



TEST REPORT

APPLICANT : PLEN Robotics Inc.

PRODUCT NAME : PLEN Cube

MODEL NAME : PC020B

BRAND NAME : PLEN Cube

FCC ID : 2AWGK-PC020BD

STANDARD(S) : 47 CFR Part 15 Subpart C

RECEIPT DATE : 2020-08-07

TEST DATE : 2020-08-19 to 2020-09-14

ISSUE DATE : 2020-10-27

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Peng Huarui (Supervisor)

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Change History		
Version	Date	Reason for change
1.0	2020-10-27	First edition



1. Technical Information

Note: Provide by applicant.

1.1. Applicant and Manufacturer Information

Applicant:	PLEN Robotics Inc.
Applicant Address:	Crepis21 303, 4-6-3, Toyosaki, Kita-Ku, Osaka-shi, Osaka, Japan
Manufacturer:	JENESIS(SHENZHEN) CO., LTD
Manufacturer Address:	401-1 Building 2nd, Runheng industrial factory building, No.1 Liu'xian 3rd Road, Xingdong Community, Xin'an Avenue, Bao'an District, Shenzhen, Guangdong, China

1.2. Equipment Under Test (EUT) Description

Product Name:	PLEN Cube	
Serial No.:	(N/A, marked #1 by test site)	
Hardware Version:	1.0	
Software Version:	1.0	
Modulation Technology:	DSSS, OFDM	
Modulation Type:	Refer to section 1.3	
Operating Frequency Range:	802.11b/g/n (HT20): 2412MHz–2472MHz 802.11n (HT40): 2422MHz–2462MHz	
Antenna Type:	FPCB Antenna	
Antenna Gain:	2.0dBi	
Accessory Information:	Battery	
	Brand Name:	N/A
	Model No.:	IP1005464
	Serial No.:	(N/A, marked #1 by test site)
	Capacity:	3450mAh
	Rated Voltage:	3.7V
	Charge Limit:	4.2V
	Manufacturer:	INTELLECT PIONEERING BATTERY TECHNOLOGY Co., LTD.

Accessory Information:	Adaptor	
	Brand Name:	N/A
	Model No.:	ATS018T-W050V
	Serial No.:	(N/A, marked #1 by test site)
	Rated Output:	5.0V $\pm$ 3A, 15W
	Rated Input:	100-240V $\sim$ 0.48A 50/60Hz
	Manufacturer:	Adapter Technology Co., Ltd.

Note 1: We use the dedicated software to control the EUT continuous transmission.

Note 2: For a more detailed description, please refer to Specification or User's Manual supplied by the applicant and/or manufacturer.

1.3. Modulation Type and Data Rate of EUT

Modulation technology	Modulation Type	Data Rate (Mbps) Note1
DSSS (802.11b)	DBPSK	1
	DQPSK	2
	CCK	5.5/ 11
OFDM (802.11g)	BPSK	6 / 9
	QPSK	12 / 18
	16QAM	24 / 36
	64QAM	48 / 54
OFDM (802.11n (HT20))	BPSK	6.5
	QPSK	13/19.5
	16QAM	26/39
	64QAM	52/58.5/65
OFDM (802.11n (HT40))	BPSK	13.5
	QPSK	27/40.5
	16QAM	54/81/108
	64QAM	121.5/135

Note1: The worst-case mode (bold face) in all data rates has been determined during the pre-scan, only the test data of the worst-case were recorded in this report.

1.4. 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		
Test Mode	Channel	Frequency (MHz)	Channel	Frequency (MHz)
802.11n (HT40)	3	2422	8	2447
	4	2427	9	2452
	5	2432	10	2457
	6	2437	11	2462
	7	2442		

Note 1: The black bold channels were selected for test.



1.5. 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	Method determination /Remark
1	15.203	Antenna Requirement	N/A	N/A	PASS	No deviation
2	N/A	Duty Cycle Of Test Signal	Sep 14, 2020	Lu Qiang	PASS	No deviation
3	15.247(b)	Maximum Peak and Average Conducted Output Power	Sep 14, 2020	Lu Qiang	PASS	No deviation
4	15.247(a)	Bandwidth	Aug 20, 2020	Lu Qiang	PASS	No deviation
5	15.247(d)	Conducted Spurious Emission and Band Edge	Sep 14, 2020	Lu Qiang	PASS	No deviation
6	15.247(e)	Power Spectral Density (PSD)	Sep 14, 2020	Lu Qiang	PASS	No deviation
7	15.207	Conducted Emission	Sep 02, 2020	Wu Runfeng	PASS	No deviation
8	15.247(d)	Restricted Frequency Bands	Aug 21, 2020	Peng Xuwei	PASS	No deviation
9	15.209, 15.247(d)	Radiated Emission	Aug 19, 2020	Peng Xuwei	PASS	No deviation

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

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.

Note 3: Additions to, deviation, or exclusions from the method shall be judged in the "method determination" column of add, deviate or exclude from the specific method shall be explained in the "Remark" of the above table.

Note 4: When the test result is a critical value, we will use the measurement uncertainty give the judgment result based on the 95% risk level.

1.6.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

Inside of the EUT has a FPCB antenna coupled with the I-PEX connector. Please refer to the EUT internal photos.

2.2. Duty Cycle of Test Signal

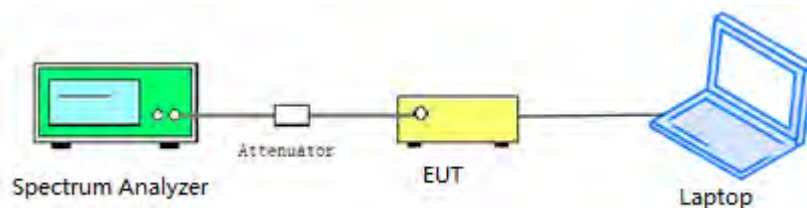
2.2.1. Requirement

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 $\pm 2\%$; otherwise, the duty cycle is considered to be nonconstant.

2.2.2. Test Description

Test Setup:



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

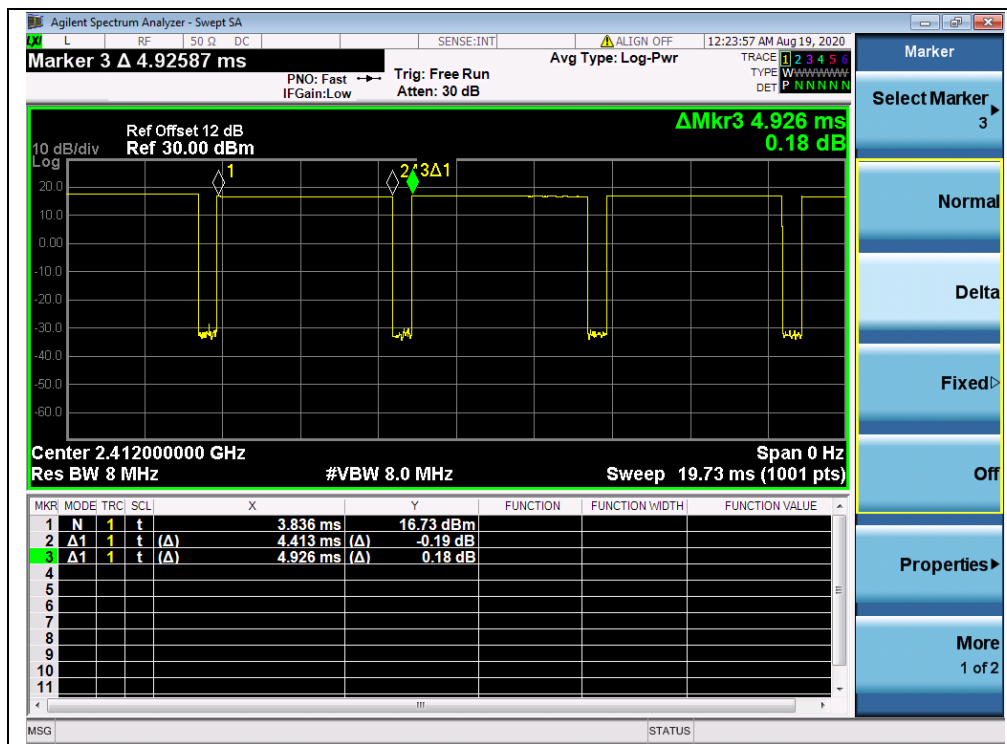


2.2.3. Test Result

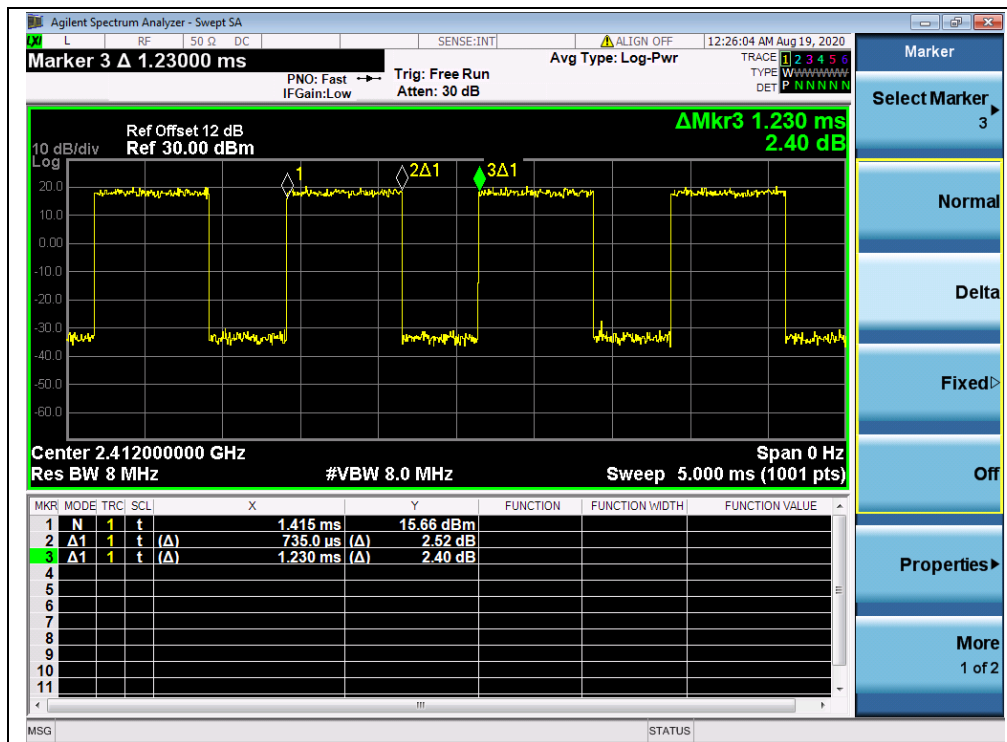
A. Test Verdict:

Test Mode	Duty Cycle (%) (D)	Duty Factor ($10 \cdot \lg[1/D]$)
802.11b	89.45	0.48
802.11g	60.16	2.21
802.11n (HT20)	89.21	0.50
802.11n (HT40)	87.15	0.60

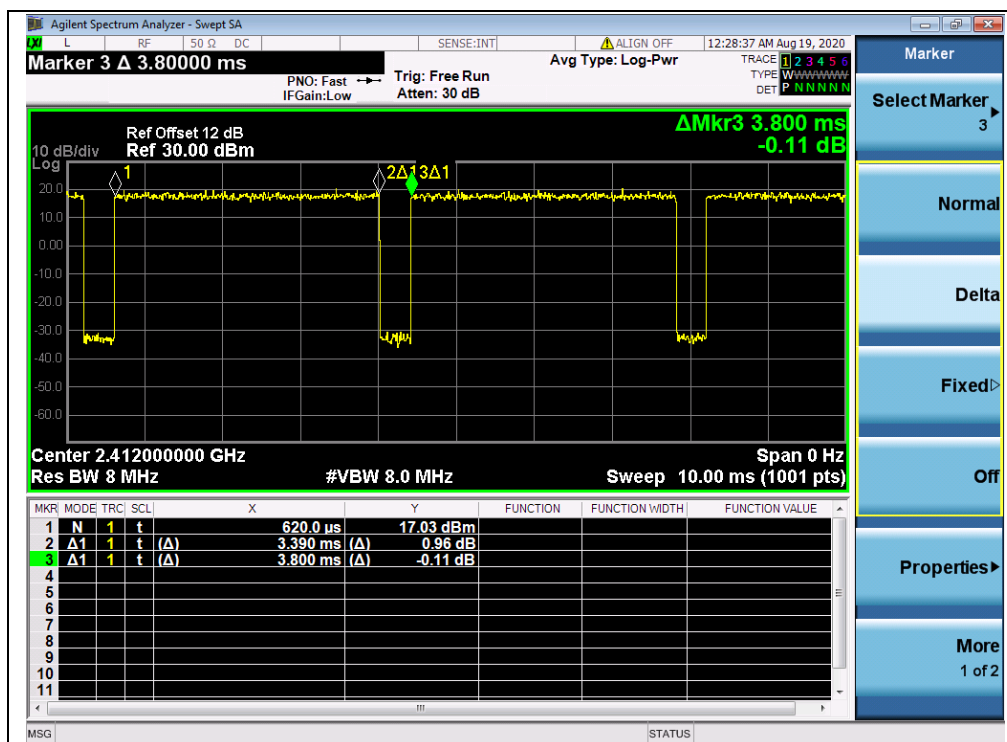
B. Test Plot:



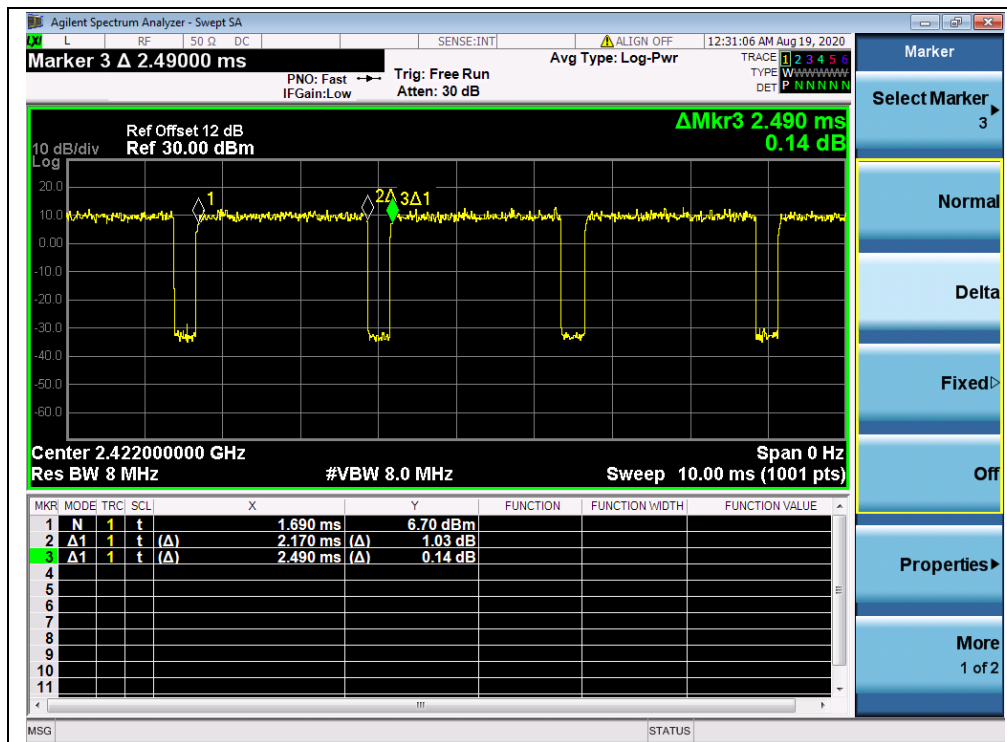
(Channel 1, 802.11b)



(Channel 1, 802.11g)



(Channel 1, 802.11n (HT20))



(Channel 3, 802.11n (HT40))

2.3. Maximum Peak and Average Conducted Output Power

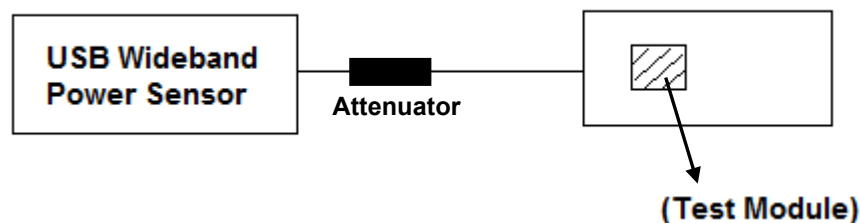
2.3.1. Requirement

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 exceed 1 Watt.

2.3.2. Test Description

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

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 Mode

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
1	2412	15.54	0.036	30	1	PASS
7	2442	16.07	0.040			PASS
13	2472	16.05	0.040			PASS

802.11g Mode

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
1	2412	19.53	0.090	30	1	PASS
7	2442	19.41	0.087			PASS
13	2472	19.47	0.089			PASS

802.11n (HT20) Mode

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
1	2412	19.52	0.090	30	1	PASS
7	2442	19.45	0.088			PASS
13	2472	19.23	0.084			PASS

802.11n (HT40) Mode

Channel	Frequency (MHz)	Measured Output Peak Power		Limit		Verdict
		dBm	W	dBm	W	
3	2422	18.01	0.063	30	1	PASS
7	2442	17.83	0.061			PASS
11	2462	16.05	0.040			PASS

**Maximum Average Conducted Output Power****802.11b Mode**

Channel	Frequency (MHz)	Average Power				Limit		Verdict
		Measured	Duty Factor	Duty factor Calculated				
		dBm		dBm	W	dBm	W	
1	2412	13.12	0.48	13.60	0.023	30	1	PASS
7	2442	13.71		14.19	0.026			PASS
13	2472	13.72		14.20	0.026			PASS

802.11g Mode

Channel	Frequency (MHz)	Average Power				Limit		Verdict
		Measured	Duty Factor	Duty factor Calculated				
		dBm		dBm	W	dBm	W	
1	2412	13.01	2.21	15.22	0.033	30	1	PASS
7	2442	12.76		14.97	0.031			PASS
13	2472	12.65		14.86	0.031			PASS

802.11n (HT20) Mode

Channel	Frequency (MHz)	Average Power				Limit		Verdict
		Measured	Duty Factor	Duty factor Calculated				
		dBm		dBm	W	dBm	W	
1	2412	13.98	0.50	14.48	0.028	30	1	PASS
7	2442	13.75		14.25	0.027			PASS
13	2472	13.44		13.94	0.025			PASS

802.11n (HT40) Mode

Channel	Frequency (MHz)	Average Power				Limit		Verdict
		Measured	Duty Factor	Duty factor Calculated				
		dBm		dBm	W	dBm	W	
3	2422	7.57	0.60	8.17	0.007	30	1	PASS
7	2442	7.68		8.28	0.007			PASS
11	2462	7.63		8.23	0.007			PASS

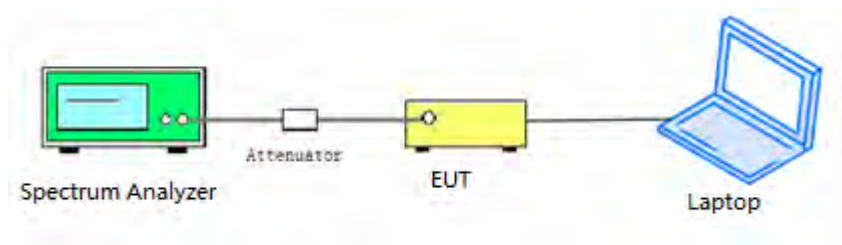
2.4. Bandwidth

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

Test Setup:



The EUT is coupled to the Spectrum Analyzer; the RF load attached to the EUT antenna terminal is 50 Ohm; 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 Mode

A. Test Verdict:

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limits(kHz)	Result
1	2412	10.06	≥500	PASS
7	2442	10.05	≥500	PASS
13	2472	10.05	≥500	PASS

B. Test Plot:



(Channel 1, 802.11b)



(Channel 7, 802.11b)



(Channel 13, 802.11b)



802.11g Mode

A.Test Verdict:

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limits(kHz)	Result
1	2412	15.09	≥500	PASS
7	2442	15.09	≥500	PASS
13	2472	15.11	≥500	PASS

B.Test Plot:



(Channel 1, 802.11g)



(Channel 7, 802.11g)



(Channel 13, 802.11g)



802.11n (HT20) Mode

A. Test Verdict:

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limits(kHz)	Result
1	2412	15.06	≥500	PASS
7	2442	15.07	≥500	PASS
13	2472	15.09	≥500	PASS

B.Test Plot:



(Channel 1, 802.11n (HT20))



(Channel 7, 802.11n (HT20))



(Channel 13, 802.11n (HT20))



802.11n (HT40) Mode

A.Test Verdict:

Channel	Frequency (MHz)	6 dB Bandwidth (MHz)	Limits(kHz)	Result
3	2422	34.93	≥500	PASS
7	2442	35.02	≥500	PASS
11	2462	32.66	≥500	PASS

B.Test Plot:



(Channel 3, 802.11n (HT40))



(Channel 7, 802.11n (HT40))



(Channel 11, 802.11n (HT40))

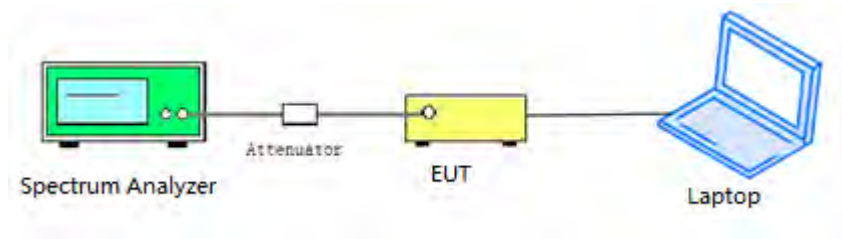
2.5. Conducted Spurious Emissions and Band Edge

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

Test Setup:



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.



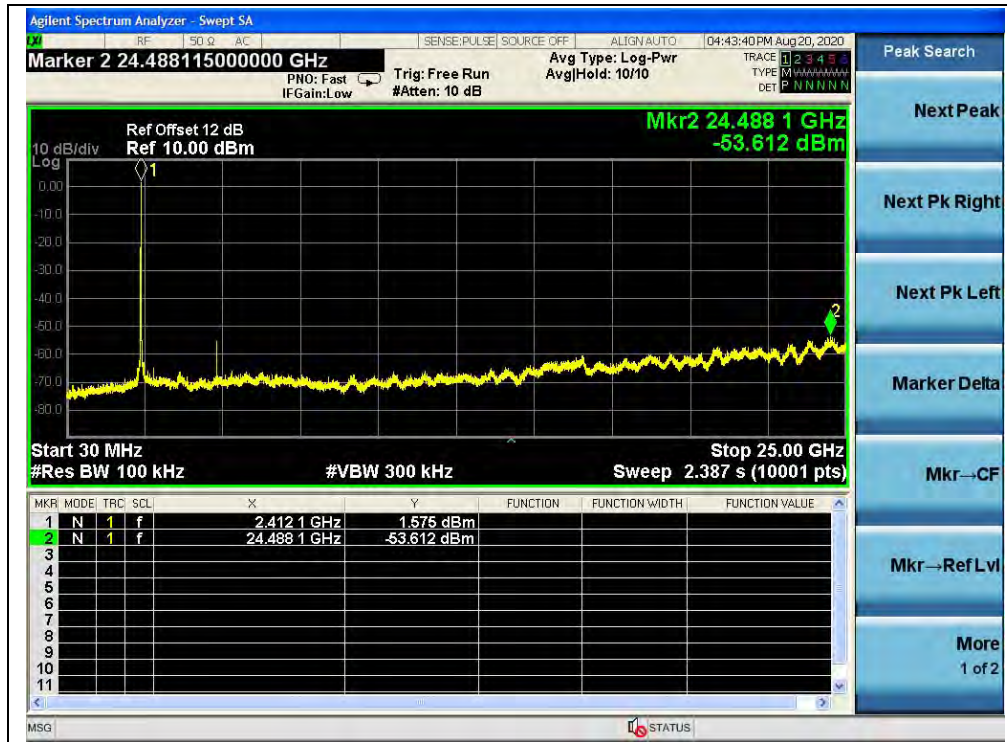
2.5.4. Test Result

802.11b Mode

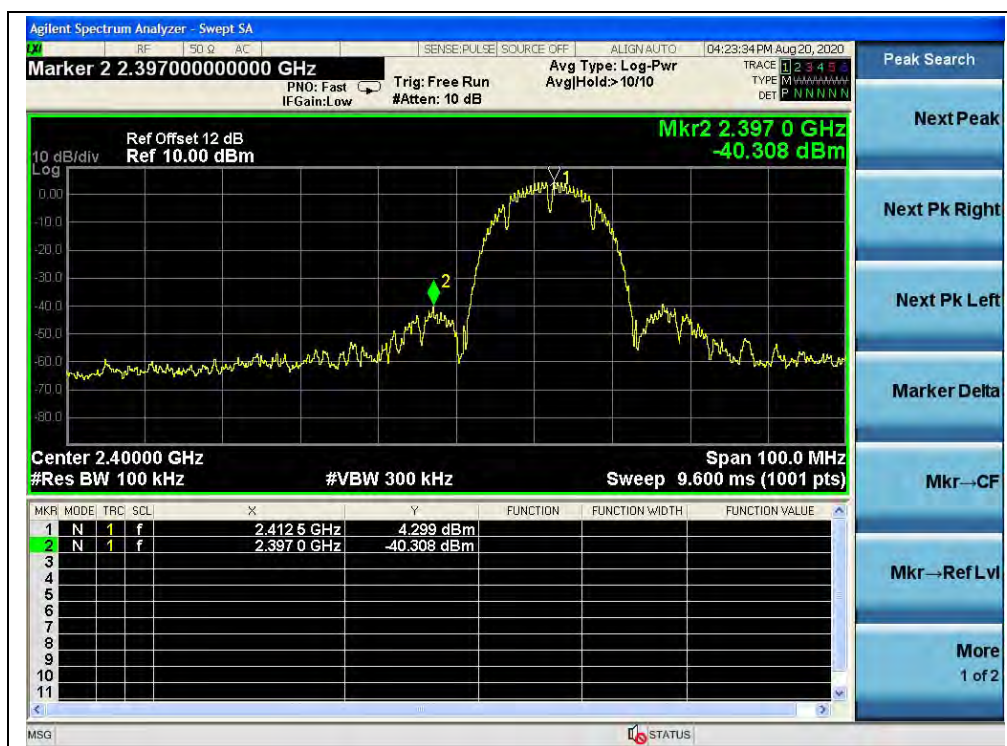
A. Test Verdict:

Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
1	2412	-53.61	1.58	-18.42	PASS
7	2442	-51.52	2.65	-17.35	PASS
13	2472	-51.70	3.69	-16.31	PASS

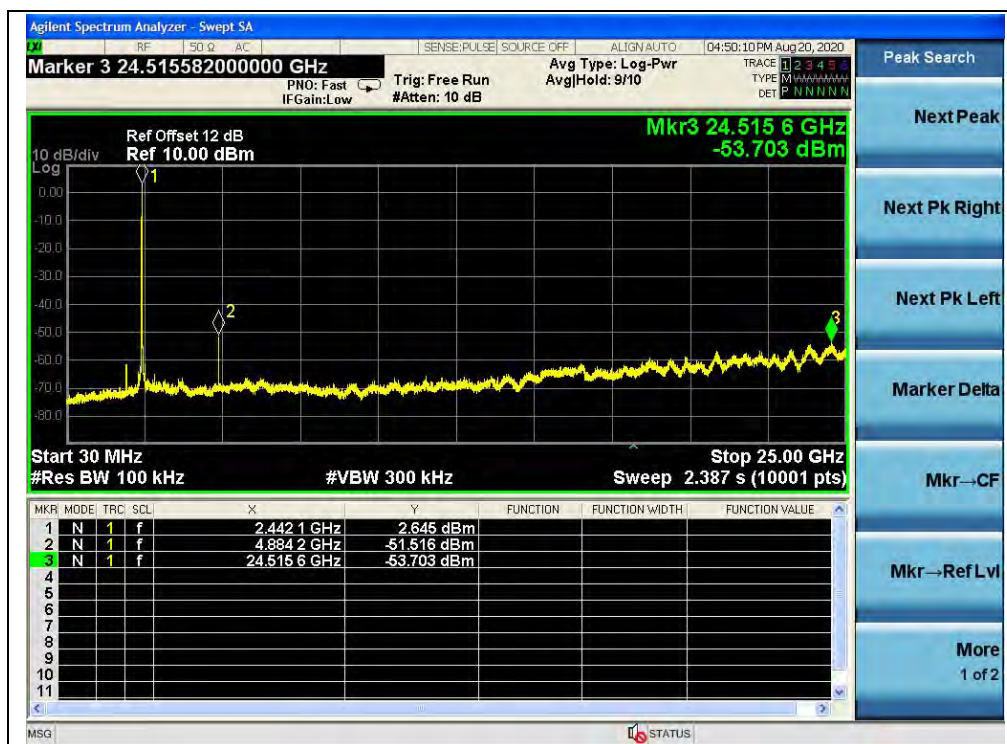
B. Test Plot:



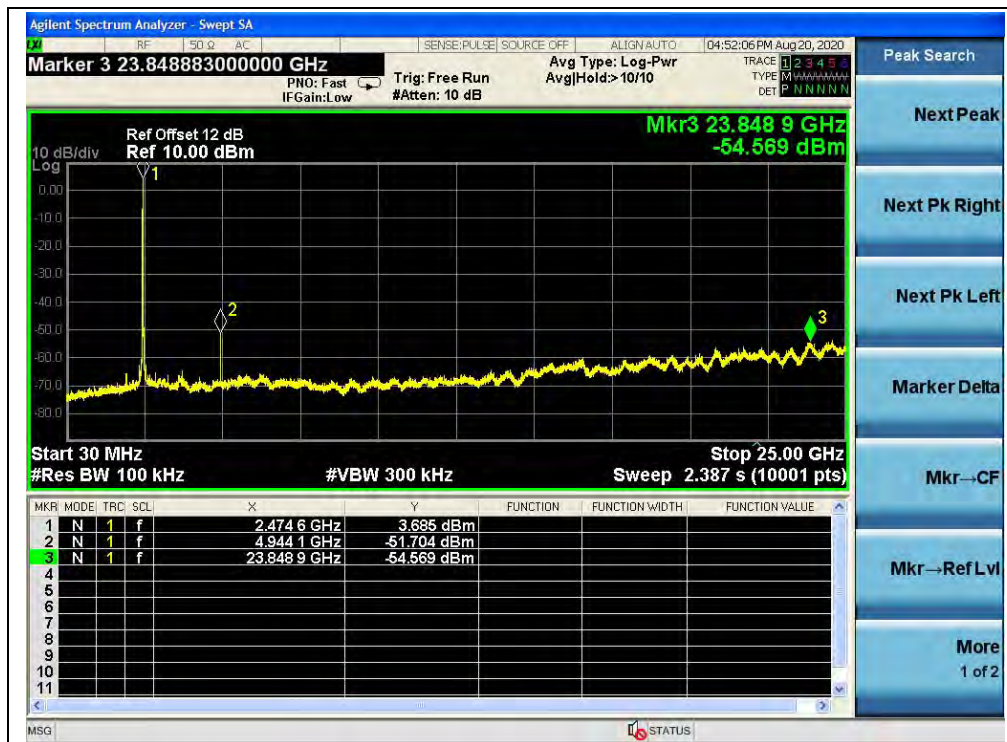
(30MHz to 25GHz, Channel 1, 802.11b)



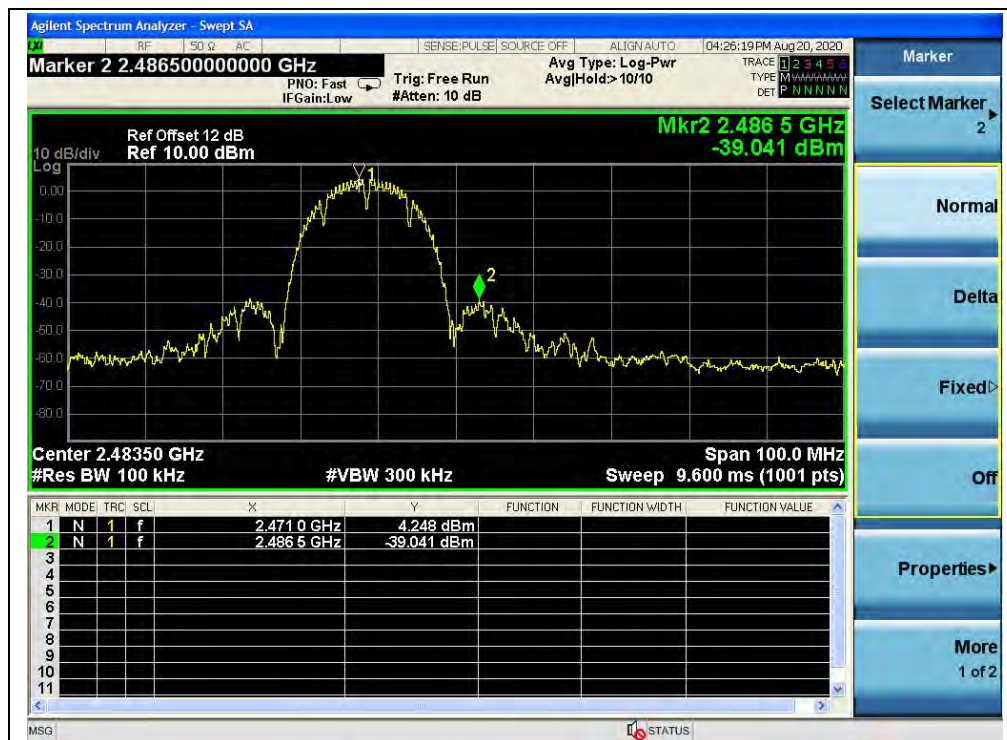
(Band Edge, Channel 1, 802.11b)



(30MHz to 25GHz, Channel 7, 802.11b)



(30MHz to 25GHz, Channel 13, 802.11b)



(Band Edge, Channel 13, 802.11b)

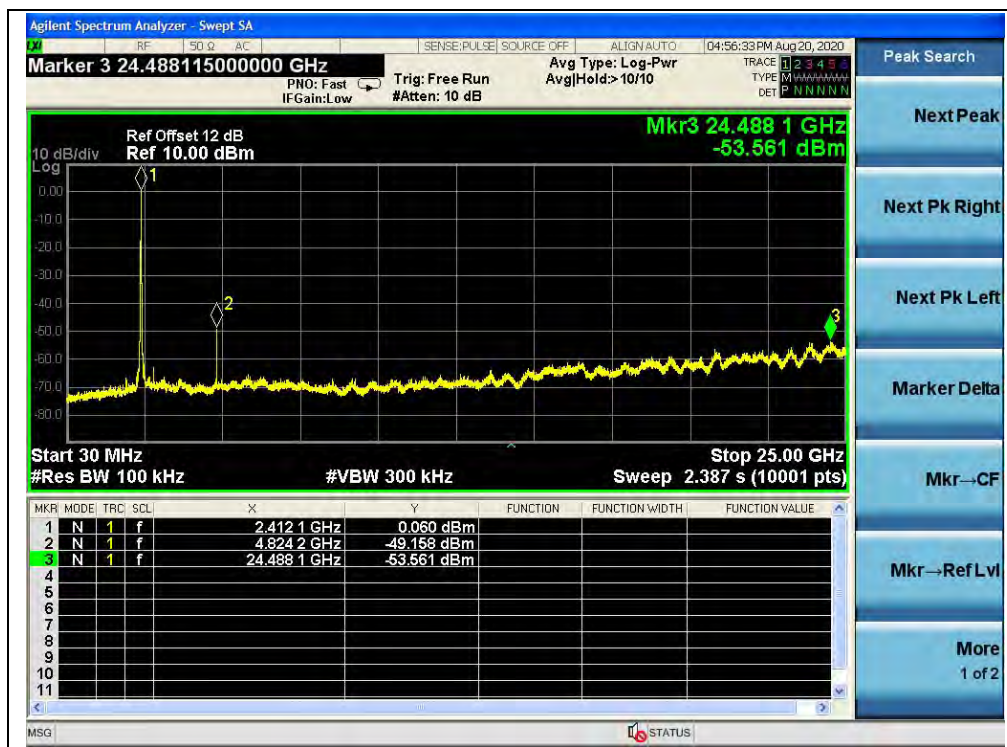


802.11g Mode

A.Test Verdict:

Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
1	2412	-49.16	0.06	-19.94	PASS
7	2442	-50.61	-0.39	-20.39	PASS
13	2472	-50.84	-0.70	-20.70	PASS

B.Test Plot:



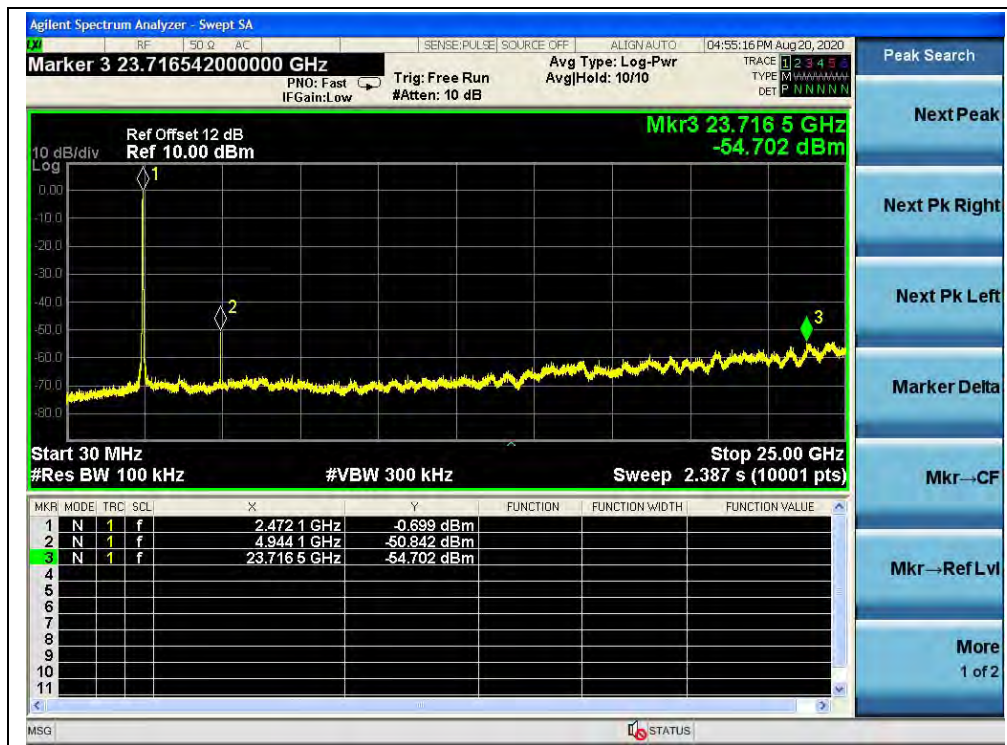
(30MHz to 25GHz, Channel 1, 802.11g)



(Band Edge, Channel 1, 802.11g)



(30MHz to 25GHz, Channel 7, 802.11g)



(30MHz to 25GHz, Channel 13, 802.11g)



(Band Edge, Channel 13, 802.11g)



802.11n (HT20) Mode

A. Test Verdict:

Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
1	2412	-50.87	-0.38	-20.38	PASS
7	2442	-51.11	-1.25	-21.25	PASS
13	2472	-53.14	0.32	-19.68	PASS

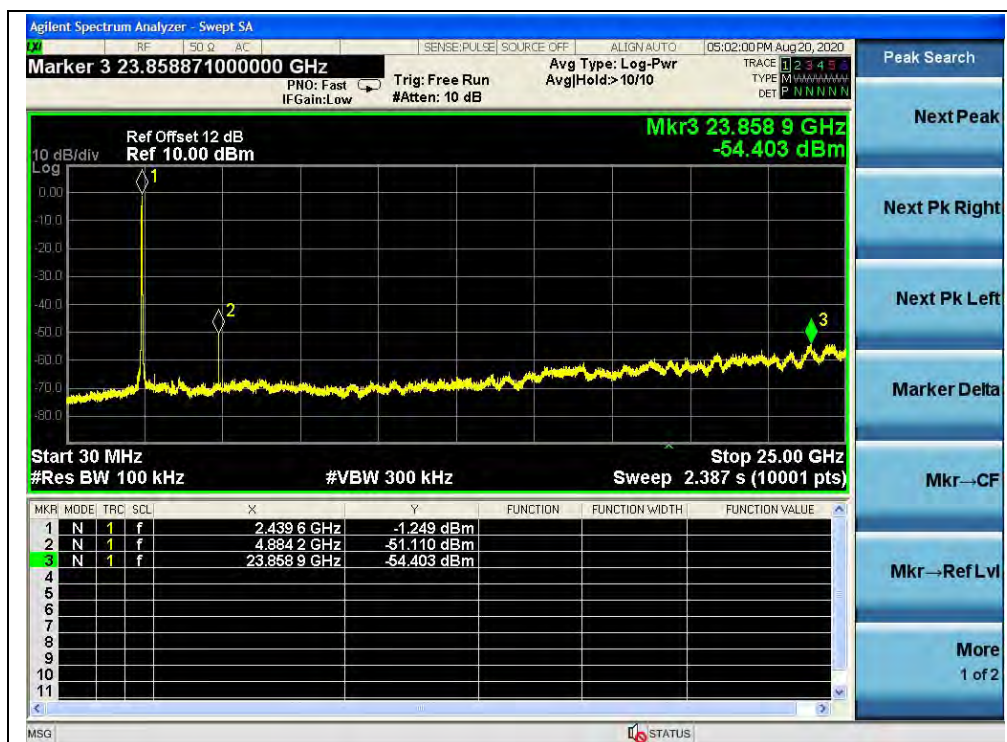
B. Test Plot:



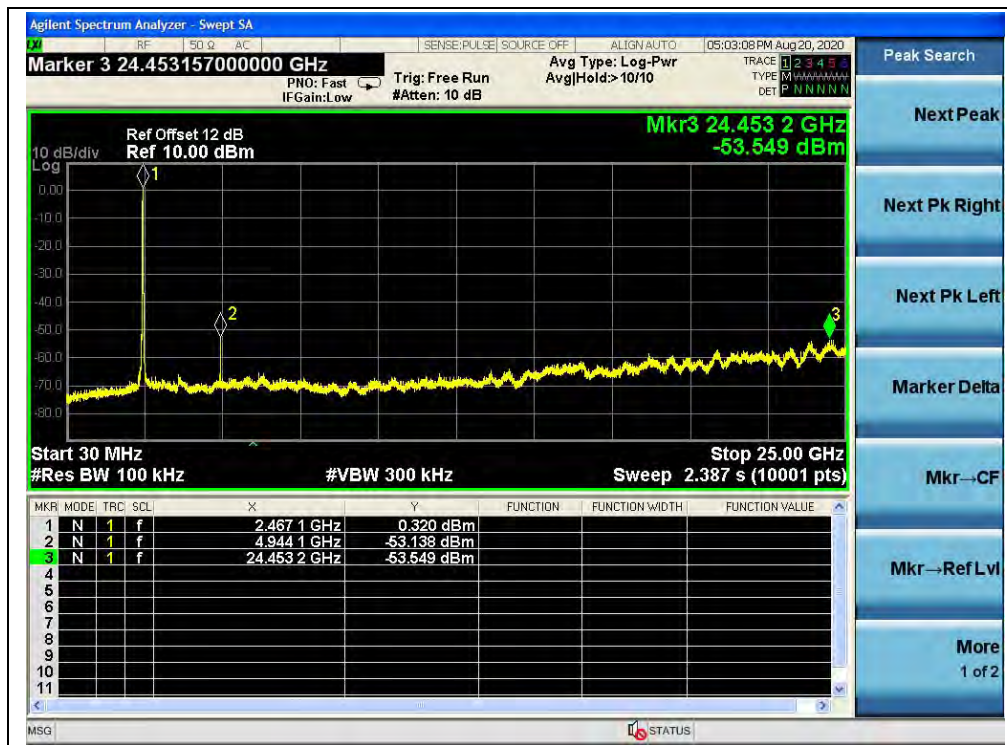
(30MHz to 25GHz, Channel 1, 802.11n (HT20))



(Band Edge, Channel 1, 802.11n (HT20))



(30MHz to 25GHz, Channel 7,802.11n (HT20))



(30MHz to 25GHz, Channel 13, 802.11n (HT20))



(Band Edge, Channel 13, 802.11n (HT20))

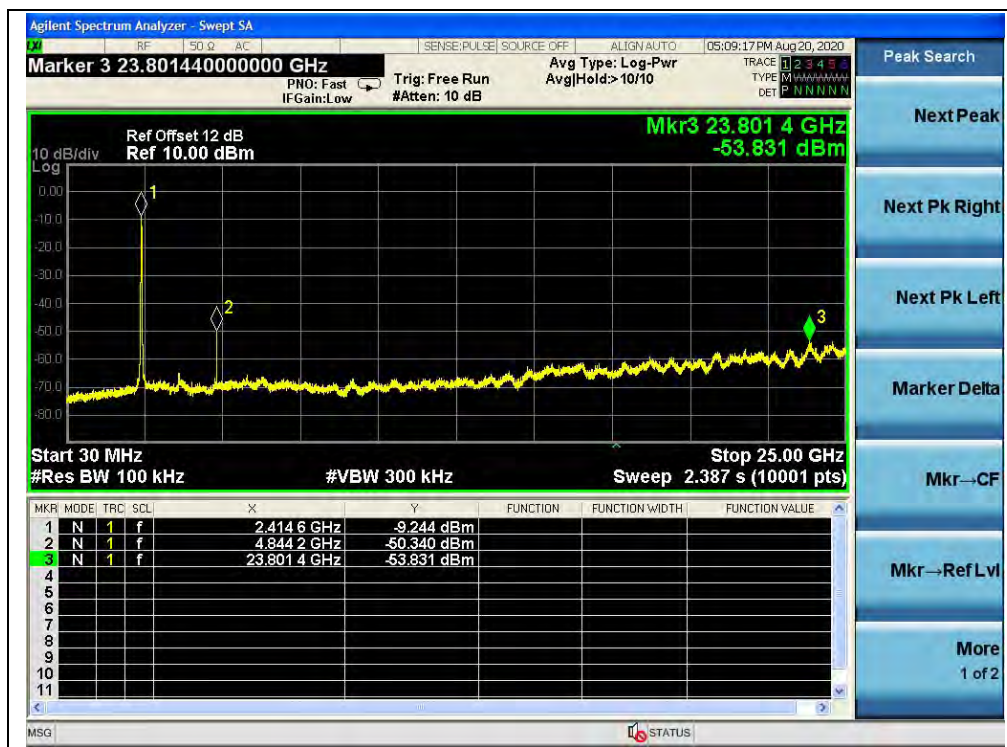


802.11n (HT40) Mode

A.Test Verdict:

Channel	Frequency (MHz)	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
			Carrier Level	Calculated -20dBc Limit	
3	2422	-50.34	-9.24	-29.24	PASS
7	2442	-51.99	-10.33	-30.33	PASS
11	2462	-52.06	-7.64	-27.64	PASS

B.Test Plot:



(30MHz to 25GHz, Channel 3, 802.11n (HT40))



(Band Edge, Channel 3, 802.11n (HT40))



(30MHz to 25GHz, Channel 7, 802.11n (HT40))



(30MHz to 25GHz, Channel 11, 802.11n (HT40))



(Band Edge, Channel 11, 802.11n (HT40))

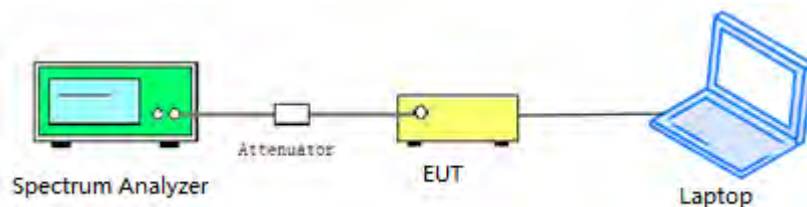
2.6. Power Spectral Density (PSD)

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

Test Setup:



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 Mode

A. Test Verdict:

Spectral power density (dBm/3kHz)				
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
1	2412	-9.33	8	PASS
7	2442	-9.23	8	PASS
13	2472	-9.47	8	PASS

B. Test Plot:



(Channel 1, 802.11b)



(Channel 7, 802.11b)



(Channel 13, 802.11b)



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
7	2442	-11.40	8	PASS
13	2472	-11.10	8	PASS

Agilent Spectrum Analyzer - Swept SA

RF 50 Ω AC SENSE:PULSE SOURCE:OFF ALIGN:AUTO 03:55:58 PM Aug 20, 2020

Average/Hold Number 100

PNO: Fast IF Gain: Low Trig: Free Run #Atten: 10 dB Avg Type: Log-Pwr Avg/Hold: 10/100

TRACE 1 2 3 4 5 6 TYPE MAAAAAAA DEF P NNNNNN

Ref Offset 12 dB Ref 10.00 dBm

10 dB/div Log

Mkr1 2.410 17 GHz -10.565 dBm

Center 2.41200 GHz Span 30.00 MHz

#Res BW 3.0 kHz #VBW 10 kHz Sweep 3.163 s (1001 pts)

Meas Setup

Avg/Hold Num 100

Avg Type Log-Pwr (Video) ▶ **Auto** Man

Limits ▶

N dB Points -3.01 dB **On** **Off**

PhNoise Opt Fast Tuning ▶ **Auto** Man

ADC Dither Medium ▶ **Auto** Man

More 1 of 2

MSG STATUS

(Channel 1, 802.11g)



(Channel 7, 802.11g)



(Channel 13, 802.11g)



802.11n (HT20) Mode

A.Test Verdict:

Spectral power density (dBm/3kHz)				
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
1	2412	-12.21	8	PASS
7	2442	-12.66	8	PASS
13	2472	-10.73	8	PASS

B.Test Plot:



(Channel 1, 802.11n (HT20))



(Channel 7, 802.11n (HT20))



(Channel 13, 802.11n (HT20))



A.Test Verdict:

Spectral power density (dBm/3kHz)				
Channel	Frequency (MHz)	Measured PSD (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
3	2422	-20.36	8	PASS
7	2442	-21.61	8	PASS
11	2462	-21.06	8	PASS

Agilent Spectrum Analyzer - Swept SA

RF 50.0 AC SENSE:PULSE SOURCE:OFF ALIGN:AUTO 04:10:43PM Aug 20, 2020

Average/Hold Number 100

PNO: Fast IF Gain: Low Trig: Free Run #Atten: 10 dB

Avg Type: Log-Pwr Avg/Hold: 10/100

TRACE 1 2 3 4 5 6 TYPE N N N N N N N N DEF N N N N N N N

Ref Offset 12 dB Ref 0.00 dBm

10 dB/div Log

Mkr1 2.424 20 GHz -20.360 dBm

Center 2.42200 GHz Span 50.00 MHz

#Res BW 3.0 kHz #VBW 10 kHz Sweep 5.272 s (1001 pts)

Meas Setup

Avg/Hold Num 100

Avg Type Log-Pwr (Video) **Man**

Limits

N dB Points 3.01 dB **Off**

PhNoise Opt Fast Tuning **Man**

ADC Dither Medium **Man**

More 1 of 2

(Channel 3, 802.11n (HT40))



(Channel 7, 802.11n (HT40))



(Channel 11, 802.11n (HT40))

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 50 μ H/50 Ω line impedance stabilization network (LISN).

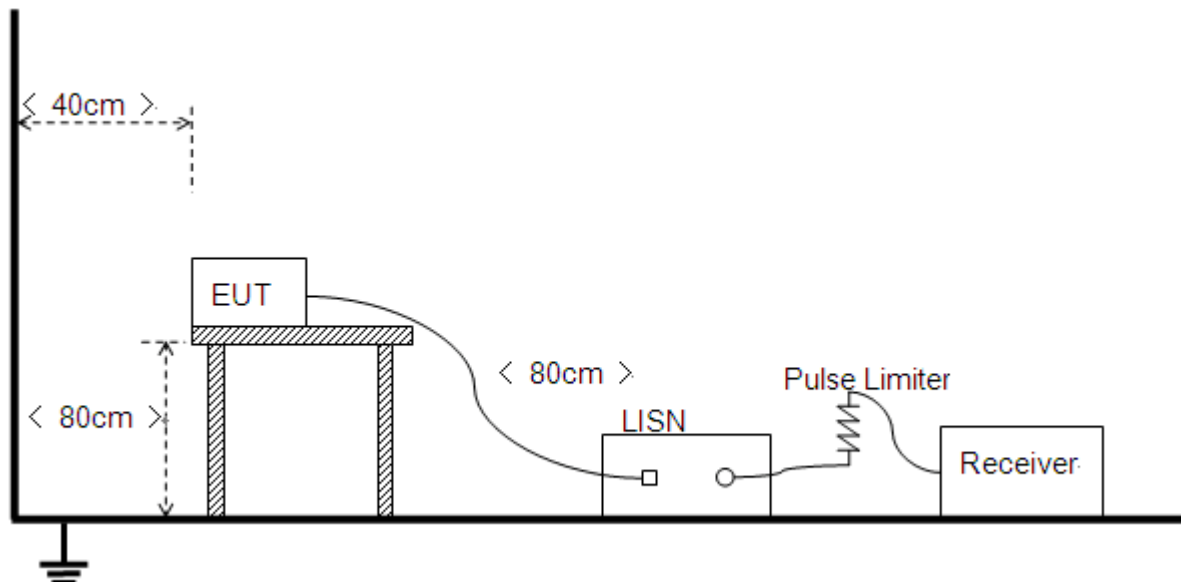
Frequency range (MHz)	Conducted Limit (dB μ V)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
5 - 30	60	50

NOTE:

- The lower limit shall apply at the band edges.
- The limit decreases linearly with the logarithm of the frequency in the range 0.15 - 0.50MHz.

2.7.2. Test Description

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 TX

Test Voltage: AC 120V/60Hz

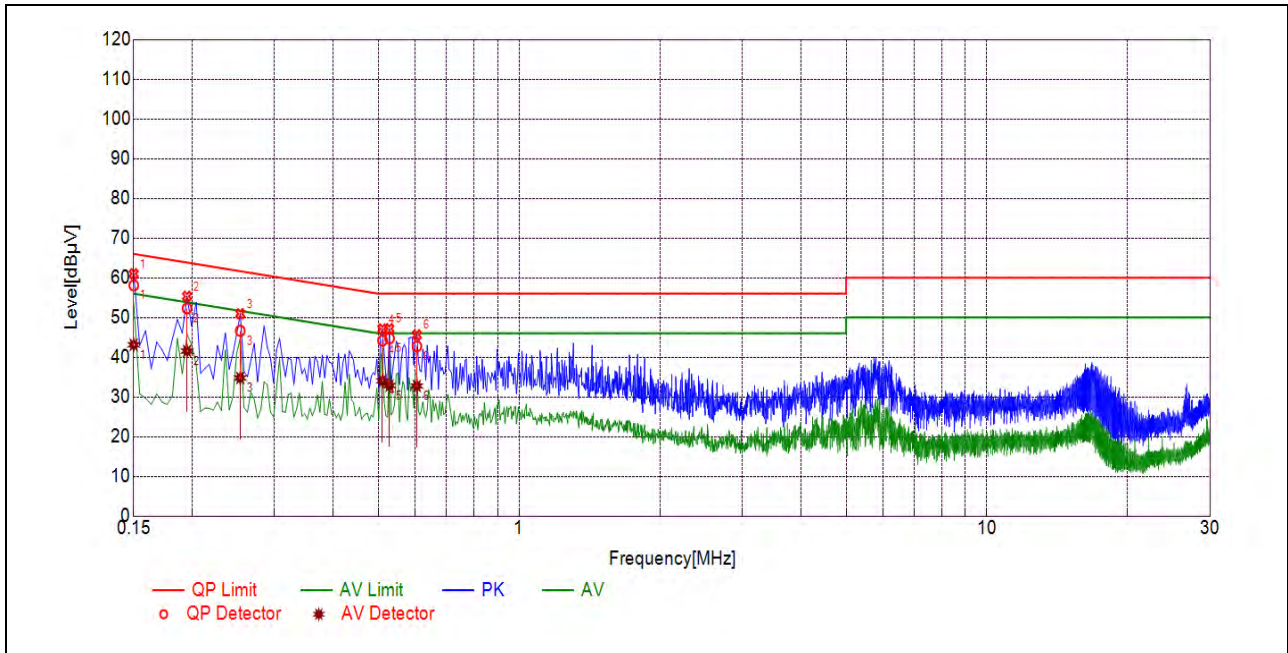
The measurement results are obtained as below:

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

U_R : Receiver Reading

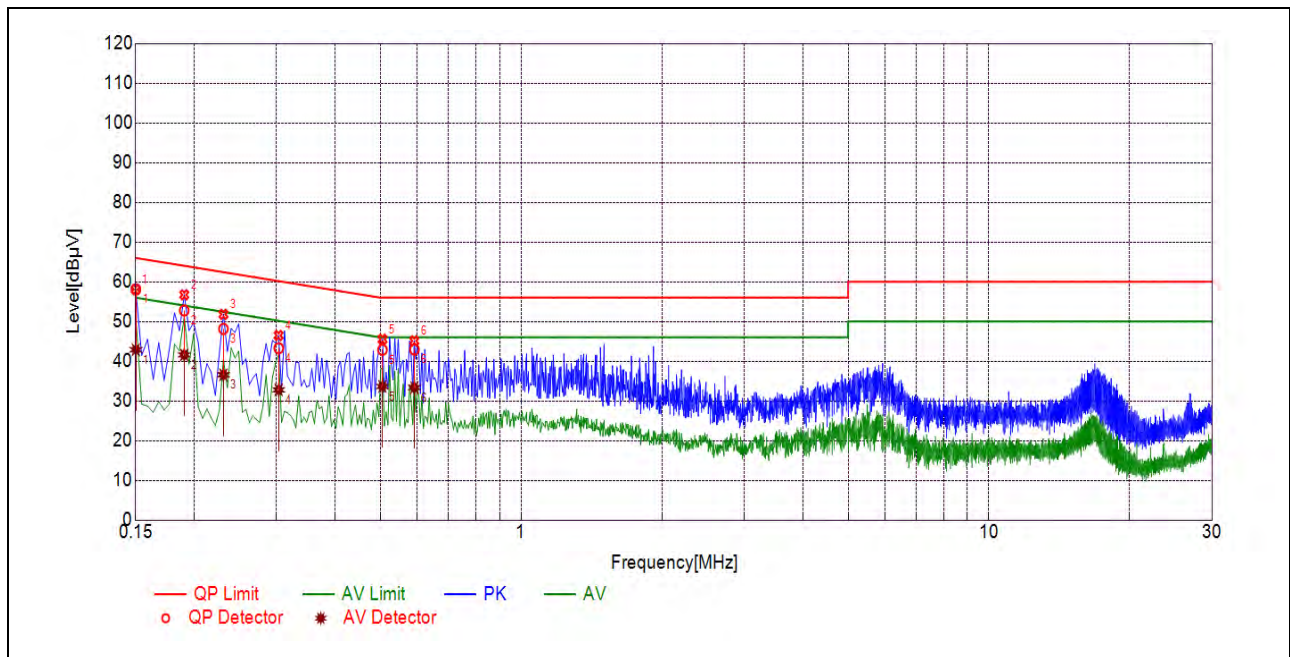
A_{Factor} : Voltage division factor of LISN

B.Test Plot:



(L Phase)

No.	Fre. (MHz)	Emission Level (dBμV)		Limit (dBμV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1500	58.11	43.13	66.00	56.00	Line	PASS
2	0.1950	52.29	41.58	63.82	53.82		PASS
3	0.2534	46.65	34.76	61.65	51.65		PASS
4	0.5103	44.20	34.04	56.00	46.00		PASS
5	0.5284	44.74	32.85	56.00	46.00		PASS
6	0.6045	42.75	32.75	56.00	46.00		PASS



(N Phase)

No.	Fre. (MHz)	Emission Level (dBμV)		Limit (dBμV)		Power-line	Verdict
		Quai-peak	Average	Quai-peak	Average		
1	0.1501	58.09	42.89	65.99	55.99	Neutral	PASS
2	0.1904	52.77	41.60	64.02	54.02		PASS
3	0.2310	48.14	36.57	62.41	52.41		PASS
4	0.3032	43.27	32.77	60.16	50.16		PASS
5	0.5051	42.87	33.65	56.00	46.00		PASS
6	0.5914	42.95	33.36	56.00	46.00		PASS

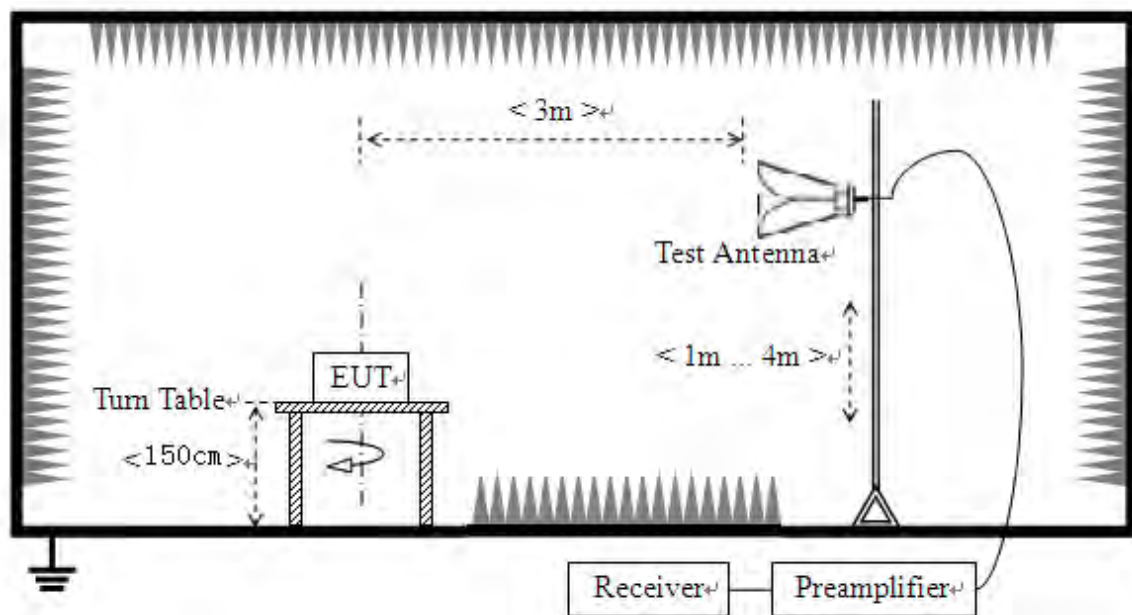
2.8. Restricted Frequency Bands

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

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:

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

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.

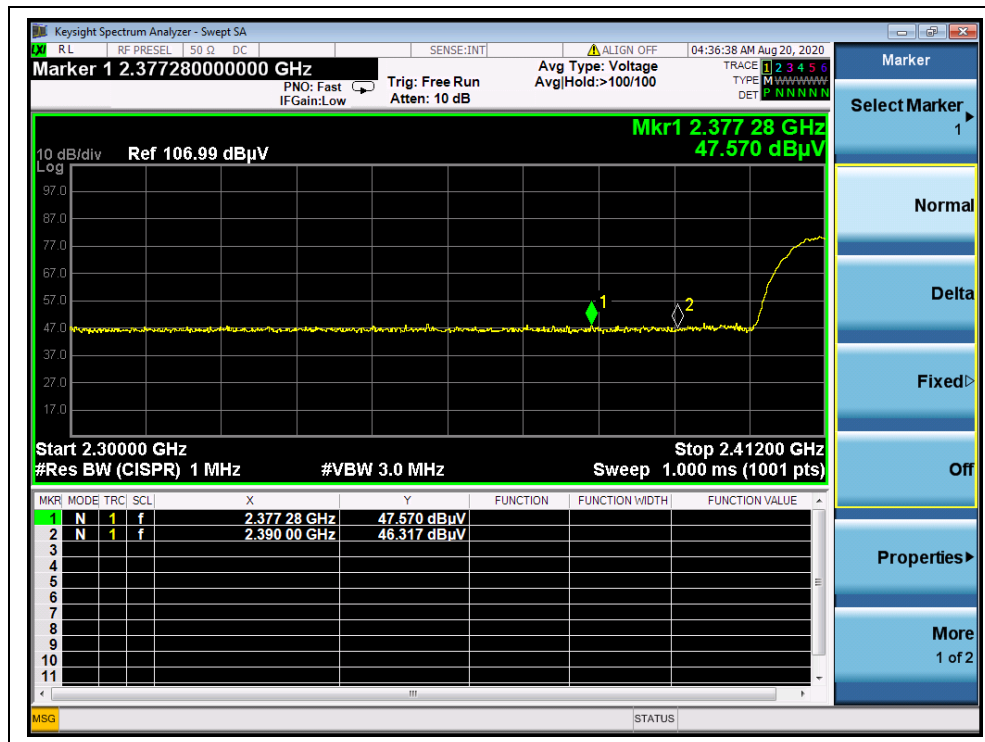
802.11b Mode

A.Test Verdict:

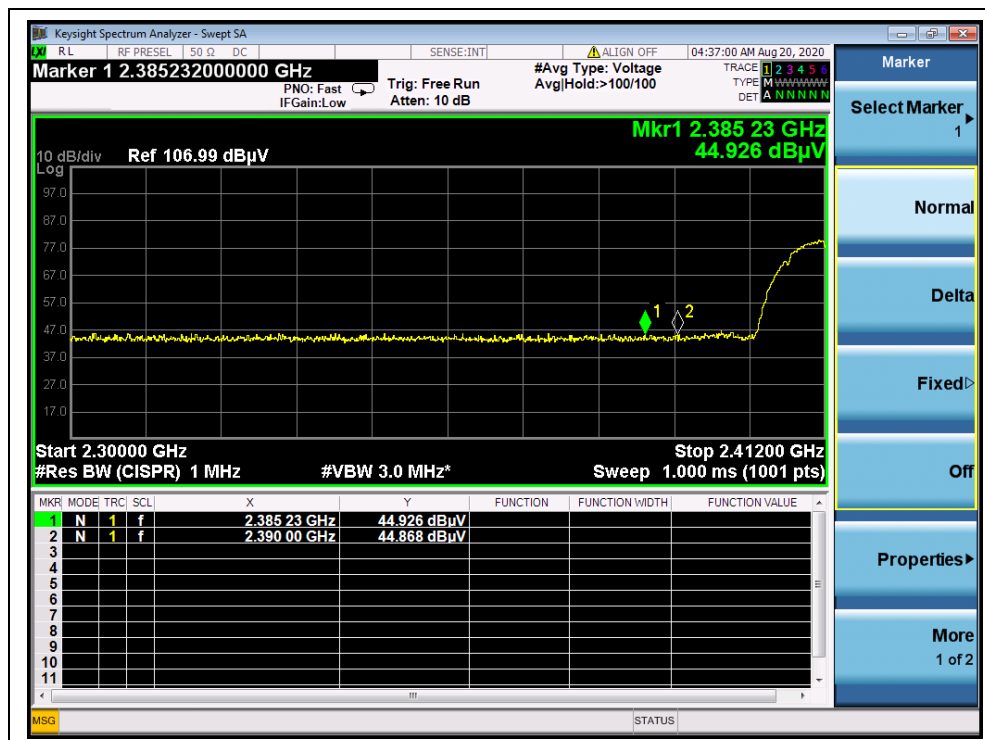
Channel	Frequency (MHz)	Detector	Receiver Reading U_R (dB μ V)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dB μ V/m)	Limit (dB μ V/m)	Verdict
		PK/ AV						
1	2377.28	PK	47.57	-29.67	32.56	50.46	74	PASS
1	2385.23	AV	44.93	-29.67	32.56	47.82	54	PASS
13	2486.18	PK	48.36	-29.67	32.56	51.25	74	PASS
13	2486.56	AV	38.06	-29.67	32.56	40.95	54	PASS



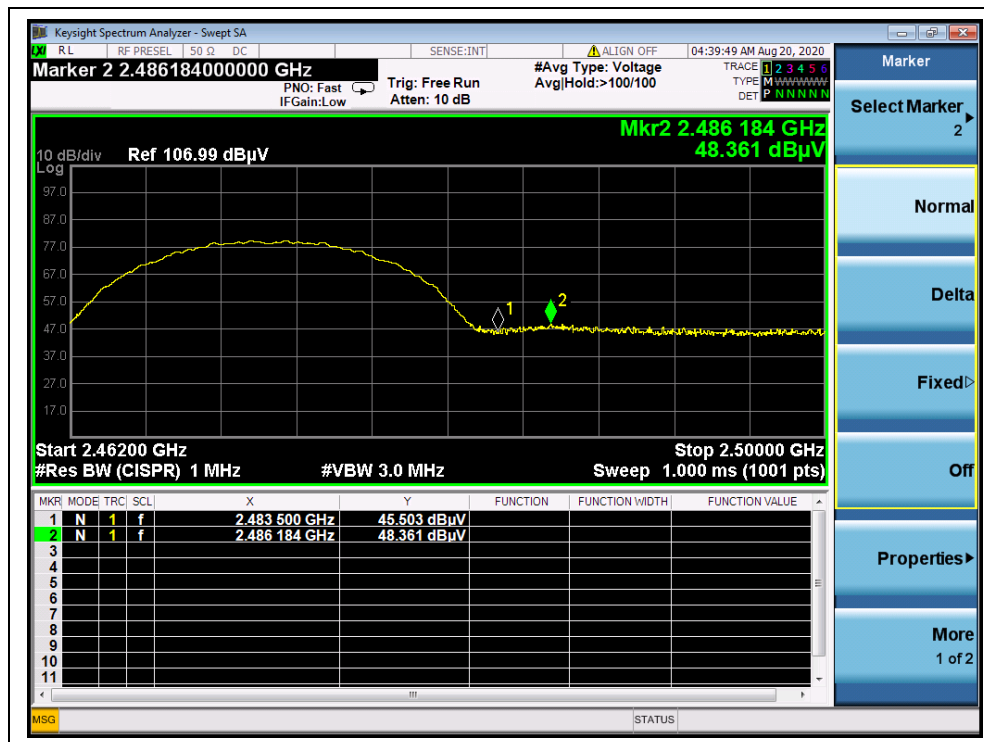
B.Test Plot:



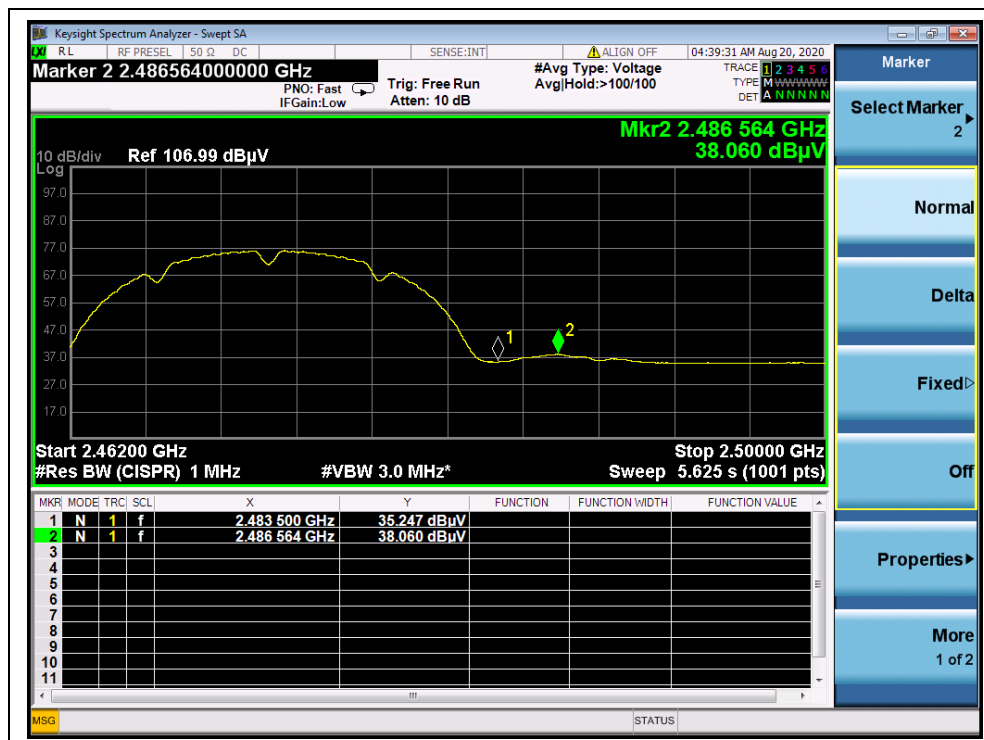
(PEAK, Channel 1, 802.11b)



(AVERAGE, Channel 1, 802.11b)



(PEAK, Channel 13, 802.11b)



(AVERAGE, Channel 13, 802.11b)

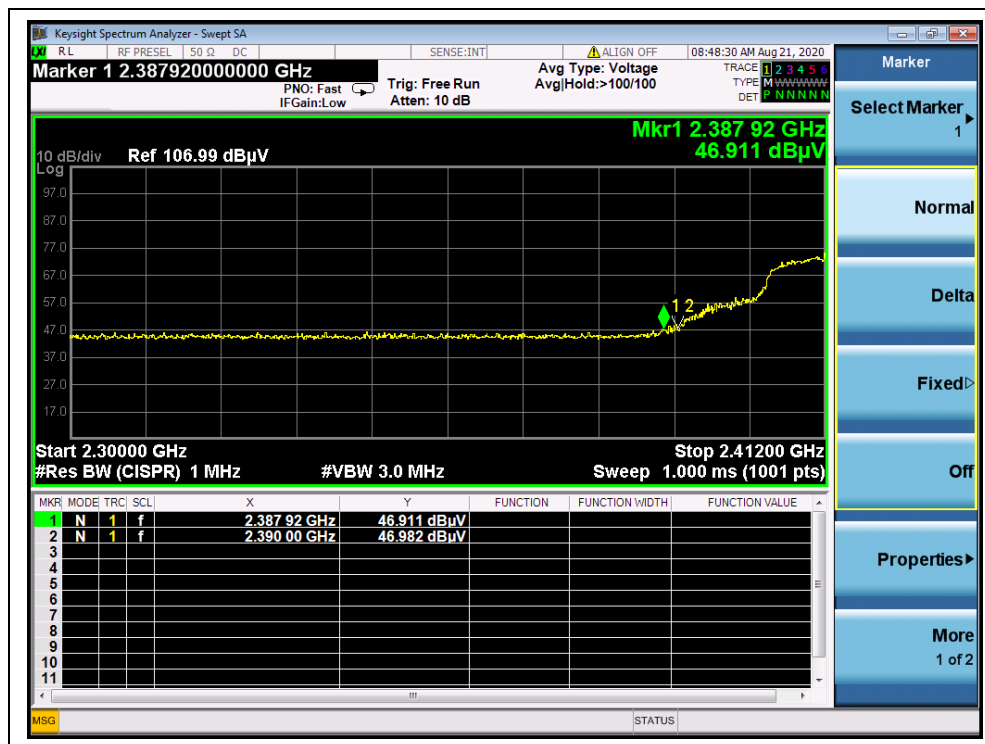


802.11g Mode

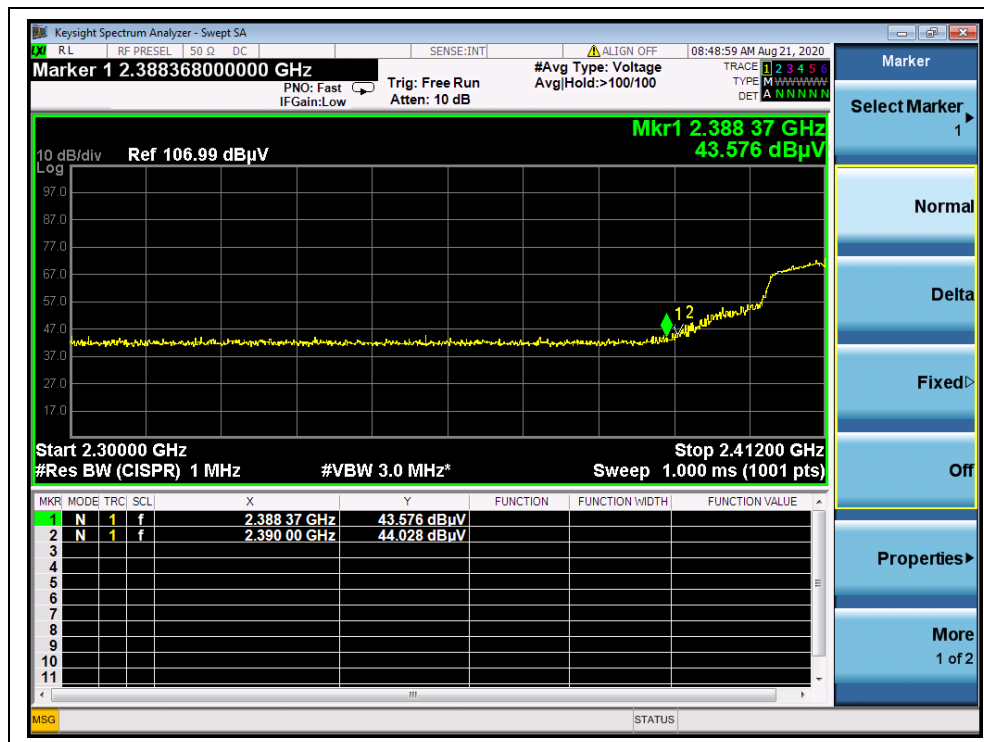
A.Test Verdict:

Channel	Frequency (MHz)	Detector	Receiver Reading U_R (dBμV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
		PK/ AV						
1	2390.00	PK	46.98	-29.67	32.56	49.87	74	PASS
1	2390.00	AV	44.03	-29.67	32.56	46.92	54	PASS
13	2484.23	PK	64.14	-29.67	32.56	67.03	74	PASS
13	2483.50	AV	46.57	-29.67	32.56	49.46	54	PASS

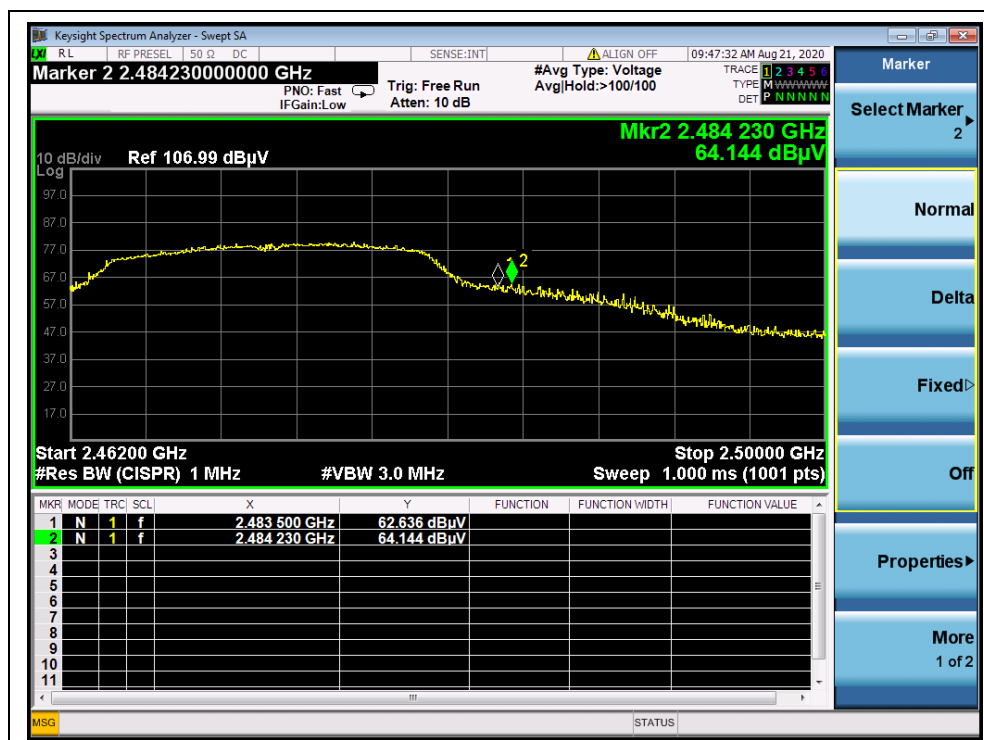
B.Test Plot:



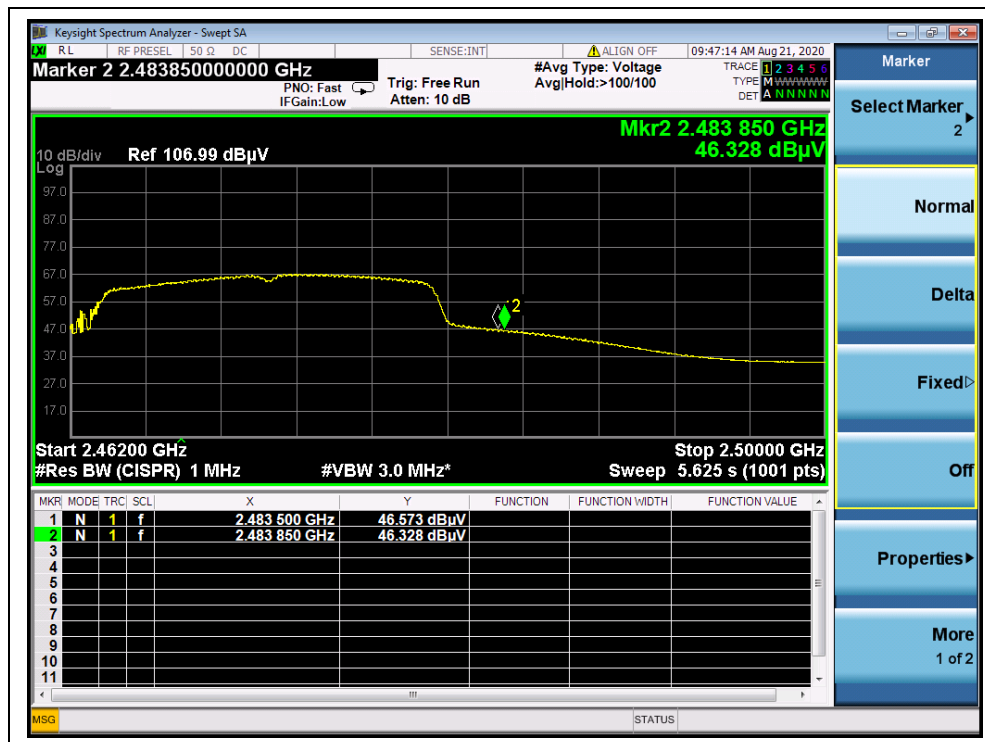
(PEAK, Channel 1, 802.11g)



(AVERAGE, Channel 1, 802.11g)



(PEAK, Channel 13, 802.11g)



(AVERAGE, Channel 13, 802.11g)

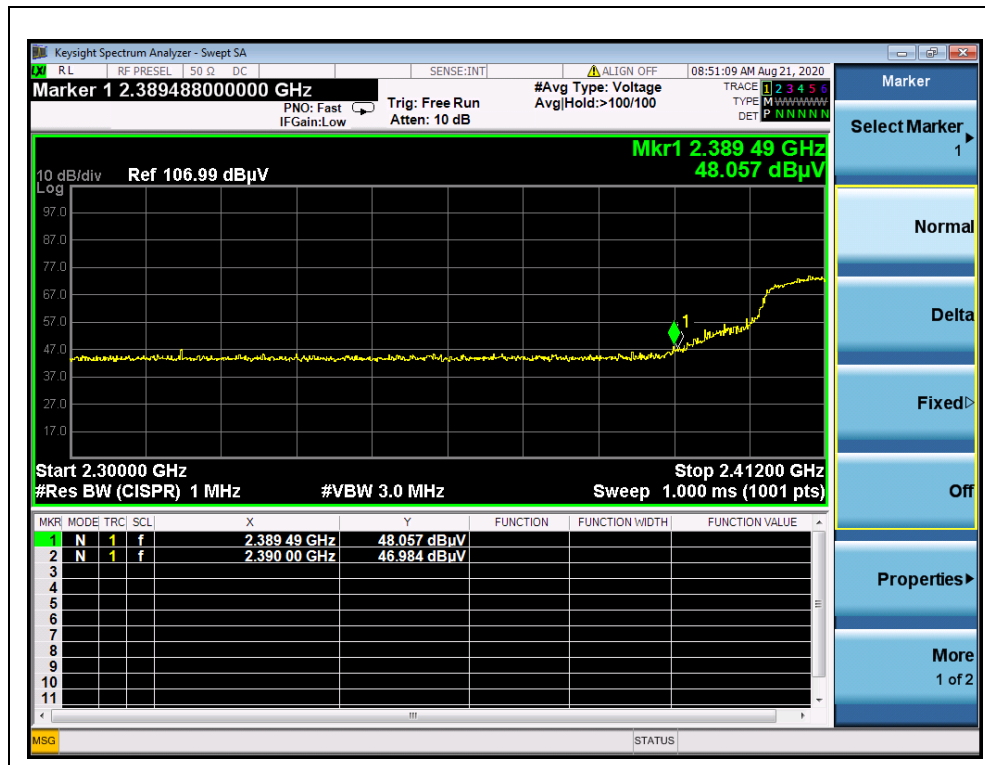


802.11 n (HT20) Mode

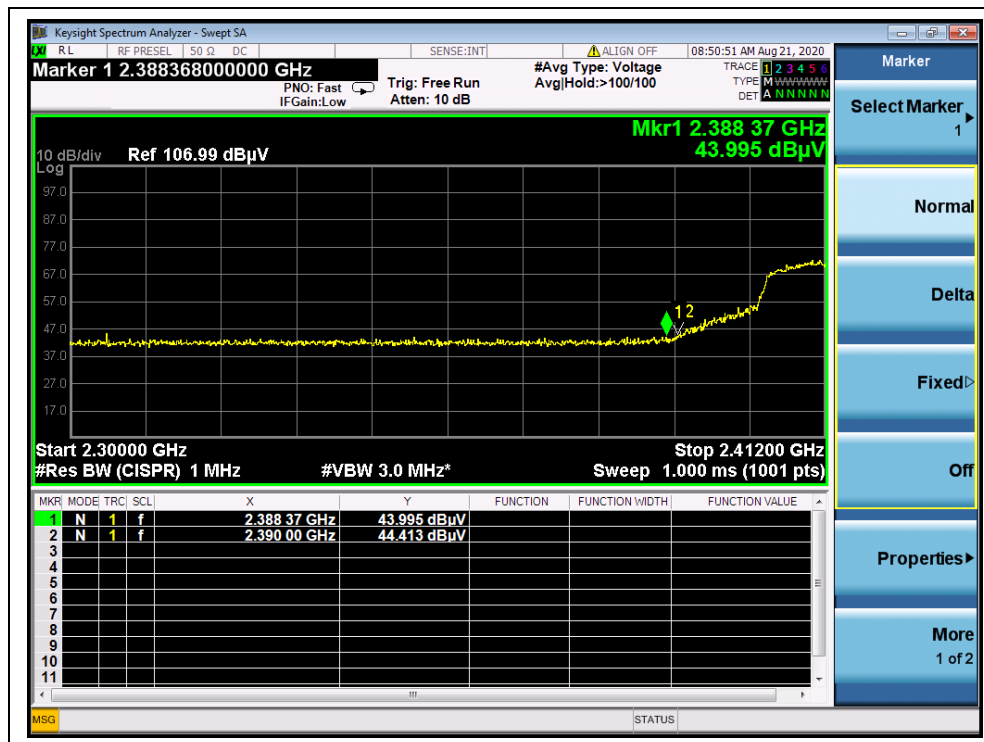
A.Test Verdict:

Channel	Frequency (MHz)	Detector	Receiver Reading U_R (dB μ V)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dB μ V/m)	Limit (dB μ V/m)	Verdict
		PK/ AV						
1	2389.49	PK	48.06	-29.67	32.56	50.95	74	PASS
1	2390.00	AV	44.41	-29.67	32.56	47.30	54	PASS
13	2483.96	PK	62.39	-29.67	32.56	65.28	74	PASS
13	2483.50	AV	46.60	-29.67	32.56	49.49	54	PASS

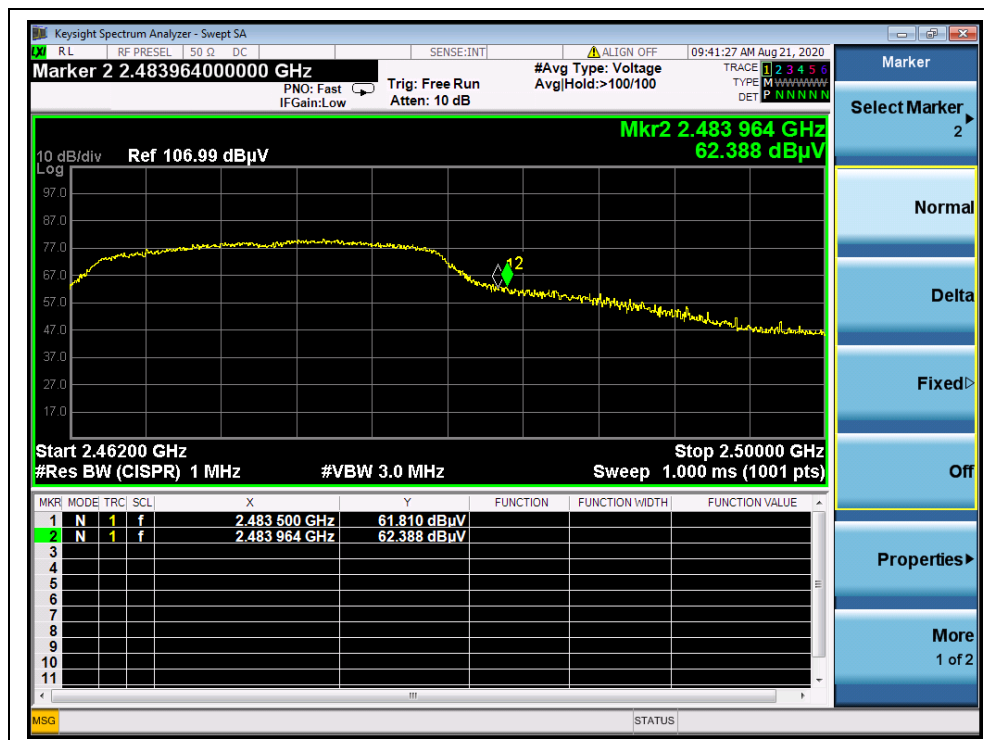
B.Test Plot:



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



(AVERAGE, Channel 1, 802.11n (HT20))



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



(AVERAGE, Channel 13, 802.11n (HT20))

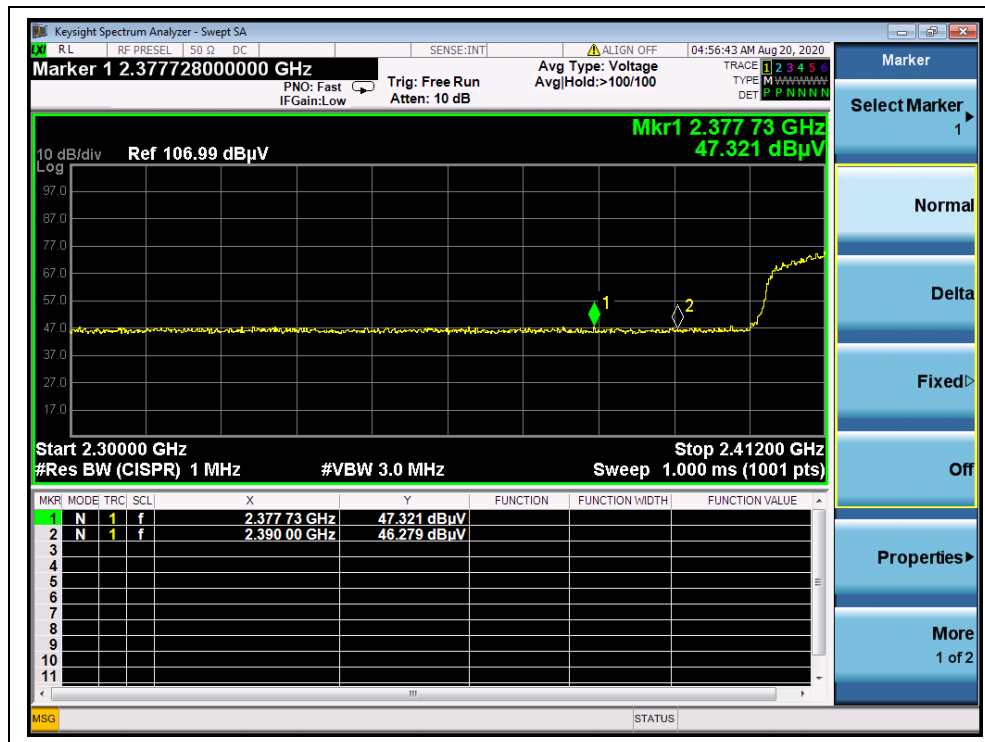


802.11n (HT40) Mode

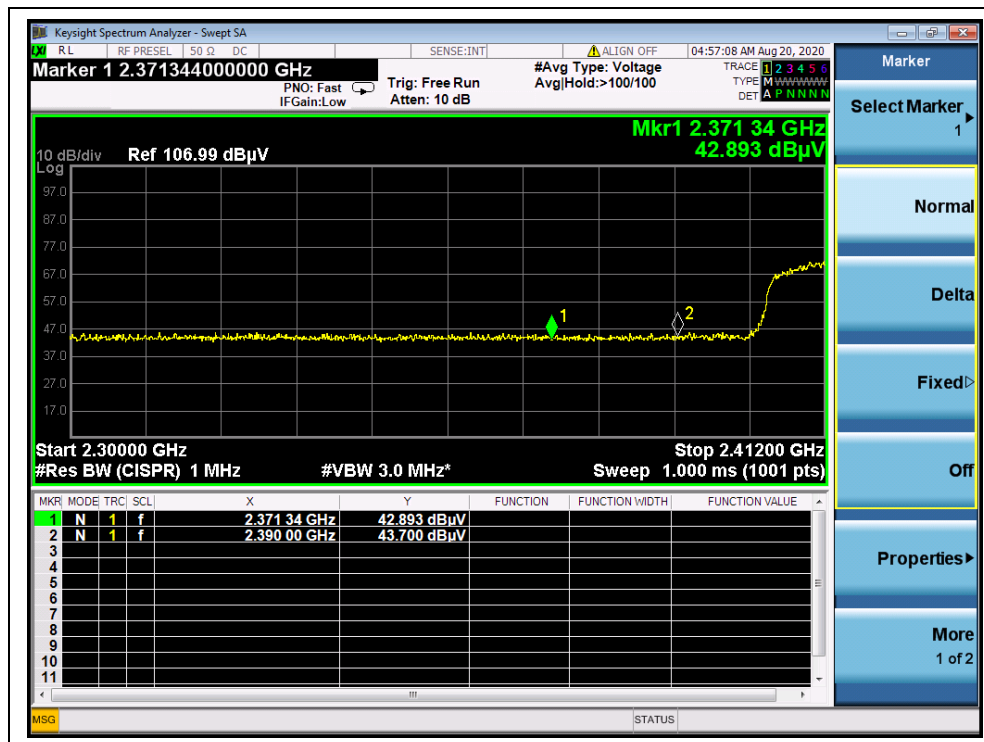
A. Test Verdict:

Channel	Frequency (MHz)	Detector	Receiver Reading U_R (dBμV)	A_T (dB)	A_{Factor} (dB@3m)	Max. Emission E (dBμV/m)	Limit (dBμV/m)	Verdict
		PK/ AV						
3	2377.73	PK	47.32	-29.67	32.56	50.21	74	PASS
3	2390.00	AV	43.70	-29.67	32.56	46.59	54	PASS
11	2484.59	PK	46.49	-29.67	32.56	49.38	74	PASS
11	2484.32	AV	45.22	-29.67	32.56	48.11	54	PASS

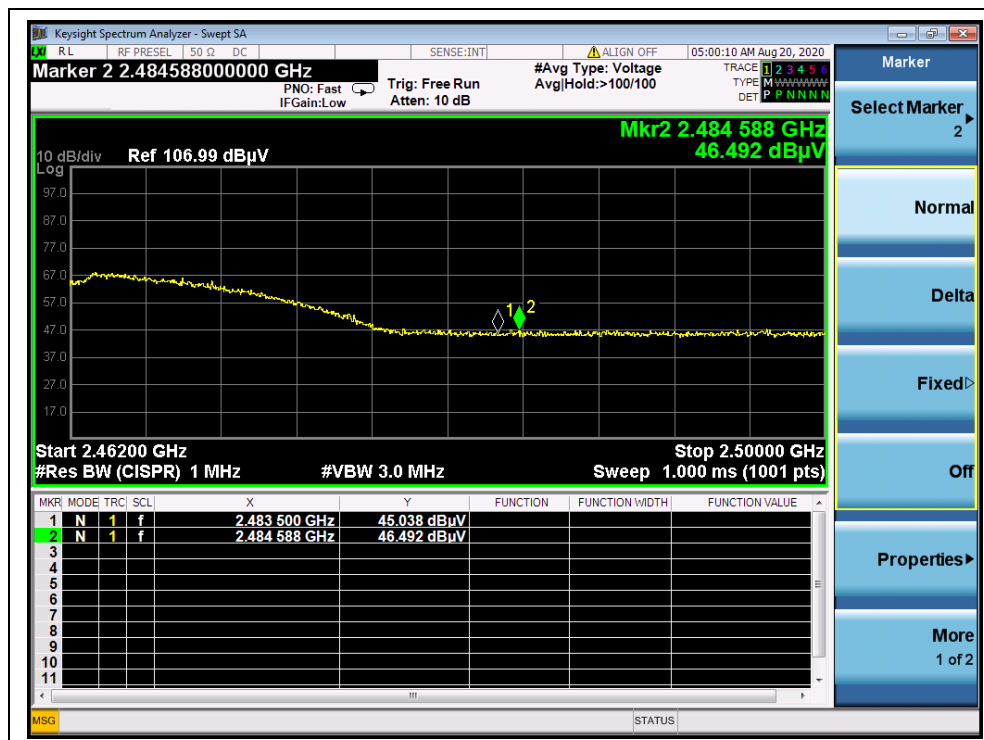
B. Test Plot:



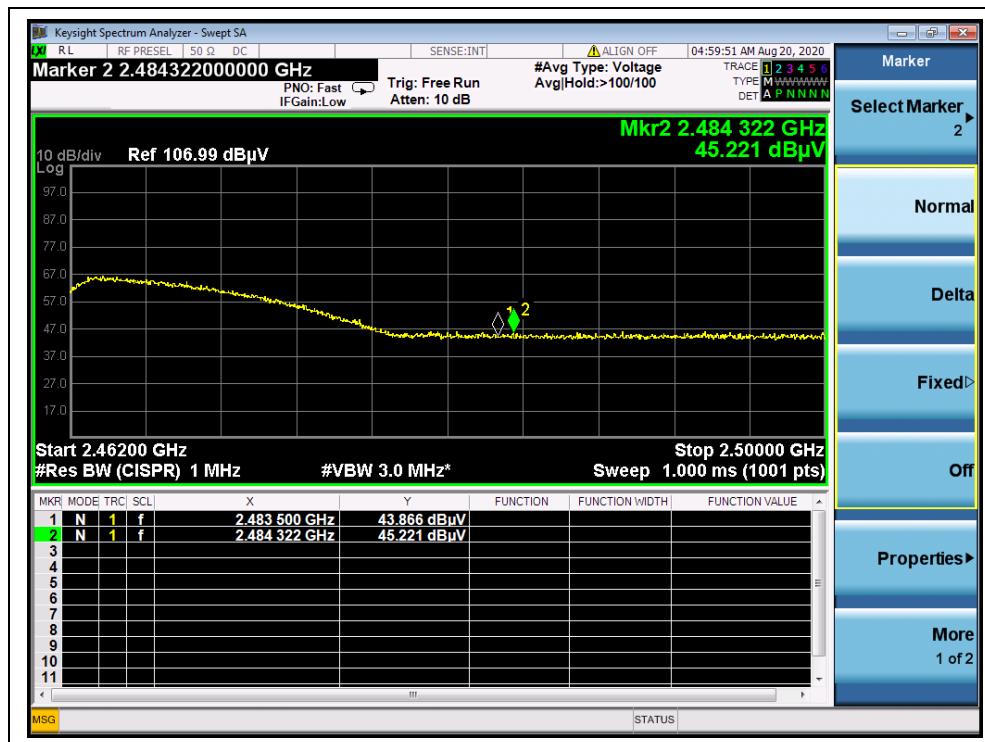
(PEAK, Channel 3, 802.11n (HT40))



(AVERAGE, Channel 3, 802.11n (HT40))



(PEAK, Channel 11, 802.11n (HT40))



(AVERAGE, Channel 11, 802.11n (HT40))

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 ($\mu\text{V/m}$)	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

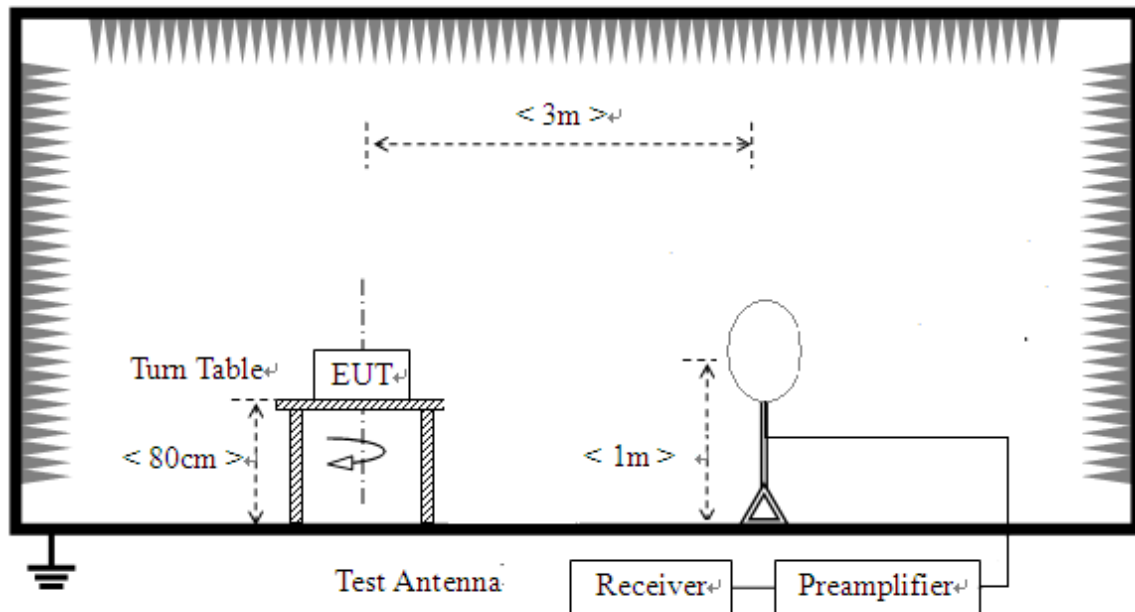
Note1: For above 1000MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.

Note2: 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).

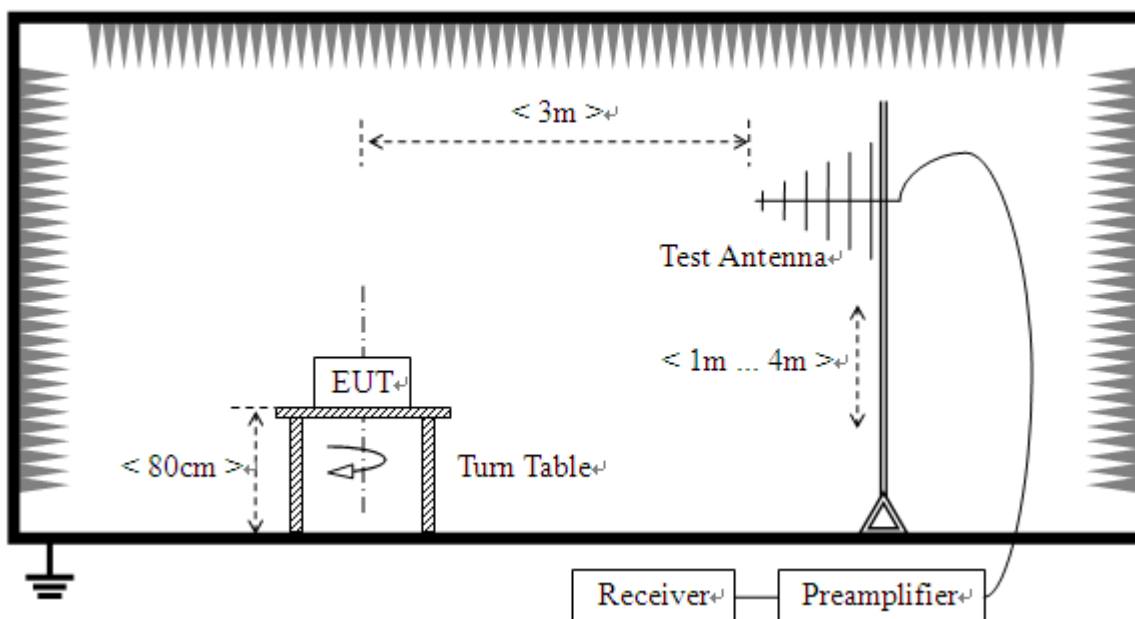
2.9.2. Test Description

Test Setup:

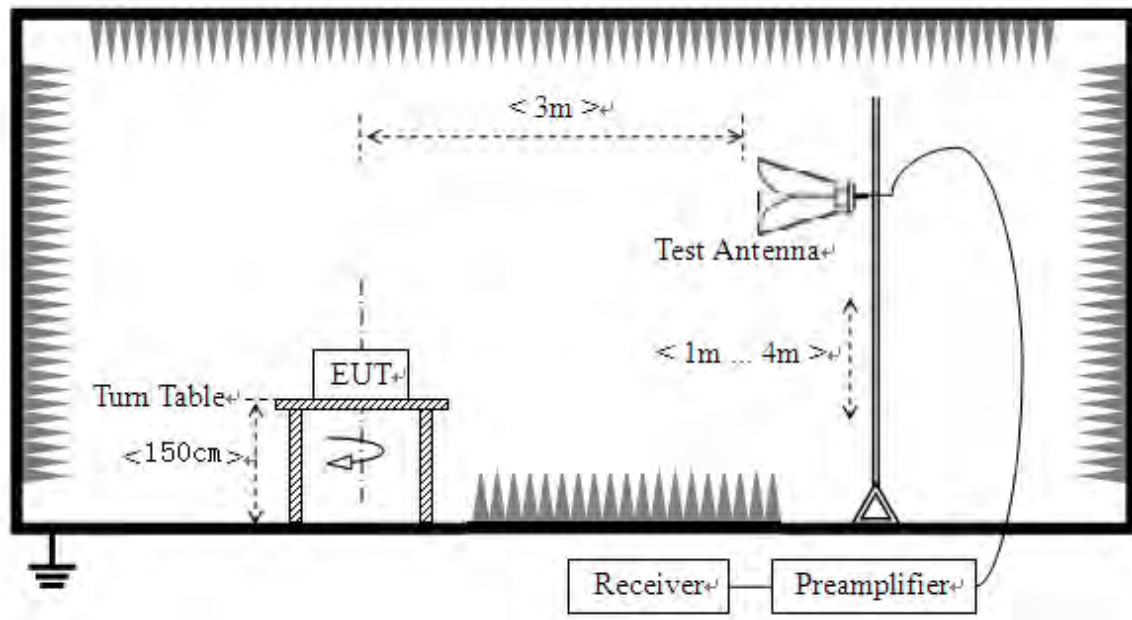
- 1) For radiated emissions from 9kHz to 30MHz



- 2) For radiated emissions from 30MHz to 1GHz



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:

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

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.

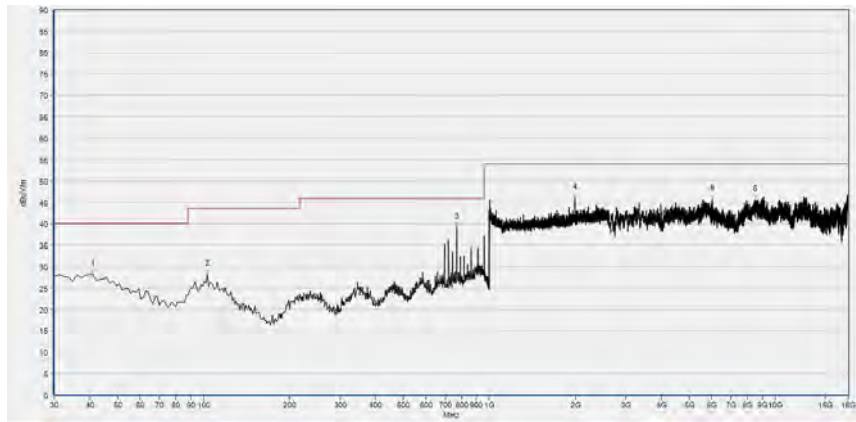
Note1: All radiated emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

Note2: For the frequency, which started from 9kHz 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 18GHz to 40GHz, was pre-scanned and the result which was 20dB lower than the limit was not recorded.

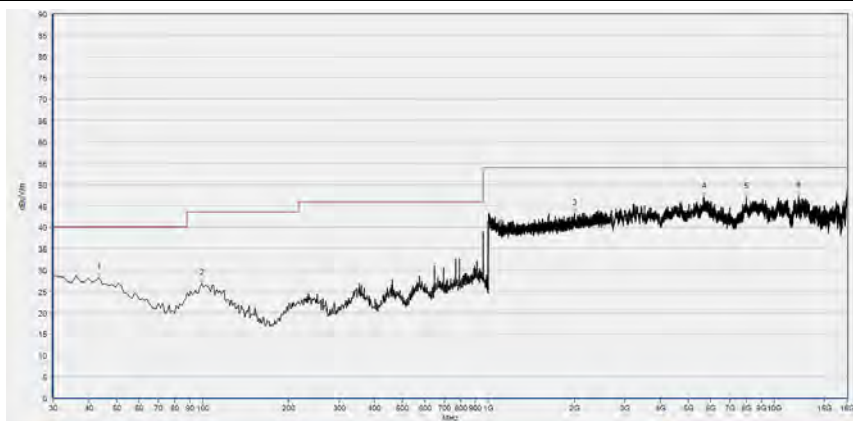
**802.11b Mode**

Plot 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
40.926	28.22	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
102.841	28.14	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
768.123	39.21	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1993.677	46.03	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
6039.025	45.76	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8489.471	45.52	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

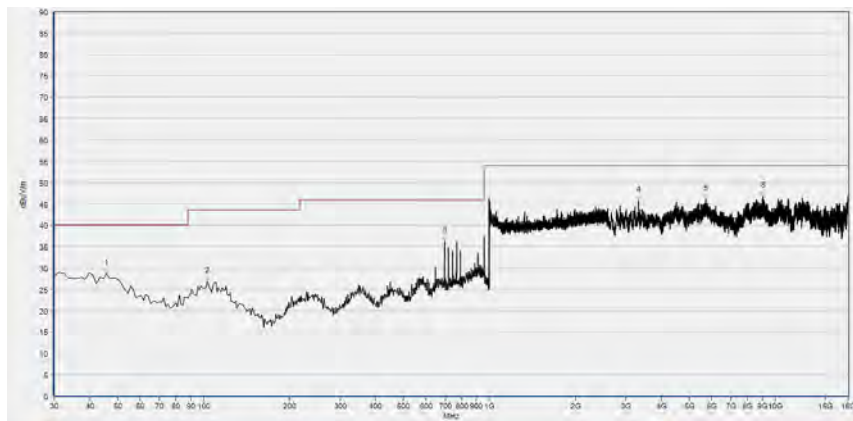
(Antenna Horizontal, 30MHz to 18GHz)



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	28.24	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
99.199	26.80	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
2005.202	43.24	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5697.363	47.09	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8004.983	47.02	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12180.542	47.33	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

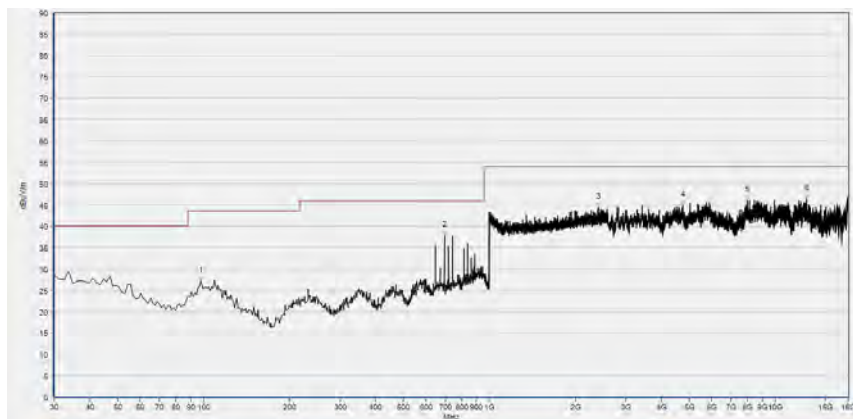
(Antenna Vertical, 30MHz to 18GHz)

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
45.782	28.64	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
102.841	26.89	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
696.496	36.16	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
3319.731	45.74	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5728.169	46.08	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
9049.573	46.76	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)

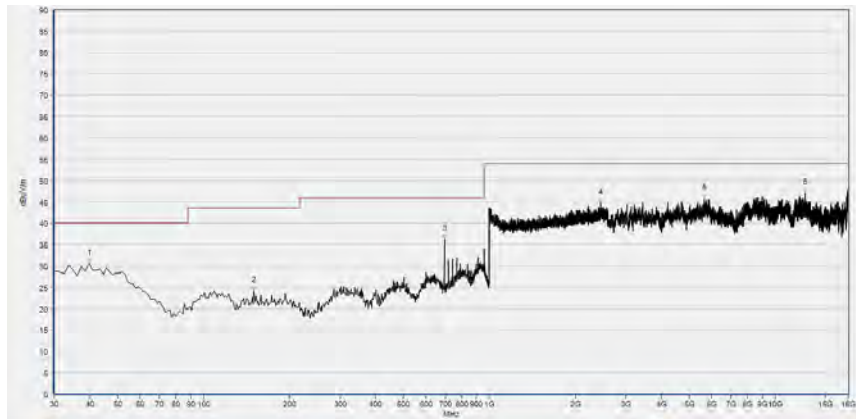


Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
97.985	27.13	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
696.496	37.89	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2407.923	44.42	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4753.592	44.84	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8007.783	46.01	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12900.273	46.49	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 18GHz)

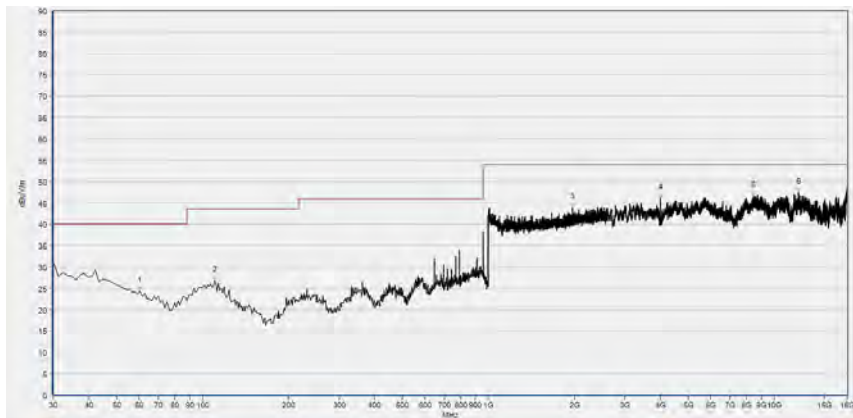


Plot for Channel 13



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
39.712	30.51	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
150.188	24.13	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
696.496	36.27	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2452.741	44.68	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5646.954	45.83	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12737.843	47.11	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)

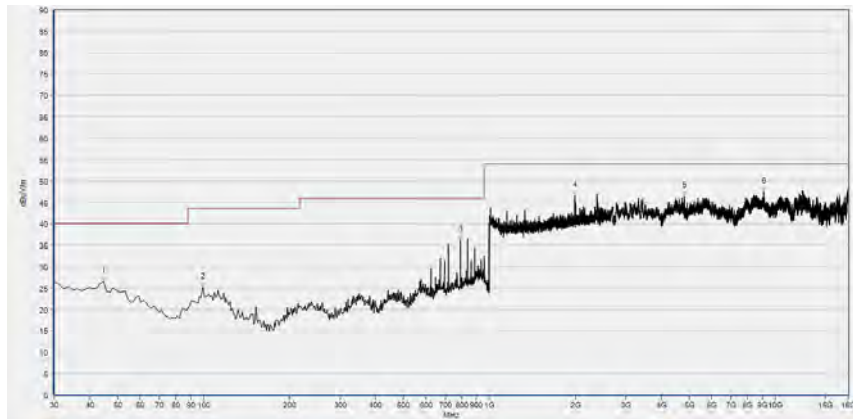


Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
60.350	24.22	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
110.125	26.76	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
1968.707	43.99	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
3991.853	46.14	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8469.867	46.65	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12180.542	47.45	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 18GHz)

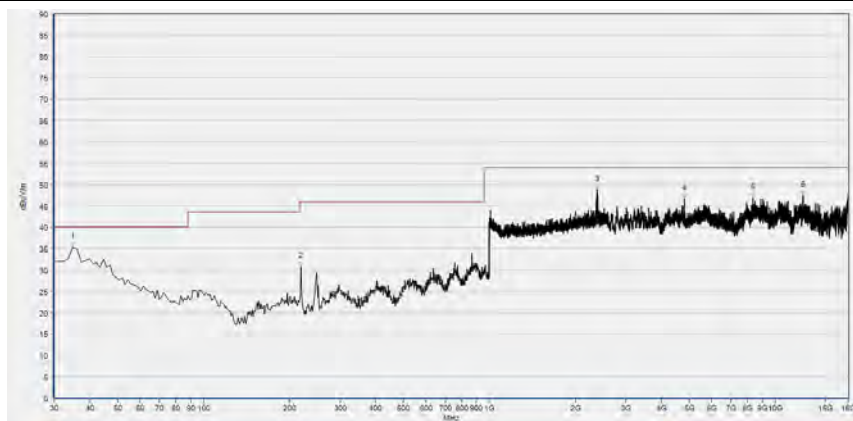
**802.11g Mode**

Plot 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
44.568	26.44	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
99.199	25.21	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
792.403	36.19	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1990.476	46.55	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4823.604	46.38	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
9141.989	47.38	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

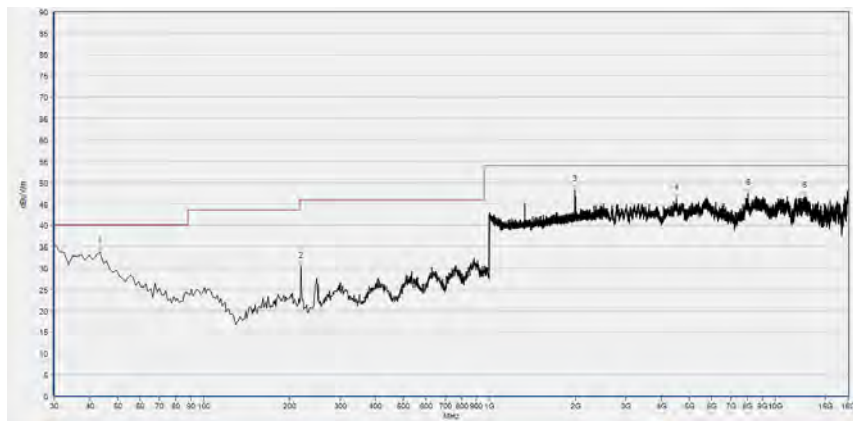
(Antenna Horizontal, 30MHz to 18GHz)



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
34.856	35.35	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
219.387	30.90	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2375.910	48.73	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4823.604	46.51	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8374.650	47.00	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12496.999	47.43	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

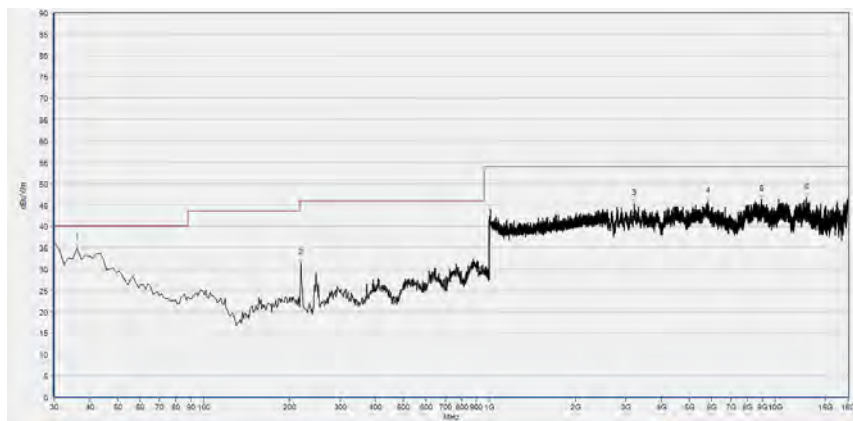
(Antenna Vertical, 30MHz to 18GHz)

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
43.354	33.64	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
219.387	30.40	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1991.757	48.24	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4521.149	46.32	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8013.384	47.50	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12670.631	46.80	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

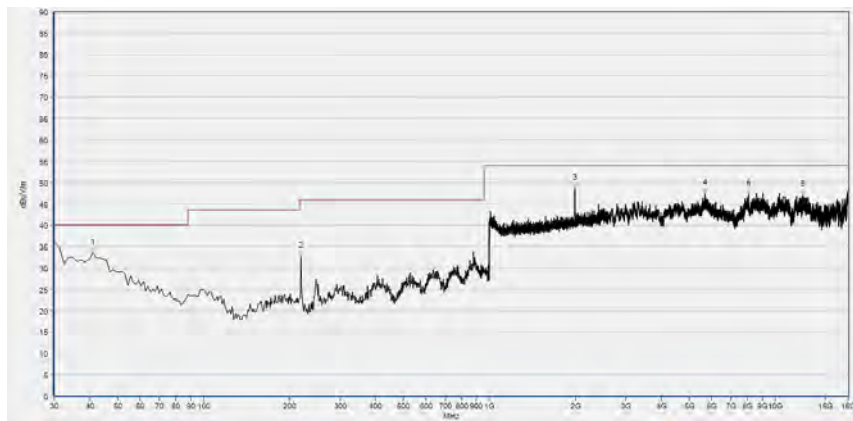
(Antenna Horizontal, 30MHz to 18GHz)



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
36.070	34.81	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
219.387	31.30	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
3210.511	45.18	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5803.783	45.71	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8982.360	46.21	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12894.672	46.54	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

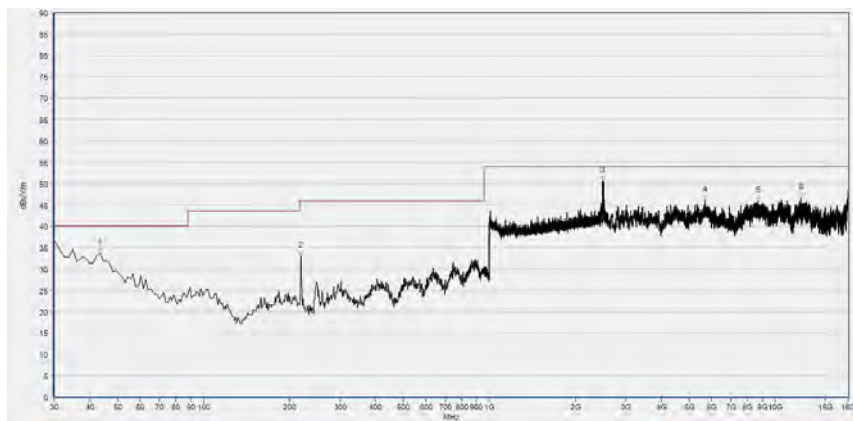
(Antenna Vertical, 30MHz to 18GHz)

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
40.926	33.47	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
219.387	32.61	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1993.037	48.67	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5669.358	47.37	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8091.799	47.33	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12513.803	47.11	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)

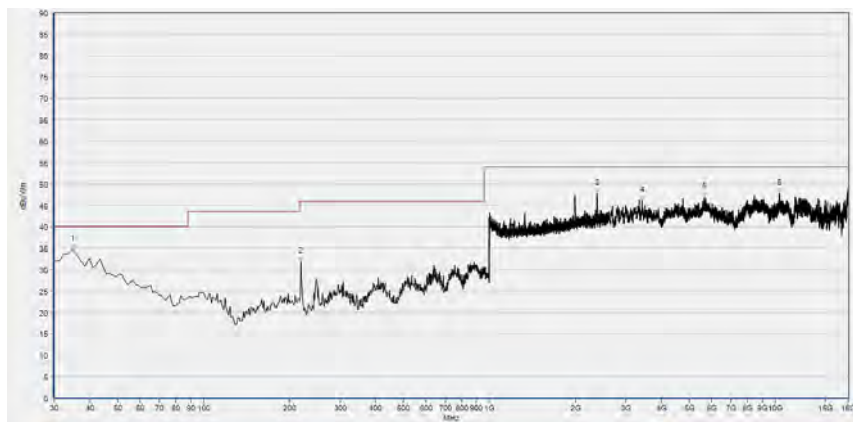


Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
43.354	33.77	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
219.387	33.03	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2492.437	50.57	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5686.161	46.17	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8727.514	45.96	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12292.562	46.58	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 18GHz)

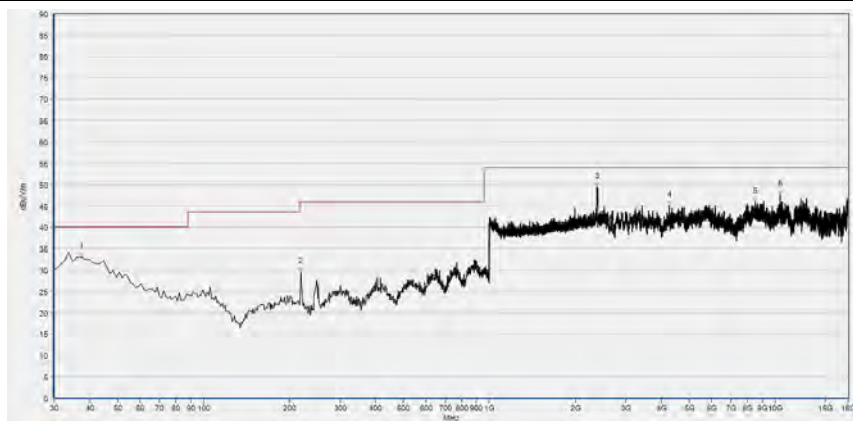
**802.11n (HT20) Mode**

Plot 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
34.856	34.73	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
219.387	31.85	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2380.392	47.70	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3426.150	46.08	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5655.356	46.98	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
10357.410	47.84	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

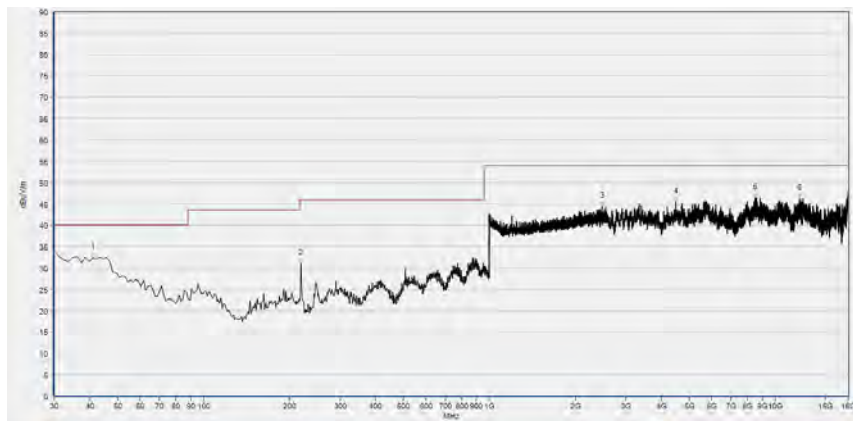
(Antenna Horizontal, 30MHz to 18GHz)



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
37.284	32.97	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
219.387	29.42	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2381.032	49.49	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
4263.502	45.01	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8520.276	45.90	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
10407.820	47.54	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

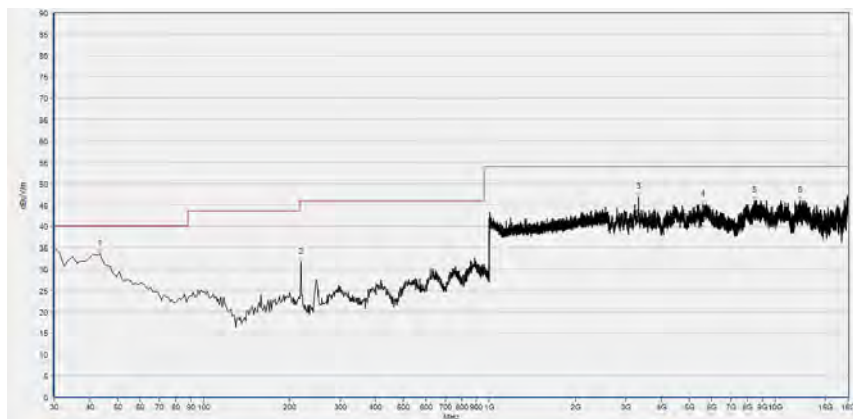
(Antenna Vertical, 30MHz to 18GHz)

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
40.926	32.39	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
219.387	30.92	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2481.553	44.41	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
4479.142	45.41	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8486.670	46.38	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12130.133	46.31	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

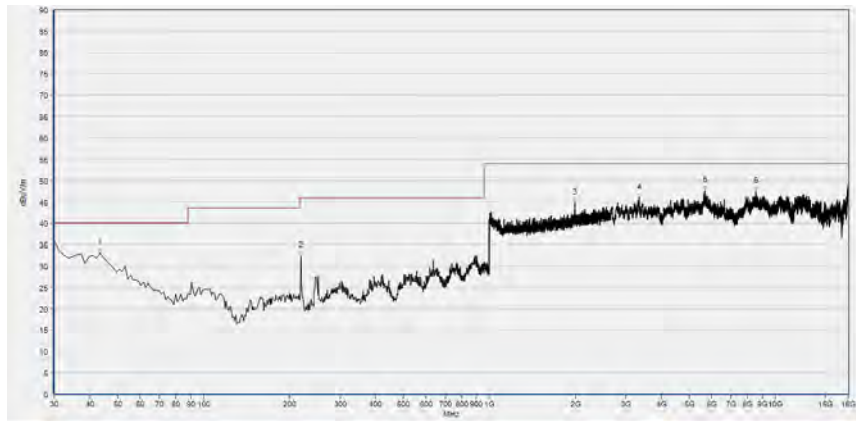
(Antenna Horizontal, 30MHz to 18GHz)



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	33.54	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
219.387	31.57	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
3319.731	46.81	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5574.141	45.11	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8475.468	46.00	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12205.746	46.00	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

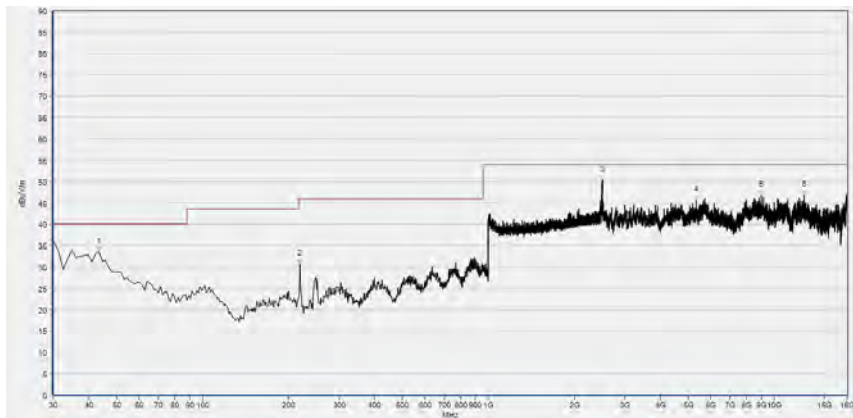
(Antenna Vertical, 30MHz to 18GHz)

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
43.354	33.07	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
219.387	32.38	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
1991.757	44.82	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
3342.135	46.00	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5672.159	47.57	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8570.686	47.37	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)

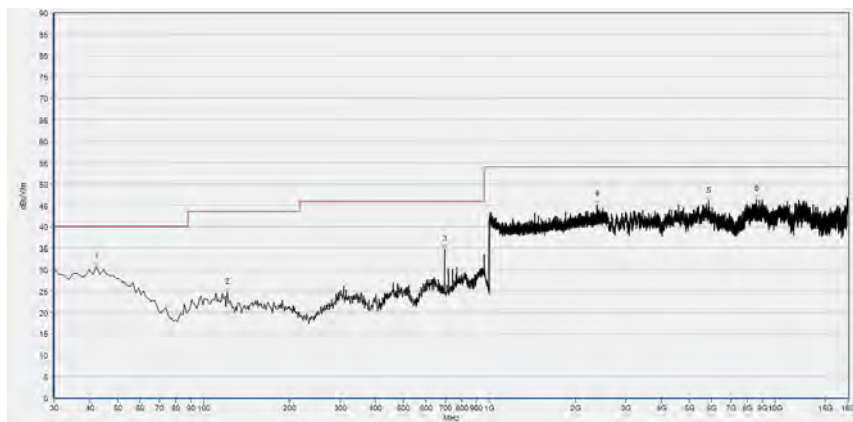


Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
43.354	33.49	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
219.387	30.74	N/A	N/A	N/A	46.00	N/A	Vertical	PASS
2501.401	50.28	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5327.696	45.61	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8996.363	46.78	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12735.043	46.79	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 18GHz)

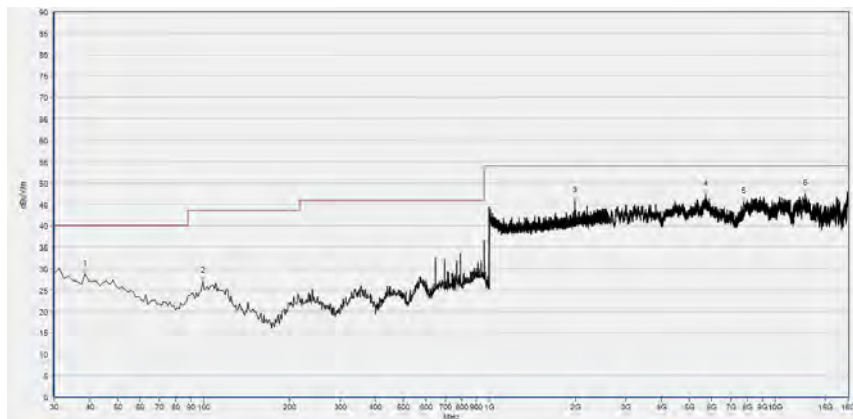
**802.11n (HT40) Mode**

Plot for Channel 3



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
42.140	30.67	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
121.051	24.65	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
696.496	34.76	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2385.514	45.17	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5842.990	45.92	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
8590.289	46.38	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)

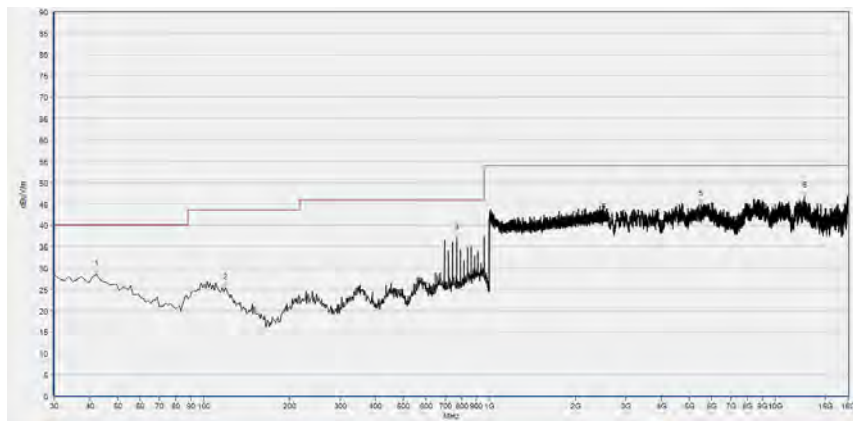


Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
38.498	28.63	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
99.199	27.00	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
1991.757	45.82	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5708.565	47.23	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
7766.939	45.64	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12746.245	47.48	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 18GHz)

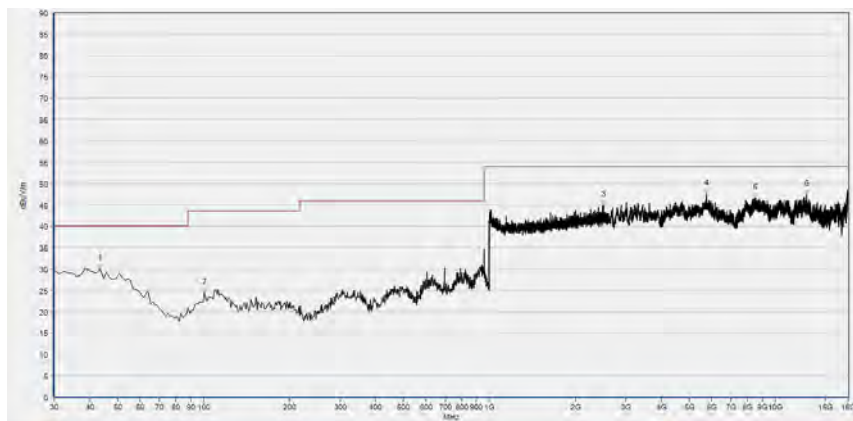


Plot for Channel 7



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
42.140	28.42	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
118.623	25.30	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
768.123	37.04	N/A	N/A	N/A	46.00	N/A	Horizontal	PASS
2512.285	44.26	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5481.724	44.94	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
12659.429	46.72	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

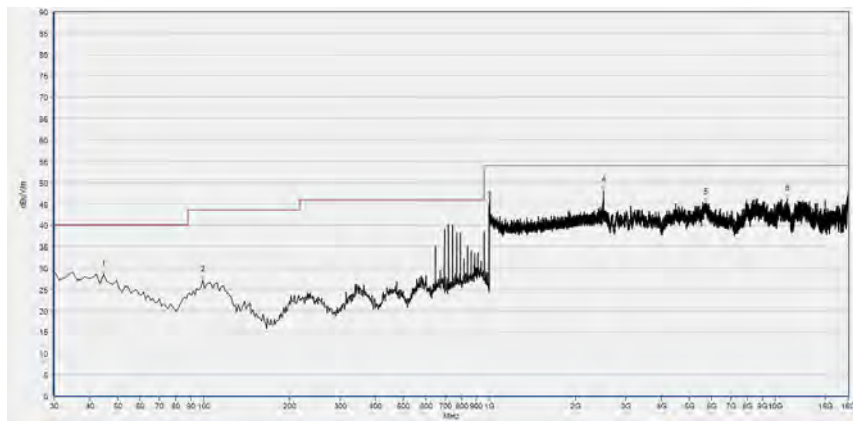
(Antenna Horizontal, 30MHz to 18GHz)



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	30.05	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
100.413	24.47	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
2501.401	44.89	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5742.171	47.57	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
8489.471	46.55	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12891.871	47.36	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

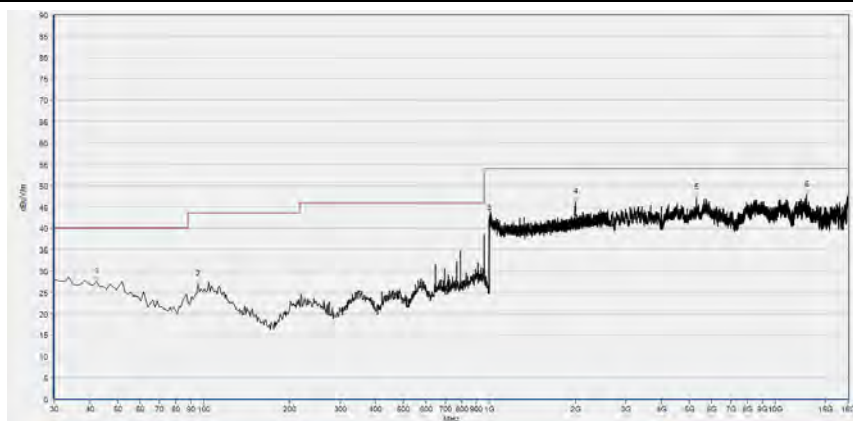
(Antenna Vertical, 30MHz to 18GHz)

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
44.568	28.55	N/A	N/A	N/A	40.00	N/A	Horizontal	PASS
99.199	27.09	N/A	N/A	N/A	43.50	N/A	Horizontal	PASS
1000.000	24.92	N/A	N/A	N/A	54.00	N/A	Horizontal	PASS
2505.882	48.04	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
5714.166	45.20	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS
11004.328	46.10	N/A	N/A	74.00	N/A	54.00	Horizontal	PASS

(Antenna Horizontal, 30MHz to 18GHz)



Fre. (MHz)	PK (dBμV/m)	QP (dBμV/m)	AV (dBμV/m)	Limit-PK (dBμV/m)	Limit-QP (dBμV/m)	Limit-AV (dBμV/m)	Antenna	Verdict
42.140	27.44	N/A	N/A	N/A	40.00	N/A	Vertical	PASS
95.557	26.87	N/A	N/A	N/A	43.50	N/A	Vertical	PASS
1000.000	24.57	N/A	N/A	N/A	54.00	N/A	Vertical	PASS
1999.440	46.11	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
5313.693	47.16	N/A	N/A	74.00	N/A	54.00	Vertical	PASS
12877.869	47.69	N/A	N/A	74.00	N/A	54.00	Vertical	PASS

(Antenna Vertical, 30MHz to 18GHz)

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	$\pm 2.22\text{dB}$
Power spectral density (PSD)	$\pm 2.22\text{dB}$
Bandwidth	$\pm 5\%$
Conducted Spurious Emission	$\pm 2.77\text{dB}$
Restricted Frequency Bands	$\pm 5\%$
Radiated Emission	$\pm 2.95\text{dB}$
Conducted Emission	$\pm 2.44\text{dB}$

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	Resent	N/A	N/A
EXA Signal Analyzer	MY53470836	N9010A	Agilent	2020.04.01	2021.03.31
USB Wideband Power Sensor	MY54210011	U2021XA	Agilent	2020.04.01	2021.03.31
RF cable (30MHz-26GHz)	CB01	RF01	Morlab	N/A	N/A
Coaxial cable	CB02	RF02	Morlab	N/A	N/A
SMA connector	CN01	RF03	HUBER-SUHNER	N/A	N/A

4.2 Conducted Emission Test Equipments

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Cal. Due
Receiver	MY56400093	N9038A	KEYSIGHT	2020.03.26	2021.03.25
LISN	812744	NSLK 8127	Schwarzbeck	2020.03.26	2021.03.25
Pulse Limiter (10dB)	VTSD 9561 F-B #206	VTSD 9561-F	Schwarzbeck	2020.07.24	2021.07.23
Coaxial cable(BNC) (30MHz-26GHz)	CB01	EMC01	Morlab	N/A	N/A

4.3 List of Software Used

Description	Manufacturer	Software Version
Test system	Townsend	V2.6
Power Panel	Agilent	V3.8
MORLAB EMCR V1.2	MORLAB	V1.0
TS+ -[JS32-CE]	Tonscend	V2.5.0.0

**4.4 Radiated Test Equipments**

Equipment Name	Serial No.	Type	Manufacturer	Cal. Date	Due Date
Receiver	MY54130016	N9038A	Agilent	2020.07.21	2021.07.20
Test Antenna - Bi-Log	9163-520	VULB 9163	Schwarzbeck	2019.05.24	2022.05.23
Test Antenna - Loop	1520-022	FMZB1520	Schwarzbeck	2019.02.14	2022.02.13
Test Antenna – Horn	01774	BBHA 9120D	Schwarzbeck	2019.07.26	2022.07.25
Test Antenna – Horn	BBHA9170 #774	BBHA 9170	Schwarzbeck	2019.07.26	2022.07.25
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
Coaxial cable (N male) (30MHz-40GHz)	CB05	EMC05	Morlab	N/A	N/A
1-18GHz pre-Amplifier	61171/61172	S020180L32 03	Tonscend	2020.07.21	2021.07.20
18-26.5GHz pre-Amplifier	46732	S10M100L38 02	Tonscend	2020.07.21	2021.07.20
26-40GHz pre-Amplifier	56774	S40M400L40 02	Tonscend	2020.07.21	2021.07.20
Notch Filter	N/A	WRCG-2400-2483.5-60SS	Wainwright	2020.07.21	2021.07.20
Anechoic Chamber	N/A	9m*6m*6m	CRT	2020.01.06	2023.01.05

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