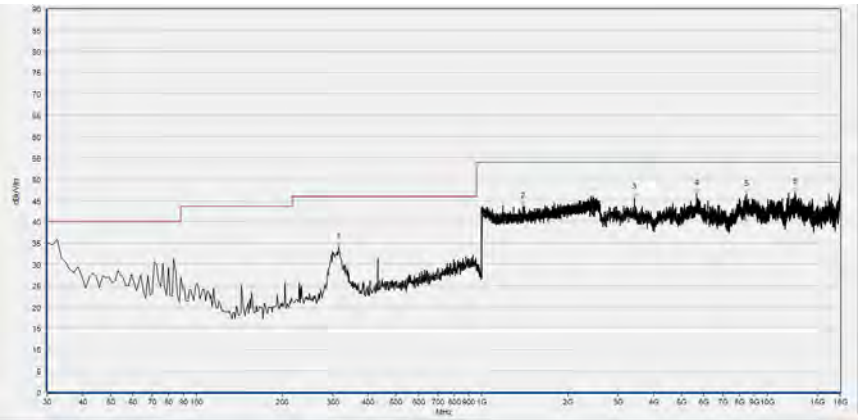
(Antenna Vertical, 30MHz to 25GHz)

Plot for Channel = 7



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
203.605	33.91	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
2370.788	46.21	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4882.415	47.77	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8447.463	46.75	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12160.938	47.57	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
18000.000	48.34	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

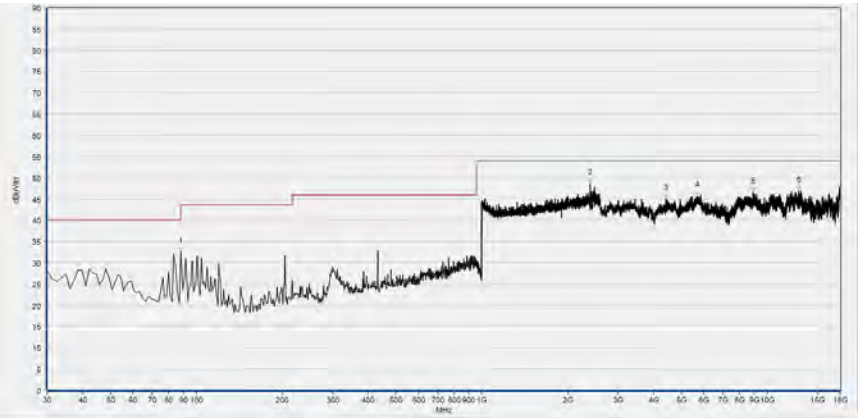
(Antenna Horizontal, 30MHz to 25GHz)



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
315.294	33.95	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
1395.038	43.54	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
3431.751	45.52	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5663.757	46.67	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8475.468	46.42	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12488.598	46.87	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

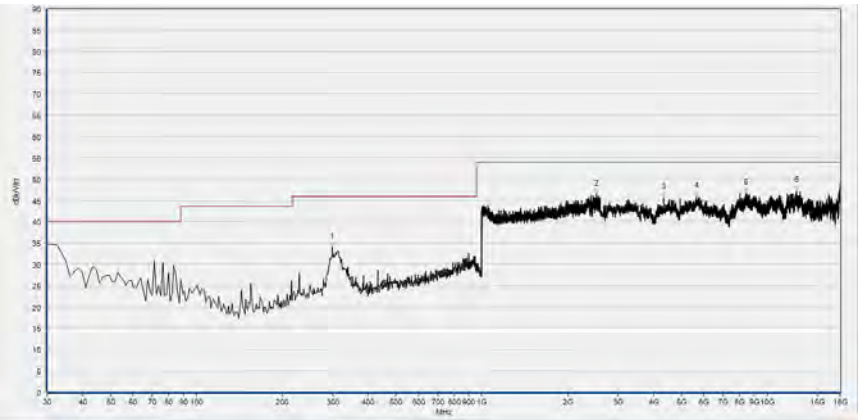
(Antenna Vertical, 30MHz to 25GHz)

Plot for Channel = 13



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
88.273	32.57	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
2401.521	48.54	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4423.131	45.12	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5686.161	45.84	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8917.949	46.55	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12905.874	47.01	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
299.512	34.06	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2521.248	46.42	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4333.515	45.65	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5658.156	45.92	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8394.254	46.68	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12676.232	47.30	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	N/A	N/A
EXA Signal Analzyer	MY53470836	N9010A	Agilent	2019.04.09	2020.04.08
USB Wideband Power Sensor	MY54210011	U2021XA	Agilent	2019.04.16	2020.04.15
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	2019.05.08	2020.05.09
LISN	812744	NSLK 8127	Schwarzbeck	2019.05.08	2020.05.09
Pulse Limiter (20dB)	9391	VTSD 9561-D	Schwarzbeck	2019.05.08	2020.05.09
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	2019.05.08	2020.05.09
Test Antenna - Loop	1519-022	FMZB1519	Schwarzbeck	2019.02.15	2020.02.14
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	2019.05.08	2020.05.09
18-26.5GHz pre-Amplifier	MA03	TS-PR18	Rohde& Schwarz	2019.05.08	2020.05.09
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